The Environmental Effects of Free Trade

Papers Presented at the North American Symposium on Assessing the Linkages between Trade and Environment (October 2000)

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Preface

In recent years, the debate about the costs, benefits and longer-term implications of free trade and economic globalization has moved to the forefront of public policy concerns. Among the key issues shaping the free trade and economic globalization debate is the question of how trade liberalization affects environmental quality, either in terms of direct effects on our environment, or indirectly, for instance, the effects that such trade laws as those codified in the North American Free Trade Agreement (NAFTA) and the World Trade Organization (WTO) have on hard-fought national environmental standards and regulations. Work in assessing the environmental effects of free trade continues to undergo significant improvements: assessment methodologies have improved; environmental data—although still filled with gaps and lack of comparability among trading partners—continue to become more robust; and tools able to draw links between trade-related economic changes and environmental changes continue to be developed.

Among these and many other improvements, perhaps the most important will be establishing the means for ensuring that civil society is engaged early, and engaged meaningfully, in environmental assessments of the free trade agenda. Indeed, of all the grievances leveled by civil society against trade agreements, the lack of transparency and public participation remains perhaps the loudest.

Since the mid-1990s, the North American Commission for Environmental Cooperation (CEC) has examined the effects of NAFTA and other trade commitments on the environment. A guiding assumption of the Commission's work is the central importance of transparency and meaningful participation in assessment work. In late 1999, upon the completion of the CEC Analytical Framework for Assessing the Environmental Effects of NAFTA, the Council of the CEC issued a public call for research papers to be presented at a public forum on trade and environment: in essence, these studies were to translate the methodological or "how to" work into action.

Of the more than 50 research proposals submitted by the public in response to the call for papers, 14 research topics were selected by an advisory group to the Commission. Authors of the papers, representing nongovernmental groups, academic researchers, representatives of intergovernmental organizations and the private sector, were given authorial independence (and, where appropriate, modest research support) to complete their work. These research papers discuss a wide range of environmental media and economic sectors in Canada, Mexico and the United States, ranging from the effects of NAFTA on forestry, fisheries and freshwater to trade in hazardous waste, transportation and services.

In October 2000, the CEC hosted a North American Symposium on Understanding the Linkages between Trade and Environment in Washington, DC. The symposium, which gathered more than 300 participants, was held at the World Bank headquarters. Following the extensive discussions and exchange of ideas and perspectives during the symposium, authors undertook several months to revise and update their papers for publication.

This report contains the final versions of 13 papers. It also highlights some of the rich discussions that took place during the two-day symposium. We are very grateful to the advisory group to the Commission for their judicious selection of contributors and to the symposium chair, Dr. Pierre Marc Johnson, for the skill and insight with which he guided this stage of the CEC's work. We also gratefully acknowledge the hard work of the authors of the research papers themselves. We thank John Dixon and his colleagues at the World Bank for graciously providing the venue for the symposium, and Douglas Kirk, Miguel López, Raymonde Lanthier, Jeff Stoub and Carol Smith of the CEC for their efforts in editing and overseeing the translation and publication of this volume.

As a practical follow-up to the Analytical Framework, this report represents the next step in the Commission's work on assessing the environmental effects of free trade. It is not by any means the last word on whether free trade has been "good" or "bad" for North America's environment. Yet the wealth of analysis contained in this report helps point the way to the work that needs to be done, both in assessing trade effects, and also in crafting policy responses to ensure that emerging environmental and economic agendas work in cooperative and sustainable way.

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Welcome from the Chair

Dr. Pierre Marc Johnson (Symposium Chair)

Dr. Johnson began by explaining that the purpose of this symposium was to examine the environmental impacts of free trade. A key question in the public debate is whether NAFTA has left the North American environment better or worse off.

For the many groups now engaged worldwide in the trade-environment debate, it is worth noting that this debate began with NAFTA.

In the six years since NAFTA was implemented, total trade in North America is estimated to have grown to approximately US$700 billion per year. How is that trade affecting our environment? For those looking at new trade negotiations, this meeting allows us to see what has already happened. And for those who do not have the interest or humility to look back before looking ahead, let me remind you of the old adage: “those who fail to learn from the lessons of history are destined to repeat them.”

A good deal of progress has been made in improving methodologies for environmental assessments and for reviews of free trade. At the same time, one of the emerging lessons from this methodological work is that we should not await a perfect way of assessing complex and dynamic trade-environment linkages. This symposium represents an opportunity to learn by doing. New evidence presented in many of the papers not only confirms trade-environment links but also suggests that the impact on the environment tends to be most noticeable when examined at the disaggregate level.

The papers suggest, then, that there has not been one overall or generalized environmental effect of NAFTA. Indeed, the results are mixed. For example, in the fisheries sector, evidence does not suggest that NAFTA, *per se,* has had much of an effect, either positive or negative, on sustainable fisheries management. For forest products, on the other hand, the restructuring of the industry has been accompanied by significant changes, including its exposure to contestation from international competition. For freshwater, concerns persist about the possibility of bulk water exports in the face of dwindling water resources and the effects of investor-state challenges under NAFTA’s Chapter 11.

Some of the evidence to be presented at the symposium suggests shifts in the composition and nature of industrial pollution. Some air pollution indicators show increases of carbon monoxide and sulfur dioxide (SO_2) levels in the US, and of SO_2 in Mexico, and significant reductions of air pollution in the Canadian and Mexican paper sectors. Data on hazardous waste show a significant increase in hazardous waste generation in some Canadian provinces, along with a decrease in some northern US states. A key finding of one of the papers presented at this conference is that the total amount of trade in hazardous wastes—in particular, waste imported into Canada from the United States—has increased dramatically since NAFTA came into effect.

Over the past decade, a lot of work has concentrated on the question of whether trade liberalization contributes to a “race to the bottom” in domestic environmental standards. Evidence presented at this meeting suggests that, at the aggregate level, a weakening of environmental regulations has not occurred. At the same time, a case study of the textiles sub-sector shows that, perhaps as expected, production relocation can be linked to free trade, and that declines in production bring both environmental “benefits”—from lessened industrial activity—and greater social dislocation linked to unemployment. At the same time, environmental problems understandably increase where production expands. The question is how these contractions and expansions are addressed through policy responses.

One of the strongest links between international trade and environmental effects is in the transport sector. The data show that, while there has been an absolute increase in truck transport through concentrated border crossings, these growth rate increases are not related to rates of environmental change.

Among the innovative papers to be presented at this meeting is a discussion of whether Mexico's pollution per unit of exported product has increased, decreased or remained the same since the advent of NAFTA. Put another way, is there any evidence of a "pollution haven"? In fact, the evidence suggests that Mexican export specialization has resulted in less and less pollution. In contrast, Canadian export specialization is now much more pollution-prone than Mexico's.

Among the groundbreaking papers are those that examine the services sector. While many of us think that the services sector is by definition "clean," this in fact is becoming an increasingly important source of pollution. New or revised approaches to assessing the services sector are needed. Evidence from the wastewater sector suggests that NAFTA has not generally altered the number of wastewater treatment violations (even though production has greatly increased). On the other hand, free trade in electricity is likely to yield positive environmental results.

It is clear from the papers to be presented that the issues examined here are complex and diverse. One of the suggestions that has been made by the environmental community since the outset of the trade-environment debate is that they be given a seat at the decision-making table. This meeting gives clear evidence that this is true: environmental concerns need to be addressed during trade negotiations and treaty implementation.

This symposium provides an opportunity for real dialogue. It is hoped that results from the meeting and papers will influence the governments, institutions, and civil society interacting on trade-environment matters. Other institutions, including the WTO, OECD and UNEP, are represented at this meeting, as well as the governments of Canada, Mexico and the United States. Public support for trade liberalization has never been more tenuous, and public scrutiny of the direction of economic policy has never been more intense or better informed. Governments, NGOs, the private sector are all living in the post-Seattle world. One lesson of the post-Seattle agenda is already very clear: environmental assessments need to be transparent and need to engage civil society in an earnest, meaningful way.

Mr. Johnson concluded by expressing his thanks to the symposium advisory committee: Gabriele Quadri de la Torre, Anil Markandya, Ford Runge, Michel Potier, Kenneth Ruffing and Jake Caldwell. He also thanked John Dixon and the World Bank for making their facilities available for the meeting.

Keynote Address

Lester Brown (Worldwatch Institute)

Mr. Brown began by saying little progress has been made in integrating environmental considerations into economic policy. There is a need to reverse traditional roles in policy development, so ecologists design projects before economists decide on their feasibility.

While economic assumptions regarding comparative advantage are valid, it is important to support not only economic outcomes, but also environmental integrity. Evidence suggests that our economy is outgrowing the ecosystem. The global economy is six times larger today than it was in 1950. By contrast, our ecosystem remains the same. Evidence clearly suggests that economic activity is increasing ecosystem stress.

Two well-known examples of ecological stress are a decline in the supply of fresh water and global warming. In the first area, new and increasingly powerful water pumps, developed over the past 50 years, have made it both feasible and relatively easy to deplete an aquifer. Groundwater supplies are now being depleted worldwide. Competition in freshwater use between cities and agriculture is becoming more pronounced. In many countries, food security is being compromised, and people are rapidly losing their capacity to feed themselves and their children.

Climate change is another example of the ecological outcome of rapid economic growth. Rising temperatures are causing polar ice to melt, increasing the risk of flooding. Evidence suggests that the melting of Himalayan ice will have drastic effects on Asian hydrology, increasing the risk of both floods and droughts.

To address these and other environmental concerns, there is an urgent need to develop a new economy, one in which alternate energy sources and forms of transportation are available. Wind energy is an example of how such alternatives can develop and take hold with the right kind of support and advocacy. Tax incentives have encouraged investment in wind turbines and, because farmers own most of the wind rights in the country, farmers are joining environmentalists in promoting wind power. Three US states—North Dakota, Kansas, and Texas—have enough wind to help meet national electricity needs.

On the demand side, many state utilities are required to offer consumers environmentally preferable or “green” power. To date, many residences and businesses have signed up, even though renewable energy still costs more than “mainstream” energy.

Among the clear lessons of efforts to promote renewable energy is the need to restructure the tax system in order to send the right signals about environmental costs and opportunities. There is a need to lower income taxes across the board, and to impose higher taxes on environmentally destructive activities (as is done in many European countries).

Session One

Trade Liberalization and Natural Resources

- NAFTA Environmental Impacts on North American Fisheries
- The Forestry Industry in the State of Chihuahua: Economic, Ecological and Social Impacts Post-NAFTA
- NAFTA Effects on Water: Testing for NAFTA Effects in the Great Lakes Basin

Session Chair:

David Schorr (Sustainable Commerce Program, World Wildlife Fund – US)

To preface the first paper reading session, Mr. Schorr stated that this symposium marks an evolution of the dialogue about the relationship between trade and the environment. He said three stages or generations of this debate can be identified.

The first generation focused on the “NAFTA good”/”NAFTA bad” debate. Although this was politically relevant, it was not useful for future policy-making, nor did it recognize the complexity of the Agreement itself or of the context in which it had been implemented. The first generation was dominated by media coverage.

More serious analysis marks the second generation of the trade-environment debate. A broader discussion is now under way, which primarily examines the regulatory impacts of NAFTA and which recognizes that this regional free trade accord forms part of a “basket” of economic policies. It is useful to examine NAFTA alone for what it can teach us about the environmental implications of economic policies more generally.

The third generation of trade-environment work will be prescriptive rather than responsive. It will begin by envisioning the desired environmental outcomes, and then will look at the links between trade and environment to determine which are likely to affect—either positively or negatively—desired environmental outcomes. This third approach does not imply that trade must be crippled or halted until the world’s environmental problems are solved, but merely that, in policy-making, it is important to bear in mind that the main goal is not free trade as in end in itself, but rather a sustainable and healthy planet.

Politically this means bringing a broader set of voices—not just commercial interests—to trade negotiations. Environmental and social advocates need to be involved in crafting trade policies, rather than just responding to them.

NAFTA Environmental Impacts on North American Fisheries

Grace V. Chomo and Michael J. Ferrantino

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Abstract

Catch levels in many North American fisheries exceed the level consistent with long-run sustainability, and falling fish stocks have been a cause of concern. However, NAFTA-related changes in trade policies are unlikely to have significantly influenced the sustainability of North American fisheries. Most tariffs were already at or near zero prior to NAFTA. For products with significant pre-NAFTA tariffs (mainly in Mexico), the associated trade flows are typically not large relative to catch levels. Trade flows with the world as a whole are significant relative to catch levels in Canada and the United States, though not in Mexico. Conclusions about the relationship of trade to region- and species-specific fish stocks are complicated by data issues.

1 Introduction

1.1 Fisheries as an Environmental Issue

During the 20th century, many of the world's fishing stocks were depleted to levels that could no longer sustain historical levels of fishing, and many of these stocks have not since recovered. There is a wide consensus on this point: observers of the environmental scene who agree on little else concur in recognizing the seriousness of over-fishing as an environmental problem.[1] Total fish harvest in the Northwest Atlantic, Southeast Atlantic, and Antarctic fishing areas has declined by over 50 percent from historic maxima of approximately thirty years ago.[2] The decline of fish stocks varies widely from region to region and species to species.

The policy response to declining fisheries has accelerated in recent years. For example, in the US exclusive economic zone, large areas of Georges Bank and the Gulf of Maine are closed to fishing with gears capable of catching groundfish (demersal fish). The United States and Canada coordinate stock assessment activities in these waters, while using different fisheries management techniques.[3] Examples of such techniques include catch limits (both numerical and on size of fish), restrictions on permissible gear, limits or prohibitions on new entry, and required reporting of landings.

There has been increased interest in the use of quantitative measurement to assess the environmental effects of trade agreements.[4] Compared with environmental issues such as manufacturing emissions and land use, there has been relatively little attention paid to the potential effects of trade liberalization on environmental indicators related to fisheries. This paper seeks to make a modest contribution in this area by assembling indicators relevant to assessing the possible effects of the NAFTA agreement on North American fisheries.[5] The analysis relies heavily on primary data from various national and international sources, and aggregations and other calculations based on that data, lightly processed, and does not employ techniques such as partial- or general-equilibrium simulation modeling.

1.2 The Role of Causation

In this paper, we consider that the effects of trade liberalization on the environment may arise in the following way. Governments, either individually or by agreement, adopt trade-liberalizing measures

1 Cf. Michael De Alessi (2000), "Fishing for Solutions: The State of the World's Fisheries," in Ronald Bailey, ed., *Earth Report 2000: Revisiting the State of the Planet*, 2000, New York: McGraw-Hill for the Competitive Enterprise Institute, pp. 85-114; Anne Platt McGinn (1998), "Promoting Sustainable Fisheries," in Lester R. Brown et al., *State of the World 1998*, 1998, New York: W.W. Norton and Co. for the Worldwatch Institute, pp. 59-78; "Diminishing Resources: World Fisheries Under Pressure" (1998), in *World Resources 1998- 99,* Oxford and New York: Oxford University Press for the World Resources Institute, United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP), and the World Bank, pp. 195-196.

2 Food and Agriculture Organization of the United Nations (FAO) (1997), *The State of World Fisheries and Aquaculture 1996,* Rome: FAO, p. 36.

3 National Marine Fisheries Service (NMFS), *Our Living Oceans: Report on the Status of US Maritime Resources, 1999,* US Department of Commerce NOAA Technical Memo NMFS-F/SPO-41, pp. 77-79 and 93-95.

4 Proceedings of recent international expert conferences on the topic include Per Fredriksson, ed. (1999), *Trade, Global Policy, and the Environment,* Washington, DC: The World Bank, OECD (1999), *Assessing the Environmental Effects of Trade Liberalisation Agreements: Methodologies,* Paris: OECD, and World Wildlife Fund and *Futuro Latinoamericano* (2000), *Background Material Prepared for the International Experts Meeting on Sustainability Assessments of Trade Liberalisation: 6-8 March 2000, Quito, Ecuador,* and the subsequent rappoteur's reports published under the title *International Experts Meeting on Sustainability Assessments of Trade Liberalisation: 6-8 March 2000, Quito, Ecuador,* Gland, Switzerland and Quito, Ecuador: WWF International and *Fundación Futuro Latinoamericano*.

5 For one example, see Godfrey Bahiigwa (1999), "The impact of trade and investment policies on the environment: Uganda's fisheries industry," in OECD, *op. cit.*

such as reductions in tariffs or non-tariff barriers (NTBs). These measures give rise to increased flows of merchandise trade, and perhaps also affect foreign direct investment (FDI). Changes in merchandise trade affect patterns of production, and these production changes in turn induce changes in the level of environmental indicators, either positive or negative.[6] Thus, at least conceptually, there is a fairly clear level of causation proceeding from trade policies to environmental indicators. This point is of some importance. During preliminary consultations on CEC's *Analytical Framework*, many participants expressed concern about the feasibility of showing clear cause-and-effect relationships between trade policies and environmental indicators.[7] We argue that these difficulties arise primarily at the level of data, measurement, and modeling, and that maintaining a clear conceptual framework often permits relatively strong statements to be made about causation.

In principle, NAFTA trade liberalization in one of the NAFTA importing countries could stimulate exports from a NAFTA partner, thus causing increased production and increased pressure on the exporting country's fishery. Conversely, those same increased imports, by substituting for domestically caught fish, may reduce pressure on the importing country's fishery. Thus, the environmental effect of trade liberalization on the status of fisheries may be positive, negative or negligible *a priori*, depending on the characteristics of the data. This suggests the following specific questions to be addressed in this paper: (1) Did NAFTA generate any significant increases in fisheries trade or production to begin with? (2) Were any increased exports of fish attributable to NAFTA drawn from relatively sustainable fisheries, or relatively depleted fisheries, and were those exports large relative to the size of the annual catch?

1.3 Data Issues and US Focus

The analysis presented here focuses most heavily on US fisheries. The primary reason for this choice relates to data constraints. While data on trade flows, trade policies, and fisheries production patterns are internationally comparable (up to a point), international data on environmental indicators are less systematically organized. This situation is typical of that facing analyses of trade and environment for other industries and environmental indicators, rather than being specific to fisheries. Since trade and production data are nation-specific, analysis of trade policies requires that these be related somehow to nation-specific measures of fisheries status, even if the fish stocks are transboundary or migratory in nature. The United States publishes a compendium of indicators of stock status and utilization levels for several hundred region- and species-specific fisheries stocks in the US exclusive economic zone.[8] Canada publishes an extensive series of stock status reports. These are for individual stocks and fisheries and issued on a rolling multi-year basis, thus not readily transformable into a "bottom line" that permits comparison of the status of, e.g., redfish in one location with cod in another.[9] Similarly, we were unable to identify a convenient compilation of fisheries status data for Mexico. Other related data issues will be discussed in more detail below.

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6 In principle, changes in the pattern of production include trade-induced changes in the *technology* of production as well as its level. At a first pass, we abstract from longer-run technological changes to focus on the simpler question of whether or not NAFTA is likely to have changed levels of fisheries activity in the short run immediately following implementation. We also abstract from changes in FDI, both because FDI is relatively less important for fisheries than for other industries and because the NAFTA agreement primarily ratified unilateral national liberalizations of FDI policy already in place (e.g., by Mexico) rather than mandated new FDI policies. These simplifying assumptions may not be equally appropriate for different commodities or different trade agreements.

7 Commission for Environmental Cooperation (CEC) (1999), *Assessing Environmental Effects of the North American Free Trade Agreement (NAFTA): An Analytic Framework (Phase II) and Issue Studies*, Montreal, CEC, p. 45.

8 *Our Living Oceans*, *op. cit.*

9 Stock Status Reports of the Canadian Stock Assessment Secretariat (CSAS), Fisheries and Oceans Canada, may be found at <http://www.ncr.dfo.ca/csas/csas/status/list97.htm>.

1.4 Preliminary Results

NAFTA-related changes in trade policies are unlikely to have significantly influenced the sustainability of North American fisheries. Most tariffs were already at or near zero prior to NAFTA. For the primary exceptions (imports of processed products in all three countries and imports of primary fisheries products in Mexico), the associated trade flows are not large relative to catch levels. This is sufficient to establish a nearly minimal effect of NAFTA on fisheries status in the aggregate. However, it leaves open two ancillary questions. First, do *overall* fluctuations in merchandise trade potentially affect the status of fisheries stocks, whether or not these fluctuations are NAFTA-related? Second, are there individual species- and region-specific stocks that may have been sensitive to NAFTA-induced policy changes, thus behaving differently from the aggregate?

For the first of these ancillary questions, it turns out that fisheries trade flows are large relative to production, particularly for Canada and the United States. NAFTA trade flows (imports plus exports) of fish accounted for 7.5 percent of total fish catch in 1997, while world trade flows accounted for 5.4 percent of world fish catch.[10] This leaves open the possibility that changes in exchange rates, relative economic growth, and other aspects of the international economy may affect fisheries status, particularly as they relate North America to Japan and the rest of Asia. Second, our initial efforts to assess NAFTA-region trade effects on region- and species-specific trade reveal some of the limitations of existing data. Data on trade, production, and sustainability of fisheries do not match well, especially the measures of trade and sustainability. The subnational nature of fisheries stocks (e.g., Atlantic/Pacific/Alaska/Gulf) poses particular problems for the analysis. In the final section we address how some of these problems might be at least partially ameliorated by different data or methods.

2 Why the Aggregate NAFTA Effect is Small

2.1 Pre-NAFTA Levels of Protection

Pre-NAFTA average tariffs on fisheries products (HS chapters 3 and relevant parts of 16) for the three NAFTA member countries are reported in Table 1, as per the WTO's Integrated Data Base (WTO- IDB).[11] Mexico maintained the highest average tariff rates on fisheries products prior to NAFTA implementation January 1, 1994. Mexico's average tariffs were similar in HS chapters 3 and 16, at levels of about 20 percent *ad valorem*. The vast majority of tariff lines for both Canada and the United States under chapter 3 were duty-free prior to NAFTA; thus, any tariff change as a result of NAFTA approach negligible at the 2-digit HS level (Canada's average was 0.8 percent, the US average was 1.3 percent). Canada and the United States had significantly higher average tariff levels in chapter 16 (1604–1605) than in chapter 3, at 6.2 percent and 5.7 percent respectively, with peak lines exceeding double digits.

At a first pass, significant tariff effects could be expected for all three countries' imports of processed products in HS1604 and HS 1605, plus Mexico's imports of products in HS 3. This is an approximation, as the US and Canada have a few tariff peaks in HS 3 and a few duty-free items in HS 1604 and HS 1605, but it will give a fair idea as to orders of magnitude. For the purposes of the following discussion we will define "high-tariff NAFTA trade" as imports of processed fish products under HS 1604 and HS 1605 by Canada, Mexico, and the United States from their NAFTA

10 Found at Internet address <http://faostat.fao.org>, retrieved September 11, 2000.

11 Tariff and trade data are reported according to the Harmonized System (HS), the last revision of which was adopted by most WTO countries in 1996 (though some still use HS 1992). The relevant sections of the HS for fisheries are Chapter 3 (fish and crustaceans, molluscs, and other aquatic invertebrates), and in Chapter 16, headings 1604 (prepared or preserved fish; caviar and caviar substitutes prepared from fish eggs), and 1605 (crustaceans, molluscs and other aquatic invertebrates, prepared or preserved). In the text and tables, "Chapter 16" refers to headings 1604 and 1605 only.

partners, plus imports of fish and fish products under HS 3 by Mexico from Canada and the United States.

Table 1. Pre-NAFTA (Pre-Uruguay Round) applied tariffs, HS chapter 3 and 1604–1605

	Chapter 3		Chapter 1604–1605	
Country	**Simple average**	**Range**	**Simple average**	**Range**
Canada	0.8	0 to 6.8	6.2	0 to 15.0
Mexico	19.6	0 to 20.0	20.0	20.0 to 20.0
United States	1.3	0 to 15.0	5.7	0 to 35.0

Source: WTO-IDB database, 1996 tariff schedules.

2.2 Levels of Trade Penetration

Table 2 shows the ratio of total exports to output and total imports to supply for each of the three NAFTA countries, for the period of 1992–95, which includes two pre-NAFTA and two post-NAFTA years.[12] As can be seen from Table 2, fish are a heavily traded commodity for Canada, with about two- thirds of output exchanged for about two-thirds of supply. The sharp increase of the traded share in 1995 is associated with a drop in production with relatively constant trade. Fish are significantly traded for the United States, with about 20–25 percent of output exchanged for about 40 percent of domestic supply. On the other hand, the Mexican fishing economy is relatively closed, with 5–20 percent of output exchanged for about 3–6 percent of domestic supply. The raw numbers (in live weight terms) underlying the share calculation show that Canada and Mexico are consistently net exporters, and the United States consistently a net importer, of fish and fishery products.[13]

Table 3 shows the ratio of NAFTA trade to total trade for each of the three NAFTA countries for the first five years of NAFTA (1994–98).

While the importance of NAFTA partners varies from country to country, it is apparent that the significance of non-NAFTA trade is substantial for NAFTA partners as a whole. About 42 percent of Canada's imports, 50 percent of Mexico's imports and 78 percent of US imports during 1994–98 were from non-NAFTA sources. This limits the effect of easing NAFTA import restraints on total fish and fish products trade of the NAFTA countries. Moreover, when only high-tariff NAFTA trade is considered (imports of HS 1604 and 1605 for all three countries, plus imports of HS 3 for Mexico), the share of trade with a likely NAFTA effect is reduced substantially. The possible downward bias in excluding tariff peaks in HS 3 for Canada and the United States from "high-tariff trade" is probably offset by the fact that the above calculation is in value terms, and high-tariff trade is concentrated in the processed products in HS 16. The average unit value (currency per metric ton) is higher for processed products than for the relatively less processed (mainly fresh, frozen, smoked or salted) products in Chapter 3. Correcting for this factor would give a significantly lower share of high-tariff NAFTA trade as a percentage of total trade (table 4).

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12 These data were the most recent available and provide symmetry between pre- and post-NAFTA time periods.

13 It is not obvious looking at share data alone that Canada is a significant net exporter of fish. This is because the denominator for the exports/production share is much larger than the denominator for the imports/supply share. The data are presented in share terms in order to facilitate the calculation of NAFTA trade shares relative to output.

Table 2. Export and import penetration for North America, 1992–1995

Country	Year	Ratio of exports to production	Ratio of imports to supply*
		Metric tons live weight	
Canada	1992	64.8	50.1
	1993	67.5	59.1
	1994	68.2	63.3
	1995	80.4	80.2
Mexico	1992	6.2	2.3
	1993	7.0	3.7
	1994	5.6	5.8
	1995	17.8	3.2
United States	1992	25.6	41.7
	1993	23.8	40.1
	1994	23.9	41.8
	1995	22.0	40.3

* FAO "supply" equals production plus imports plus stock variations minus exports minus non-food uses. The share of production for non-food uses is about 9% (Canada), 15% (Mexico) and 17% (United States). Over the data period, stock variations are small.

Source: Fish and Fishery Products, 1998, FAO Fisheries Circular No. 821 Revision 4, FAO—United Nations, Rome, Italy.

2.3 The Magnitude of Possible NAFTA Effects

Our overall strategy is to determine whether high-tariff NAFTA trade is large or small relative to levels of fish production, and to use this calculation as a starting point for assessing the effects of NAFTA on sustainability. Using tables 2 and 3 together, the share of high-tariff NAFTA trade relative to total production or supply can be calculated as follows:

$$\text{High-tariff NAFTA exports/production} = \frac{\text{High-tariff NAFTA exports}}{\text{total exports}} \times \frac{\text{exports}}{\text{production}}$$

and :

$$\text{High-tariff NAFTA imports/supply} = \frac{\text{High-tariff NAFTA imports}}{\text{total imports}} \times \frac{\text{imports}}{\text{supply}}$$

It should be noted here that the first term on the right-hand side of each equation (the ratio of high-tariff NAFTA trade to total trade) is taken from HS-based trade data and are in product weight, while the second term in each equation is taken from FAO data and is in live weight equivalent. In general, live weight equivalent exceeds product weight for most products (e.g., it takes a large volume of live fish to produce a smaller volume of fillets, etc).[14] The second term is calculated as a ratio of live weight to live weight, so is not affected by this problem. In the first term, since chapter 3 has whole or "round" fish while chapter 16 doesn't, and since high-tariff NAFTA trade is disproportionately in chapter 16, using the first term as calculated adds an additional upward bias to the share of high-tariff trade expressed entirely in live-weight terms (Table 4).

[14] An exception to this is the addition of oils, sauces, etc., to product weight for products in HS 16. Cans or other packing materials are not counted in product weight.

Table 3. Ratio of NAFTA trade to total trade in fish, molluscs and other aquatic invertebrates (including in processed form), HS 3, HS 1604 and HS 1605

	1994	1995	1996	1997	1998	Period average
Canada			**Percent**			
Export share to:						
Mexico	0.02	0.00	0.01	0.02	0.01	0.01
United States	57.01	52.22	55.03	62.52	67.38	58.83
High-tariff NAFTA trade1	5.75	5.82	6.79	8.24	9.26	7.17
Import share to:						
Mexico	0.33	0.50	0.57	0.43	0.37	0.44
United States	42.25	43.63	40.38	40.40	39.20	41.17
High-tariff NAFTA trade	11.12	10.75	8.69	7.54	7.65	9.15

	1994	1995	1996	1997	1998	Period average
Mexico			**Percent**			
Export share to:						
Canada	0.08	0.10	0.16	0.19	0.06	0.12
United States	95.82	89.46	82.43	81.95	87.20	87.37
High-tariff NAFTA trade*	21.65	19.42	20.35	19.26	16.06	19.35
Import share to:						
Canada	7.82	9.07	6.43	6.41	4.67	6.88
United States	42.16	45.36	49.89	42.34	37.69	43.49
High-tariff NAFTA trade	49.98	54.43	56.32	48.75	42.37	50.37

	1994	1995	1996	1997	1998	Period average
United-States			**Percent**			
Export share to:						
Canada	12.58	14.13	15.68	16.69	20.62	15.94
Mexico	1.65	0.67	0.77	1.28	2.01	1.28
High-tariff NAFTA trade	4.99	4.17	4.16	4.39	6.05	4.75
Import share to:						
Canada	16.52	15.97	16.61	16.38	16.69	16.43
Mexico	5.20	6.43	6.56	6.21	5.75	6.03
High-tariff NAFTA trade	2.28	2.11	2.49	2.67	2.69	2.45

* "High-tariff NAFTA" trade is defined as imports of HS 1604 and 1605 by all three NAFTA countries, plus imports of HS 3 by Mexico, from NAFTA partners.

Source: UN COMTRADE data. Calculated from value data.

Using period averages over 1992–95 for exports/production and imports/supply, and period averages over 1994–98[15] for the ratio of high-tariff NAFTA trade to total trade yields the following:

[15] The use of the earlier years for the exports/production and imports/supply ratio is justified on the grounds not only that it is the most recent data that we had available, but that it is worthwhile to smooth out the annual fluctuations in supply which are significant for this industry. On a closer look, the 1995 increase in the two Canadian trade ratios and the Mexican export ratio looks like an artifact of production fluctuations rather than a NAFTA effect.

Table 4. High-tariff NAFTA trade as a percentage of production and supply

Country	High-tariff NAFTA exports / production	High-tariff NAFTA imports / supply
	Percent	
Canada	5.1	6.9
Mexico	1.8	1.9
United States	1.1	0.1

These ratios are probably biased upward, because for the high-tariff processed fish products in HS 1604–1605 the unit values are higher, and the ratio of product weight to live weight is lower, than in HS 3. Based on these data, any effects of NAFTA tariff changes on the condition of fisheries, either positive or negative, are more likely to be experienced in Canada than in the United States or Mexico.

2.4 Introducing Trade Policies

It remains to determine the impact of removing intra-NAFTA tariffs of about 6 percent on Canadian and US imports in HS 1604–1605 and of about 20 percent on Mexican imports of both fish and fisheries products. We focus on the long-run impact of complete tariff removal and ignore issues of year-by-year phase-in of the NAFTA commitments. The most computationally simple way to do this is to assume that imports are supplied perfectly elastically by each NAFTA exporter, so that the percentage change in imports is equal to the tariff cut multiplied by an elasticity. This procedure also has the advantage that it yields an upper-bound estimate of the largest possible change in trade attributable to the tariff cut.[16]

Trade-weighting each of the relevant trade flows by country and chapter gives a relevant high-tariff NAFTA trade of about 10 percent for US exports, about 20 percent for Mexican imports, and about 6 percent for the other flows. It thus remains to choose an elasticity. Long-run estimates of the price elasticity of import demand, either in aggregate or for individual commodities, generally cluster in the range of -0.5 to -2.0, meaning that a 1 percent drop in the import price (arising, under our assumptions, from a 1 percent tariff cut) gives rise to a 0.5 to 2 percent increase in imports.[17] Estimates specific to imports of agricultural commodities and foodstuffs in the NAFTA countries are also in this range, though some estimates of the import elasticity of demand for Mexican consumer goods exceed -3.[18] To further impose a "precautionary principle" on our estimates, we choose an import elasticity of demand of -4, and assume further (and unrealistically) that all increased exports to NAFTA countries must be met by increased production and further depletion of the fishery, rather than simply diverted from domestic or non-NAFTA markets. This will again give an upper bound of NAFTA effects. This yields the following final "upper bound" effect of NAFTA tariff cuts relative to domestic production and supply (Table 5):

[16] If fish are difficult to catch, for example, due to scarcity from over-fishing, and if exports to NAFTA markets are a significant share of production, the assumption of perfectly elastic import supply is unrealistic. Increased export demand leads to markedly greater fishing effort causes prices to rise, so that the increase in imports is smaller. Indeed, in overfished fisheries one can get the case of a backward-bending supply curve, so that greater fishing effort leads to smaller catch, but at higher prices (see e.g., Scott Gordon (1954), "Economic Theory of a Common Property Resource—the Fishery," *Journal of Political Economy* vol. 62 (April), pp. 124–142). In some extreme cases, backward-bending fish supply can lead to smaller trade as a result of lower tariffs. The assumptions used here lead to the largest possible hypothetical trade and production increases as a result of tariff reduction.

[17] Morris Goldstein and Mohsin S. Khan (1985), "Income and Price Effects in Foreign Trade," ch. 20 in R.W. Jones and P.B. Kenen, *Handbook of International Economics Vol. II*, Amsterdam: Elsevier Science Publishers, pp. 1042–1105.

[18] W. Charles Sawyer and Richard L. Sprinkle (1999), *The Demand for Imports and Exports in the World Economy.* Aldershot, England: Ashgate Publishing Co., pp.15–116 ff.

Table 5. NAFTA-induced changes in fish and fishery products trade, as a percentage of production and supply

	Increased exports / production	Increased imports / supply
Country	**Percent**	
Canada	1.2	1.7
Mexico	0.4	1.5
United States	0.4	0.02

After all attempts to obtain large NAFTA effects, the final results approach negligible. Moreover, in the case of Mexico (for which the ratio of production to supply is about 4:3), the significant trade liberalizations imposed by NAFTA may have relieved pressure on fisheries in the aggregate by permitting substitution of imported fish for the domestic catch. In the case of Canada and the United States, the fact that most of the trade is at low stages of processing (and thus, at low tariffs) and fairly little is with Mexico, determines the result.

3 Additional Data Issues

Having established the *de minimis* effect of NAFTA on North American fisheries as a whole, we now turn to the effect on particular stocks of fish. It could be that a large part of the catch of a particular type of fish in a particular location (e.g., cod in the Canadian North Atlantic) is exported to a NAFTA market which is protected with a significant tariff specific to that product. If that particular stock is over- fished, then there may be a localized NAFTA effect of concern. Moreover, even in the absence of NAFTA effects *per se*, increases and decreases in export demand more generally may link the condition of North American fisheries to macroeconomic conditions outside the NAFTA region, and the health of fisheries in one part of the world may affect that in other parts via effects transmitted through international trade.

Since both NAFTA effects and non-NAFTA trade effects may differ for different fish stocks, it is worthwhile to examine data at the level of individual varieties of fish in individual locations. This necessitates matching of data on protection levels, trade, production, and sustainability, which arise from different sources and use different definitions. Data from various sources must be aligned with one another by means of concordances. Such concordances, which are a staple of applied work in international trade, are invariably imperfect. Concordance problems are particularly severe in trade-environment research since data on environmental indicators are frequently collected for a different audience, and use different categories, than data on economic indicators. At the present stage of our research, we find that data-matching problems severely limit the ability to make statements about the relationship between particular fish stocks and international trade. Different methods and data may potentially alleviate some of these problems.

International trade and tariff data are collected in most countries according to the Harmonized System. This system provides for a certain amount of international comparability, down to the six-digit HS tariff line. All countries using the 1996 revision of the HS will distinguish fresh or chilled trout (0302.11) from fresh or chilled salmon (0302.12). However, finer categories in the Harmonized Tariff Schedule of the United States (HTS), such as 10-digit classifications, may be defined differently by different countries. For example, farmed Atlantic salmon (0302.12.00.03), pink (humpie) salmon (0302.12.00.32) and sockeye (red) salmon (0302.12.00.42) in the US HTS may differ from classifications in the Canadian 10-digit tariff lines. Similarly, smelts (0302.69.20.10), cusk (0302.69.20.21), pollock (0302.69.20.23) and pike (0302.69.20.52) are defined at levels which are not internationally comparable, but which may be distinct in production or sustainability data. Moreover, a significant volume of products at a higher degree of processing which appear in the trade data (e.g., fish sticks) cannot be assigned to any species. In the absence of specific information on industry practices, these products cannot be readily correlated with production or sustainability data at all.

We obtained North American production data from the United Nations FAO's online database and US sustainability data from the US Department of Commerce NOAA publication *Our Living Oceans* as described above. Concording these data with trade data presents further problems. The most widely available trade data aggregate imports and exports for the whole nation, while production and sustainability data are generally for specific waters. Moreover, the definition of regions varies from source to source. For example, NOAA's "Pacific Coast" fisheries are divided by FAO into "Northeast Pacific" (which also includes NOAA's "Alaska" fisheries), and "Eastern Central Pacific" (which also includes part of NOAA's "Western Pacific"—Hawaii and small US islands), the rest of which matches FAO's "Western Central Pacific."

We adopted the strategy of grouping fish and marine invertebrates into twenty broad categories, relying primarily on FAO groupings. Matching the production and sustainability data is relatively straightforward. However, we had little in the way of stock measures for freshwater fish. Also, as will be seen below, many of the fish stocks which have been identified by NOAA as declining do not concord well with FAO production data.[19]

4 Preliminary Tabulations on Specific Fish Stocks

As stated above, we proceeded by gathering the available data on trade, production and sustainability into 22 broad categories of fisheries, as described in the Appendix. These include one broad catchall category for unconcorded fish (No. 22) and two small categories consisting mostly of freshwater and nearshore fish (No. 8 and 9), which fall outside of the scope of our source of sustainability data which is primarily ocean-specific. The latter is not a severe limitation since the large bulk of fisheries production and trade consists of marine fish. We do only partial analysis of the nineteen remaining categories.

Tables 6 and 7 categorize different types of fish according to two different measures of sustainability; long-term potential yield (LTPY) and the utilization rate. LTPY is defined as the maximum long-term average catch that can be achieved from a fisheries stock, and is analogous to the concept of maximum sustainable yield (MSY) in fisheries science.[20] The degree of utilization describes the current level of fishing effort compared with the appropriate levels necessary to achieve LTPY.[21] Broadly, stock levels below LTPY and utilization rates labeled "over" indicate unsustainable use of the resource, while stock levels above LTPY and underutilized stocks indicate resources which could be exploited more intensively without affecting sustainable output. The utilization rate fluctuates more from year to year than does LTPY and can be affected, e.g., by a single year's new fishing restrictions.

An analysis of the FAO sustainability data indicates that a large number of stocks of environmental concern (22 of the 73 below LTPY, and 13 of the 54 over-utilized stocks) could not be readily concorded with trade or production data. There are no trade data at all for most of these fish species, many of which are reef fish in the Gulf of Mexico and Caribbean. Moreover, the limitations of comparing national trade data with ocean-specific production or sustainability data are revealed.

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[19] This problem could be partially alleviated in future research by using US production as well as sustainability data. Our original choice to assemble FAO data was driven by a desire to produce comparable indicators for the entire NAFTA region; but this is undermined by the apparent lack of comparable NAFTA-wide sustainability data.

[20] *Our Living Oceans*, p. 5.

[21] *Our Living Oceans,* p. 14.

Table 6. Number of North American fisheries within each stock level relative to long-term potential yield (LTPY) for the 22 data concordance categories

Category	Below LTPY	Near LTPY	Above LTPY	Unknown
Shad and sturgeon	4	1	0	0
Flatfish	7	8	4	4
Cod, hake, haddock, cusk, pollock	9	4	1	1
Herring, sardines, anchovies	0	5	1	1
Tuna	3	7	2	2
Mackerel	1	0	2	4
Sharks, rays, chimeras	2	4	1	0
Tilapia and other chiclids	4	4	3	1
Eels	3	1	2	2
Salmon, trout, smelts	4	5	1	5
Lobster and rock lobster	1	0	2	2
Shrimp and prawns	3	8	0	6
Abalone and conches	2	1	0	0
Oysters	1	2	0	1
Mussels	0	1	0	0
Scallops	2	1	0	1
Clams	1	6	0	3
Squid, cuttlefish, octopus	0	4	0	3
Sea urchins and other echinoderms	1	2	0	2
Other	38	20	5	33

Source: *Our Living Oceans,* 1999, NOAA—Department of Commerce

Generally, stock levels and degrees of utilization vary widely from fishery to fishery.[22] Many varieties which are depleted in the North Atlantic or the lower-48 Pacific are abundant or underutilized in the Alaskan Pacific (which accounts for approximately half of the US catch) or in the Western Pacific.

Appendix Tables 2, 3 and 4 provide preliminary calculations of the ratio of exports to output and imports to apparent consumption[23] for the various fish categories defined in Appendix Table 1. These are given for US trade with the world, Canada, and Mexico relative to US production. The degree of exposure of fish stocks to both NAFTA and non-NAFTA trade varies widely by type of fish. A significant problem with the data here is that because production and trade come from different sources, it is possible for exports to exceed output, giving an export/output ratio of over 100 percent and usually, an imports/apparent consumption ratio which is negative. For a significant number of the fish stocks, the calculation gives nonsensical results. This result is all the more surprising considering the fact that the FAO data are in live-weight terms while the US trade data are in production-weight terms, which ought to bias the export/output ratio downward. Based on these results, it is difficult to conclude, for example, that more intensive exploitation of a category of fisheries (classified by fish type) for export is more or less associated with sustainability.

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22 *Our Living Oceans*, p. 11, table 3.

23 Defined as production plus imports minus exports, apparent consumption is close to (but not identical with) “supply” as it appears in the FAO data.

Table 7. Number of North American fisheries within each utilization level for the 22 data concordance categories

Category	Under	Full	Over	Unknown
Shad and sturgeon	0	2	3	0
Flatfish	9	7	6	2
Cod, hake, haddock, cusk, pollock	1	8	5	0
Herring, sardines, anchovies	2	4	0	
Tuna	4	3	3	4
Mackerel	3	3	1	0
Sharks, rays, chimeras	1	2	2	4
Tilapia and other chiclids	0	9	3	1
Eels	0	4	2	2
Salmon, trout, smelts	1	10	0	4
Lobster and rock lobster	0	1	2	1
Shrimp and prawns	0	10	0	7
Abalone and conches	0	1	2	0
Oysters	0	2	1	1
Mussels	0	0	0	1
Scallops	0	1	2	1
Clams	2	5	1	2
Squid, cuttlefish, octopus	0	3	1	3
Sea urchins and other echinoderms	0	2	1	2
Other	13	27	26	39

Source : *Our Living Oceans* (1999), NOAA – USDOC.

5 Potential Extensions

The fact that North American fisheries trade is primarily extra-NAFTA rather than intra-NAFTA suggests that there are important linkages between the international economy and fisheries sustainability which may well be larger than those arising from the NAFTA agreement itself. The largest part of NAFTA exports are to Japan and other Asian economies. A sustained appreciation in the yen, or a decline in the productivity of Asian Western Pacific fisheries which raises Asian prices, could feed back into overfishing of North American fisheries via increased exports. Similar linkages likely exist with Europe and Latin America, and are probably more interesting than NAFTA effects, *per se*.

Some of the problems in this preliminary work could be resolved with different data. Many types of fish which are not isolated in the FAO data appear in NOAA's own production data,[24] though this would not resolve the absence of many types of fish of environmental concern from the trade data. Improved internationally comparable sustainability data would help.[25] Another promising line of inquiry involves using US export data by port to match trade data with locations of specific fisheries.

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[24] *NOAA, Fisheries of the United States 1998* (July 1999). Washington, DC: US Department of Commerce.

[25] FAO (1997), *Review of the State of World Fisheries Resources: Marine Fisheries*, downloadable at <http://www.fao.org/fi/publ/circular/c920/c920-1.asp>, provides a convenient overview of sustainability indicators for broad fish categories for all the world's oceans. These are not country-specific, however, preventing concordance with trade data.

Appendix

Table 1. The 22 data categories defined for the concordance of trade and production data used in this study

Nº	Species included in the data category
1	Shad and sturgeon
2	Flatfish (flounder, sole, etc.)
3	Cod, hake, haddock, cusk, and pollock
4	Herring, sardines, anchovies
5	Tuna, skipjack, bonito
6	Mackerel
7	Sharks, rays, chimeras
8	Tilapia and other cichlids
9	Eels
10	Salmon, trout, and smelts
11	Ocean perch, bass, other redfish
12	Crab and sea-spiders
13	Lobster and rock lobster
14	Shrimp and prawns
15	Abalone and conches
16	Oysters
17	Mussels
18	Scallops
19	Clams
20	Squid, cuttlefish, octopus
21	Sea urchins and other echinoderms
22	Other

Table 2. US trade penetration ratios with the world, 1994–1996

	Exports/output			Imports/apparent consumption		
	1994	1995	1996	1994	1995	1996
Data categories	Percent					
Shad and sturgeon	0	0	0	5	6	4
Flatfish	71	77	63	37	48	30
Cod, hake, haddock, cusk, pollock	6	26	22	9	12	13
Herring, sardines, anchovies	5	8	7	3	4	4
Tuna	18	21	24	57	61	64
Mackerel	104	213	218	102	584	-422
Sharks, rays, chimeras	63	89	63	18	45	15
Tilapia and other cichlids	2	1	2	68	62	73
Eels	1556	4837	2786	-7	-5	-6
Salmon, trout, and smelts	116	105	115	-454	160	501
Ocean perch, bass, other redfish	0	1	1	9	8	6
Crab and sea-spiders	179	134	98	-11	-40	86
Lobster and rock lobster	403	510	522	-44	-31	-26
Shrimp and prawns	56	58	46	83	82	77
Abalone and conches	24	49	35	23	31	20
Oysters	4	4	3	4	3	3
Mussels	17	17	21	36	38	50
Scallops	20	20	21	33	30	35
Clams	1	1	1	2	2	3
Squid, cuttlefish, octopus	64	68	70	49	50	52
Sea urchins and other echinoderms	43	45	55	13	20	30

Table 3. US trade penetration ratios with Canada, 1994–1996

	Exports/output			Imports/apparent consumption		
	1994	1995	1996	1994	1995	1996
Data categories	Percent					
Shad and sturgeon	0	0	0	5	4	3
Flatfish	2	2	2	10	9	7
Cod, hake, haddock, cusk, pollock	0	1	1	2	2	3
Herring, sardines, anchovies	1	1	2	2	2	2
Tuna	1	1	3	2	2	2
Mackerel	7	11	12	29	122	-86
Sharks, rays, chimeras	2	3	2	8	27	10
Tilapia and other cichlids	1	0	0	0	0	0
Eels	7	24	15	-2	-1	-3
Salmon, trout, and smelts	5	6	9	-300	92	240
Ocean perch, bass, other redfish	0	0	0	7	5	4
Crab and sea-spiders	1	2	2	-7	-16	37
Lobster and rock lobster	22	25	27	-29	-19	-16
Shrimp and prawns	5	5	5	1	2	3
Abalone and conches	0	0	0	0	0	0
Oysters	0	0	0	0	0	1
Mussels	6	5	4	10	15	18
Scallops	1	1	1	11	9	8
Clams	0	0	0	1	1	1
Squid, cuttlefish, octopus	4	6	4	0	0	2
Sea urchins and other echinoderms	3	3	3	10	17	26

Table 4. US trade penetration ratios with Mexico, 1994–1996

	Exports/output			Imports/apparent consumption		
	1994	1995	1996	1994	1995	1996
Data categories	Percent					
Shad and sturgeon	0	0	0	0	0	0
Flatfish	0	0	0	0	0	0
Cod, hake, haddock, cusk, pollock	0	0	0	0	0	0
Herring, sardines, anchovies	0	0	0	0	0	1
Tuna	1	1	0	0	1	1
Mackerel	1	1	0	1	14	-33
Sharks, rays, chimeras	1	0	0	4	5	2
Tilapia and other cichlids	0	0	0	0	0	0
Eels	13	13	2	0	0	0
Salmon, trout, and smelts	0	0	0	0	0	1
Ocean perch, bass, other redfish	0	0	0	0	0	0
Crab and sea-spiders	0	0	0	0	-1	5
Lobster and rock lobster	0	0	0	-1	-1	-1
Shrimp and prawns	3	1	1	7	10	9
Abalone and conches	2	0	1	2	2	1
Oysters	0	0	0	0	0	0
Mussels	0	0	1	0	0	0
Scallops	0	0	0	0	0	2
Clams	2	0	0	0	0	0
Squid, cuttlefish, octopus	2	0	1	1	3	2
Sea urchins and other echinoderms	0	0	0	1	1	1

The Forestry Industry in the State of Chihuahua: Economic, Ecological and Social Impacts Post-NAFTA

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Abstract

This paper examines how NAFTA has influenced the forestry and forest product industries in the northern Mexican state of Chihuahua. It also explores how these changes are affecting the forests, environment and indigenous peoples of the Sierra Tarahumara. The Sierra is an area rich in biodiversity and cultural traditions, but also one plagued by sociopolitical conflict, much of which centers around the forestry industry. Many of these conflicts have become more acute since 1993.

Wood production, particularly of pine, has increased substantially in Chihuahua since Mexico's entry into NAFTA, paralleling both an increase in exports of wood and wood products from Mexico and an increase in imports, particularly from the US. During this same period, there has been significant consolidation of the forestry and forest product industries in Chihuahua and a large increase in the number of private sawmills. Forest ejidos, however, have generally remained impoverished suppliers of raw wood, with pressure on the forests intensifying greatly over the last few years. Historically, the sociopolitical structure that controls wood production in forestry ejidos—a structure under which a few powerful leaders profit but the majority of ejido residents receive very little compensation for the wood they own in common—has persisted and adapted to changing times.

Pre-NAFTA tariffs on wood and wood products will be progressively reduced to zero by 2003 under NAFTA, though most US and Canadian tariffs were already at or near zero and most Mexican tariffs were fairly low (0 to 15% in most cases). The major forest products industries operating in Chihuahua contend that reduction of Mexico's tariffs will not affect their competitive positions or production levels significantly. The trade data, however, show that imports of pulp and paper products from the US into Mexico have increased rapidly since NAFTA took effect. Chihuahua producers are thus under pressure to keep product prices low in order to maintain their share of the Mexican market. This dynamic could put pressure on the forest products industry in Chihuahua to oppose environmental regulations that increase its cost of doing business by either making the raw wood more expensive or by imposing additional environmental controls on pulp and paper operations.

NAFTA's provisions regarding non-tariff trade barriers could adversely affect the ability of Mexico to create and/or foster development of markets for sustainably-produced wood and wood products. This is particularly true of the NAFTA rules for adopting product standards and for government purchasing programs. Much depends on how these provisions are ultimately interpreted and applied. Of more immediate concern, however, are recent interpretations of NAFTA's Chapter 11 investment provisions, particularly the Metalclad case. If this type of case is allowed to stand, it would pose a substantial threat to Mexico's ability to adequately regulate forestry or forest product operations of companies from the US or Canada.

In the last few years, indigenous leaders and others have filed hundreds of citizen complaints about illegal cutting and other unsustainable forestry practices in the Sierra Tarahumara. Government response to these complaints, and enforcement of forestry and environmental laws in the Sierra, has, on the whole, been inadequate. Indigenous leaders, peasants, nongovernmental organizations, the Diocese of the Tarahumara and others are now asking for public audits of forestry operations. They are also seeking comprehensive environmental studies to assess the damage being done by these forestry operations and provide the basis for a land management system that protects the forests, the environment and the longer-term viability of the forestry industry itself. A CEC Article 13 study could assist in this regard. Forestry ejidos in the Sierra will require substantial technical and financial resources, including market development assistance, to move toward more sustainable forestry. The current corrupt ejido control system that dominates forestry practices in many Sierra ejidos will also have to be addressed if real progress is to be made.

1 Introduction and Methodology

1.1 Methodology

This report applies the CEC's *Final Analytic Framework for Assessing the Environment Effects of NAFTA* to the forestry and forestry products sectors[1] in the State of Chihuahua, Mexico. While the report does not cover the furniture-making and construction industry per se, the role of these sectors as the ultimate users of wood is considered.

The report examines the applicability of three of the hypotheses contained in the CEC's final analytic framework to the Chihuahuan forestry and forest products industries. As applied to these industries, the hypotheses give rise to the following questions:

- Does economy-wide liberalization associated with NAFTA intensify competitive pressures for companies and individuals in the forest and forest product industries to reduce the component of their production costs associated with environmental compliance? As a corollary question, is government enforcement of environmental regulations adequate to prevent adverse environmental effects that might be associated with increased production triggered by NAFTA or related factors?
- Has NAFTA merely led to a reorganization of the forestry or forest product industries, concentrating production in Chihuahua in sectors where it takes place most efficiently, or do these changes in the industry have further negative implications for social organization and biodiversity of the Sierra Tarahumara's ecosystems?
- Do or could NAFTA's liberalized rules of trade impede or enhance the implementation of sustainable forestry practices in Chihuahua?

In preparing the report we relied on government documents,[2] literature sources and the considerable "on the ground" experience of the *Comisión de Solidaridad y Defensa de los Derechos Humanos, A.C.,* (COSYDDHAC) in its work with indigenous Tarahumara forestry ejidos in Chihuahua.

1.2 Report Organization

Chapter 2 examines the broader context—including environmental, legal, economic, and geographic factors—that influence the forestry and forestry products sectors in Chihuahua. Chapter 3 explores the specific potential impacts that NAFTA could have on these sectors and on the regulation of their effects on the environment. It also inquires whether NAFTA rules and practices do or could impede the implementation of more sustainable forestry practices in Chihuahua. Chapter 4 examines post-NAFTA trends in trade of wood and wood products and profiles developments in the wood processing and pulp and paper sectors in Chihuahua, as well as key factors underlying these trends.

The links between changes in production patterns and social and environmental consequences are discussed in Chapter 5. These links include the degree to which the underlying sociopolitical structure in forest ejidos contributes to unsustainable logging practices, the response of the Sierra's indigenous peoples to perceived threats to their forests, and how the government has—or has not—acted to adequately enforce environmental and forestry laws. Chapter 6 presents the limited available information on environmental indicators that can be used to quantify the impacts of changes in these industries as they operate in Chihuahua. These indicators include deforestation, loss

[1] Including logging operations, sawmills, and manufacturing of particleboard, plywood, molding, wood crates, consumer and industrial pulp and paper products.

[2] The government documents come from several Mexican agencies, including Semarnap, Profepa, Secofi and the *Banco de Comercio Exterior*.

of biodiversity, impacts on water quality and reservoir sedimentation through erosion of forest soils. Conclusions and recommendations are presented in Chapter 7.

2 Broader Context: Geographic, Environmental, Economic, Social, and Political Background

Many of the geographic, environmental, economic, social and political factors that influence the forestry sector in the Sierra Tarahumara have a long history and are not directly related to NAFTA itself. This chapter provides an abridged guide to some of those factors.[3]

2.1 Geography and Environment

The state of Chihuahua accounts for 12.6% of Mexico's landmass and is located in the northernmost extreme of the country, bordering Texas and New Mexico. While most of the state is arid and typified by the Chihuahuan Desert region, the Sierra Madre Occidental, the southward continuation of the Rocky Mountains, covers about 53,400 square kilometers, or approximately 25% of the state's total landmass (Map A). The Sierra Madre Occidental in Chihuahua, sometimes called the Sierra Tarahumara, contains two well-defined topographic regions, each with its own climate, wildlife, and demographic distribution patterns. One region, the highlands, has cool, temperate pine-oak forests, including many species with commercial value, such as the ponderosa, arizonica and chihuahuana pines. The lowlands, toward the west, have a drier, hotter tropical climate and deep, rugged canyonlands. The State of Chihuahua has 7.6 million hectares of forested lands, more than any other state in Mexico, though the extent of its forests have been reduced dramatically due to various factors, including logging.

Not surprisingly, both the highlands and lowlands give rise to unique habitats and together are considered one of the most biodiverse regions of the North American continent.[4] One study found that the region has 4,000 species of flora, hundreds of medicinal and edible plants, and 438 vertebrate species; and 268 species of birds (Ceballos 1993). Many species of birds, reptiles and amphibians are endemic to the region. Some of these species are already extinct, and several are endangered, including the Thick-billed Parrot. The region is also important hydrologically, with the forests capturing precipitation, recycling nutrients and helping form stable waterways that benefit enormous river basins. The water that originates in the Sierra feeds into five major river basins. These include the headwaters of the Yaqui and Mayo Rivers, which flow west into Sonora; the headwaters of the Fuerte and Sinaloa Rivers, which flow west into Sinaloa; and headwaters of the Conchos River, which flows north to join the Rio Grande/Bravo at Ojinaga, just upstream of Big Bend National Park. Much of the farming that occurs in Texas, Coahuila, Nuevo León and Tamaulipas—as well farming in the Conchos basin itself—depends heavily on the flow Conchos River and, consequently, upon what happens in the Sierra Madre.

2.2 Peoples and Land Ownership

Most of the Chihuahua's population is located in the central plains, within the Cd. Chihuahua or the border city of Juárez. The Sierra Madre region itself is sparsely populated. According to 1990 figures, 280,000 individuals live in the 19 municipalities making up the Sierra Tarahumara, about 20% of whom are indigenous peoples with their own unique culture (INEGI 1994). The largest of

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3 Much of the information presented in this chapter is derived from a previous COSYDDHAC/TCPS report on the impacts of the forestry industry in Chihuahua (COSYDDHAC/TCPS 2000).

4 Along with adjoining mountains in southern Arizona and New Mexico, the Sierra Madre Occidental in Chihuahua has been nominated by a group of scientists for IUCN designation as a center of "mega-diversity."

these groups is the Tarahumara, who call themselves Rarámuri in the highland region and Rarómari in the lowland region. Other indigenous groups include the Tepehuán, Guarojíos and Pima. These indigenous peoples coexist with mestizos (mixed blood), although the mestizos tend to occupy the region's main urban centers and towns within the ejidos, while the indigenous people tend to live in isolated hamlets that are spread throughout the ejidos. The ejido is a form of social property, the result of the 1910 Mexican revolution and subsequent land reforms.[5]

About 40 percent of all land in Chihuahua is considered social property, and about 17.5% of this lies in the Sierra Madre Occidental. As in other areas of Mexico, the forests themselves are mainly owned as social property by ejidos. Forest ejidos (those ejidos with a large portion of their land being forest) were given jurisdiction of the forest resource and arable lands within their property boundaries. Forest ejidos presently account for more than 90% of the state's timber production.

In November 1992, before NAFTA was signed, President Carlos Salinas de Gortari introduced a series of fundamental reforms of the Mexican Constitution, including Article 27, dramatically altering the traditional, social ownership of land and management of natural resources. The modifications of Article 27 allowed ejido land to be rented or sold to individuals or to foreign or domestic corporations. Ejidatarios could now sell their private forest holdings to whomever they choose or offer their land rights as collateral for loans. In addition, the 100-hectare limit on private forestry holdings was eliminated, and replaced with a limit of 20,000 hectares for development of forest management areas or forestry plantations. In making these changes, the Mexican government was both seeking a way for ejidatarios to increase productivity on their lands and to attract direct investment from domestic and foreign corporations, primarily in anticipation of NAFTA (Cornelius and Myhre 1998).

Despite the Article 27 changes, in the Sierra Tarahumara most ejidos have continued to operate as traditional ejidos, and have not attempted to turn their social property into individual parcels. In fact, through April of 1999, only 33 of the 1004 ejidos of the state of Chihuahua had requested "pleno dominio."[6] Only 4 had actually completed the process known as PROCEDE to certify and title their land, and then voluntarily dissolve the ejido. In all of the Chihuahuan *indigenous* forest ejidos, in fact, farmers have used the PROCEDE process to reaffirm the social ownership of land. Nonetheless, the changes in Article 27 mean the forests are subject to the possibility of outside direct investment through the selling or leasing of ejido lands.

2.3 Economic History of the Sierra

Given its abundant natural resources (forests, minerals and water), the Sierra Tarahumara region has historically attracted attention as an economic niche for the extraction of raw materials. Mining was the first industry in the Sierra, developing during the eighteenth and nineteenth centuries. The forests provided needed raw materials for this activity, but forestry itself did not become a primary economic activity until the second half of the nineteenth century. Early in the twentieth century, the Chihuahuan forests became a source of raw material for US industry and for fuel for new steam engines which crisscrossed the Sierra. Large concessions were granted to US lumber and railroad companies during the Porfirio Díaz era in Mexico by Chihuahuan governor Enrique Creel. Later, these lands would be expropriated and given to national lumber companies following the 1910 Mexican Revolution. During the 1950s and 60s, the Executive Branch in Chihuahua gave concessions for harvesting trees to companies such as *Bosques de Chihuahua, Ponderosa de Chihuahua, Chihuahua Industrial, Comercial e Industrial Pacífico* and *González Ugarte.*

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[5] The revolution resulted in the system of land reform laid out in Article 27 of the Mexican Constitution of 1917. Article 27 broke up foreign-owned haciendas and limited individual holding to no more than 100 hectares of land for most agricultural purposes.

[6] This is the process by which the social property of the ejido can be converted to individually held parcels.

In 1952, a large paper mill (*Celulosa de Chihuahua,* owned by the *Grupo Chihuahua)* was opened in Anáhuac. That same year a concession over 613,000 acres of forested land was given to the company *Bosques de Chihuahua* to supply the Anáhuac plant, as well as other industries. In the 1970s, this policy of granting concessions to national companies was changed as land was redistributed to ejidos. For example, in 1971, President Luis Echeverría rescinded the *Bosques de Chihuahua* concession in the municipality of Madera, turning it over instead to 1,455 farmers. Slowly, land was turned over to ejidos. Some of the forestry business was turned over to state-controlled enterprises which provided technical forestry services to the ejidos, led by the company *Productores Forestales de la Tarahumara* (Profortarah). Private companies were forced to negotiate with ejidos, private landowners, or these state-owned companies to find timber supplies. Both the large concessions and the state-controlled production led to over-logging and poor management of the forests.

In 1989, Profortarah ceased operation, turning its profits over to nine unions of ejidos, which were supposed to process the wood and mill it into beams and boards. In the last ten years, many of these "social" production businesses have failed, and ejidos have largely been supplying raw wood to privately-owned sawmills, forestry companies and pulp manufacturers. As Chapter 4 details, there has been significant reorganization of the Chihuahuan forestry industry in the last few years, with large multinational companies consolidating their position in the Chihuahuan forestry and forest product sectors. Today, Chihuahua is second only to its neighbor Durango in total wood production, and Chihuahua as a state earned more money from forestry products than any other state in Mexico during 1997 (Semarnap 1998A, 19).

While the forests of Chihuahua have generated profits for the owners of lumber companies and paper and pulp sector, ejidos and indigenous communities have received little benefit from their forest resources. Thus, while ejidos have historically controlled the forest's timber, it has only been a source of subsistence income, with the ejidatario entitled to an annual dividend from the sale of the wood (see Chapter 5 for further discussion).

The forests are important to their inhabitants in ways other than as a source of commercial timber. They provide the construction materials for their dwellings and are the source of many edible plants and medicinal herbs, several of which are endemic to the region and depend on a health ecosystem. Even though some indigenous people participate in forestry activities, the majority cultivate corn, beans and vegetables, and some have small herds of goats and cattle. Some residents emigrate to work in the fields of nearby states of Sinaloa and Sonora, or work in larger cities in maquilas or the construction industry. Still others have sought better living conditions in the US. Finally, in the last 20 years, the cultivation of marijuana and opium poppy has spread to some areas of the Sierra. Some farmers have supplemented their income by cultivating these crops, despite the risk of being punished by authorities.

2.4 Governmental Regulation and Support of Forestry

2.4.1 Forestry Regulation

Mexico has been regulating forestry since 1884, through a series of federal laws. While a complete history of these efforts is beyond the scope of this report, certain more recent developments in forestry legislation—both before and after NAFTA—are particularly relevant. Mexico's 1986 Forestry Law was an effort to strengthen regulation of the forestry industry and reduce its potential adverse impacts on the environment. The law assigned institutional responsibilities for forestry to two main government agencies: the Ministry of Agriculture and Water Resources (SARH) and the Ministry of Social Development (Sedesol). Within SARH, the Undersecretary of Forestry Development (SDF) was responsible for the regulation of silviculture, soil conservation, and reforestation; the inventory of Mexico's forest resources; promotion of research; and management of certain forested public lands (ELI 1998, 43). SARH staff worked closely with foresters and engineers of commercial and quasi-governmental entities to inventory timberlands and regulate timber harvests. Meanwhile, Sedesol was the central environmental ministry. Within Sedesol, the Institute of Ecology (INE) had general responsibility for setting standards for environmental and natural resource protection. The INE also required companies to submit forest management plans for all forestry projects.

The 1986 Forestry Law introduced more systematic environmental regulation for the forestry sector, including requirements for forest management plans and permits for transport, processing and sales of wood. However, in response to criticisms that the law was overly burdensome for the forestry industry, a new law was enacted in 1992, while NAFTA was being negotiated. The 1992 reforms represented a concerted effort to greatly reduce regulation of forestry operations. It deregulated controls on logging and left "forest management plans" as the main regulatory mechanism for most forest projects.

The 1992 law did require applicants seeking permission to harvest timber to either hold title to the land or hold a legal right to harvest its timber. Among other requirements, the forest management plans had to be written by qualified foresters, delineate the location of plots, describe the physical and biological characteristics of the forest ecosystem, identify the techniques that would be used for extraction, forestation, or reforestation, and specify the measures that would be used conserve and protect natural habitat (World Bank 1995, 71). The 1992 law, however, deregulated the transportation of forest goods, an activity previously controlled by documentation (*guías forestales*) that served as both a permit and a way to calculate the volume of wood being extracted. Under the 1992 law, the only requirement was the appearance of a hammer mark on the logs: each ejido had its own stamp and the mark was supposed to prove that the wood had been legitimately cut. This approach, however, made the statistical documentation of annual wood production virtually impossible and is believed to have increased illegal logging (Profepa 1998).

The changes that began in 1992 with the reformed Forestry Law, continued in 1994 (just after Mexico's entry into NAFTA) with reform of Mexico's federal environmental law (*Ley General de Equilibrio Ecológico y Protección Ambiental*—LGEEPA) and culminated in 1997 with further reforms of the Forestry Law. These reforms combined the forest management functions of SARH with the general environmental responsibilities of Sedesol into a new, centralized Ministry of Environment, Natural Resources and Fisheries (Semarnap). Semarnap was charged with: (a) defining the principles for ecological policy and ecological management; (b) preservation, restoration, and improvement of the environment; (c) protection of natural areas, wild and aquatic flora and fauna; and (d) prevention and control of air, water and land pollution. These duties also included managing and protecting Mexico's forestry resources.

The 1994 reforms also created the Attorney General's Office for the Protection of the Environment (Profepa) to enforce environmental regulations, investigate violations, administer justice and respond to "popular complaints." Tarahumara and Tepehuanes of the Sierra have made use of popular complaint provisions in the federal environmental law to defend their forests (See Chapter 5).

On April 16, 1997, President Ernesto Zedillo's administration presented the Mexican Congress with new reforms to the Forestry Law. The 1997 reforms focused on solving the problems of illegal cutting (*tala ilegal*), unregulated commercial forest plantations and technical forestry services. The new law reestablished some regulations that had been eliminated in 1992 by requiring documentation and control of activities such as harvesting, transport, storage and processing. It is important to note, however, that many of the measures to implement the changes contained within the 1997 Forestry Law were only put in force in Chihuahua in February 2000. Table 1 summarizes relevant legislative changes.

Table 1. Legislative changes affecting the forestry sector

Legislation	Principal relevant changes
Article 27 of the Mexican Constitution and Agricultural Law (1992)	* End agricultural land distribution programs. * Introduce means to promote private, corporate investment in the countryside. * Allow for the possibility of privatizing social property (ejido and communal property).
Article 27 of the Mexican Constitution and Forestry Law (1992)	* Introduce the concept of sustainable development. * Eliminate regulations for the transport and sale of forestry products. * Privatize technical forestry services.
New Federal Environmental Law (1994)	* Incorporate forestry management responsibilities into new over-arching environmental agency, Semarnap. * Create Profepa to investigate and resolve environmental complaints and enforce environmental regulations.
Art. 4 of the Mexican Constitution and Revisions to the Federal Environmental Law	* Provide that each person has a right to an environment adequate for their development, linked to Art. 4 of the Mexican Constitution. * Established more precise procedures for handling popular complaints.
Forestry Law Revisions (1997)	* Reinstate controls over transport and sale of wood. * Include commercial forestry plantations as an authorized forestry development approach.

Taken together, the changes to Art. 27 of the Mexican Constitution and to the federal forestry and environmental laws provi de increased commercial access to land and natural resources in Mexico, under the rubric of "sustainable development." In practice, however, the concept of sustainable development can sometimes include only the application of economic and technological principles, with minimal consideration being given to environmental and social concerns.

In addition to these domestic programs to regulate and encourage forestry production, Mexico is signatory to several international binding treaties covering forest management. For example, in 1992, Mexico signed and ratified the United Nations Conference on Environment and Development (UNCED) and adopted the Convention on Biological Diversity. Since then, Mexico has taken steps to fulfill obligations under the Convention, including the creation of the National Commission for Knowledge and Use of Biodiversity (Conabio), which has established both a computer network for biodiversity information (REMIB) as well as a national system of biodiversity information (SNIB). Other treaties signed and ratified by Mexico with potential implications for forest management include the UN Convention on Climate Change (1992), the Convention on International Trade in Endangered Species (CITES—ratified in Mexico in 1991), which restricts trade of flora and fauna, the La Paz Agreement (Agreement between the United States of America and United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area (1983), and the Migratory Bird Treaty between the US and Mexico (1937, amended in 1972). In addition, the US and Mexico have signed a Memorandum of Understanding on Cooperation in Management of National Parks and Other Protected Natural and Cultural Heritage Sites. The US Forest Service and the US Fish and Wildlife Service have worked cooperatively with Mexican officials under these and other international agreements.

Along with nine other countries, Mexico has also formed a Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests ("the Montreal Process"). This group has come up with a list of criteria and indicators for the sustainable management of forests. In addition, one well-known NGO—the Forest Stewardship Council—has produced its own criteria for sustainable forest management and established headquarters in Oaxaca, as has the *Consejo Civil Mexicano para la Silvicultura Sostenible.* Finally, Mexico is participating in Canada's Model Forest Program, which was intended to set up pilot projects in Chihuahua and Campeche with Canadian funds.

2.4.2 Support for the Forestry Industry

The 1997 Forestry Law reforms also established the Program for Forest Development (Prodefor) and the Program for Plantation Development (Prodeplan). These programs provide various government subsidies for the production of wood from natural forests and commercial plantations.

Prodefor operates through subsidies and grants provided by Semarnap, primarily to ejidos in order to improve the ejidos' technical handling of forest resources. Prodefor is essentially a subsidy program for forestry development designed to benefit producers by increasing economic integration and competitiveness. The program has the objective of promoting the development of the social forestry sector by forming more efficient production units. According to Semarnap, in 1997 Prodefor provided nearly 23 million pesos in direct subsidies to ejidos, communities, and small forest properties nationwide, which permitted the incorporation of 316,000 hectares of forested lands into timber production. Over 3,000 landowners have also received training through the program (Semarnap B1998). In Chihuahua, forest ejidos do not directly receive Prodefor funding. These resources are channeled instead through the forestry consultancy associations, the organizations responsible for managing and applying the programs.

Prodeplan, on the other hand, was designed to finance commercial plantations through a combination of direct subsidies and tax incentives that could cover up to 65% of the cost of establishing and maintaining the plantations over a seven-year span. Through subsidies, the Mexican government encourages the private sector to convert both degraded and agricultural lands into commercial timber plantations as a viable method of silviculture. The objective is to establish 875,000 hectares of commercial forest plantations in a period of 25 years. Though the reforms prohibited commercial plantations in areas where they would substitute for the natural vegetation of forested lands, the plantation program focuses on creating large commercial plantations of rapid-growth species that require optimal soil and humidity conditions.

In this favorable business climate, large consortia have formed to establish commercial plantations in Mexico. According to Semarnap figures, only 15,000 hectares were designated for commercial plantations in 1970. In 1997, however, Semarnap approved 13 new plantation projects covering 48,000 hectares through the Prodeplan program. (See Table 2.) Semarnap projected that in 1998 it would channel about 250 million pesos into direct subsidies to help set up an additional 68,000 hectares of commercial plantations and to reforest 10,000 hectares with native vegetation (Semarnap 1998B).

Table 2. Types and sizes of projects approved under Prodeplan, 1997

Type of Wood	Less than 100 Hectares	100–1,000 Hectares	Greater than 1,000 Hectares	Total Number of Projects	Total Hectares
Pine/ Christmas Trees	8	9	1	18	9,155
Eucalyptus	0	1	3	4	11,609
Red Cedar, Mahogany, and tropical species	10	6	2	18	7,101
Total	**18**	**16**	**6**	**40**	**27,865**

Source: Semarnap, *Anuario Estadístico de Producción Forestal, 1997*, p. 101.

Several companies have started operating large-scale commercial plantations in southeastern Mexico through subsidies provided by Prodeplan. The companies include PLANFOSUR-Simpson (in Tabasco and Veracruz), PULSAR International of Monterrey (now called SAVIA), Nuevo León (in Tabasco, Campeche, Chiapas), and International Paper Company (in Tabasco, Chiapas, Veracruz and Campeche). Commercial plantations set up in the warm, tropical climates of northern Nayarit and southern Sinaloa have been established through agreements between private farmers and companies, including Kimberley-Clark de Mexico. In Chihuahua, however, despite some proposals, only a few small plantations in the northeast of the state near Ojinaga have been established, and the Prodeplan program has not yet had much effect. New eucalyptus projects are being established or proposed for several ejidos in the municipality of Ojinaga.

3 NAFTA Connections and Institutions

3.1 Introduction

North American trade in wood and wood products is affected by many factors, including, but not limited to:

- currency values;
- macro-economic conditions (e.g., a healthy economy driving a construction boom);
- production costs (e.g., labor costs, environmental standards and/or production subsidies); and
- tariff and non-tariff barriers to trade.

As other research indicates, and as we discuss in this report, factors such as currency values, macro-economic conditions and production costs significantly affect on North American trade in wood and wood products.[7]

This section of the report, however, focuses primarily on NAFTA's effect on existing and potential tariff and non-tariff measures related to trade in wood and wood products. We also examine the provisions of the NAFTA Environmental Side Agreement as they relate to overall economic and environmental policy decisions potentially affecting forestry in Mexico, particularly in the state of Chihuahua.

We include a discussion of how the scope and work plans of various NAFTA institutions relate to forestry production in Mexico and North American trade in wood and wood products. We conclude with a brief discussion of how trade/export promotion, much of which is at least indirectly associated with NAFTA, does (or does not) incorporate notions of sustainable forest management and conservation.

3.2 Changes in Tariffs and Quantitative Restrictions

Under Article 302 of NAFTA, tariffs on goods are progressively eliminated over a 10- to 15-year period. Most US tariffs on imported wood and wood products are already near zero. Canadian tariffs have also been reduced to near zero on most products as a result of the US/Canada free trade agreement, with reductions beginning in 1989 (Kosco 1998). Thus, NAFTA tariff reductions are most significant for wood and wood products imported into Mexico. Table 3 shows the basic reductions in Mexican tariffs on a variety of wood and wood products.

According to one analyst, one of the most important tariff reductions was the immediate elimination of the duty on lumber used in timber-frame housing (Lyke 1998). Wood producers in the US want to export more wood to Mexico for timber-frame housing. Currently, for a variety of reasons (including weather conditions, durability, pest resistance, stability, price, and use of local materials) most housing in Mexico is constructed of concrete, masonry or adobe. However, US exporters want to promote timber-frame housing and were counting on a general post-NAFTA boom

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7 This is especially true for US-Canada trade (Kosco 1999). Macro-economic conditions and currency valuation, however, have also played a very strong role with respect to US/Mexico trade in wood and wood products (Juárez, et al. 1999; Lyke 1998).

in the Mexican economy to drive the housing market and demand for timber. The continued push by US interests to promote use of timber-frame housing in Mexico—in place of existing construction methods that rely on more sustainable local construction materials—is discussed further in Section VI, below.

Table 3. Mexican wood and wood product tariff elimination under NAFTA

Commodity	Pre-NAFTA tariff	Post-NAFTA tariff
Softwood lumber, rough or dressed	10 to 15%	0*
Particleboard	20%	Phase out over 10 years
Softwood plywood	15%	Phase out over 10 years
Wood pulp:		
-Mechanical	5%	Phase out over 10 years
-Other	0 to 5%	0
Newsprint	15%	Phase out over 5–6 years
Other paper and board	10%	Phase out over 0–10 years

*Immediate phase-out applied to lumber used in the manufacture of timber frame housing. For all other lumber, tariffs are phased out equally over five years.

Source: Lyke, 1998.

In addition to progressive elimination of tariffs, Mexico agreed under NAFTA to convert its quantitative restrictions on imports of certain wood and wood products to “tariff rate quotas” or TRQs. These TRQs provide that a certain quantity of product can enter the country duty-free, while anything over that amount is subject to a tariff. This tariff, however, is also reduced to zero over a 10-year period. In addition, the amount of product that can be imported duty-free can increase. Table 4 shows the *initial* Mexican TRQs for various wood and wood products.

Table 4. Mexico’s TRQs for various lumber products

Product	TRQ (metric tons)	Over-quota tariff (%)
Oak lumber over 6mm thick	3,325	15
Logs	14,250	10
Pine and fir lumber	119,700	10
Other lumber	2,470	15
Coniferous lumber	9,500	15
Coniferous wood chips, particles	66,500	10
Coniferous lumber, small boards	950	10
Stained logs	750	10

Mexico is implementing the TRQ system through “auctions.” That is, the Mexican government “auctions” off the right to import the product duty-free, up to the quota limit. In one of the recent auctions, however, most of the duty-free quota was unallocated, except for oak planks (Juárez, et al. 1999, 5). According to the US Department of Agriculture’s Foreign Agricultural Service, “importers do not rely on the TRQs, particularly for softwood plank…. Reportedly, they continue to prefer paying the import duty (now four percent) instead of participating in the auction process” (Juárez, et al. 1999, 5). Previous reports indicate that industry was complaining that the Mexican TRQ system was “neither efficient nor effective” (Lyke 1998, 27).

Virtually all North American tariffs on wood and wood products (i.e., tariffs imposed by one of the NAFTA countries on products from another of the NAFTA countries) will be eliminated under NAFTA by 2003. Given that, and given the delay in the WTO’s proposed “Accelerated Tariff

Liberalization" package for forestry products,[8] the ATL should not have much effect on forestry trade *among* the US, Canada and Mexico.

3.3 Non-Tariff Barriers

There are various types of restrictions, regulations and standards that are often characterized as "non-tariff" barriers to trade. With respect to wood and wood products, these generally fall into seven categories (Sizer et al. 1999):

- Quantitative restrictions on imports (see discussion in Section II, above);
- Phytosanitary standards to prevent importation of exotic pests and diseases;
- Technical regulations designed to protect human health and safety (e.g., wood strength or use of chemicals on wood);
- Labeling requirements (including quality-labeling and voluntary eco-labeling);
- Requirements for recycling and waste recovery;
- Subsidies, tax breaks and export promotion for domestic producers; and
- Export restrictions (e.g., export restrictions on raw logs).

Article 309 of NAFTA essentially provides that import/export restrictions are governed by the rules of the General Agreement on Tariffs and Trade (GATT). Annex 301.3 specifically provides that Article 309 rules *do not apply* to the "export of logs of all species."

Chapter 7 of NAFTA governs the adoption and implementation of phytosanitary standards. Chapter 9 governs the use of technical product standards in NAFTA countries. Provisions that relate to treatment of investors are contained in NAFTA's Chapter 11. Restrictions on government procurement procedures are set out in Chapter 10. The application of countervailing duty measures to counter subsidies provided by one country to its domestic producers is governed by Chapter 19, and by a specific WTO agreement on subsidies.

These NAFTA provisions and their relationship to the types of non-tariff barriers to forestry trade that have been discussed in the literature are examined below. It should be noted, however, that NAFTA refers to and/or incorporates various provisions of GATT/WTO agreements and, in some instances, the controlling legal authority is not clear (Abbot 1999). Thus, to some extent, an examination of GATT/WTO agreements and decisions is important to interpreting the potential effect of NAFTA on various standards or policies that might be challenged as non-tariff barriers to forestry trade among the US, Canada and Mexico.

3.3.1 Phytosanitary Standards

Chapter 7 of NAFTA applies to sanitary and phytosanitary standards (SPS) that may "directly or indirectly" affect trade between the NAFTA Parties. Article 710 essentially exempts SPS development, adoption and enforcement from the GATT/WTO regime incorporated into Articles 301 and 309 of NAFTA. Instead, NAFTA has its own set of standards for "trade-legal" SPS. Article 712 sets out the basic rights and obligations of the NAFTA partners with respect to SPS. The relevant provisions are set out in Box 1.

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[8] The November 1999 meetings of the WTO in Seattle did not result in an agreement to proceed with development and implementation of the ATL. As proposed, the ATL would have eliminated WTO country tariffs on a wide range of wood and wood products by 2002). A USTR study predicted that harvesting of secondary forests in Mexico would *decrease* by about 2 % under the proposed ATL (US Trade Representative, 1999).

Box 1. Provisions of Article 712 of NAFTA

Article 904: Basic Rights and Obligations

Right to Take Standards-Related Measures

1. Each Party may, in accordance with this Subchapter, adopt, maintain or apply any sanitary or phytosanitary measure necessary for the protection of human, animal or plant life or health in its territory, including a measure more stringent than an international standard, guideline or recommendation.

Right to Establish Level of Protection

2. Notwithstanding any other provision of this Subchapter, each Party may, in protecting human, animal or plant life or health, establish its appropriate level of protection in accordance with Article 715.

Scientific Principles

3. Each Party shall ensure that any sanitary or phytosanitary measure that it adopts, maintains or applies is:

   a) based on scientific principles, taking into account relevant factors including, where appropriate, different geographic conditions;

   b) not maintained where there is no longer a scientific basis for it; and

   c) based on a risk assessment, as appropriate to the circumstances.

Non-Discriminatory Treatment

4. Each Party shall ensure that a sanitary or phytosanitary measure that it adopts, maintains or applies does not arbitrarily or unjustifiably discriminate between its goods and like goods of another Party, or between goods of another Party and like goods of any other country, where identical or similar conditions prevail.

Unnecessary Obstacles

5. Each Party shall ensure that any sanitary or phytosanitary measure that it adopts, maintains or applies is applied only to the extent necessary to achieve its appropriate level of protection, taking into account technical and economic feasibility.

Disguised Restrictions

6. No Party may adopt, maintain or apply any sanitary or phytosanitary measure with a view to, or with the effect of, creating a disguised restriction to trade between the Parties.

The core requirements are that SPS have a "scientific" basis, be based on "risk assessments," not discriminate against imported products, and not pose "unnecessary obstacles" or constitute a "disguised restriction on trade." Chapter 7 also has a multitude of provisions for the development of SPS, including preferential reliance on "international standards" (Article 713), requirements for risk assessments (Article 715), adoption of standards to regional conditions (Article 716) and various mandatory adoption and implementation procedures (Articles 717-721).

It appears that, to date, there have not been many wood or wood-product related SPS disputes between US and Mexico or Canada and Mexico. One pending matter, however, offers insight into how the governments view SPS issues. In 1998, Mexico's natural resource agency, Semarnap, proposed two new regulations relating to the importation of new and used lumber (FAS #s MX8061 and MX8062 1998). These rules would have required certification that the lumber came from a zone "free of pests and disease." The rules would also have required inspection of the lumber at the border. If the inspection found any of three special pests of concern, the load would be destroyed or returned.[9] If the inspection found *any* pests, the lumber would have to be fumigated at the border for 48 hours, with either methyl bromide or aluminum phosphorus.

In commenting on the proposed regulations, the Foreign Agricultural Service of the US Department of Agriculture stated that making the required "certification" would be "a serious problem." It also noted that that wood exporters were concerned about what would happen to their

9 The special pests of concern are gypsy moth, the Formosan subterranean termite and the powderpost beetle.

shipments under the new regulation, which could, in turn, cause a disruption in lumber trade and "hardship" for the US lumber industry (FAS #s MX8061 and MX8062 1998). Nowhere does the public record indicate that the FAS also commented that a top US environmental priority has been the elimination of the use of methyl bromide (a dangerous fumigant and a substance implicated in the thinning of the ozone layer),[10] nor does the public record indicate that the FAS expressed concerns about potential effects on customs workers or communities living near border entry ports that might be exposed to the fumigant. Available information indicates that Mexico has yet to adopt the two proposed regulations. Semarnap has apparently agreed the final rules will be based on "sound science and will not impede US wood exports to Mexico." (Juárez et al. 1999, 4).

This proposed SPS highlights two important points. First, it shows clearly how the SPS chapter of NAFTA allows non-domestic entities (whether private or government) to have significant influence on the adoption of domestic standards—in this case a standard designed to prevent the spread of notorious wood pests from imported products. While these types of exchanges might have happened before NAFTA, the fact that NAFTA has so many specific requirements for "trade legal" SPS gives the non-domestic entities significant leverage.

Second, it shows that the US government, in commenting on Mexico's proposed SPS, focused only on the problems the standard would pose for US commercial interests (in this case the US lumber industry), apparently ignoring the potential adverse environmental or human health effects of the standard (in this case, fumigation with methyl bromide). While the lack of attention to these issues is not necessarily a direct result of NAFTA, it does illustrate how, under the current system, the focus of government efforts related to standards issues will be on trade effects, not on accompanying environmental or human health effects.

3.3.2 Technical Barriers to Trade (including Labeling)

NAFTA also limits the ability of governments to adopt standards relating to the quality or characteristics of a product, the way the product is produced, and labeling of a product. These NAFTA rules are wide-ranging and complex. (See Box 2.) The provisions apply to standards that may "directly or indirectly" affect trade in goods or services. They apply to national standards, but also require national governments to ensure that standards adopted by states or provinces and "nongovernmental standardizing bodies" comply with the provisions of Chapter 9 (Article 902).[11] The countries' "rights and obligations" under GATT/WTO Agreement on Technical Barriers to Trade (TBT) are expressly recognized as binding.

Article 904 sets out the basic rights and obligations of the NAFTA partners with respect to technical standards. This article affirms the countries' basic rights to adopt standards that are necessary to protect human, animal or plant life or health, the environment or consumers, and "legitimate objectives" of standards specifically include "sustainable development."[12] Nevertheless, Chapter 9 imposes a host of substantive conditions on the adoption and implementation of such standards. For example, the standards must adhere to "national treatment" and "most favored nation" principles; must not pose an "unnecessary obstacle" to trade between the parties; should be based on international standards unless specific conditions require otherwise; and "to the greatest extent practicable" be compatible with standards in the other NAFTA countries. Article 907 defines elements of "risk assessments" used to set standards. The chapter also has several provisions for opening the standards setting process to interests from the other NAFTA countries.

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[10] The Montreal Protocol on Substances that Deplete the Ozone Layer calls for phase-out of methyl bromide in developed countries by 2005. See 40 C.F.R. part 182 for US EPA rules on domestic phase-out of methyl bromide.

[11] A standardizing body is a body having "recognized activities in standardization." Article 915.

[12] Article 915, definition of "legitimate objective."

Box 2. Provisions of Article 904 of NAFTA on Standards

Article 904: Basic Rights and Obligations

Right to take Standards-related Measures

1. Each Party may, in accordance with this Agreement, adopt, maintain and apply standards-related measures, including those relating to safety, the protection of human, animal and plant life and health, the environment, and consumers, and measures to ensure their enforcement or implementation. Such measures include those to prohibit the importation of a good of another Party or the provision of a service by a service provider of another Party that fails to comply with the applicable requirements of such measures or to complete its approval procedures.

Right to Establish Level of Protection

2. Notwithstanding any other provision of this Chapter, each Party may, in pursuing its legitimate objectives of safety or the protection of human, animal or plant life or health, the environment, or consumers, establish the levels of protection that it considers appropriate in accordance with Article 907(3).

Non-Discriminatory Treatment

3. Each Party shall, in respect of its standards-related measures, accord to goods or service providers of another Party

   a) national treatment in accordance with Article 301 (Market Access) or Article 1202 (Cross-Border Trade in Services); and

   b) treatment no less favorable than that it accords to like goods, or in like circumstances to service providers, of any other country.

Unnecessary Obstacles

4. No Party may prepare, adopt, maintain or apply any standards-related measure with a view to or with the effect of creating an unnecessary obstacle to trade between the Parties. An unnecessary obstacle to trade shall not be deemed to be created if:

   a) the demonstrable purpose of such measure is to achieve a legitimate objective; and

   b) such measure does not operate to exclude goods of another Party that meet that legitimate objective.

What these provisions mean for various standards applicable to forest and forestry products industries is not fully settled (Goldman et al. 1999; Sizer et al. 1999, 7, 11). From the NAFTA text it would appear that a move by one country to ban imports of timber that was not produced in a sustainable manner would probably be subject to a challenge, even if sustainable production were required in domestic forests. If GATT/WTO jurisprudence is any guide, such a challenge could be successful. For example, in 1998, a WTO panel held that the US law prohibiting imports of shrimp from countries that had not been certified as having a program to require the use of turtle excluder devices (TEDs)[13] or comparable protections for shrimp harvesting violated GATT provisions (WTO 1998). The panel also found that the Article XX exceptions of GATT (which allow countries to adopt standards to protect human, animal or plant life or health or to conserve exhaustible natural resources) did not provide an exception for the shrimp import prohibition. The panel concluded, essentially, that Article XX did not allow a country to condition access to its markets on the adoption of certain conservation policies by an exporting country.[14]

[13] Under US law, US shrimpers are required to use TEDs to help protect endangered sea turtles. The TEDs help keep turtles out of the shrimping nets, thus reducing mortality rates.

[14] For a summary of the background to the Shrimp decision and current status of the US response (as of May 2000) see Government of Australia. 2000. *US Shrimp Import Ban: Public Information Paper.* Canberra, Australia. Department of Foreign Affairs and Trade, Trade Negotiations Division. Available at <http://www.dfat.gov.au/trade/negotiations/environment/us_shrimp_update.html>. Similarly, a 1991 GATT panel decision (which was never formally adopted) held that the US import prohibition on tuna that had not been caught in a "dolphin-safe" fashion could not stand under GATT rules. The US and Mexico, the country that had challenged the ban, negotiated a resolution. That GATT panel decision did, however, seem to uphold the use of a "dolphin-safe" labeling system for tuna, as long as that system was applied equally to domestic and imported products.

But the jury is still out on labeling measures, especially those that relate to how a product is produced, versus those relating to physical or other aspects of the product itself (WTO 2000; Sizer et al. 1999, 11). Labeling measures that just apply to the physical or other aspects of the product should be "trade-legal" if they do not discriminate between domestic and imported products. It is much less clear whether, for example, a government *requirement* that wood be labeled as to whether or not it is sustainably produced (in accordance with some set of sustainable forestry standards) would be "trade-legal" under Chapter 9 of NAFTA or related GATT/WTO rules and jurisprudence. Commercial interests may argue that such "process/production method" requirements violate GATT's TBT Agreement (and Chapter 9 of NAFTA) because they pose an "unnecessary obstacle" to trade (even if they apply to domestic products as well).

A government could mandate that wood and wood products be labeled regarding how the wood is harvested or how the forest the wood came from is managed. Such a requirement would be very useful in promoting expanded consumer awareness and increasing the impact of ecolabeling programs, such as the Forest Stewardship Council's certification and labeling program. But there is potential for such a requirement to be challenged as trade-illegal, either because it illegally discriminates against "like products" from an importing country; because it poses an "unnecessary obstacle to trade"; or—if GATT rules govern—because process/production methods are generally disfavored under GATT (Goldman et al. 1999).

As some commentators have noted, if such a requirement was found to violate NAFTA or other trade agreements, the incentive for use of voluntary ecolabeling programs could be reduced (Sizer et al. 1999, 11). Nevertheless, voluntary labeling—as opposed to government eco-labeling programs—should be less vulnerable to challenge under NAFTA or related GATT/WTO provisions.

There are other potential implications of NAFTA for government efforts to require more sustainable forest management. For example, a recent draft study by the Asian Pacific Economic Council (APEC) on non-tariff barriers to forest trade actually argued that forest conservation measures such as restrictions on logging are "a threat to the global trading system" (Sizer et al. 1999, 7). As suggested by one analysis: "Such expansive definitions of "trade-distorting" non-tariff measures, based on extreme applications of standard trade policy principles and terms of analysis, suggest that the current framework of trade rules and policies may pose a risk to forest conservation laws." (Sizer et al. 1999, 7). Thus, for example, would it be possible for US timber interests to convince the US government to challenge Mexico's environmental requirements for forest management plans if those requirements limited timber harvest in ecologically-sensitive areas? While this might sound far-fetched now, given the state of NAFTA/GATT/WTO jurisprudence, some of the arguments being made in the WTO context appear to indicate that these types of challenges may be raised (at least behind closed doors, if not in "official proceedings").

3.3.3 Investment Provisions

Recently, some very troublesome cases have arisen under the investment provisions of Chapter 11 of NAFTA. Briefly, several companies have used the provisions of Chapter 11 that allow private companies to bring actions against NAFTA governments to seek compensation for a variety of actions by the host government, from lack of "fairness" and due process to "expropriation" without compensation (Mann et al. 1999). These claims are resolved in secret arbitration proceedings with no public participation. For example, a US hazardous waste company, Metalclad, brought a Chapter 11 action against Mexico for damages allegedly resulting from the decision of a local government in Mexico to prohibit operation of Metalclad's hazardous waste landfill, after the company had obtained federal permits. In late August 2000, the arbitration panel awarded Metalclad almost $ 17 million (DePalma, 2000).

Especially in the wake of the Metalclad ruling, US or Canadian forestry investors operating in Mexico could use these Chapter 11 provisions to challenge denial of forestry extraction permits or logging limits. Whether or not such a challenge would succeed depends on the facts of the particular case, but just the ability to bring these high-dollar damage claims is likely to have a chilling effect on how forestry regulations are developed and enforced.

Article 1114 was touted as one of the "green" provisions of NAFTA. It provides that countries *should not* waive or "otherwise derogate from" their environmental standards in order to encourage or retain investment. But the language is merely oratory and, unlike the provisions for investors, there is no cause of action or dispute resolution process for nongovernmental groups who believe a country may not have complied with Art. 1114.

3.3.4 Government Procurement Requirements

Federal, state and local governments have increasingly begun using their procurement processes to help develop markets for sustainably produced goods. With respect to wood and wood products, these actions can take the form of recycled or post-consumer waste content for paper, prohibitions on the use of certain types of wood in government projects or bid-advantages for projects that will use sustainably harvested wood. NAFTA rules on government procurement processes, however, may pose a barrier to this strategy, at least at the federal government level.

Chapter 10 of NAFTA applies to government procurement process. At this time, it applies only to federal processes, though states may be included in the future (Article 1024). Article 1007 provides that technical specifications used in goods procurement cannot create "unnecessary obstacles" to trade. The term "unnecessary obstacles" is not defined. Article 1007 further provides that the technical standards for procurement should be based on "performance criteria" not "design or descriptive" characteristics and should be based on international standards "where appropriate."[15]

Article 1018 provides that the procurement measures "necessary to protect human, animal or plant life or health" are exempt from these requirements, as long as they are not a "means of arbitrary or unjustifiable discrimination" between Parties or a disguised restriction on trade. Notice that procurement measures designed to protect the environment or conserve natural resources (e.g., sustainable wood requirements or recycled content requirements) are not exempt from the Chapter 10 If government procurement processes designed to favor sustainably-produced wood or wood products were to be subject to successful challenge under NAFTA, it would hamper the ability of governments to help create markets for sustainable products. This could be especially damaging in a country like Mexico where advantageous or preferential access to the government market could make or break efforts to implement sustainable forestry practices, particularly at the community forestry level.

3.3.5 Subsidies and Countervailing Duties

Forestry production—and production of wood products—can be subsidized by governments in a variety of ways (Sizer, et al. 1999, 11), including government-constructed roads, direct assistance to the timber or wood products industries, low fees for access to government-owned timber and, at least indirectly, weak or un-enforced forest management or environmental regulations. Under NAFTA, the basic remedy for a government that is concerned that a trading partner is unduly subsidizing an industry is to impose "countervailing duties" on imports. Article 19 of NAFTA lays out specific procedures for resolution of disputes over countervailing duties.

In addition to NAFTA's provisions, since all three North American countries are members of the WTO, the legality of countervailing duties imposed in response to alleged subsidies may be decided under the WTO Agreement on Subsidies and Countervailing Measures ("the SCM

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[15] Article 1003 further provides that the principles of national treatment and most-favored nation status apply to government procurement processes in the NAFTA countries.

Agreement").[16] This agreement limits the types of subsidies for which CVD can be imposed. Maybe most important is the limitation of the definition of "subsidy" to those that involve a "financial contribution" from the government to an enterprise or set of enterprises, as opposed to other types of government intervention that could be considered a subsidy. The SCM Agreement prohibits certain types of outright subsidies (export subsidies and local content subsidies), with a transition period for developing countries such as Mexico and specifies various threshold tests for subjecting other subsidies to CVD.

In the context of the present analysis, we note that two Mexican programs provide subsidies for forestry production: Prodeplan and Prodefor. The details of these programs were described above in Chapter 2. Prodeplan, which offers direct subsidies and tax incentives for establishment of commercial plantations appears to be open to both domestic and foreign companies operating in Mexico. No Prodeplan subsidies have been provided in Chihuahua, as far as the authors can determine. The Prodefor subsidies are primarily directed at improving the efficiency of *ejido* forestry operations.

3.4 The NAFTA Environmental Side Agreement

There are several provisions of the NAFTA environmental side agreement that potentially relate to government policy decisions having an impact on forestry management. The objectives of the side agreement, set out in Article 1, include promoting sustainable development, but also include "avoid creating trade distortions or trade barriers." As shown above, there may be substantial conflict between these two objectives with respect to forestry management, depending on the interpretation of what constitutes a "trade distortion" or "trade barrier."

Article 2(1)(e) allows the [North American] Commission for Environmental Cooperation to "assess environmental impacts." Also, under Article 10(2), the Council of CEC may consider and develop recommendations on "environmental matters as they relate to economic development" and on eco-labeling. These are important cornerstones for potential CEC involvement in a more in-depth examination of the effect of NAFTA on forestry management—not only in Chihuahua, but throughout North America. Such an examination could proceed under Article 13 of the agreement. This provision allows the CEC Secretariat to prepare a report on any matter "within the scope" of the annual work plan and, unless vetoed by a two-thirds vote of the Council, on any other matter except the effectiveness of environmental law enforcement.[17]

Three other provisions of the NAFTA side agreement are relevant to forestry. First, under Article 10(6), CEC is to cooperate with the NAFTA Free Trade Commission, acting as a "point of inquiry" on disputes with an environmental aspect, playing a role in any consultations under Article 1114 of NAFTA, and assisting in the prevention and resolution of environmentally-related trade disputes. Thus, CEC would likely have a role to play in any forestry-related trade disputes that reach a government consultation or dispute level. Some commentators have also suggested that CEC should also play a much more active role in investor-state disputes under Chapter 11 of NAFTA (Mann 1999).

Second, Article 10(7) provides that CEC is to develop an agreement on assessing transboundary environmental impacts. That accord was supposed to be completed within three years of the side agreement's enactment, though that deadline has not been met. An assessment of transboundary impacts could be important, however, for large-scale forestry projects in Chihuahua that could affect

[16] A summary of this agreement is available at <http://www.wto.org/english/tratop_e/scm_e/scm.htm>.

[17] The governments are obligated, under Article 5 of the side agreement, to "effectively enforce" their environmental laws, including publicly releasing "noncompliance information" and securing timely remedies for violations. These two obligations are at the heart of the forestry-related Article 14/15 citizen submissions to CEC (see below).

transboundary surface waters (e.g., the Rio Conchos, which is the major tributary to the binational Rio Grande.)

Finally, Articles 14 and 15 of the side agreement establish procedures for citizen submissions alleging that a NAFTA government has failed to effectively enforce its environmental laws. CEC can respond to such submissions through the preparation of a "factual record." [18] Forest management laws and regulations, however, are specifically excluded from the Article 14/15 process. Article 45(2)(b) provides that the term "environmental law" does not include "any statute or regulation, or provision thereof, the *primary purpose* of which is managing the commercial harvest or exploitation, or subsistence or aboriginal harvesting, of natural resources" (emphasis added). Nevertheless, a citizen submission dealing with failure to effectively enforce environmental laws that apply to the effects of forestry on water quality or endangered species should be possible.

In fact, CEC has received at least three citizen submissions focusing on forestry issues. The first, filed by Sierra Club and others, challenged the salvage-logging rider adopted by the US Congress in 1995. That submission was dismissed for lack of jurisdiction, as the CEC Secretariat concluded it did not have authority to review legislative action (CEC 1998, 79–85). The second was filed by the David Suzuki Foundation in 2000. This submission alleges a general failure to effectively enforce the Canadian Fisheries Act with respect to logging operations in British Columbia.

The third submission, which was filed in June 2000, relates directly to the environmental aspects of forest operations in the state of Chihuahua. Filed by the *Centro de Derecho Ambiental del Noreste de México* (Cedanem) (now *Fuerza Ambiental, A.C.)* and others, the submission alleges that Mexico has repeatedly failed to enforce environmental requirements applicable to logging operations in the Sierra Tarahumara and failed to respond to citizen complaints. Processing of this submission has just begun. The complaints are discussed in more detail in Chapter 5.

3.5 NAFTA Institutions

3.5.1 Commission for Environmental Cooperation

CEC does not currently have specific programs related to forest management or protection. Nevertheless, some aspects of existing CEC programs do relate, at least indirectly, to forest protection, including those for conservation of Important Bird Areas (IBAs) and protection of biodiversity. Mexico has designated an IBA in the southern part of the Sierra Madre, near the Durango border, for protection of Thick-billed Parrots, Mexican Spotted Owls and other threatened birds (Nabhan 1997). And, as mentioned earlier, the un-cut areas of the Sierra have a high degree of biodiversity and endemic species, as well as a wide variety of useful medicinal plants.

3.5.2 Free Trade Commission

The authors have not been able to locate any cases or issues where NAFTA's Free Trade Commission—or its subsidiary bodies such as the Committee on Sanitary and Phytosanitary Standards (SPS) or the Committee on Agricultural Trade—have examined aspects of Mexico's forestry industry or environmental regulations applicable to that industry.[19]

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[18] See <http://www.cec.org/citizen> for more information on the citizen submission process.

[19] For a description of these institutions, see Commission for Environmental Cooperation. 1997. *NAFTA's Institutions: The Environmental Potential and Performance of the NAFTA Free Trade Commission and Related Bodies*, Montreal.

3.6 A Note about Export Promotion

One at least indirect effect of NAFTA has been to focus US government agencies and US industry on promoting exports of US products to Mexico. In the wood products area, the US Department of Agriculture's Foreign Agricultural Service (FAS) provides US industry with detailed analyses of the Mexican market for wood and of competition from Mexican sources. In at least one aspect of its export promotion activities—promoting the increased use of wood for timber frame housing in Mexico—the FAS appears to have largely ignored environmental concerns. In its 1999 analysis of US/Mexico trade in wood and wood products (Juárez 1999), the FAS states that the "lack of a wooden house 'culture' in Mexico continues to inhibit consumption of lower grade construction lumber. A key factor is the Mexican "perception" that homes constructed with wood are more expensive and less durable than homes built of traditional masonry materials [such as adobe and concrete block, which are used extensively in Mexico.]" The FAS quotes an industry study that favors a "massive educational campaign stressing the advantages of solid wood products for constructing homes as compared to traditional materials, and addressing the often false perception regarding its disadvantages." The FAS report does not recognize that traditional materials such as adobe and concrete may, in fact, be more durable, pest-resistant and lower cost than timber-frame housing in Mexico, nor does it even broach the fact that a substantial switch to timber frame housing would put incredible new pressure on US forests, as well as on Chihuahuan pine forests.

The authors raise this issue to demonstrate that some *indirect* impacts of NAFTA, especially in the export promotion realm, can have substantial environmental implications. Yet there are few safeguards that would ensure environmental considerations are integrated into such programs.

3.7 Conclusions

1) Pre-NAFTA tariffs on wood and wood products are reduced to zero under NAFTA, though most US and Canadian tariffs were already at or near zero and Mexican tariffs were not very high (0 to 15% in most cases)
2) NAFTA's provisions regarding non-tariff trade barriers may adversely affect the ability of Mexico to create and/or foster markets for sustainably produced wood and wood products. This is particularly true with respect to the technical standards provisions of Chapter 9 and the government procurement provisions of Chapter 10. Much depends on the interpretations of ambiguous provisions in the NAFTA text and developing WTO "jurisprudence" may influence these interpretations. While wholly voluntary certification programs for sustainably produced wood are not likely to be significantly affected by these provisions, options to use government action to promote the programs and develop markets for the wood are made less viable by NAFTA's provisions on standards.
3) Recent interpretations of the investment provisions of NAFTA Chapter 11, particularly the Metalclad case, pose a substantial threat to Mexico's ability to adequately regulate forestry or forestry product operations of companies from the US and Canada.
4) While not necessarily a direct *result* of NAFTA, it does not appear that environmental and natural resource considerations are at all integrated into the actions of the US agencies responsible for monitoring and promoting exports of wood to Mexico.
5) CEC has authority, within and in addition to current program areas, to take a more active role in addressing some of the adverse environmental impacts of post-NAFTA forestry operations in the Sierra Tarahumara.

4 The Forestry and Paper Industries in Chihuahua Post-NAFTA

With respect to the forestry sector, Mexico's entry into NAFTA has coincided with modernization and consolidation of the forest products industry in Chihuahua and with increased wood production from the native forests of the Sierra Tarahumara. As shown in Figure 1, Mexico's annual forestry production, including production of pine, suffered a gradual decline in the early 1990s, reaching its lowest level in 1995, and then beginning to increase steadily from 1996 on. Figures 2 and 3 show similar trends for forestry production in Chihuahua, with production bottoming out in 1994 and increasing thereafter. Today, Chihuahua is the state with the greatest number of hectares of forest in Mexico and second to Durango in the total value of forest products. In addition, Chihuahua is tied with Durango as the largest producer of pine; each state accounts for 23% of total pine production.

Figure 1. Mexico's annual forestry production 1989–1998

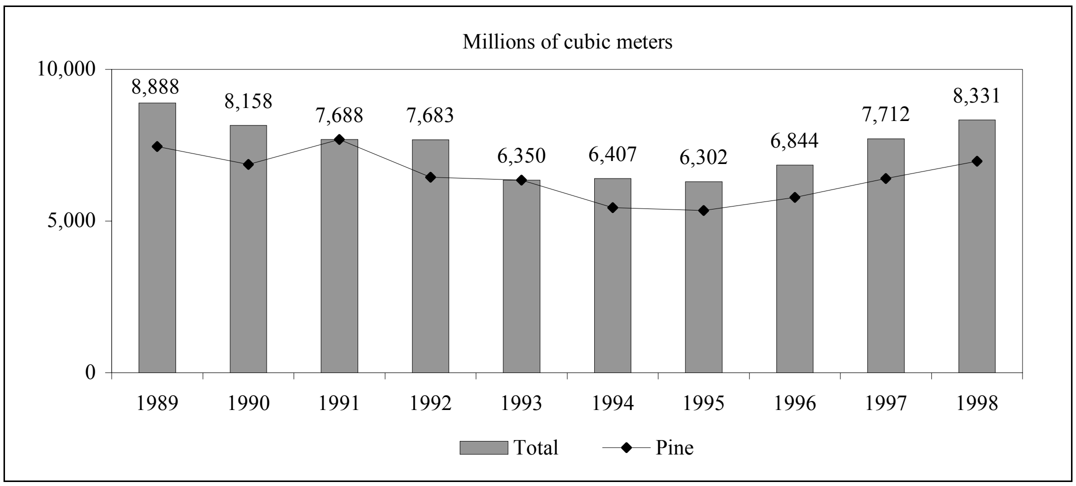


Figure 2. Chihuahua's annual forestry production 1989–1998

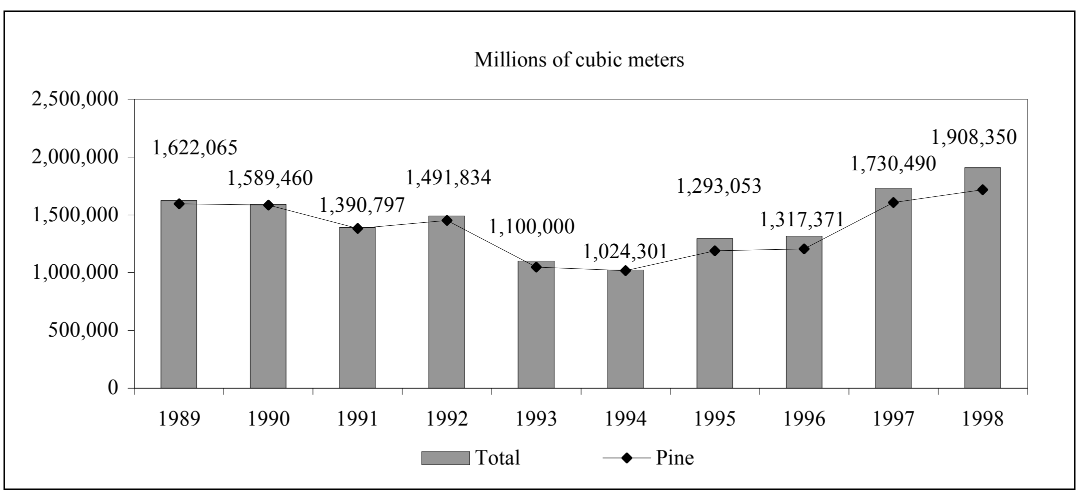
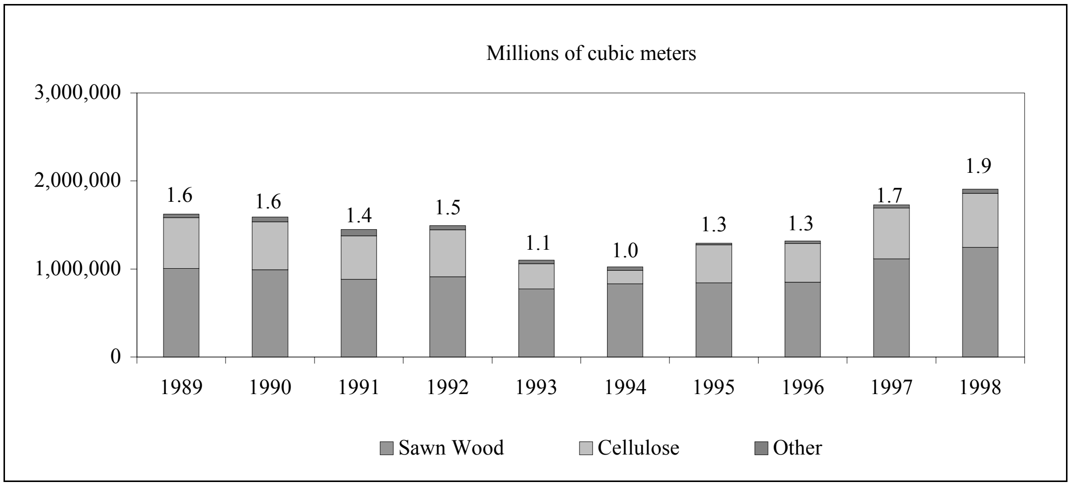


Figure 3. Volume of forestry production in Chihuahua by principal products 1989–1999



4.1 Trends in Post-NAFTA Trade in Forestry Products

This section analyzes trends in the imports and exports of wood and wood products during the period from 1993 to 1999.[20] The intent is to examine the relationship between these trade trends and wood harvesting practices in the natural forests of the Sierra Madre of Chihuahua.

The analysis examines trade flows (imports, exports and production from primary producer states, including Chihuahua) for products in three major wood and wood products catergories under the International Harmonized Tariff Schedule:

- Chapter 44: wood and articles of wood and wood charcol;
- Chapter 47: pulp of wood or other fibrous cellulose materials (including recovered paper or paperboard); and
- Chapter 48: paper and paperboard; articles of paper pulp, paper, or paperboard.

4.1.1 Trade Balance in Forest Products

Mexico's overall exports showed a 164% increase between 1993 and 1999, from a base of US$51.8 billion dollars in 1993 to $136.7 billion in 1999. The total value of imports rose from $65.4 billion in 1993 to US$142 billion in 1999, which corresponds to a 117% increase. Thus, Mexico continues to have an overall trade deficit, though it now has a US$11.9 billion trade surplus with the US.

Mexico had an overall negative trade balance in forest products during the 1993 to 1999 period, and the size of the deficit has grown steadily in the last few years. In 1993, wood and wood product exports reached US$917 million, while imports were valued at US$2,545 million, representing a deficit of US$1,628 million in products with Chapters 44, 47 and 48 (Figure 4 and Table 5).

[20] This analysis is based on trade statistics from the Mexican *Secretaría de Fomento y Comercio Industrial* (Secofi) and Mexico's *Banco de Comercio Exterior* (Bancomext).

Figure 4. Mexico's trade balance in forestry products, 1993–1999

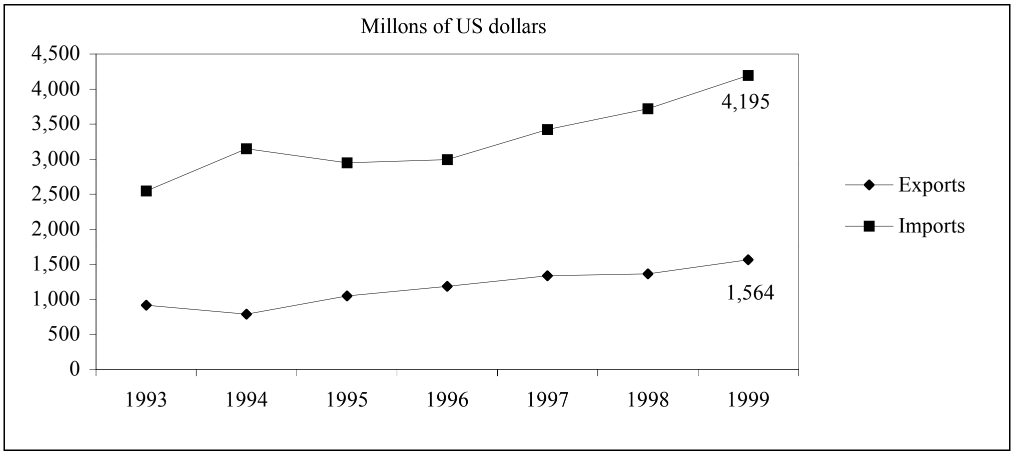


Table 5. Mexico's trade balance in forestry products, 1993–1999 (Millons of US dollars)

	1993	1994	1995	1996	1997	1998	1999
Exports	917.10	790.04	1,049.21	1,187.86	1,337.58	1,364.27	1,564.22
Imports	2,545.36	3,148.02	2,947.12	2,993.83	3,421.26	3,720.58	4,195.02
Trade Balance	-1,628.26	-2,357.97	-1,897.91	-1,805.97	-2,083.68	-2,356.31	-2,630.80

In 1999, imports of wood and wood products in these categories were valued at $4,195 million and exports reached $1,564 million, representing a deficit of more than $2,630 million. It is expected, based on these trends, that Mexico's trade deficit in forestry products will likely continue to increase in the next few years. Table 6 shows that the US and Canada are Mexico's major trading partners for imports of wood and wood products.

Table 6. Principal countries from which Mexico imports wood and wood products
(Percent of total imports)

44 Wood, articles of wood, and wood charcoal		47 Pulp of wood or other fibrous cellulose materials		48 Paper and paperboard; articles of paper pulp; of paper; or of paperboard	
United States	77.3	United States	90.77	United States	88.61
Indonesia	5.9	Canada	4.94	Canada	2.63
Canada	3.4	Brazil	2.49	Spain	0.95
Chile	3.4	Chile	1.21	Finland	0.92
Brazil	1.9	Switzerland	0.19	Germany	0.91

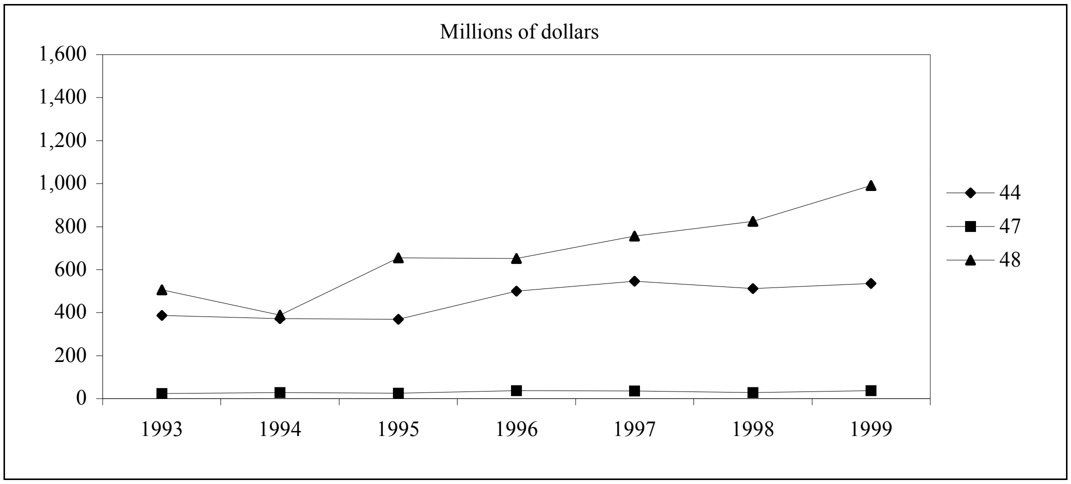
The trade deficit of Chapter 48 products is growing rapidly due to a large increase in imports of paper and paperboard into Mexico. In 1993, the deficit was $1,088 million; it rose to $2,115 million in 1999, an increase of over 94%.

4.1.2 Trade in Wood and Wood Products

Exports of Wood and Wood Products

Figure 5 shows the volume of exports of wood and wood products in the chapter 44, 47 and 48 categories, with products in chapter 48 (paper, paperboard and paper and paperboard products) being among the most important.

Figure 5. Trends in Mexico's exports of wood and wood products 1993–1999



In 1999, the value of exports of wood and wood products from Mexico totaled $1,564 million, representing an overall increase of 70.6% from 1993.

Figure 5 and Table 7 show that exports of wood and wood products have exploded during the 1993 to 1999 time period, especially in the paper and paperboard category, even though the increase has been less than the 164% overall increase in Mexico's exports during this same period. As discussed in more detail below, exports of some products—including picture frames and mirrors; plywood and veneered panels and sheets (HTS 4408 and 4412)—have increased at a rate greater than the overall national average.

Table 7. Growth in exports of wood and wood products, by HTS chapter, 1993–1999
(Percent increase)

44 Wood, articles of wood, and wood charcoal	47 Pulp of wood or other fibrous cellulose materials	48 Paper and paperboard; articles of paper pulp; of paper; or of paperboard
38	49	95.5

The US was by far the principal destination for exports of wood and wood products from Mexico during the 1993 to 1999 period, as shown in Table 8.

Table 8. Destination of Mexican wood and wood product exports, 1993–1999
(Percent of total production)

44 Wood, articles of wood, and wood charcoal		47 Pulp of wood or other fibrous cellulose materials		48 Paper and paperboard; articles of paper pulp; of paper; or of paperboard	
United States	96	United States	96.61	United States	84.5

Due to its forest resources, wood product processing industry and geographic location, Chihuahua leads all Mexican states in exports of wood and wood products in HTS chapters 44, 47 and 48. Table 9 shows how Chihuahua's exports of these products ranks in comparision to those from other states.

Table 9. Participation of the principal wood exporting states (Millons of US dollars)

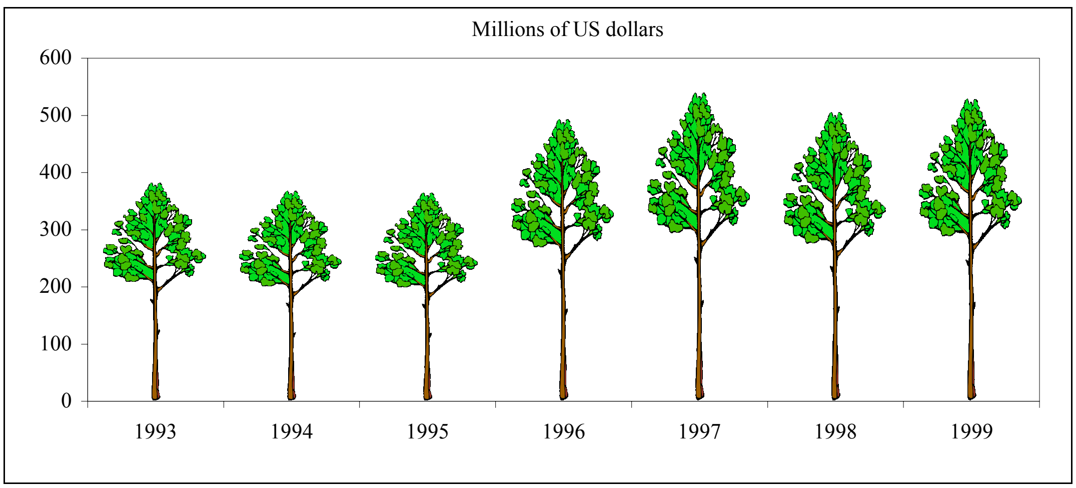
44 Wood, articles of wood, and wood charcoal		47 Pulp of wood or other fibrous cellulose materials		48 Paper and paperboard; articles of paper pulp; of paper; or of paperboard	
Chihuahua	118.0	Chihuahua	14.2	Chihuahua	286.0
Baja California Norte	68.6	No state specified[21]	13.9	No state specified	271.4
Tamaulipas	33.7	Baja California Norte	3.3	Federal District	126.8
Durango	28.3	Sonora	2.8	Baja California Norte	78.8

Analysis of Exports by HTS Chapter

Wood, articles of wood; wood charcoal—Chapter 44

Figure 6 shows the export trends for Chapter 44 products from 1993 to 1999.

Figure 6. Trends in exports of products in Chapter 44, 1993–1999



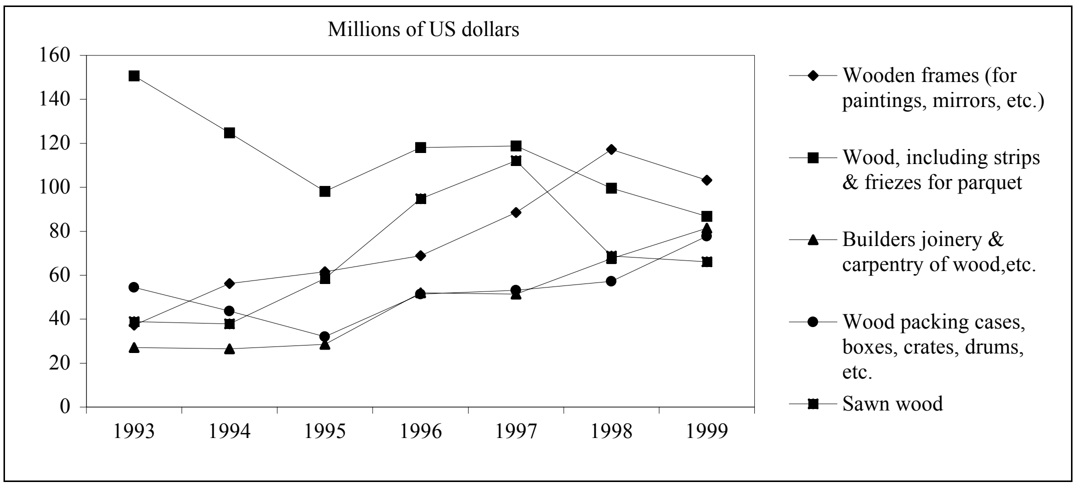
[21] Export statistics show a considerable portion of the exports as not registered to a particular state.

The value of Mexico's exports of Chapter 44 products grew 38.5% during the study period, from $387 million in 1993 to about $536 million in 1997. Exports of these products reached a level of $546 million in 1999. Figure 7 shows trends with respect to five of the most important products included in Chapter 44.

Exports of wooden frames for paintings, mirrors etc. (HTS 4414) increased 177% over 1993 levels, to reach a total of $103.25 million. Exports of products in HTS 4409, which includes wood for parquet flooring, decreased 42.4% from a high of $150.6 million in 1993 to $86.8 million in 1999.

The value of plywood and veneer panel exports (HTS 4412) increased from $1.1 million in 1993 to $9.5 million in 1999, an increase of 450%, but a value much lower than the other types of products. Other products for which the value of exports increased during the 1993 to 1999 time period were veneer sheets and sheets for plywood (HTS 4408), with a growth of about 546% and hoopwood, split poles and wood stakes (HTS 4404), with a growth of 661%, reaching a value of $140 million in 1999.

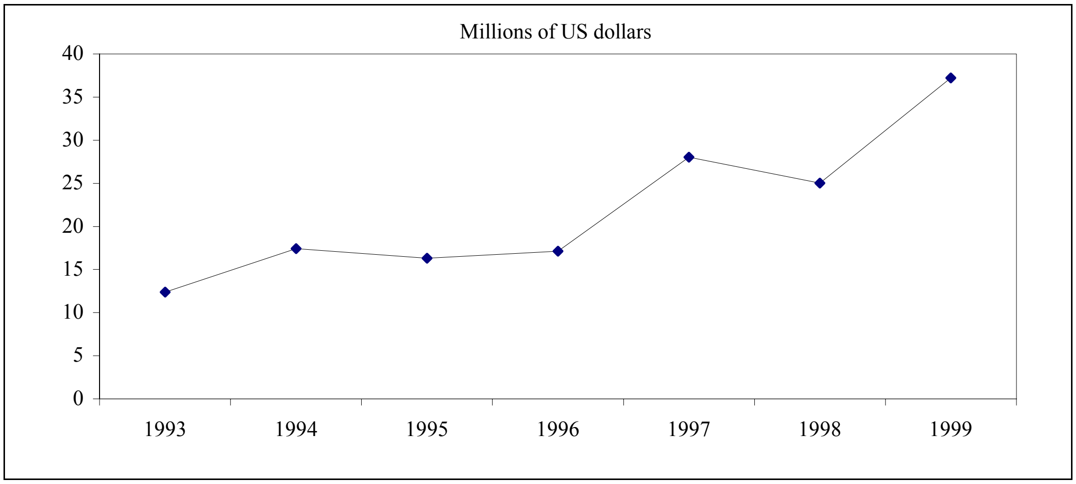
Figure 7. Trends in Mexican exports of five products in Chapter 44, 1993–1999



Pulp of wood or other fibrous cellulosic material (Chapter 47)

Recovered (waste and scrap) paper and paperboard (HTS 4707) accounts for over 99% of all Mexican exports in HTS Chapter 47. Trends in exports of these products are shown in Figure 8. The value of exports in this category grew from US$12.4 million in 1993 to $37.2 million in 1999, an increase of more than 200% in just six years.

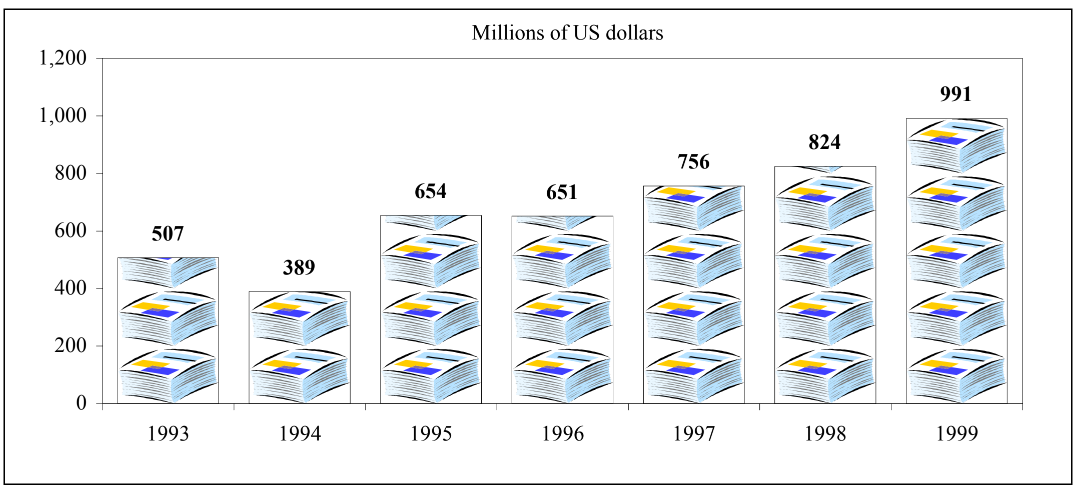
Figure 8. Trends in exports of recovered paper and paperboard (HTS 4707), 1993–1999



Paper and paperboard; articles of paper pulp, paper or paperboard—Chapter 48

The value of Mexico's exports of products encompassed in HTS Chapter 48 increased almost 96% between 1993 and 1996, growing from US$506.6 million in 1993 to US$991 million in 1999. This trend is shown in Figure 9.

Figure 9. Trends in exports of HTS Chapter 48 products



In 1999, the products shown in Table 10 together accounted for over 94% of HTS Chapter 48 exports. Toilet paper and tissues (HTS 4818) represented 43% of the value. In this category, exports from Chihuahua accounted for US$220 million (more than 51% of the total).[22] About 85% of the exports in this category were destined for the US.

[22] In this category, exports not registered to a particular state accounted for almost 27% of the total exports, making full assessment of Chihuahua's participation difficult.

Table 10. Exports of products in HTS Ch. 48, 1999 (Millions of US dollars)

Code SH	Produits	1999
	Total	$991,017,292
4818	Paper used for various household, sanitary uses	430,939,420
4820	Registers, account books, notebooks, etc.	167,063,623
4819	Paper/paperboard cartons, boxes, etc.	148,069,095
4823	Other paper/paperboard products; adhesive paper	67,061,459
4803	Stock for various tissues, paper towels, etc.	58,365,246
4810	Kaolin-coated paper and paperboard	18,947,541
4801	Newsprint, in sheets or rolls	14,829,548
4802	Uncoated paper and paperboard	14,467,917
4821	Paper and paperboard labels	14,392,042

Imports of Wood and Wood Products

Imports of wood and wood products into Mexico increased over 65% between 1993 and 1999, with the fastest growth coming in imports of paper and paperboard and associated products (HTS Ch. 48).

In 1999, paper and paper products (HTS Ch. 48) accounted for 74% of the imports into Mexico of products in HTS Chapters 44, 47 and 48. Figure 10 shows import trends from 1993 to 1999 and Figure 11 shows the composition of imports in 1999.

Figure 10. Imports of wood and wood products into Mexico (HTS Ch. 44, 47 & 48), 1993–1999

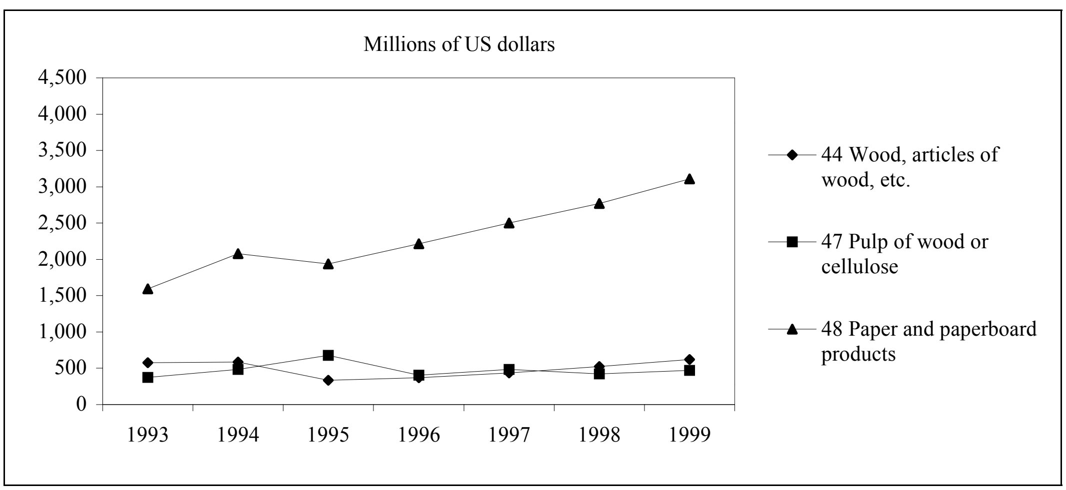
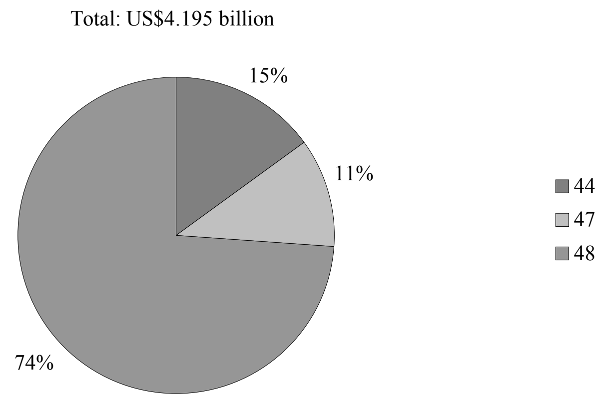


Figure 11. Relative composition of imports by HTS Chapter, 1999



4.2 Post-NAFTA Changes in Forestry and Forestry Products Industry in Chihuahua

4.2.1 Forest Harvesting

As shown in Table 11, the number of forest harvesting permits, as well as the authorized volume of wood to be harvested from Chihuahua forests has increased since 1993. INEGI data for Chihuahua indicate that for 1998 only about 45% of the authorized volume was actually harvested (1.157 million cubic meters of 2.517 million cubic meters authorized). However, other data from Semarnap show a production of about 1.9 million cubic meters in 1998 (Semarnap 1999B). None of these figures accounts for illegal harvesting of wood. Profepa has estimated that on a national basis illegal cutting is reaching about 50% of authorized volumes. If that figure were applied to Chihuahua, the 1998 annual harvest would total about 2.42 million cubic meters according to INEGI harvest figures, or 3.16 million cubic meters based on Semarnap harvest data.

Table 11. Authorized forestry permits and harvest amounts—Chihuahua

	1993	1997	1998
Forestry permits	576	726	759
Wood authorized (cubic meters)	2.33 million	2.45 million	2.517 million

Sources: INEGI 1994, 1998 and 1999.

4.2.2 Forest Products Industries

According to Semarnap, the Chihuahua forest products industry consists of 441 enterprises, including over 300 sawmills. Many of these facilities are small, marginal operations, producing at well below their installed capacity, but Chihuahua also has some of the largest paper and cellulose plants in Mexico. Two post-NAFTA trends are important: (1) a large increase in the number of sawmills, particularly private mills and (2) a consolidation of pulp and paper production brought about by the participation of two large multinational corporations: Copamex and *Grupo Industrial Durango, S.A*. (GIDUSA). These developments are discussed below.

Sawmills

The number of private sawmills grew at an incredible pace in Chihuahua—215 percent over the period of 1993 to 1998. In 1993, there were about 108 sawmills in the state (43 on ejido lands and 65 private mills). By 1998, there were 309 sawmills, with 104 on ejido lands and 205 private mills, indicating the much faster growth of private mills. As the number of private mills grows, forest ejidos become primarily suppliers of raw wood, instead of developing capacity to mill and produce their own higher-value products. The rapid growth of sawmills also increases competition between ejidos and private loggers to find the best wood, in turn exerting massive pressure on the Sierra's forest ecosystems.

Pulp and paper production

In 1999 Chihuahua was the leading Mexican state in the production of wood pulp (more than 36% of chemical pulp) and the fifth largest in terms of paper production (approximately 6%). See Table 12. Most of this production came from large multinational companies that purchased Chihuahuan-based companies in the paper and pulp industries, and to a lesser extent the forest product industry, during the 1990s.

Table 12. 1999 Production of paper and cellulose in Chihuahua

Category	Total production (metric tons)	Percentage of total Mexican production	Rank among Mexican states
Paper	141,479	15.0	2nd
Packaging	90,541	4.2	7th
All Paper Products	232,020	6.1	5th
Wood Pulp	128,552	36.8	1st
Pulp of all types	128,552	23.7	2nd

Source: *Cámara Nacional* 2000, 21, 33

In 1999, a single plant in Chihuahua produced more than 128,000 tons of chemical pulp from bleached hardwood and softwood (*Cámara Nacional* 2000, 21). The facility, *Celulosa y Papel Ponderosa,* or Pondercel, currently has the capacity to produce 144,000 tons of bleached hardwood (short fiber) and softwood (long fiber) pulp at its facility in Anáhuac, Chihuahua, as well as 135,000 tons a year of bond paper per year from pulp (Copamex 2000, 2). This paper is used mainly by the printing and publishing industry and for high-speed copying.

Originally owned by *Grupo Chihuahua* as part of the consortium *Ponderosa Industrial, S.A.* (PISA), *Celulosa y Papel Ponderosa* was acquired by Copamex, a Monterrey-based consortium, in December of 1994.[23] In the process, Copamex also acquired the pulp operations as well as several other Chihuahua-based facilities (see Table 13). This broad ownership of Chihuahua pulp and paper plants allows Copamex to significantly control raw material costs for many of its products (Copamex 2000, 2).

Copamex is currently one of the largest Mexican producers of paper-based consumer products like bathroom and facial tissue (second only to Kimberly-Clark of Mexico); printing and writing products like bond and cut-sized paper; and industrial paper products, including multi-wall bags mainly for cement companies, corrugated containers and specialty papers. While many of these products rely on recycled, secondary fibers, bond and specialty papers require bleached virgin fibers. According to company reports, the Anáhuac plant provides 59% of Copamex's virgin fiber requirements, with the rest imported from US, Canadian and Brazilian producers. Copamex purchases wood from Mexican ejidos and from its own plantations to feed the PONDERCEL plant,

[23] Labor disputes and other factors had resulted in the closure of this plant in 1994. It was reopened after being acquired by Copamex.

although no information was located on how much of this wood comes from forest ejidos in Chihuahua.

Table 13. Plants and annual capacity owned by Copamex in Chihuahua, 1999

Name of Plant	Location	Product	Annual Capacity (metric tons)
Pondercel	Anáhuac	Long and Short-fiber Bleached Pulp	144,000
	Anáhuac	Bond Paper	135,000
Papelera de Chihuahua	Chihuahua	Kraft Paper,	100,000
		Bond Paper	26,000
Sacos y Envases Industriales	Chihuahua	Glued Bag Production	90,000

In 1994, *Empresas la Moderna,* a subsidiary of the Monterrey holding company Pulsar International, purchased other operations of PISA, including *Ponderosa de Chihuahua, Ecofibras Ponderosa, Ponderfibers Corp, Paneles Ponderosa,* and *Bosques de Chihuahua.* In 1996, *Grupo Industrial Durango* (GIDUSA), a major forestry and paper products company, purchased the Ponderosa holding company and four forest product companies for $32 million from *Empresas la Moderna.* The acquisition provided GIDUSA access to raw material sources in Chihuahua where it previously had not operated.

GIDUSA is believed to be the largest forest products company in Mexico, with a capacity to produce 50,000 tons of plywood, 135,000 tons of particleboard and 6,000 tons of lumber for the furniture and construction industries (GIDUSA 2000, 10, 14). In 1999, the company exported 31% of its wood and forest products to the US (GIDUSA 2000, 10). In addition, GIDUSA is a major producer of paper and packaging products, mainly producing corrugated containers for industries, including maquiladoras on the US/Mexico border. Most of these products use secondary recycled fibers, although some unbleached virgin pulp is used for production of multi-wall sacks and bags. In addition to its Mexican holdings, in 1997 and 1998, GIDUSA purchased McKinley Paper Company, which operates a paper mill in New Mexico and two recycling centers. It also acquired two corrugated container plants in Texas, as well as a sheet plant in Arizona. About 55% of the company's revenue is derived from the Mexican market, with the remainder coming from the US and Canada (GIDUSA 2000,1).

GIDUSA obtains most of its woods from ejidos in Durango, Jalisco and Michoacán, though it is also apparently getting wood from some areas of the Sierra Tarahumara. It obtains most of its pulp from its plant in Durango. The company runs both a corrugated container plant and several forestry product companies in Chihuahua (Table 14).

Table 14. Plants owned by GIDUSA in Chihuahua

Name of Plant	Location	Product	Annual Capacity (metric tons)
Cajas y Corrugados de Chihuahua	Chihuahua	Corrugated Containers	26,000
Ponderosa Industrial de México	Chihuahua	Plywood	24,000
		Particleboard	120,000
		Resins	24,000

In addition to these companies, *Smurfit Carton y Papel de México,* another major paper products producer, runs a maquiladora in Ciudad Juárez that makes cardboard products.

In 1995, US-based International Paper Company entered the Chihuahuan market by contracting, first through intermediaries and then more directly, with the Ejido San Alonso in the municipality of

Urique in the Sierra Tarahumara. The forest permit would have tripled the allowable cut in the ejido and included small diameter young pines (9–15 cm). Thirteen ejidatarios, concerned about this intensity of cutting and the ecological damage it could do, filed a complaint with environmental authorities, and the operations were eventually discontinued.

4.3 Key Factors Underlying Post-NAFTA Trends

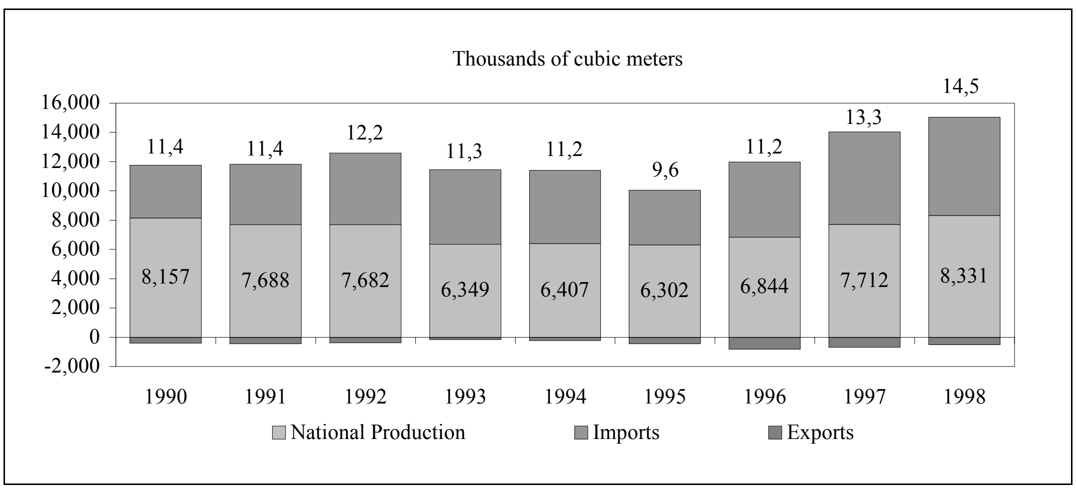
Based on available information, it appears that the current trends in the forestry and forestry product industries in Chihuahua are being driven as much or more by domestic economic conditions (including the value of the peso), changes in domestic forestry law and industry consolidation than by NAFTA tariff reductions. It should be noted, however, that none of these factors is necessarily unrelated to NAFTA and the generalized neo-liberal and globalization policies to which NAFTA is linked.

As discussed in Chapter 3, most of the US tariffs on forest product imports from Mexico were at or near zero before NAFTA. Thus, although exports of several Mexican (and Chihuahuan) forest products have increased significantly in the post-NAFTA period, it appears that the increases are more linked to international and US paper prices and US demand, at least for Chihuahua producers (GIDUSA 2000, 8, 13).

Production in the Chihuahuan forestry and forest product industries also appears to be highly linked to Mexico's domestic demand for forest products, particularly in the paper, furniture and construction sectors (Semarnap 1999A; GIDUSA 2000, 10; Copamex 2000; Juárez 1999, 2). As shown in Figure 12, consumption of forest products in Mexico has increased sharply since 1996, after a large decrease in 1995 due to the economic crisis triggered by the devaluation of the peso.

Imports are supplying a greater portion of Mexico's demand due to inefficiencies and undercapacity in the Mexican forest product industry (Juárez 1999, 1, 3; Semarnap 1999, 2, 3).

Figure 12. Consumption of forest products in Mexico



In terms of forestry product imports into Mexico and competition with products from Mexican producers, both major companies operating in Chihuahua state that reduction of Mexican tariffs on such imports under NAFTA will not affect their competitiveness (GIDUSA 2000, 9-10; Copamex 2000, 5). However, as they struggle to maintain their share of the Mexican market in the face of increasing US imports, Chihuahua paper and forest product companies *are* having to reduce prices to remain competitive (GIDUSA 2000, 7, 9, 35). This, in turn, could mean that these companies will resist new environmental controls or forestry regulations that could increase the costs of the raw wood or increase the costs of their production operations.[24] While this is not the traditional "race to the bottom" in terms of the forestry industry moving to a less-regulated country, it could induce the companies to pressure the Mexican government to avoid adoption of stronger regulations or dissuade the government from strong enforcement of existing regulations.

4.4 Conclusions

1) Even as Mexico's trade in wood and wood products has increased during the post-NAFTA period, Mexico still has a large—and growing—trade deficit in wood and wood products.
2) Prior to NAFTA, Mexico's forestry production was primarily for internal consumption (Semarnap 1999). Imports began to increase in 1992 and 1993, and in those years there were charges that the US was "dumping" cellulose on the Mexican market and that Chile was dumping wood.
3) Wood production, particularly of pine, has increased substantially in Chihuahua since Mexico's entry into NAFTA, paralleling an increase in both exports of wood and wood products from Mexico and an increase in imports.
4) During this same post-NAFTA period, the wood products processing industry in Chihuahua (primarily cellulose and paper manufacturing) has undergone a restructuring process, passing from reliance on local capital to investment and ownership by transnational corporations. There are signs that the production of paper and paper/paperboard products in Chihuahua is tending toward control by two large transnational corporations, Copamex and GIDUSA.
5) Based on available information, it appears that the current trends in the forestry and forestry product industries in Chihuahua are being driven as much or more by domestic economic conditions (including the value of the peso), changes in domestic forestry law and industry consolidation than by NAFTA tariff reductions. It should be noted, however, that none of these factors is necessarily unrelated to NAFTA and the generalized neo-liberal and globalization policies to which it is linked.
6) In terms of forestry product imports into Mexico and competition with products from Mexican producers, both major companies operating in Chihuahua state that reduction of Mexican tariffs on such imports under NAFTA will not affect their competitiveness. However, as they struggle to maintain their share of the Mexican market in the face of increasing US imports, Chihuahua paper and forest product companies *are* having to reduce prices to remain competitive. This could, in turn, mean that these companies will resist new environmental controls or forestry regulations that could increase the costs of the raw wood or increase the costs of their production operations. While this is not the traditional "race to the bottom" in terms of the forestry industry moving to a less-regulated country, it could induce the companies to pressure the Mexican government to avoid adoption of stronger regulations or dissuade the government from strong enforcement of existing regulations.
7) Chihuahua is the leading wood products exporting state in Mexico and is second only to Durango in wood production. The installed capacity of the cellulose and paper plants in Anahuac may be greater than the annual harvest of wood in Chihuahua, indicating that these

[24] GIDUSA notes that "Were enforcement of existing [environmental] laws to increase, or were new environmental laws to be enacted [sic], Durango could incur additional compliance costs, which could be material." (GIDUSA 2000, 17). Copamex states that "[h]istorically, Mexico's environmental laws have not been enforced as vigorously as have environmental laws in the United States….[after NAFTA] we cannot assure you that our operations will not be subject to more strict Mexican federal or state environmental laws or more strict interpretation or enforcement of those laws in the future." (Copamex 2000, 14)

plants would likely receive wood from other areas of Mexico and from outside Mexico if they were to produce at full capacity.

8) The increased demand for wood has served to promote intensive cutting of the Sierra Madre forests and has also apparently increased illegal cutting, as discussed in more detail in Chapter 5. The authors have not been able to locate any studies evaluating the effect of increased wood harvesting on the productive potential of the Chihuahua forests.

9) The demand for virgin wood is exerting considerable pressure on Chihuahua's forests, even to the point where the resource could be exhausted in the not-too-distant future. On the other hand, imports of wood and wood products are increasing and the local wood is at a competitive disadvantage relative to wood and fiber from the US, Chile, Brazil and other countries. These trends raise the question of whether it is worth risking Chihuahua's forestry resources (especially pine and oak) by this rapid pace of cutting, and, as a consequence, sacrificing the forests' other functions such as serving as a carbon sink and headwaters of key rivers. What alternatives might be available to the forestry industry in these circumstances?

5 Environmental and Social Linkages with the Post-NAFTA Forestry Industry

5.1 The "*Cazicazgo*" System and the "*Rentista*" Model

In Chihuahua, as in the rest of the country, about 80% of the forested lands are ejido property. The remaining 20% are either privately owned or held in some other form of social ownership (COSYDDHAC/TCPS 2000, 8, 15-16). The ejido system of land tenure has favored forest exploitation through a rigid social control structure known as "cazicazgo."[25] The cazicazgo system (in the Sierra) was at least temporarily weakened when wood production decreased during the 1993–94 period (see Chapter 4). The structure was also weakened by the collapse of sociopolitical control that, until 1993, had been exercised by the *Liga de Comunidades Agrarias del la Confederación Nacional Campesina* (CNC), an arm of the *Partido Revolucionario Institucional* (PRI).[26]

Since Mexico's entry into NAFTA, the cazicazgo system has adapted to the increase in forestry activity taking place, but now it has to adopt the policy of a chameleon—that is to say it has to maintain relationships with whichever political party is in power.

Cazicazgo forms the basis of the network of power relationships among actors linked to forest activity and forest policy. The key actors are both within and external to the ejido. Within the ejido, power is usually concentrated in one or two families that exercise it through the control of the ejido governing structures (*comisariado ejidal* or the *consejo de vigilancia*) and/or in those who transport the harvested wood (the transport is run as a private business, whether it involves ejidatarios or not). Outside the ejido, the cazicazgo network is established among the ejido administrator (who is generally external), the providers of technical forestry services, the contract representative for the companies buying the wood and, in some cases, the government authorities with responsibilities for the forestry sector.

[25] Cazicazgo is very entrenched in the Sierra Tarahumara, and the peasant population, and especially indigenous people, are subject to its control. Generally, the powerful "*caciques*" who control the system are mestizos. The cazicazgo system is manipulated to obtain contracts for wood that primarily benefit these powerful leaders and the companies buying wood. In some cases, the system has also been used to garner votes for political parties, especially the *Partido Institucional Revolucionario* (PRI) (COSYDDHAC/TCPS 2000, 18-20).

[26] In the Sierra Madre of Chihuahua, the cazicazgo structure was historically reinforced by the PRI, through the *Confederación Nacional Campesina* (CNC). The PRI has had a strong relationship with the CNC and the CNC played an important role as an intermediary in development of contracts for wood harvesting, while at the same time controlling the election process in the region. The change in state leadership from the PRI to the *Partido Acción Nacional* (PAN) in 1994 was also a blow to the traditional cazicazgo system in the Sierra Tarahumara.

Even though there is an institutional ejido organization required by Mexico's Agrarian Law, the control of contracts between companies and the ejido generally occurs through the cazicazgo structure described above. For example, the contracts for wood are generally approved in the ejido assemblies, but these assemblies are often controlled by the caciques, frequently in spite of the majority opinion. This is the case because, as we have described in other work (COSYDDHAC/TCPS 2000), the ejido system is superimposed on the traditional indigenous system. In most forestry ejidos, the indigenous residents have not taken advantage of the institutional procedures established for the ejido system. Instead, that system has been used by the few who profit most from harvesting of the natural resources.

Historically, the cazicazgo control of the wood production and the administration of forest resources has eliminated attempts to organize and communally administer processes that would guarantee more sustainable resource management and improve social welfare. The factors through which cazicazgo reproduces itself and maintains its dominance over the production and commercialization of the forest resources include: lack of information on the part of indigenous people; coercion; providing alcohol; bribes; the economic debts the ejido owes to commercial enterprises; and alliances with political and economic powers.

In essence, cazicazgo in the Sierra is dominant, authoritarian and racist. This power structure supports a "rentista" model of forestry production that is predominant in the forestry ejidos of the Sierra Tarahumara.[27] The characteristics of the rentista model of forest exploitation include: (1) the wood is contracted for in logs (raw wood); (2) the company contracting for the wood conducts the production cost studies; (3) the company transfers the supervisory functions to the comisariado ejidal (which is generally controlled by the caciques); (4) the company sets the contract price; (5) the company administers the payments; (6) the company gives the responsibility for transport of the wood to private enterprises; (7) the ejido is essentially paid a "salary" for these activities, but it is not paid for the value of the wood, nor does it profit from the wood itself; (8) the ejido organizes the harvesting of the wood and the documentation; and (9) the ejido remains a decapitalized enterprise.

5.2 Linkages between Forestry Activity and Social Conflicts

5.2.1 Social Conflicts in Forestry *Ejidos*

Several social movements in the Sierra Tarahumara involving forestry disputes during the 1990s. Some of the most representative include those in Chinatú (1993), Cusarare (1994), Ocóvichi (1997) and Montede (1998), all of which are ejidos with considerable forestry resources.[28] The roots of the conflicts in these cases were poor ejido administration and corruption, which were reflected in over-exploitation of wood and failure of the majority of the ejidatarios to see any profits. To understand these movements, it is important to understand the cazicazgo structure (described above) as well as the payments that are made to the ejido for forest harvesting. To understand the latter, we ask: How much employment does the forestry activity generate in an ejido? What are the production costs? What does forestry work represent for peasants?

On average, forest harvesting activities generate employment for only about 10% of ejido members, leaving 90% without employment. In theory, however, 100% of the ejidatarios have the right to the forest because it is communal property. All members of the ejido should receive the benefits from forestry activity or direct use of the forest resources.

[27] The rentista model is essentially based on the companies paying small salaries for supervision and cutting and transport of the wood. The ejidos do not get a fair return for the value of their forest resources, nor enough to cultivate and preserve the forest for future harvests.

[28] Some of these movements are described in COSYDDHAC/TCPS 2000, 41-42.

On the other hand, production costs, especially those for transport and technical services, are generally high. These costs are calculated based on the volume of wood for which the purchasing company contracts.

It can be seen from Table 15 that the amount of "profit" realized (6%) is ridiculously low, especially in comparison to the value of the resource and even in comparison to the amounts paid to the ejido authorities. Clearly, the majority of the ejidatarios—who own the resource in common—are not benefiting from this system of production.

An example of how this plays out in practice is provided by the Ejido Rocoroyvo, which has a population of about 2,270. The ejido occupies about 45,000 hectares and should support an annual harvest of about 18,500 cubic meters of wood. The following account from a forestry technician working in the ejido illustrates the problems:[29]

> In this ejido, like others in the Tarahumara lowlands, the ejidatarios are in charge of forestry activity—from the countryside until the product they are selling is delivered to the buyer. The ejidatarios, with the organization, are in charge of looking for all the means to carry out these activities. But, as a result, they are left with a minimum amount of earnings for a resource that belongs to the ejido, that is to say all the ejidatarios.
>
> Before, the participation of the ejidatarios was small since they didn't know about forestry activities, they were badly organized and they didn't have control over the development [of the forestry resource]. Now, they want to organize their own business in order to have more control over the development [of the forestry resource], to empower their directors and the [ejido] assembly, to have direct administration, to better inform the [ejido] assembly [and] to obtain fair prices for the wood.

Table 15. Distribution of production costs for typical forestry *ejido*

Activity	Percent of total costs
Transport of wood	60
Cutting, cleaning, moving, loading	20
Technical forestry services and other services[30]	7
Administration[31]	5
Other costs	2
Direct Profit	6

In the best of cases, the ejidatarios, as owners of the forest resources, are getting about 1000 pesos/year/ejidatario (about $8.90/month) (COSYDDHAC/TCPS 2000, 13). However, day-by-day, the ejidatarios observe the intensive cutting and the increased scarcity of useful forest plants; decreasing humidity; the delay of rains that affect harvesting of their corn, bean and vegetable crops, the disappearance of useful plants and the scarcity of firewood; in sum, the continued deterioration of the forest.

[29] Recorded in the files of *Consultoría Técnica Comunitaria, A.C.* June 2000.

[30] Payments for other services include payments to producers associations, which form part of the structure of the new (1998) *Fideicomiso Chihuahua Forestal*. The ejidos contribute to the producer associations fees for administration of *guías forestales*, fire-fighting services and for support of the Fideicomiso operation. The operating capital of the Fideicomiso is also supported by contributions from private forest companies, and the fees are set per cubic meter of wood. According to the Fideicomiso's proposed budget, the ejidos that participate should receive payments for investing in forest cultivation. At this point, the amounts paid for this purpose, their investment and the effects on the forest have not been evaluated. The Fideicomiso is a very interesting alternative; however, there have been conflicts between the ejidos and the producer associations due to the high costs of the fees (about 15 pesos per cubic meter, compared to about 11 pesos per cubic meter paid by the timber companies) and the fact that the associations act as intermediaries in doing what the ejidos could do for themselves.

[31] Includes the administrator, paymaster, documentation, foreman and ejido authorities.

5.2.2 Illegal Cutting

During the time that the forests of the Sierra were thick, the harvesting of wood was done without any controls—the forest was treated as something without limit, as a renewable resource. But the forests of the Sierra were severely diminished during the twentieth century. One researcher (Lammertink 1997) found only 19 old-growth pine and oak stands. These old-growth forests occupy a total area of 571 square kilometers, estimated to be only 0.61% of the original 93,560 km^2 of original pine/oak forest in the Sierra Madre Occidental. Much of the Tarahumara forest has been cut severely, up to five times in cycles of 15 years, leaving the forest impoverished.

The 1992 forestry law's elimination of the controls that existed on production and transportation of wood and the lifting of restrictions on the installation of sawmills and other wood processing facilities promoted more intensive illegal cutting (Profepa 1998, 2). Because of these trends, in 1997 the government took a step back from its deregulatory efforts and reinstated the requirements for *guías forestales* (documentation) for the shipment, transportation and storage of wood. It was not until February 2000, however, that the state of Chihuahua implemented this legislative mandate.[32]

Between 1996 and 1999, 411 complaints (*denuncias populares*) involving forestry matters were presented to Profepa.[33] This statistic reflects the level of participation by peasants and indigenous peoples from forestry ejidos through the use of citizen complaints against illegal cutting of pine and oak. Also, between 1998 and 1999, COSYDDHAC and *Fuerza Ambiental, A.C.*[34] (nongovernmental organizations in Chihuahua) assisted in the preparation and follow-up of 43 judicial actions against illegal cutting. These actions were filed with Profepa on behalf of 20 indigenous and mestizo communities of the Sierra Tarahumara (Table 16).

Table 16. Judicial actions filed with Profepa regarding illegal cutting (1998–99, with assistance from Cosyddhac and *Fuerza Ambiental, A.C.*)

Denuncia popular	*Denuncia penal* (criminal complaint)	Appeal (*recurso de revisión*)	Request for information	Total
31	7	3	2	43

With respect to these actions, as of March 2000, none had been resolved, even though the administrative time limits for resolution had expired. Due to the failure of Profepa to respond to these complaints, the communities and the nongovernmental organizations providing assistance to them decided to begin a campaign "Against Impunity and For Environmental Justice in the Sierra Tarahumara."[35] This campaign's goal is to force Semarnap, and specifically Profepa, to resolve the administrative complaints lodged by the indigenous and mestizo communities. The campaign is centered on three demands of the responsible authorities:

32 This was done only after significant pressure and was apparently done more with an eye towards improving the environmental image of the state government than of strong law enforcement. Profepa noted in 1998 that Chihuahua had failed to comply with its obligations under an agreement with the federal government to increase state and local enforcement of forestry laws (Profepa 1998). Chihuahua was the only state with which the federal government signed such agreement that failed to meet its obligations.

33 Oficio:DG/003/RN/0105/2000. Expediente: 911/119/08.

34 Formerly the *Centro de Derecho Ambiental del Noreste de México,* a public-interest legal defense fund.

35 This campaign is supported by various local organizations, including the Diocese of the Tarahumara, COSYDDHAC, *Fuerza Ambiental*, the Sierra Madre Institute and people involved in the Inter-Institutional Program for Indigenous Support. At the national level in Mexico it is supported by the *Red Nacional Todos los Derechos para Todos* (a human rights network) and others. At the North American level, it is supported by the Texas Center for Policy Studies, the Rural Coalition and the *Comité pour la Justice Social du Canada,* among others.

- Conduct audits of the Forest Management Plans to ensure that they are in compliance with environmental regulations;
- Prepare an overall land use regulation for the Sierra, identifying areas that should be off-limits to tree harvesting and identifying areas that should be protected for flora and fauna or as biological corridors; and
- Provide civil society organizations with sufficient information supporting these analyses.

In addition, in June 2000 the groups have presented an Article 14 compliant to CEC regarding Profepa's failure to effectively enforce the relevant environmental laws involved in these cases.

Table 17 summarizes the basis for the complaints about illegal logging. In general, the complaints involve violations of Mexico's federal environmental law, including the procedures requiring response to and resolution of citizen complaints; violations of Convention 169 of the International Labor Organization (referring to the rights of indigenous peoples); and violations of Mexico's federal penal code (*Procedimientos Penales).*

The four principal violations alleged in these complaints are: (1) failure of the *Ministerio Público* to participate in cases where there are probable environmental crimes; (2) denial of environmental justice to Tarahumara and Tepehuan indigenous communities; (3) failure to issue penalty orders even when violations have been documented through inspections; and (4) denial of information requested by citizens. The groups filing these complaints believe that these violations show a pattern of the inability or unwillingness of the responsible authorities to enforce the relevant laws. The causes of this failure are multiple and include lack of personnel and budget (see Chapter 6); bureaucratic inertia; and undue influence of the private sector.

Table 17. Summary of bases for pending complaints about illegal cutting in the Sierra Tarahumara

Legal basis included in complaint	Number of cases[36]
Failure to properly apply or comply with Arts. 189, 190, 191 of Mexico's federal environmental law, relating to the admission of, standing to file or other aspects of the citizen complaint (*denuncia popular)*	18
Failure to properly comply with Art. 176 and/or Art. 199 of the federal environmental law, regarding appeals and final resolution of complaints	12
Failure to properly comply with Art. 169 of the federal environmental law, requiring referral to the *Ministerio Público*	2
Failure to comply with Art. 159 of the federal environmental law regarding responses to citizen requests for information	7
Failure to properly comply with various aspects of Arts. 190-193 of the federal environmental law regarding processing of, response to and final resolution of citizen complaints	5
Failure to comply with Art. 202 of the federal environmental law, regarding requirements upon identifying violations during an inspection	15
Failure to effectively apply Art. 15.2 of Convention 169 of the International Labor Organization regarding authorizations for forestry development in indigenous lands	10
Violations of various provisions of Mexico's federal penal code	37

5.2.3 Results of the Campaign

The Campaign against Impunity and for Environmental Justice in the Sierra Tarahumara was initiated at the September 1999 assembly of the Rural Coalition, which was held in Creel, Chihuahua.[37] One of the resolutions from this assembly was to present to Semarnap Secretary M. Julia Carabias a written petition emphasizing three important points:

[36] Cases may involve one or more of the legal basis cited.

[37] The Rural Coalition is a trinational association of agricultural producers and workers, based in Washington, DC.

1) The need to establish an effective process for resolving the 1998–1999 citizen complaints about illegal cutting;
2) The need to conduct an audit of the forest harvesting permits and associated forest management plans approved during 1998–1999 with the goal of determining whether these operations are in compliance with the permit and plan terms and the applicable environmental regulations, with the results of these audits being available to nongovernmental organizations and citizens; and
3) Evaluate, in a scientific manner, the environmental impact of the forestry industry on the Tarahumara ecosystems, with the objective of a more rational plan for future forestry operations in the area and a land use plan to determine: forestry development areas; areas off-limits to forestry; protected areas for flora and fauna; conservation areas for old-growth forests; and biodiversity corridors.

A detailed report on the effects of forestry development in the Sierra Tarahumara was prepared by COSYDDHAC and the Texas Center for Policy Studies (COSYDDHAC/TCPS 2000). This report was released by COSYDDHAC at the Montreal Colloquium for Environmental and Human Rights in March 2000. In March and April 2000, COSYDDHAC distributed the report to state and federal authorities and presented its results in various public and press fora in Mexico. In early March, the Diocese of the Tarahumara published a declaration about forestry issues in the Sierra.

On May 23, 2000, Profepa's Forestry Enforcement Division convened a first follow-up meeting regarding the legal actions that had been filed by peasants and indigenous leaders. Since that first meeting there have been four follow-up meetings that have also been attended by representatives of the Chihuahua delegation of Profepa and Semarnap; a representative of the Chihuahua State Advisory Commission on Forests and Soils; a representative of the Chihuahua state government; NGOs involved in supporting the citizen complaints; and ejido and indigenous representatives that have filed the complaints. Representatives of the Ecology Committee of the Chihuahuan Congress and the *Confederación Nacional Campesina* have also periodically attended the meetings.

In addition, COSYDDHAC has been invited to participate in the Chihuahua State Advisory Commission on Forests and Soils. The Diocese of the Tarahumara has worked with the Inter-institutional Program for the Support of Indigenous People (PIAI) to establish a working group to discuss forestry-related problems of the Sierra's indigenous populations.

The campaign and these related activities have resulted in Profepa giving more priority to the issues. This progress is due not only to the public mobilization of the campaign and to the hundreds of campensinos and indigenous leaders behind each citizen complaint, but also to the national and international support for the campaign. As of September 2000, 23 of 29 cases have been concluded, at least with respect to the administrative process. Fines totaling over 1 million pesos (approximately US$100,000) have been assessed, though this does not correspond to the real economic value of the pines that have been cut illegally. Collection of the fines, however, is a responsibility of municipal authorities and, to date, none have been paid.

On the other hand, there remain several omissions in the application of the penalty process, especially with regard to: (1) lack of impartiality in inspections; (2) in six cases (*Cuiteco, El Consuleo, Monterde, Basonayvo, El Refugio* and *Rocoroyvo*) the complainants themselves were fined; (3) claims of criminal violations have not received the necessary attention from the Office of the Public Ministry; (4) time limits for responses set out in the law have not been met; and (5) several of the final responses to the complaints do not identify the parties responsible for the violations or, in some cases, do not state clearly what violations were found or what the ultimate resolution of the complaint was. In the six cases where the complainants themselves were fined, it seems to be potentially a way of discouraging future complaints. Also, the Rocoroyvo ejido was fined for a forest fire, though such fines have not been issued to other ejidos where fires have occurred.

There have been other benefits of the increased focus it has brought to forestry issues in the Sierra, including:

1) The development of a broad-based movement for protection of the forests and against impunity for environmental violations, with the authorities moving to address some of the citizen complaints that have been presented;
2) The creation of an opportunity for the indigenous people of the Pino Gordo ejido, who joined the movement in presenting a complaint to Profepa against illegal logging in that ejido, to seek additional protection for their forest. With the support of the *Alianza Sierra Madre*, the Pino Gordo ejidatarios are seeking the establishment of a Protected Natural Area for Flora and Fauna.[38]
3) The suspension of private concessions for sand and gravel removal from the Río Rochéachi in the municipality of Guachochi, and the delegation of oversight and protection of the river to the local ejido.
4) The institution of a permanent program, "Saving the Forest," under the auspices of the PIAI.

5.3 Conclusions

1) The cazicazgo structure has helped to foster an increase in forestry activity in the Sierra since Mexico's entry into NAFTA, with a new image of "productive work" for the Sierra and with a capacity to adapt to political changes in the state and the country;
2) Forestry activity under the "rentista" model that reigns in the Sierra Madre has decapitalized the ejidos, provoked greater poverty and further degraded the natural resources, all in exchange for very small payments to the ejidos.
3) Since NAFTA, the application of environmental laws in Mexico has acquired particular importance for the peasants and indigenous people in the defense of their forests. The legal defense—and not violent confrontation—has followed from the indigenous people exercising their legal rights. However, Profepa has not functioned the way many citizens have hoped it would and economic powers have even more autonomy. In some instances, this problem can be attributed to lack of sufficient personnel and resources. In other cases, however, it appears that the "inefficiencies" are more intentional, because the complicity among the authorities, caciques, intermediaries and the timber companies is real.
4) Based on the experience with the citizen complaints about forestry in the Sierra Tarahumara, there is a need for legislative reform of the federal environmental law. These reforms should be directed toward establishing a more autonomous enforcement structure that has greater management capacity; that is, an enforcement process that better integrates the results of the inspection; ensures that the level of fines imposed is commensurate with the severity and economic value of the violations; and ensures that penalties assessed are, in fact, collected. Currently, the citizen complaint process does not have much credibility for those who have used tried to use it and, in many of the cases familiar to COSYDDHAC, the penalties are subject to negotiation, and may even be paid by revenues from cutting more pine.
5) The Sierra Tarahumara presents an extremely complicated situation, considering the cazicazgo system, the lack of the rule of law with respect to forestry operations and the difficulties with the citizen complaint and penalty processes, all of which lead to a certain level of impunity for unsustainable forestry operations. There need to be new measures

[38] *Diagnóstico del Área Natural Protegida con Categoría de Área de Flora y Fauna Pino Gordo:* Application to Semarnap. Prepared by *Alianza Sierra Madre*, *Pueblo Indígena de Pino Gordo*, *Mujeres Indígenas Tepehuanas y Tarahumaras, A.C.* and *Fuerza Ambiental, A.C.,* September 2000.

developed to ensure sustainable development principles are implemented for the forestry and forestry products industries; for consumers who want to know if they are purchasing wood and wood products that are produced in a sustainable manner; and especially for the sustainability of the indigenous communities that make their home under the pines of the Sierra Tarahumara and that are now, after a long period of silence, raising their voice with the law in their hands. These new measures and reforms are extremely important, because no one will be well-served if the forests of the Sierra Tarahumara disappear.

6 Indicators of Environmental Impact of Post-NAFTA Changes in Chihuahua's Forestry Industry

This chapter briefly examines available information regarding the post-NAFTA environmental impact of forestry in Chihuahua, particularly in the Sierra Tarahumara. One problem we face is the lack of sufficient environmental baseline data to which post-NAFTA conditions can be compared. Studies by the World Bank and others in the late 1980s and early 1990s indicated that the forests and the environment of the Sierra were already suffering from overlogging and poor forest management (Lowerre 1994).[39] Pre-NAFTA comprehensive studies of the Sierra Tarahumara forests, however, are generally lacking (COSYDDHAC/TCPS 2000, 21-26).

A second problem we encountered is that there have not been any comprehensive studies—and few site-specific ones—on the environmental effects of logging in the Sierra Tarahumara since 1994.[40] Given these serious limitations, we are constrained to making some general observations about the known and potential environmental effects of the forestry industry in the Sierra Tarahumara. The data we present in Chapter 4 shows, however, that logging in the Sierra Tarahumara is on the increase since 1994 and, thus, the severity of the impacts is very likely increasing.

6.1 Deforestation and Biodiversity

As described in Chapter 2, the Sierra Tarahumara still has a rich variety of flora and fauna and more forested land than any other state in Mexico, including some of the only remaining stands of old-growth temperate forests (see also Lammertink 1997). The diversity of flora, in particular, was an important factor in the area's nomination—as part of the Apachean/Madrean Region—as a "megadiversity" center, one of the few in North America (Felger and Wilson 1994).

At least two research teams concluded, even before NAFTA went into effect and before the recent increases in timber cutting, that logging is likely to be the greatest threat to these forests and their biodiversity (Ceballos 1993; Felger and Wilson 1994). This certainly appears to be the case now in certain forestry ejidos that have become "hot spots" of controversy about logging practices, including illegal logging, and the need for more sustainable forestry management (COSYDDHAC/TCPS 2000, 60-64). These include the San Alonso and Churo Ejidos, in the municipality of Urique; the Ciénaga de Guacayvo Ejido in the municipality of Bocoyna; and the Pino Gordo and Llano Grande Ejidos in the municipality of Guadalupe y Calvo.

Much of the logging in the Sierra is by methods that approximate clear-cutting, removing all but a few mature trees at one time. The remaining trees are often cut after they drop their seeds for

[39] These studies, most of which were under-funded and were based primarily on reviews of the scant existing literature, were done for a World Bank forestry loan for Chihuahua and Durango. The Bank ultimately cancelled the loan.

[40] Researchers in the Geological Sciences Department at the University of Texas in El Paso, including Dr. Robert Schmidt, are finalizing studies on land use change in the headwaters of the Conchos and other rivers that originate in the Sierra Madre, using satellite imagery technology, but the results of these studies are not yet fully available.

"reforestation." Researchers have long expressed concern that this technique is very damaging to biodiversity and long-term forest health in the Sierra, particularly because of the area's highly erodible soils, arid climate and slow forest regeneration rates (Ceballos 1993; Lammertink 1997).

Profepa has identified two regions of the Sierra as "critical zones" for deforestation (Profepa 1998). These zones, which are supposed to warrant increased attention for enforcement and analysis of the causes of deforestation, are shown in Table 18.

Table 18. Critical zones identified by Profepa in Chihuahua

Zone	Municipalities
Tomochic-Basaseachic	Guerrero, Ocampo, Uruachi, Temosachi, Moris
San Juanito-San Rafael	Bocoyna, Urique, Maguarachi, Carachi

6.2 Water Quality and Sedimentation

Apparently, there are no regular water quality monitoring stations located in the forested headwaters of the Conchos or the other rivers that flow out of the Sierra Madre (*Comisión Nacional de Agua* 1997). Thus, it is difficult to assess whether there have been adverse effects on these rivers from increased cutting in the forests. However, given the highly erodible soils of the Sierra and the higher rates of legal and illegal cutting, it would not be surprising if such effects were occurring.

In addition to localized stream degradation, increased erosion could result in increased sedimentation of downstream reservoirs. Mexico's National Water Commission (CNA) reports that several of the Chihuahua reservoirs downstream of the Sierra Madre are experiencing "significant" sedimentation, but the agency has not yet completed reservoir bottom elevation studies necessary to quantify the degree to which storage capacity of the reservoirs has been reduced.

There is limited information available on the discharge of pollutants from various pulp and paper plants and wood products plants in Chihuahua (*Comisión Nacional de Agua* 1997, 5.1.3). However, the data does not include information on instream concentrations of pollutants, the effect of these pollutants on aquatic ecosystems or trend data over time. Thus, this information is insufficient for drawing quantifiable conclusions about the environmental effects of increased production of paper, pulp and other wood products in Chihuahua.

6.3 Conclusions

Much more information is necessary to determine the actual and potential effects of increased forestry production on the environment and public health in Chihuahua. The authors believe that comprehensive studies on deforestation in the Sierra Tarahumara should be undertaken immediately, building on the information gathered in the limited studies that have been conducted to date. The studies should focus on defining deforestation rates; the degree of compliance with authorized forest management plans; impacts on biodiversity, soil erosion and water quality; and the effects of increased logging on the ability of area residents to engage in traditional farming and harvesting practices.

In addition, these comprehensive studies should be designed to define areas that would be off-limits to commercial harvesting (such as old growth stands with high levels of biodiversity); define sustainable harvesting rates and techniques for other forested areas; and define additional protected areas for flora and fauna.[41]

[41] In September 1999 and again in 2000, COSYDDHAC asked Mexican authorities to conduct such studies but, to date, it has not received a response.

Additional studies on the effect of water and air pollution discharges from pulp and paper factories on the environment, especially as production has increased since NAFTA are necessary.

There is also a demonstrated need for more effective enforcement of environmental and forestry laws and more rapid response to the complaints of indigenous ejidos seeking to protect their forests from over-harvesting and illegal cutting by commercial timber interests. (See Chapter 5.) The 1997 forestry law reforms provided Profepa with important new enforcement powers, including expanded audit authority, power to close or suspend damaging operations and power to order violators to restore ecological damage caused by their operations (Profepa 1998). It is likely, however, that Profepa will need additional resources to increase the effectiveness of its enforcement efforts, or will need to shift resources to the Sierra Tarahumara from other areas of the country.[42]

Finally, we believe there is a critical need to promote increased knowledge of sustainable forestry management in the Sierra Tarahumara and to assist ejidos in developing markets for sustainably harvested timber.

The authors believe that the CEC could potentially help the government of Mexico address these issues with an Article 13 study, bringing resources and expertise to ensure the necessary environmental studies are conducted and supporting efforts to implement more sustainable forestry management practices.

7 Overall Conclusions

The foregoing chapters demonstrate the complexity of attempting to determine how NAFTA has influenced the forestry and forest product industries in Chihuahua and how, in turn, those changes affect the environment and peoples of the Sierra Tarahumara. Any attempt to answer these questions has to consider the history of forestry operations in the area (Chapter 2), as well as the sociopolitical factors that determine, for all practical purposes, how forestry and enforcement of forestry and environmental regulations are carried out (Chapter 5). While export/import and other trade data demonstrate some clear post-NAFTA trends in production, these trends are significantly influenced by domestic economic conditions and prices for wood products (especially pulp and paper products) (Chapter 4). Finally, the analysis of environmental effects in this case is hampered by the lack of both pre-NAFTA and post-NAFTA comprehensive environmental studies (Chapter 6). The absence of this information makes it exceedingly difficult to quantify—either with respect to scope or location—the degree to which changes in forest harvesting and production patterns have affected the forest and other natural resources.

Despite this complexity, however, the authors believe there are some relevant and interesting conclusions that can be drawn from the analysis provided in this report. We also have identified a number of steps that can be taken to help forest ejidos move to more sustainable forestry management and to better protect the unique biodiversity of the Sierra Tarahumara. Detailed conclusions and recommendations are presented in Chapters 3, 4, 5, 6 and 7. We highlight here those we believe are of most interest and import from the perspective of CEC and the governments of Mexico and the United States.

7.1 Post-NAFTA Trends in Forestry Production and Forest Products Industries

Wood production, particularly of pine, has increased substantially in Chihuahua since Mexico's entry into NAFTA, paralleling an increase in both exports of wood and wood products from Mexico

[42] In 1997, Profepa had only one inspector for every 1.19 critical areas and only one inspector for every 208 forestry operations or facilities. It had only about $30,000 for monitoring of each critical area and only $180 for monitoring each forestry operation (Profepa 1998).

and an increase of imports, particularly from the US. During this same period, there has been significant consolidation of the forest and forest products industries in Chihuahua and a large increase in the number of private sawmills. Forest ejidos have generally remained impoverished suppliers of raw wood, with pressure on the forests intensifying greatly over the last few years. The historical sociopolitical structure that has controlled wood production from forestry ejidos—a structure under which a few powerful leaders profit but the majority of ejidatarios receive very little in compensation for the harvesting of wood they own in common—has persisted and adapted to changing times.

7.2 Effect of NAFTA Tariff Reductions

Based on available information, it appears that the current trends in the forestry and forestry product industries in Chihuahua are being driven as much or more by domestic economic conditions (including the value of the peso), changes in domestic forestry law and industry consolidation than by NAFTA tariff reductions. It should be noted, however, that none of these factors is necessarily unrelated to NAFTA and the generalized neoliberal and globalization policies to which NAFTA is linked.

Pre-NAFTA tariffs on wood and wood products will be progressively reduced to zero by 2003 under NAFTA, though most US and Canadian tariffs were already at or near zero and most Mexican tariffs were fairly low (0 to 15% in most cases). The major forest products industries operating in Chihuahua have contended that reduction of Mexico's tariffs will not affect their competitive position or production levels significantly. The trade data show, however, that imports of pulp and paper products from the US into Mexico have increased rapidly since NAFTA took effect. Chihuahua producers are thus under pressure to keep product prices low to maintain their competitive positions in the Mexican market. This dynamic could put pressure on the forest products industry in Chihuahua to oppose environmental regulations that increase its cost of doing business by either making their raw wood more expensive or by imposing additional environmental controls on pulp and paper operations.

7.3 Effect of NAFTA's Provisions on Non-tariff Barriers

NAFTA's provisions regarding non-tariff trade barriers may adversely affect the ability of Mexico to create and/or foster markets for sustainably produced wood and wood products. This is particularly true with respect to the technical standards provisions of Chapter 9 and the government procurement provisions of Chapter 10. Much depends on the interpretations of ambiguous provisions in the NAFTA text and developing WTO "jurisprudence" may influence these interpretations. While wholly voluntary certification programs for sustainably produced wood are not likely to be significantly affected by these provisions, options to use government action to promote the programs and develop markets for the wood are made less viable by NAFTA's provisions on standards.

Recent interpretations of the investment provisions of NAFTA Chapter 11, particularly the Metalclad case, pose a substantial threat to Mexico's ability to adequately regulate forestry or forestry product operations of companies from the US and Canada.

7.4 Adequacy of Mexican Forestry and Environmental Laws and their Enforcement

In the last few years, indigenous leaders and others have filed hundreds of citizen complaints about illegal cutting and other unsustainable forestry practices in the Sierra Tarahumara. Our analysis indicates that there are substantial deficiencies in the adequacy and enforcement of forestry and environmental laws in Chihuahua and that response to these complaints has, on the whole, been inadequate. There are a number of reasons for this, including earlier efforts to deregulate forestry operations, intensive pressure to harvest the forest, a corrupt sociopolitical control structure in forestry ejidos, and lack of resources, personnel and, in some cases, political will on the part of Profepa.

Indigenous peoples, ejido residents, nongovernmental organizations and others have now joined in a concerted campaign to help address these problems. They are asking Semarnap to conduct full and public audits of whether forestry operations in the Sierra Tarahumara are complying with their forestry management plans; to conduct and make public land use and ecological studies needed to identify which areas of the Sierra should be off-limits for further harvesting and to identify areas that should be protected to help sustain the Sierra's biodiversity and indigenous communities. A CEC Article 13 study could assist in meeting this need. These actions must be accompanied by swifter and more effective enforcement of existing forestry and environmental laws, at the federal, state and municipal levels.

In addition, there is an identifiable need to provide substantial technical and financial assistance to increase application of sustainable forestry techniques in the Sierra Madre and to create markets for sustainably-harvested wood. Fully accomplishing these goals, however, will also require addressing the problems caused by the current corrupt ejido control structure that dominates forestry in many ejidos in the Sierra. This system, under which the ejidos have become mere suppliers of raw wood at prices well below its real value, has prevented the ejidos from breaking the cycle of poverty and natural resource degradation that is forcing many people off the land and doing great and irreversible damage to the magnificent forests of the Sierra Tarahumara.

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NAFTA Effects on Water:
Testing for NAFTA Effects in the Great Lakes Basin

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1 Introduction

In response to the North American Commission for Environmental Cooperation (CEC) Call for Papers relating to the Analytic Framework for Assessing the Environmental Effects of NAFTA, the Sierra Club of Canada, on behalf of our research partners Great Lakes United and the Sierra Club Eastern Canada Chapter, are pleased to submit: Testing for NAFTA Effects on Water in The Great Lakes basin.

The waters of the Great Lakes have been called the lifeblood of the region. This paper tests for NAFTA impacts to these important waters. This paper also tests the test for assessing NAFTA Effects. The first part introduces the research team and highlights our findings to improve in general the Framework for Assessing NAFTA Effects. The second part describes NAFTA impacts related to the Great Lakes basin in three main areas: bulk water exports and use, privatization of water services and water quality, especially related to the growth in intensive livestock operations in southern Ontario.

Part three contains the elements for a new Common Standard to Protect the Great Lakes, that we recommend, among other things, be listed as a paramount environmental agreement under NAFTA Article 104. The incorporation of the Common Standard by legislation in the appropriate jurisdictions, together with enforcement that includes a community-based approach, are key to resolving growing pressures on this exhaustible resource. In addition, we feature a case study that directly applies the Framework to the tragic Walkerton water-crisis in Ontario, following the downloading of government responsibility for clean water testing to private facilities. The emerging human right to clean water and a healthy environment is described as a focus of strategies for water in this century. We conclude that the Framework, while helpful in identifying NAFTA impacts, requires significant improvements to fulfil the CEC mandate to protect the North American environment.

1.1 The Research Team and Process

The Sierra Club of Canada is a national environmental organization with extensive trade-related expertise, and a member of the Canadian Water Watch Network. The Club's efforts in preparing this paper were complemented by the excellent binational work of Reg Gilbert of Great Lakes United, especially as it relates to Great Lakes institutions and organizations, including the International Joint Commission.

To feed in the essential work at the grass roots, particularly relating to water quality, the Sierra Club Eastern Canada Chapter in Ontario contributed greatly to this paper. Particular mention is made of the efforts of Juli Abouchar of Birchall Northey who conducted the Walkerton Case Study, where a direct link is made to NAFTA induced beef and hog production in Ontario and the withdrawal of government from clean water protection. The energy and vision of the Chapter's Clean Water Campaigner Kirsten Valentine Cadieux is also gratefully acknowledged as well as that of Eric Wilson, Chapter staffperson. Special recognition of our volunteers, the Club's true strength is also due to Johnny Lo, Kate Kempton, and Sarah Bradley and Catherine McTeer of Queen's University Environmental Law Students Society. In addition to our water experts, this project would not have been complete without the careful analysis of Robert Gibson and Anita Walker of the University of Waterloo, Environment and Resource Studies on Assessing the CEC Assessment, Appendix 1 below. Special thanks are also extended to Sarah Richardson and Elizabeth May.

In preparation for this paper, the research team hosted a public workshop in Toronto, September 11, 2000, where aspects of the paper were presented and discussed. The many comments and suggestions we have received improved the paper and we extend our thanks to all participants, and sponsors, including CEC and the Canadian Union of Public Employees, for the opportunity to conduct the workshop and present these findings on NAFTA Effects to water, water being an essential element to all living things.

1.2 Assessing the CEC Assessment of NAFTA Effects

The purpose of the CEC Call for Papers is to apply the draft Analytic Framework for Assessing the Environmental Effects of NAFTA to particular issues or sectors of concern. The hope is to identify linkages, mitigate negative impacts and contribute to our knowledge about important variables. The framework does not pretend to be static. Thus the papers should identify areas for further research and framework refinement.

Prior to application of the framework to water, however, it is prudent to analyze the structure and content of the overall Final Analytic Framework (See Appendix 2). Some assessment processes are narrowly designed and applied as a means of identifying and mitigating significantly adverse biophysical effects of economic activity. However, environmental assessment thinking and practice have moved towards becoming more ambitious, more integrative and more comprehensive. Indeed then, the Final Analytic Framework should strive to follow this trend and approach environmental assessment in an ecosystemic and participative nature. A set of basic environmental assessment principles can be drawn from the last 30 years of environmental assessment experience and associated learning can be examined in light of these principles to determine whether they have been incorporated. The principles include respecting uncertainty, adopting sustainability as the central objective, setting clear rules for application and implementation, ensuring transparency and openness and facilitating public participation, monitoring the results and applying the lessons, and being efficient.

When these principles are applied to the Final Analytic Framework, it is found that there are three major areas within the Framework that need to be addressed in order to achieve a higher level of environmental assessment that is credible, efficient and appropriately focused on sustainability issues. First, the purpose of the Framework should be expanded to allow a realistically integrated approach centerd on achieving sustainability. This entails broadening the focus of the Framework from the ambient environment to include social, economic and ecological factors, and broadening the scope of the assessments to move beyond considering adverse effects to considering taking positive steps towards greater sustainability. Secondly, the Framework should ensure consideration of alternative immediate responses and alternative trade arrangements that might be worthy of adoption in revisions to NAFTA or in the design of new trade arrangements for North America or elsewhere. Thirdly, the process should be more open and participative. Local knowledge and other contribution from a variety of stakeholders should be valued and included throughout the process. It is important to consider these built-in limiting factors when applying the Framework to any issue.

2 Applying the Framework to Water

In this part we apply the Framework to water in the Great Lakes basin. Despite the sparse amount of information, we consider the question posed in the Framework: whether the NAFTA context is reinforcing the pollution haven effect, i.e., that economic activity tends to concentrate in areas without adequate technical, management, physical infrastructure and/or institutional capacity. In addition we consider whether NAFTA is leading to a regulatory and/or migratory race to the bottom in terms of investment and production facilities and processes, with negative impacts on the water quantity, and public access to clean drinking water. We identify two examples where NAFTA is clearly having negative impacts on both water quantity and quality. We suggest that a new Common Standard to protect the Great Lakes is necessary in order to ensure sustainable water management. A business as usual case where NAFTA effects and the global water crisis go unaddressed, can only led to the further depletion and contamination of these great Lakes and other freshwater resources in North America.

2.1 Water Facts: Great Lakes—St. Lawrence River Basin

In this part of the paper we describe how the CEC Analytic Framework was applied to specific issues concerning freshwater, in particular: water exports and use, privatization, and water quality. An outline of the basic facts around the Great Lakes basin, as they are currently understood by the leading institutional players, is provided. Attention turns to the best evidence available on climate change impacts associated with this region in order to more fully appreciate the unique and exhaustible nature of this major resource. After this context, we then turn to the environmental stress to the resource as a result of NAFTA-related economic activity.

2.1.1 Institutional Setting and State of Play

Before describing some basic facts about water, this section briefly describes the complex framework of institutions currently managing this resource. The Great Lakes basin lies within eight states and two provinces, and comprises the lakes, connecting channels, tributaries, and groundwater that drain through the international section of the St. Lawrence River up to Trois-Rivières and out to the Atlantic ocean. Major outflows from the Great Lakes currently provide needed freshwater input to fish populations as far away as the Gulf of Maine. The Great Lakes and St. Lawrence River basin is an ecosystem that includes the interacting components of air, land, water and living organisms, including humans and their economic and social activity. Approximately one quarter of Canada's population and 10 percent of the US population live in the basin, 80 percent of whom get their water from the Lakes.

More than a dozen federal agencies in both countries have responsibilities for the system's resources management. Additionally, numerous municipalities, and local agencies have jurisdiction in matters related directly to water levels and qualities issues. The Great Lakes are managed by the 1909 International Boundary Waters Treaty by the International Joint Commission (IJC). The Commission rules upon applications for approval of projects affecting boundary or transboundary waters and may regulate the operation of these projects; it assists the governments of Canada and the United States of America in the resolving of disputes, and in the protection of the transboundary environment, including air quality and the implementation of the Great Lakes Water Quality Agreement.

Under the Treaty, boundary waters (i.e., the waters along which the boundary passes) are treated differently from transboundary rivers or tributaries. With some exceptions, Article III provides that the use, diversion, or obstruction of boundary waters must be approved by the Commission if water levels or flows on the other side of the boundary are to be affected. With respect to tributaries of boundary waters and transboundary rivers, however, Article II states each nation reserves "the exclusive jurisdiction and control over [their] use and diversion." The treaty does not explicitly refer to groundwater. Thus the Treaty does not deal with all waters of the Great Lakes basin in the same way leading to fragmentation of policy development for the ecosystem as a whole. The IJC can not therefore address issues regarding Lake Michigan and its tributaries because the Lake is wholly within US territory, despite its flows into the boundary waters between Canada and the US. Moreover, the Commission, unlike CEC, is not accessible to public complaints regarding compliance with the Treaty obligations.

1999 IJC Reference on Bulk Water Exports

In February, 1999 the two governments submitted a reference to the IJC on the protection of the waters of the Great Lakes, largely in response to the public outcry over a permit granted by the Ontario government in 1998 to NOVA Group to take up to 600 million liters (160 million gallons/ a lot!) of water annually from Lake Superior for export, via ships to Asian markets. Ontario later revoked the permit but the concerns around bulk water exports out of the basin remain. Based on a public consultation, the IJC submitted its final report to governments in March 2000.[1] This paper will respond to some of the major findings and recommendations.

The Boundary Waters Treaty is buttressed by the Great Lakes Water Quality Agreement, which the governments of Canada and the United States of America (US) signed in 1978. The objective of that agreement is to protect the physical, chemical, and biological integrity of the waters of the Great Lakes basin ecosystem, based on an ecosystem approach. Prior to this Agreement, the US entered into the Great Lakes basin Compact, which was agreed to by the eight Great Lakes states and approved by the US Congress in 1968. The Compact created the Great Lakes Commission, and provides, among other things, for joint or cooperative action to promote the orderly, integrated, and comprehensive development, use, and conservation of the water resources of the Great Lakes basin. It has developed a role to plan for the welfare and development of the Great Lakes Charter, currently a non-binding instrument.

The 1985 Great Lakes Charter is an arrangement among the Great Lakes states and the provinces of Ontario and Quebec. Although the Charter is voluntary, it focuses the Great Lakes' states and provinces on a number of resource issues and fosters cooperation among them. The Charter provides that the planning and management of the water resources of the Great Lakes basin should be founded upon the "integrity" of the natural resources and ecosystem of the Great Lakes basin. Moreover, the Charter stipulates that the water resources of the basin should be treated as a single hydrologic system that transcends political boundaries in the basin. New or increased major diversions and consumptive use of the water resources of the Great Lakes are said to be matters of serious and common concern.[2]

In addition, the US government enacted federal legislation. The Water Resources Development Act of 1986 (WRDA) is a US federal law that prohibits any further diversion of water from any US portion of the Great Lakes or their tributaries for use outside the basin unless such diversion is approved by the governors of all Great Lakes states. It also prohibits federal studies of diversions without the concurrence of the governors. The impetus for the Charter and for WRDA was the concern in the US portion of the Great Lakes basin, in the early 1980s, that there would be major demands for Great Lakes basin water from the agricultural and energy sectors of the western and southern United States. Given North American economic integration, the geographic scope of water demand pressures have extended even further south and west to Mexico.

Triggers to Limit New Use

In principle, the Charter provides that no state or province will approve or permit any major new or increased diversion or consumptive use of the water resources of the Great Lakes basin without notifying and consulting with and seeking the consent and concurrence of all affected Great Lakes states and provinces. The trigger point for notification and for seeking the consent and concurrence of other Great Lakes states and provinces is an average use of 5 million gallons (19 million liters)

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1 International Joint Commission. 2000. *Protection of the Waters of the Great Lakes*. Final Report, March. <www.ijc.org>. (IJC Final Report).

2 The Charter states that "[it] is the intent of the signatory states and provinces that diversions of basin water resources will not be allowed if individually or cumulatively they would have any significant adverse impacts on lake levels, in-basin uses and the Great Lakes ecosystem."

per day in any 30-day period. While environmental groups are cautious that the Charter not be turned into a licensing agreement to permit water diversions or exports where the trigger requirements are meet, nevertheless advocate for the lowering of the trigger level from 19 to 3.8 million liters (5 to 1 million gallons) per day.[3]

According to the IJC, typically, the level of withdrawal that triggers US state permitting requirements is well below that which triggers review under the Great Lakes Charter. Although some basin states (Minnesota, New York, and Wisconsin) include a statutory provision that specifically requires consultations with the other Great Lakes states and provinces in the event of diversions from the basin that fall within the Charter's trigger provision, others have not provided for this explicitly.

The implementing resolutions for the Great Lakes Charter that were approved by the Great Lakes governors and premiers in 1987 outlined a review process for diversion proposals. A process has evolved for reviewing and approving diversions pursuant to the Charter and the WRDA, noted above. A custom and usage has developed of employing the Charter procedures regarding consultation for diversion proposals covered by WRDA that do not meet the Charter trigger point, so that the provinces are consulted although they have no rights under WRDA. The WRDA applies only to diversions in the United States, does not address consumptive use, contains no criteria for the governors to use in considering proposals, contains no appeal procedure, and may not cover groundwater

But the fears on both sides of the border around the Ontario government's approval of NOVA Group's bulk water export project made it clear that the Charter's trigger for consideration of significant proposed new diversions and consumptive use was too high to encourage the degree of consultation regarding the use of Great Lakes water that is needed to assure the sustainable use of these resources. Even if the Nova's export plans did not include North American markets, the prospect that all trade and investment agreements could lock in a practice and expectation of freshwater access for export was and is a real one. The weakness of a voluntary approach was also evident. The Charter does not require the consent of all Great Lakes states and provinces before allowing a new diversion or consumptive use, including exports to proceed, it does not establish standards for when such consent should be given or withheld, and it does not provide for public involvement during the consultation process.

The Promise of a New Common Standard

In response to these developments, on October 15, 1999, the Great Lakes governors issued a statement, endorsed by the premiers, renewing their commitment to the principles contained in the Great Lakes Charter, and pledged to develop a new Common Standard, based on the protection of the integrity of the Great Lakes ecosystem, against which water projects will be reviewed.[4] Environmental groups in both Canada and the US have responded positively to this challenge and opportunity, keeping in mind that even a good Common Standard for Protecting the Great Lakes will not be sustainable if it fails to deal effectively with NAFTA impacts on the waters.

2.1.2 Water Availability: Levels and Flows

Water from the most northern point of the basin—Lake Superior—flows into Lake Huron through the St. Marys River. From Lakes Huron-Michigan, water flows through the St. Clair River, Lake St.

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3 Great Lakes United and Canadian Environmental Laws Assoc. 1997. *Fate of the Great Lakes*. Sustainable Water Resources Task Force, p. 8. See <glu@web.net>.

4 IJC Final Report, section 8, p. 33. The IJC defined "ecosystem integrity as the capacity of the ecosystem to maintain operations under normal conditions, to cope with external influences, and to continue the dynamic process of self-organization indefinitely."

Clair and the Detroit River into Lake Erie. Lake Erie, the most shallow lake, discharges through the Niagara River and the Welland Canal into Lake Ontario. The portion of flow diverted to Lake Ontario through the Welland Canal many years ago is relatively small (about 4 to 5 percent of the total Lake Erie outflow). Water from Lake Ontario flows to the Atlantic Ocean through the St. Lawrence River. The average St. Lawrence River flow, recorded at Cornwall, Ontario, during the period 1900–95, is 6,910 cubic meters (244,000 cubic feet) per second. This average outflow is said to be relatively small (less than one percent per year) in comparison to the total volume of water contained in the system.[5]

Upon careful consideration, it appears that this one percent outflow rate is the basis by which Canadian governments at least, maintain that the Great Lakes waters are a renewable resource, and therefore the hydroelectricity power produced by the lakes is also a renewable energy source. The one percent "renewability factor" also appears relevant for decision-making about minimum lake levels and in stream flow rates when approving water projects. CEC is well aware of issues around Canadian approaches to and the effectiveness of water use management plans.[6]

Lack of Sound Data

It is our conclusion that the data behind most water policy and project decisions is seriously flawed. The data is old and unreliable given the uncertainty that all water takings and uses are known, knowable and regulated. What we do know is that the pressure for additional water takings will increase and that climate change impacts alone, without any further development, are likely to reduce lake levels 70 centimeters (2.2 feet!) by 2030, only 30 short years away.

In fact the current lack of verifiable information on the basin's actual water quantity and capacity for rejuvenation, despite records having been kept on water levels and outflows since the late 1800s, is likely the number one challenge in effective sustainable water management. Yet this information is critical in determining adequate "use-to-resource ratios"—the annual water withdrawals divided by annual renewable water resources—providing an overall gauge of the average physical pressure on available resources authorities use for approving ongoing and new water uses. A related formula that is also highly uncertain is the recharge rate, the quantity of water per unit of time that replenishes or refills an acquirer, and the interconnected relationship with other components of the ecosystem.

Determining the accuracy of these formulas is daunting given fragmented and dated information. Equally important is the problem of lack of transparency on how these formulas are designed and applied. Indeed the underlying approach to water project decision-making is inaccessible to the local public most at risk from reduced or altered water levels, flows and water quality Recognizing this, the Great Lakes Commission, now a binational agency of US and Canadian federal and provincial, state, including First Nation authorities, and other regional interests, announced a new two year project on Great Lakes water use and management. The purpose is to "lay the framework of data, information and process required to ensure timely and well-informed public policy concerning the use and management of surface and groundwater resources."[7]

Importantly the project promises to conduct a status assessment of the abundance and threats to the resource, taking an inventory of current water withdrawals, instream uses and consumptive use. Based on this data the seventeen-member project team purposes to inform policy-makers on how

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5 Great Lakes Information Network, Hydrology and Levels Section: "Hydrology | Levels | Flows," Sept. 2000.

6 CEC, Factual Record for Submission SEM-97-001 (BC Aboriginal Fisheries Commission, et al., regarding enforcement matters of the Canadian Fisheries Act). May 2000, pp. 17–19.

7 Great Lakes Commission, Press Release. "GLC Announces Project Management Team." August 22, 2000. <www.glc.org>.

ecological evaluations and cumulative impact analysis as a management regime can be designed and implemented. Currently there are no plans for public input into this broad mandate to protect the ecological system for future generations.

Given that the Great Lakes Commission does not intend to report its findings until late 2002, and the negotiations for a new Common Standard are ongoing, any decisions by authorities for additional new water projects would be imprudent, even if the current water budget of the Lakes is blessed as manageable by the IJC.[8] Moreover, the GLC's project will lack any creditability with the public unless invited to participate and to test the design of refined water management tools including triggers for notice and use to resource ratios. We call for a moratorium on major new water projects until institutional and water management tools are agreed to ensure sustainability.

Sustainable water management

The GLC project promises to consider how ecological impacts "might be accommodated" in water removal, withdrawal and use decision-making. But will this emphasis reach the end-state of sustainable water management? Sustainability in this context is best understood as human beings living on the natural "interest" of the resource and not unduly drawing down the natural capital. In other words, sustainability requires that human activity not destroy the regenerative capacity of natural capital or irreversibly stress atmospheric, hydrological or terrestrial ecosystems with waste and pollution.[9] The water ethic environmental groups seek is this: the waters naturally available within the watersheds where we live [must suffice to provide for our needs].[10]

Rather than exploiting a resource to its limit, the ecological focus is on reducing throughput levels— flows of water, materials and energy into and wastes out of production and consumption activities— towards levels that are within the renewable resource flows and assimilative capacities of ecosystems. Throughput levels are driven by growing economies, trade and consumption patterns, population growth, technologies and other factors that need to be kept with the carry capacity of our environment. To maintain Great Lakes use—the water level and intensity of human activity—within its regenerative capacity is the main challenge before us.

The renewability factor

In four successive cold periods of the Pleistocene, ending 10,000 to 15,000 years ago, vast masses of ice moved across Ontario scraping off much of the unconsolidated material and breaking off pieces of the bedrock itself. These ice sheets then rode over the top of the debris, further crushing and moulding the entrained fragments, creating the Great Lakes. It is reported only 2.7 percent of the earth's water is freshwater, with Canada holding about 20 percent of it. But this 20 percent is mostly "fossil" water, e.g., melted water from the glaciers retained in lakes, underground aquifers, and permanent ice.[11] This water is a one-time gift, once removed it is gone forever.

It is considered more accurate by Environment Canada to say Canada has nine percent of the world's renewable supply of freshwater where renewable is understood to mean renewed by the hydrological cycle, i.e., the average renewed annually by precipitation, surface water runoff, and inflow, which replaces the water taken and which flows out and evaporates.[12] More than half of this

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8 In over 90 years, the IJC has never denied a request for approval of a control works or diversion, *Fate of the Great Lakes,* supra fn 3.

9 Paul Raskin. 1989. *Water Futures: Assessment of Long-range Patterns and Problems.* See also Herman Daly. 1989. *For the Common Good*. Beacon Press, Boston.

10 *Fate of the Great Lakes*, *supra* fn 3, p.6.

11 The US Environmental Protection Agency (EPA) recently established an electronic watershed database that provides flow and water quality information for basins across the country: Index of Watershed Indicators: <www.epa.gov/surf/iwi>.

12 Environment Canada, Water Facts <http://www.cmc.ec.gc.ca/climate/hydrology>. The Canadian Hydrographic Service (DFO) also posts information on recent water levels on the Great Lakes at <http://chswww.bur.dfo.ca/danp/recent.html>.

water drains northward into the Arctic Ocean and Hudson Bay. As a result, it is unavailable to the 90 percent of the Canadian population who live within 300 kilometers of the southern border. That means the remaining supply, while abundant, is heavily used and often overly stressed.

Yet Environment Canada considers water to be an "inexhaustible resource" because "the total supply of water in the biosphere is *not affected by human activities*…water is not destroyed by human uses, although it may be held for a time in combination with other chemicals. To be useful, however, water must be in a particular place and of a certain quality, and so it must be regarded as a renewable, and often scarce, resource, with cycling times that depend on its location and use" (emphasis added).[13]

But freshwater is not an inexhaustible resource when it is not returned to its original watershed and not returned to its original or indeed, an improved quality. We know that lake levels, and thus the amount that is renewed, is influenced by the combined factors of: precipitation (the primary source of natural water supply to the Great Lakes), upstream inflows, groundwater, surface water runoff, evaporation, diversions into and out of the system, consumptive use, dredging, and water level regulation Human activity that creates out-of-basin diversions or other removals and consumptive uses reduce water levels and flows in the system.[14] For example, the dredging of the St. Clair and Detroit rivers resulted in a drop 40 centimeters, or 16 inches, in the water levels of Lakes Michigan and Huron.

The IJC, however, maintains that the waters of the Great Lakes are, for the most part, a non-renewable resource.[15] They are composed of numerous aquifers (groundwater) that have filled with water over the centuries, waters that flow in the tributaries of the Great Lakes, and waters that fill the lakes themselves. Although the total volume in the lakes is vast, the IJC restates that on average less than one percent of the waters of the Great Lakes—approximately 613 billion liters per day (162 billion US gallons per day) is reported to be renewed annually by precipitation, surface water runoff, and inflow from groundwater sources.

The one percent renewable value is derived by dividing the average annual outflow from the Great Lakes (i.e., the outflow at Cornwall) into the total volume of water in the Great Lakes. As revealed below, based on the Canadian Center for Climate Modeling and Analysis,[16] by 2030 the renewable portion will decline to 0.80 percent, and by 2050 it will further decline to 0.75 percent. Thus if water is a renewable resource, it is only to the extent that the base water levels, the natural capital, remain constant in that region. Any reduction in the base means a reduction in the amount of renewed water resources, the interest, to the point of not being renewed at all! The healthy functioning of the Great lakes freshwater ecosystems depend upon the quantities of water levels in them, within natural fluctuations, remaining undisturbed. When water is removed from the lakes, it draws down the natural capital, represents an externalized cost at the expense of the environment and thus reduces opportunities for sustainable water development in the region.

Whether this resource is renewable or not is relevant to the strength of the environmental case to be made in anticipated trade and investment disputes regarding bulk water export bans and other

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13 Environment Canada. *Water Levels: The Great Lakes*, ibid., identifies that a number of human factors influence water levels—dredging, diversions, consumptive use, climate change—which appears to contradict the claim that "the total supply of water in the biosphere is not affected by human activities."

14 IJC Final Report, p.8

15 IJC Final Report, Section 2, p.6 for reference to Levels Reference Study Board (1993), Levels Reference Study, Great Lakes—St. Lawrence River basin, Submitted to IJC, March 31, 1993, see <www.ijc.org>. Reference is also made to a Feb 2000 publication but this data merely restates 1993 numbers.

16 Environment Canada, calculations prepared for NAFTA Effects on Water Workshop.

measures.[17] This question is also relevant to environmental aspects of North American Electricity Restructuring, the subject of an Article 13 CEC Secretariat report. This factfinding should address a current trade irritant/dispute about whether Canadian hydroelectricity power should qualify for certain US renewable energy requirements and programs in place to ensure environmental improvement. Because hydropower production is proportional to the amount of water available to be pumped through the system, how can hydropower be considered a renewable energy source when the fuel resource it is based upon is in fact exhaustible?[18] In addition, how can hydropower be considered a renewable energy resource when it can have such significantly negative environmental and social impacts?[19]

In principle a renewable resource should be one that can be and is replenished. Conversely, a resource is not renewable if it is not replenished. Removals from the Great Lakes basin reduce the capacity of the Lakes to replenish themselves, contrary to notions of sustainability.

But at best, the numbers on water availability in the Great Lakes, and their rejuvenative capacity are uncertain, and inconclusive for decision-making purposes and at most misleading. If reliance by authorities in water policy and project approvals is placed on maintaining an annual freshwater renewability factor of one percent, then this assumption is dangerously misplaced, given increasing consumptive use, removals and climate change impacts on the Great Lakes—unquestionably an exhaustible resource.

Climate change

As we have seen, climatic conditions control precipitation (and thus groundwater recharge), runoff, and direct supply to the lakes, as well as the rate of evaporation. These are the primary driving factors in determining water levels. The IJC acknowledged that the rate of increase in concentrations of greenhouse gases in the atmosphere is related to human activity,[20] and, at a minimum, a doubling of carbon dioxide concentrations in the atmosphere will occur in the 21st century, with a corresponding increase in the average global temperature of 1–4 degrees C.[21] While finding growing evidence that the changing composition of the atmosphere is beginning to influence specific components of the hydrologic cycle, the IJC was not able to differentiate such effects from the natural variability in the levels of the Great Lakes. Because of the vast water surface area, water levels of the Great Lakes remain remarkably steady, with a normal fluctuation ranging from 30 to 60 cm (12–24 in.) in a single year.

There is no doubt that the water levels of the Great Lakes fluctuate. But during the 12-month drought period from April 1998 to May 1999, the volume of water in the Great Lakes decreased by about 120 cubic kilometers. This is equivalent to close to two years of flow over Niagara Falls, or 42

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[17] As discussed below, GATT Article XX (g) speaks to environmental measures "relating to the conservation of exhaustible natural resources" and NAFTA Article 2101:1 (b) expands this, saying: "relating to the conservation of living and non-living exhaustible natural resources."

[18] While less severe than the levels shown in the climate change scenarios, the extreme low levels and flows of the 1960s resulted in electricity production losses of 19 to 26 percent on the Niagara and St. Lawrence rivers. See Environment Canada 1998, *Adapting to Climate Change, Ontario.* A renewable resource should be one that is replenishable and [is] in fact replenished. Can this be said any longer of water from the Great Lakes?

[19] See World Commission on Dams <www.dams.org> and Philip Raphals, Helios Centre, *Hydropower in the Era of Competitive Markets* (forthcoming) <www.helioscentre.org>.

[20] Increased UV-radiation on the earth's surface is the result of depletion of ozone layers, which is ultimately the cause of increased emission of carbon dioxide and other gases in the atmosphere. It is hypothesized that increased light penetration on freshwater lakes could result in lake stratification, increased visibility and chemical and biological changes of the water, and increased amount of UV-radiation as well. Considerable research has been carried out on chemical and biological changes of the lake water but, the particularly the impacts of UV-radiation on freshwater fish and zooplankton are not studied extensively.

[21] IJC Final Report, Section 5, p 24.

additional Chicago Diversions.[22] The IJC did recognize how quickly/non-linearly water levels can change in response to climatic conditions when it recalled that during this drought, the water levels of Lakes Michigan and Huron dropped 57 cm (22 in.).

Early impact assessments, based on equilibrium 2 x CO_2 scenarios, suggest global warming will result in a lowering of water supplies and lake levels and in a reduction of outflows from the basin. Based on projections using several state-of-the-art models,[23] experts from the US National Oceanic and Atmospheric Administration (NOAA) and Environment Canada believe that global warming could result in a lowering of lake level regimes by up to 70 centimeters or 2.2 feet or more by 2030, a development that would cause severe economic, environmental, and social impacts throughout the Great Lakes region. Identified impacts include: losses in hydroelectricity power generation,[24] reduced shipping, increased dredging, flood damage, infrastructure declines (e.g., docking facilities, shoreline properties) and human health.[25] Existing regulation plans for the Great Lakes are not designed for expected climate change scenarios with low net basin supplies and connecting channel flows, with declines in lakes levels of 70 cm to 2.2m and annual runoff and in stream flows decreases of up to 50 percent.[26]

The decrease in lake levels will vary with location. For example, the most recent studies suggest a decrease in Lake Michigan water levels by 0.72 meters in 2030 (only 30 years away!), and by 1.01 meters by 2050.[27] By 2030 Lake Ontario levels decline by up to 1.30 meters, a dramatic decrease in water availability. By 2030 water levels in the freshwater portion of the St. Lawrence River may decrease by a meter (3.3 feet), a 23 percent reduction in mean flow.[28] It was recognized by the IJC that the reductions of freshwater discharges into the St. Lawrence estuary, the gulf and beyond, would also affect the Atlantic ecosystem. For example, reduced lake level outflows could lead to saltwater encroachment from the Atlantic Ocean up to and through the St. Lawrence River. This could have dramatic impacts on the freshwater ecology as well as contaminating the drinking supplies for Montreal and surrounding communities in Quebec.[29] A decrease in water quality is expected because of the resurfacing and dredging of buried contaminated sediments, with less water available for dilution of toxic substances.

Surely climate change of such large magnitude and sheer common sense indicates that anticipated climate change impacts are beyond historic periods of normal variability in Great Lakes levels.[30] The IJC did question whether, in the long term, increases in evaporation due to global warming will significantly offset expected increases in precipitation, thereby reducing net water

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[22] Ralph Moulton and Douglas Cuthert. 2000. "*Cumulative impacts of water removal or loss from the Great Lakes—St. Lawrence River System*," Canadian Water Resources Journal, 25 (2), p. 24.

[23] L. Mortsch. 2000. "*Climate change impacts on hydrology, water resource management and the people of the Great Lakes—St. Lawrence System*," Canadian Water Resources Journal, 25 (2).

[24] IJC, Final Report, Section 5, p. 25: Even though they were not nearly so severe as those projected in climate change scenarios, the record low levels and flows in the 1960s caused hydropower losses of between 19 and 26 percent on the Niagara and St. Lawrence Rivers. A small proportion of these [climate change-related] losses would be offset by lower heating costs, but this in turn would be offset by increases in air conditioning costs. See H. Hartman (1990) "Climate change impacts on Great Lakes levels and flows: Energy and transportation," in G. Wall and M. Sanderson (ed.) Occ. Paper n. 11, University of Waterloo, Dept of Geography.

[25] Environment Canada. *Canada Country Study, Climate Change Impacts*, v. 11, p. 4: Extreme hydrological events, such as floods and intense rainfall, cause overflows of storm and sewage sewers leading to contamination of drinking water (e.g., *crytosporidium*). Excessive precipitation creates breeding sites for insects/ rodents that carry diseases.

[26] Environment Canada. *Canada Country Study, Climate Change Impacts*, v. 11, p. 72 and 76.

[27] Mortsch. 2000. supra. fn. 23

[28] Moulton. 2000. p. 8, supra. fn. 22

[29] *Fate of the Lakes*, p. 25 and the reference therein.

[30] For Lakes Michigan, Huron, St. Clair, and Erie, the mean levels for the 2030 scenario would be lower that the recorded minimum levels, Moulton. 2000, supra fn. 22, p8.

supplies.[31] And it recognized that the timing and regional climate change patterns of precipitation and run off could have "a dramatic effect on water levels and outflows" and recommended "considerable caution with respect to factors potentially reducing water levels and outflows." At a minimum, the IJC agreed that cost-effective measures should be taken to modify human activities that contribute to climate change and *other unsustainable environmental impacts on resources*" (emphasis added).

Since the IJC Final Report, a new US report[32] concludes:

- Water levels in the lakes are predicted to drop by up to 1.38 meters (4.5 feet!) by 2090—so much that this is outside the 150-year historical fluctuation of the lakes (two meters, i.e., one meter above and below the mean). Two models were used throughout the paper, the Canadian CGCM and the Hadley HadCM2.
- "Dramatic declines in water levels and flows by 2030, according to CGCM1"—rather than the later years, 2050 and 2090, of previous studies.
- "Drastic reductions in ice cover" under both CGCM1 and HadCM2. Under CGCM1 Lake Erie would go to 96 percent of winters completely ice-free by 2090.
- "Concern is warranted for water supplies derived from aquifers in the Great Lakes basin."
- "Water resource strategies/policies should be developed which are robust enough to cope with either the high or low water supplies projected for the future by the two models."

Indeed, current evidence suggests that it will be the extremes of climate change events that could be the most crippling to the region. Indeed as early as 2030, current climate change scenarios point to tremendous impacts on the levels and flows throughout the basin which are not taken into account in regional water policy or project approvals.[33]

2.2 Water Use: Consumption, Withdrawals and Removals

Turning from water levels to uses, it is important to define the terms adopted by the IJC. A water withdrawal is considered a water taking from either surface or groundwater for uses such as municipal, industrial and electricity generation that is returned to the basin, while often not in the same quality or at the temperature. Consumptive use is that portion of water withdrawn that is evaporated, transpired from plants, incorporated into products or otherwise lost, and thus is not available for further use in the basin. For example, water taken from the basin in bottles, beverages and slurries are consumptive uses, representing a loss to the Great Lakes. Removals, on the other hand, are considered to be bulk quantities of water conveyed outside its basin by any means, including diversions, tanker ships or trucks that carry water out in large volumes.

Importantly, neither the IJC nor the governments of Canada or of Ontario, consider water "incorporated into products or otherwise bottled for retail sale" to be a removal, despite the cumulative impacts and the fact that water leaves the basin, lowering levels and flows in the system. This failure to count consumptive use as a removal is a legal fiction that hides the water intensity of economic sectors that incorporate water into products and production processes, including industry and agriculture. This fiction reinforces and indeed facilitates unsustainable water use, environmental

31 Environment Canada, *Canada Country Study* v. 11, p.16: Increases in precipitation do not necessarily mean that regions become "wetter." Higher evaporation losses due to the warmer temperatures could make many areas drier.

32 Brent M. Lofgren, Frank H. Quinn, Anne H. Clites, and Raymond A. Assel. 2000. *Climate Change Impacts on Great Lakes basin Water Resources* NOAA/Great Lakes Environmental Research Laboratory, Buffalo District, US Army Corps of Engineers, and US Geological Survey, July.

33 Moulton. 2000. supra.fn.22, p 9

degradation, trade and investment. We cannot reach a 21st-century concept of sustainable water management with a 19th-century concept of abundant supplies for the taking of Great Lakes water.

2.2.1 Current Use Data Unreliable

The Commission determined that 1993 consumption data would be the basis for its final report. The average consumption rate, considering all types of uses, was said to be approximately five percent. The 1993 data shows:

- By country: Canada, 33 percent, and the United States, 67 percent, with per capita consumptive use being approximately equal.
- By jurisdiction: Ontario, 27 percent; Michigan, 21 percent; Wisconsin, 20 percent; Indiana, 7 percent; New York, Quebec and Ohio, 6 percent each; Illinois, 4 percent; Minnesota, 2 percent; Pennsylvania, 1 percent.
- By type of water use: irrigation, 29 percent; public water supply 28 percent; industrial use 24 percent; fossil fuel thermoelectric and nuclear uses, 6 percent each; self-supplied domestic use 4 percent; and livestock watering, 3 percent.

The percentage of withdrawn water that is consumed within the Great Lakes system varies with the type of use to which the water is put. When water is used for irrigation, over 70 percent is consumed. This percentage increased to 94 percent for US by 1995.[34] At the other extreme, when water is used for thermoelectric power, less than one percent is consumed. This conclusion ignores, *inter alia,* increased temperatures of returned waters, causing evaporation and thus water to leave the system.[35] The percentage of water lost to the basin when it is used for public supply and for industrial purposes—other large water-using categories—is said to be of the order of 10 percent for each. Ontario, Wisconsin and Michigan took over 70 percent of the water consumed in the Great Lakes basin. More recent information for Lake Ontario in particular, shows mean outflow for 1918–98 as 6980 CMS with consumption at about 1.7 percent of outflow, and annual consumption equivalent to about 0.01–0.02 percent of total volume of the Great Lakes.[36] By 1996 agricultural uses in Ontario accounted for 32 percent of total water consumption in the province.[37]

The IJC advised that future water demand projections identified a possible increase of 20 percent overall consumption in all sectors over the next 20 years based on current trends.[38] Interestingly, the IJC found that industrial and commercial use had declined given a change in industrial mix from heavy industry to other sectors. The US Environmental Protection Agency found, however, that US manufacturing companies used about four percent more water in 1995 than in 1990.[39] Canadian industry, on the other hand, remains both water intensive and water dependent. Indeed these industries significantly contribute to the fact that Canadian per capita water use is among the highest in the world.[40] Whereas heavy industry may have moved south, resource-based

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[34] IJC Final Report, footnote 11, showing 1995 USGS data indicating that irrigation consumption in US portion of the Great Lakes increased 94 percent from 1993 levels.

[35] Report to the Council of the Great Lakes Governors, Governing the Withdrawal of Water from the Great Lakes, legal opinion, p. 12 (on file with author), quoting a 1992 uses study to the effect that cooling projects for coal and nuclear operations consumed/lose to evaporation up to 14 percent of water used.

[36] Ralph Moulton. 1999. [n.t.] Environment Canada, *Canadian Water Resources Journal*, p. 183, v.25. n.2.

[37] Environment Canada, *Country Study, Climate Impacts,* v. 11, 1998, p. 57.

[38] Canadian Environmental Laws Association, Submission to IJC re Water Uses Reference, Dec. 1999.

[39] US EPA, *Liquid Assets 2000: Americas Water Resources at a Turning Point*. May 2000, p. 8.

[40] Canadian Environmental Law Assoc. 1999. *Elements of a Sustainable Water Strategy for Canada*. Sept., p.1. The study recommends a program to reduce water consumption by 25 percent compared to 1999 usage by the year 2010, placing priority on sectors with the highest consumption—such as industry and agriculture—and imposing a fee structure

industries did not have the option to relocate and instead focused on removing regulatory barriers, downsizing their workforces and privatization schemes.[41]

It can now be observed that at best the average consumption rate of the Great Lakes, considering all types of uses, is approximately five percent, and that does not include groundwater consumption.[42] The IJC found consumptive use in the Great Lakes basin was estimated to be 121 cubic meters (4,270 cubic feet) as compared to a withdrawal of about 2,493 cubic meters/second (88,060 cubic feet/second).[43] It was estimated that existing consumptive uses have lowered the levels of the Great Lakes from less than 1 cm (0.4 in) to 6 cm (2.4 in). The trend is towards increasing consumptive uses. In 1992, for example, consumptive use in the Great Lakes increased by 37 percent from the year before.[44] As soon as the Great Lakes Commission reports its finding from the new Inventory Project, described above, the trends related to consumption should become more evident. Data from 1993, pre-dating NAFTA, are available to serve as a baseline for further analysis.

It is also important to emphasize that if only one percent of the Great Lakes waters is renewed annually, from an ever declining base, immediate conservation and the prohibition of unsustainable consumptive use, especially if removals of water from the basin are necessary.

2.2.2 Removals

The IJC frames public concerns that the potential movement of freshwater in bulk beyond the Great Lakes basin will be by ocean tankers alone, rather than the broader concern with the removal of water by any means, including by consumptive use. Given the narrow scope of inquiry, the IJC was able to report that: “To date, no contracts are in place, and no regular trade has begun to ship water in bulk from the Great Lakes basin or from North America as a whole.”[45] The IJC did find that entrepreneurs have actively pursued foreign markets and have sought approval to export from jurisdictions on both the west and east coasts. When the IJC’s interim report was written, Alaska, Newfoundland, and Quebec were considering proposals to export freshwater in bulk by ocean tankers, although both Newfoundland and Quebec since moved to prohibit such exports subject to certain exceptions.[46] The IJC concluded that the cost of export shipments makes it unlikely that there will be serious efforts to take Great Lakes water to foreign markets. At most it believes companies in these jurisdictions have captured only small markets for small-scale bottled water removal,

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for water taken by profit-making enterprises, while keeping the privatization of water and wastewater services and ensuring that all citizens have equitable access to adequate and clean water.

41 Cameron Duncan and Mel Watkins. 1993. *Canada under Free Trade.* Toronto: James Lorimer and Company, Ltd.

42 IJC Final Report, Section 6, p. 27 and note on p. 29: In any case, owing to the interconnection of surface water and groundwater, whether water consumption is from the lakes, the tributaries, or groundwater sources, the eventual physical impact on average lake levels is virtually identical.

43 Cubic meters (or feet) per second expresses the rate of discharge. One cubic meter per second equals 35.315 cubic feet/second. As a comparison of magnitude, the flow over Niagara Falls in daylight hours in the tourist season is 100,000 cubic feet/second (2832 cubic meters/second)..

44 Canadian Environmental Law Association. 1998. *Some Great Lakes Water Facts.* May. See <www.cela.ca>.

45 IJC Final Report, p 15. The Commission learned that one exporter in Alaska was shipping a small volume of water, 378,500 liters per week (100,000 gallons/week), but that orders for Alaskan water had fallen significantly since the beginning of 1999. The water is placed in containers that are barged to Washington State where the water is bottled. It is then shipped to Taiwan, and Korea.

46 The Quebec government enacted a moratorium on bulk water exports, the Water Resources Preservation Act, and the Quebec Public Hearings Bureau (BAPE) released its final report on water management in Quebec. See <www.bape.gouv.qc.ca/eau/index>, where it recommended that all water projects, including commercial bottlers, involving the daily removal of more than 75 cm of groundwater and water sold in containers of more than 25 liters, be subject to impact assessment and review by the Environment Minister. See background studies for BAPE by Karel Mayrand for additional information on international water issues.

finding that the basin imports more bottled water than it exports.[47] Trade in other types of beverages is believed to be of a similar order of magnitude.[48]

Considering the alleged small magnitude of trade in bottled water and other beverages, it appeared to the IJC both impractical and unnecessary to treat bottled water and other beverages any differently than any other products that either include water or use water in their production processes. This conclusion about the limited scale of these removals of water is understandable given the legal fiction that water incorporated into products is not "consumed," even if the water is no longer available for use in the basin. Given the uncertain data on current and future water availability and use, together with climate change impacts, the IJC is exposed to criticism for ignoring consumptive use impacts to the water when bottled or contained, and when incorporated in a production process such as in slurries, and then taken from the basin. In addition the IJC largely ignored the ease of removal of basin water by truck and by rail, presumably the least cost approach to water trade.

Finally, the IJC dismissed public anxiety over renewed interest in major diversions out of the basin, especially to the southwestern US states—by canal, pipeline, channel—as not being "economically, environmentally or socially feasible in the foreseeable future." The mega-projects era was declared over, barring significant climate or technology changes and other factors. It is commendable that the IJC recognized the environmental costs of big projects are enormous. The suggested course was to price water at its "true value," making it more cost effective to increase the available supply of water by using existing supplies more efficiently as they are allocated among basin interests. Conservation techniques were identified to reduce use by 50 percent[49] and water rights' markets in the West Coast of the US were said to shift available water from agricultural to urban uses.[50] We take up the issues of water pricing below.

The IJC found, however, that neighboring communities in Ohio, Indiana and Wisconsin might look to the Great Lakes for water supplies in the future. Such diversions, the IJC acknowledged, would require the approval of the Great Lakes governors under the Water Resources Development Act of 1986, and would fall within the provisions of the Great Lakes Charter.

Cumulative Impacts and the Precautionary Approach

There are interactions among various water uses, bringing about cumulative impacts. The IJC acknowledged that even modest changes induced by individual, discrete actions have incremental and other cumulative impacts on both a localized and system-wide basis. These implications become more pronounced as one proceeds downstream through the Great Lakes–St. Lawrence system; Lake Ontario is the lowest of the Lakes.

The IJC conceded, however, how difficult it is to quantify with any degree of precision the ecological impacts of most water withdrawals, consumptive uses, and removals.[51] In particular, impact assessment data is lacking with respect to fisheries productivity and composition, the extent and range of coastal wetlands, near-shore water quality, habitat and the degree of slope lakeward of the habitat, and biodiversity. But we know, for example, that healthy wetlands are critical to the

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47 IJC Final Report, p. 16, and footnotes 19 and 20. Two unpublished papers, dated 1999.

48 For example, 272 million liters (72 million gallons) of bottled water were exported in 1998 from all of Canada to the United States. That represented 33 percent of all beverage exports from Canada to the United States that year, compared with 44 percent for beer and 19 percent for soft drinks.

49 OECD. 1999. *The Price of Water: Trends in OECD Countries*. Paris. United States and Canada use (withdraw) nearly twice as much water per capita than the OECD average. Even taking into account differences in economic structure and lifestyle between the United States and Canada and other OECD countries, significant improvements in water use could be made by using appropriate, existing water-conservation and demand-management techniques.

50 IJC Final Report, p. 20.

51 IJC Final Report, p. 22 and footnote 32 on Cumulative Impacts in the Great Lakes – St. Lawrence River basin.

recharge fresh groundwater supplies. We also know that over one-fifth of Canada's 71,000 species live in freshwater, where most endangered and threatened freshwater fishes and molluscs occur in southern Ontario and British Columbia.[52]

Nevertheless the IJC urged "great caution" regarding likely demand factors such as future consumptive use, small-scale removals of water, and climate change. Despite the uncertainty, present indications are that all three factors are likely to place downward pressures on water levels, with reinforcing and cumulative impacts. In the end the IJC adopted the precautionary approach that dictates removals should not be authorized unless it can be shown, with confidence, that they will not adversely affect the integrity of the Great Lakes basin ecosystem.[53] At this time, removal from the basin of water in containers of 20 liters or less should not be considered, prima facie, to endanger the integrity of the ecosystem of the Great Lakes. However, the IJC urged caution should be taken to properly assess the possible significant local impacts of removals in containers. Removal of water for short-term humanitarian purposes, according to the IJC, should be exempt from the above restriction. No recommendation was made to better account for and where necessary limit production processes that incorporate water into products that leave the region, as facilitated by trade and investment agreements.

But the problem with relying on how much impact a community can tolerate by the withdrawal of water is that it assumes a linear relation between levels, flow and impact. Such a model implies a threshold effect, whereby there is some safe level of water that can be removed without substantial impact to the ecology. There is no good evidence to support this approach. Rather, no matter how much water is removed from a system, the ecology will be impacted to some degree. If the goal of Great Lakes management as proclaimed by the IJC and the Great Lakes governors and premiers is to protect the integrity of the Great Lakes system, then a basin-wide water budget or "use to resource ratio" for water project approval should use/take no more water than can be renewed, taking into account the best estimates of impacts, including climate change, to the waters both at the local watershed level as well as system-wide.

Our research indicates that we cannot assume any additional large-scale or multiple small-scale consumptive uses and removals without threatening the ecosystem integrity of the basin. The current numbers just do not add up to a sustainable water management regime. The total annual withdrawal and consumption of the Great Lakes basin waters, based on 1993 levels, that does not reflect NAFTA-related economic growth,[54] and does not account for climate change to current lake levels and river flows, is not sustainable. Even assuming the one percent annual renewability number is correct, there is no foundation for ignoring the scale effects of growing consumptive uses in and removal of the waters from the region.

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52 McAllister, Don. 1994. "Biodiversity in Canadian fresh and marine waters," in Stephen Bocking (ed.) *Biodiversity in Canada.* Peterborough, Canada: Broadview Press, and Mosquin T, et al., *Canada's Biodiversity.* Ottawa: Canadian Museum of Nature.

53 IJC Final Report, Section 10 where the IJC recommended: a) no major new or increased consumptive use of water from the Great Lakes basin to proceed unless a full consideration has been given to the potential cumulative impacts, taking into account the possibility of similar proposals in the foreseeable future, b) effective conservation practices will be implemented in the requesting area, c) sound planning practices will be applied with respect to the proposed consumptive use, d) states and provinces shall ensure that the quality of all water returned meets the objectives of the Great Lakes Water Quality Agreement, coupled with additional opportunities for public involvement and e) *there is no net loss to the area from which the water is taken and, in any event, there is no greater than a five percent loss (the average loss of all consumptive uses within the Great Lakes basin*) (emphasis added).

54 Total exports to the US from Canada represent 41 percent of Canadian GDP, an increase from 25 percent in 1995, a very high ratio, see Scott Vaughan. 2000. *Understanding the environmental Effects of NAFTA, Learning the Lessons from NAFTA*, Yale Center of Environmental Law.

Amending the Great Lakes Charter Campaign

The premiers and governors of the Great Lakes provinces and states are nearing agreement on changing basin water management so that water-use proposals are judged by their effects on the ecosystem. The hope is to provide a better basis than current law for defeating proposals to export or divert bulk water out of the Great Lakes basin. Current state and provincial water use laws are designed to prevent harm to other users of water, with little consideration given to the effects of water use projects on the ecosystem, plant or animal life. In some jurisdictions this purpose is not even enforced through government permitting, but by "common law"—non-statutory general principles enforced in the courts. This regional provincial and state effort would change all that.

The IJC recommended, without prejudice to the authority of the federal governments of the United States and Canada, the Great Lakes States and Ontario and Quebec, in carrying out their responsibilities under the Great Lakes Charter, should develop, within 24 months, with full public involvement and in an open process, the standards and the procedures that would be used to make decisions concerning removals or major new or increased consumptive uses.[55] The IJC suggested that federal, state, and provincial governments should not approve or permit any new removals and should exercise caution with respect to major new or increased consumptive use until such standards have been promulgated or until 24 months have passed, whichever comes first.

A draft of the proposal so-called "Annex 2000" released by Governor John Engler of Michigan lays out the basic guidelines that would be used for assessing proposed new or increased "withdrawals" of water from anywhere in the basin water system: "The aforementioned agreement(s) will include a standard that no State or Province will allow a new or increased withdrawal of the Waters of the Great Lakes basin unless the applicant for the withdrawal establishes that its proposal, together with any existing use being increased: A. Results in an improvement to the Waters and Water-Dependent Natural Resources of the Great Lakes basin; and B. Does not, individually or cumulatively, cause significant adverse impact to the quantity or quality; and C. Includes implementation of all reasonable and appropriate water conservation measures; and D. Complies with all applicable laws."

The new system is being proposed as an amendment to the Great Lakes Charter, a 1985 nonbinding document signed by the states and provinces that, among other things, provides for consultations among the jurisdictions on proposals to divert more than 5 million gallons of water a day out of the Great Lakes basin. Among other important provisions, the governors and premiers' proposal would make the new elements of the charter binding and formally include the public in future water-related decision-making. The intention is to protect the basin from export and diversion proposals that are sure to increase in number and seriousness as the continent gets drier in coming decades.

While the effort is welcomed by environmental groups because the proposal would require *both* no significant damage *and* improvement in order to obtain a water use permit, there are still many weakness.[56] The Michigan proposal contains significant omissions, most significantly in failing to call for an overall plan for conserving Great Lakes waters and restoring damage already done to the Great Lakes water system.[57] Without such a plan, any future improvements under the state's proposal will be haphazard and potentially result in no overall benefit to the system contrary to for example the expectations created under the 1992 Biodiversity Convention or recent improvements

[55] IJC Final Report, Section 10.

[56] See Appendix 3 for a list of environmental "must haves" in any regional water uses and withdrawals agreement.

[57] GLU Press Release "Michigan Water Proposal a Start, Needs Improvement." Contact Reg Gilbert, (716) 886-0142. Great Lakes United is a coalition of 170 organizations from the United States, Canada, and First Nations, working to protect and restore the Great Lakes—St. Lawrence River ecosystem. GLU was founded in 1982, has offices in Buffalo and Montréal, and has been actively working on Great Lakes water quantity issues since the negotiation of the Great Lakes Charter in 1984.

to international agreements on transboundary waters. This could keep the region vulnerable to trade challenges claiming that basin water protection measures are really disguised barriers to trade. basin residents will know our waters are protected from harmful forces both inside and outside the region only when the Great Lakes states and provinces create a plan for protecting the lakes, reducing water use and restoring damage to the water system.

The definition of the term “improvement” in Michigan’s proposal is too broad, implicitly including virtually any form of positive environmental action, not necessarily water-related. The water conservation provisions of Michigan’s proposal are weak. The states and provinces should require maximum achievable water conservation measures before new or increased uses are approved. Indeed, strong conservation measures are the cornerstone of both effective environmental protection of the Lakes and international credibility that we are truly attempting to protect the lakes for their own sake, rather than for the benefit of local economic interests.

The scope of human water-related actions affected by state and provincial scrutiny should go beyond mere water “withdrawals” (that is, taking water out of lakes, rivers, or the ground) to include the full range of human actions that damage the basin water system and the living things that depend on it. For example, simply slowing down a river’s flow can make it impossible for certain fish to reproduce in the river. Public involvement must be broadened to include both creation of the initial state and provincial agreement as well as design of the individual provincial and state policies following up on that agreement.[58]

Public involvement should also include local governments, because they must eventually play a lead role in the implementation of most water protection measures. The Great Lakes basin should be defined to include the St. Lawrence River. Being the farthest downstream, the province of Québec is the jurisdiction most vulnerable to abuses of the Great Lakes water system; it needs to be centrally involved in protecting it. The Great Lakes Charter and any new binding agreements for managing the basin’s water uses should include the basin’s First Nations and tribes, who have sovereign rights to basin waters and a long history of concern for environmental protection. If improved, the proposal governors and premiers are now considering could potentially be the most sweeping change in regional environmental law in a generation.

It is absolutely advisable to ensure that “Annex 2000”—a new Common Standard on water use—be improved and implemented into the domestic law of all applicable jurisdictions. Recall that the CEC was unable to find that the Great Lakes Water Quality Agreement was “environmental law” for the purposes of a public submission on enforcement matters under Article 14 of the North American Environmental Cooperation Agreement. It found that those international obligations had not been imported into domestic law by way of statute or regulation pursuant to a statute.[59] Given the absence of opportunities for the public to make submission to the IJC about the lack of enforcement of Great Lakes agreements, and the fact that NAFTA facilitates trade and investment in water-related activities, it would be appropriate for the CEC to be the lead North American agency to monitor the enforcement of the new Common Standard by basin jurisdictions. This recommendation is not intended to preclude direct public interest actions to ensure enforcement in local jurisdictions. Early press reports indicate that the governments of Ontario and Quebec are not currently on board with the Annex 2000 proposal as currently designed. It should also be noted that the government of Ontario, unlike Quebec, has seen fit to undertake the trade and environment-related obligations associated with NAAEC, despite its enthusiastic support of NAFTA.

[58] Please note that Sierra Club Eastern Chapter proposes a community-based monitoring model with oversight on water quantity and quality factors.

[59] CEC determination on the Planet Earth, et al., submission, concerning the United States, January 1999.

2.2.3 Trade-proofing a New Common Standard on Water Use and Bulk Water Export Bans

Before undertaking this analysis, it is important to note that the new Common Standard on Great Lakes protection needs to be assessed not only for trade-related challenges/impacts but also whether it complies with the sprit of other binding international agreements and customary international law, such as the Biodiversity Convention, ratified by over 170 nations, the Law of the Seas Convention, Ramsar, as well as agreements relating to world culture, natural heritage and international human rights law and practice. We will take up the emerging right to water shortly.

Having said that, it is true that the status of water under the terms of North American Free Trade Agreement are at best ambiguous. Water is included in the definition of a "good" under the General Agreement on Tariffs and Trade,[60] which in turn has been incorporated into the North American Free Trade Agreement.[61] But it is not clear at what point on the continuum from the natural state through human economic processes that water becomes a good. The NAFTA signatories issued a joint statement addressing the issue, but the status of the statement as an enforceable part of NAFTA is a matter of debate. Despite calls to at least amend NAFTA to further clarify the ambiguities, disputes around water trade already exist. Clearly the most straightforward approach to ensuring that protection of water and/or any other common property resources is not eroded by trade agreements is to re-negotiate or remove Canada from them. NAFTA's existence does nothing to help protect water, but it can undermine our ability to protect both the quantity and quality of Canada's water.[62]

The Canadian government considers water in its natural state not a good and therefore not subject to Canada's trade obligations.[63] Accordingly it has proposed a limited form of ban on the export of water from Canada's main watersheds. Two credible nongovernmental analyses of trade and water from a policy perspective both disagree with the government of Canada, but in different ways. A group of lawyers contracted by the Great Lakes Protection Fund submitted an opinion to the Council of Great Lakes Governors that NAFTA does not apply to international trade in water due to the joint statement issued by the signatories excluding water in its natural state from the purview of the agreement; but concluded that the General Agreement on Tariffs and Trade substantially limits the ability of basin and federal governments to unilaterally limit trade in water of the Great Lakes basin.[64]

The West Coast Environmental Law Association concurs, but considers NAFTA a more powerful restriction on such government action due to its investment and services sections; the Association considers the joint statement by the NAFTA signatories on water unlikely to be legally enforceable and, in addition to recommending clear Canadian federal legislation to ban water exports, suggests the NAFTA be amended to clearly carve out water from its scope.

Ambiguities about water in trade agreements have concerned citizens and nongovernmental organizations in the Great Lakes and St. Lawrence River basin because they have struggled since the early 1980s to prevent large alterations to basin water systems, such as dams, large takings, erosion control projects, flow control structures, and diversions of water from the basin. Ambiguities about water in trade agreements threatened to make diversions, in the form of tanker, pipeline, bulk export, and multiple small-scale removals and consumptive uses impossible to prevent. As a result, they

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60 The GATT Harmonized Commodity Description contains a tariff item for water: 22.01 "water, including natural or artificial water; ice and snow."

61 NAFTA Article 201 defines "goods" as domestic products as understood in the GATT or as the Parties may agree.

62 Elizabeth May, Executive Director, Sierra Club of Canada, NAFTA Effects on Water Workshop, Sept. 11, 2000.

63 See Annex 9 to IJC Final Report for Canadian government submission on this point. Given the reference in the GATT tariff schedule to water is listed as a good, water will be treated as a good both under the GATT/WTO and NAFTA, according to Barry Appleton, *Navigating NAFTA*, Carswell, 1994, p. 201. The Canadian government's response is the tariff schedule only tells us when water is classified as a good, when it is traded, it falls under a particular tariff heading.

64 Governing the Withdrawal of Water from the Great Lakes, May 18, 1999 (copy on file with author).

have called upon the NAFTA signatories to resolve the ambiguities surrounding trade in water. In addition work has begun on a proposal for non-discriminatory, ecosystem-based management of human water use in the Great Lakes and St. Lawrence River basin that could serve as a model for ecosystem conservation and protection in other North American regions. Given recent tribunal decisions under NAFTA Chapter 11's investor-state dispute mechanism, even non-discriminatory measures are open to challenge.

In this section we outline parts of a strategy to trade proof a new Great Lakes Common Standard on protecting the Great Lakes, especially respecting bulk water removal and exports. Importantly this Common Standard could form the basis of a new Canada-US bilateral environmental or conservation agreement to be listed in NAFTA Annex 104.1 that could override inconsistent NAFTA obligations, including those related to investment and services, without requiring the direct amendment of NAFTA. Like the Montreal Protocol and its presumed coverage by the general exception in the GATT Article XX, this new regional environmental agreement could make distinctions between parties and non-parties, and parties (together with those sub-national jurisdictions or enterprises subject to the agreement) found to be out of compliance with it.[65]

The IJC concluded it is unlikely that water in its natural state (e.g., in a lake, river, or aquifer) is included within the scope of any of trade agreements since it is not a product or good. The IJC relied in great part on the fact that the NAFTA parties issued a statement to this effect[66]. Following the signing of NAFTA, the three parties issued a joint declaration that NAFTA creates no rights to the natural water resources of any party; that unless water, in any form, has entered into commerce and has become a good or product, it is not covered by the provisions of any trade agreement, including NAFTA. The IJC maintained that international rights and obligations respecting water in its natural state are contained in separate treaties, such as the Boundary Waters Treaty, negotiated for that purpose. This position appears to consider the Boundary Waters Treaty, and perhaps the new Common Standard, an environmental agreement appropriate for listing under NAFTA Article 104.

WTO/GATT/GATS

The key GATT provision with significance for water exports is the prohibition of quantitative restrictions in Article XI.[67] The GATT, however, creates a number of exceptions. Of these, the most relevant to trade in water would appear to be those in Article XX related to measures "necessary to protect human, animal, or plant life or health" (Article XX (b) the "health exception") or "relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption" (Article XX (g) the "conservation exception"). The IJC concedes that there may be a question as to whether water is an exhaustible natural resource, although this raises less of a problem in the case of a discrete ecosystem such as

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[65] Christine Elwell, "New Trade and Environment Enforcement Provisions to Enhance Conventional Arms Agreements" in *Treaty Compliance*: *Some Concerns and Remedies*, Canadian Council on International Law (eds), 1998, Kluwer Law International, London, p.84-85.

[66] See Vienna Convention on the Law of Treaties, Art. 31 (2) providing that instruments such as official statements are authoritative sources in the interpretation of international agreement. But Stephen Shrybman of the West Coast Environmental Law Association, in a legal opinion for the Council of Canadians reports that the US Trade Representative in a press release dated Dec. 2, 1993, and referring to the 1993 Statement, said: "None of these statements change the NAFTA in any way."

[67] There is debate whether this prohibition on quantitative restrictions (product bans and quotas) applies only to import and not exports bans. NAFTA Article 301 incorporates the same national treatment obligations for goods as in the GATT Article X1 that speaks only to imported goods. There are no national treatment requirements regarding obligations to export goods, including a duty to export water, according to Appleton, supra fn.63. But there are two cases, both concerning Canadian restrictions of salmon and herring caught off Canada's West Coast, constituting an unacceptable export control contrary to GATT Article X1—Canada, Measures Affecting Exports of Unprocessed Herring and Salmon, L/6268, 1988, and In the Matter of Canada's Landing Requirements for Pacific Coast Salmon and Herring, October 1989. National treatment obligations around a new Great Lakes standard are quite probable.

the Great Lakes basin, where only a small part of the resource is replenished annually. Both exceptions are qualified by a requirement that they “[not] be applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade.”

Although dispute-settlement panels considering these GATT exceptions have affirmed, in principle, that trade interests may have to give way to legitimate environmental concerns, it is also true that the same panels have questioned very closely whether measures nominally taken for environmental reasons have underlying protectionist elements. Many public submissions to the IJC in this reference noted that to date, in all the cases before the WTO involving issues of protecting environmental or natural resource interests, the WTO had ruled against those interests.

Since the IJC reference, and after Seattle, the WTO ruled that the French ban on Canadian asbestos could be upheld on public health grounds under Article XX(b).[68] This is the first time any public health measure has survived the GATT and should be acknowledged as such.[69] But if this result represents the floor required before a general exception to trade obligations can succeed, there remains serious doubt that Article XX has developed adequately to ensure the observance of legitimate domestic objectives, including Great Lakes water protection. The WTO decision-making process remains non-transparent.

Relying on the GATT/WTO general exceptions, the IJC concluded “Clearly the achievement of a coherent and consistent approach to water conservation and management in the Great Lakes basin—an approach clearly grounded in environmental policy—would be an important step in addressing any trade-related concerns with respect to the use of basin waters.” Indeed this recommendation has been taken up by the Great Lakes Governors and indeed environmental groups such as Great Lakes United to develop a Common Standard on water use and removals that is focused on the environmental aspects of conserving the resource in hope of coming within the GATT/NAFTA general exceptions.

In addition to this effort, the WTO Committee on Trade and Environment could consider whether the new Great Lakes Common Standard might be recognized as a regional environmental agreement for the purposes of its mandate around accommodating multilateral environmental agreements in general.

NAFTA Effects

The IJC agreed that NAFTA trade obligations with respect to goods, while rooted in the GATT, appear to constrain the availability of certain GATT exceptions—including the conservation exception—in some important ways,[70] in effect making it more difficult to “turn off the tap” once trade in water has been established. According to the IJC, these constraints do not apply to the health exception, and the NAFTA wording of that exception specifically provides that it is understood by the parties to include environmental measures. The IJC was able to reach this conclusion, however, by the narrow scope of its inquiry—to water as a good and not to water as a service and as an investment.

The IJC recognized that in the United States, the Dormant Commerce Clause Doctrine could be a constitutional restraint on state efforts, as opposed to federal efforts, to protect the resources of the

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[68] But the Canadian government Department of Foreign Affairs and International Trade is appealing the decision, see Press Release September 18, 2000 (11:15 a.m. EDT) No. 239 *Canada To Appeal WTO Decision Regarding France’s Ban on Chrysotile Asbestos.*

[69] See, <www.wto.org>. Sept 21, 2000

[70] NAFTA Article 301 on export controls, Article 315 on the proportional sharing obligation, and the removal of GATT Article XX general exceptions from NAFTA investment and services obligations in Chapters 11 and 12.

Great Lakes.[71] However, it need not prevent genuine, well-supported cooperative management and conservation and co-operation among the Great Lakes states and provinces. According to the IJC, and submissions received by the two federal governments, "the potential restraint is reduced considerably if the states can agree on Common Standards for the use and protection of Great Lakes waters and can co-ordinate their water-management programs with federal and binational efforts." This is the current challenge and opportunity to protect the Lakes.

The Commission conceded, however, that when water is "captured" and enters into commerce, it may attract obligations under the WTO/GATT, the FTA, and the NAFTA. Indeed the NAFTA and WTO agreements contain provisions prohibiting export restrictions and discrimination between nationals and foreigners who are entitled to national treatment under those treaties. According to the IJC, sales of water that are allowed could not be restricted to the domestic market unless they fit within the health and conservation exceptions referred to above. The conclusions of the IJC are limited, however, to a review of trade obligations concerning water as a good. It did not develop the critique that free trade in services, including investment, both at the WTO and NAFTA facilitates out of jurisdiction service providers to engage in water-related services, including development, delivery and treatment on terms "no less favorable" than domestic service providers.[72]

Investor rights and trade in water

Even if water in its natural state might be considered as falling outside the definition of a good, there is no doubt that it could still be considered a NAFTA-protected investment and a service. The IJC agreed that with respect to water diversions or sales that nationalize or expropriate an investment of a foreigner can lead to a claim under Chapter 11 of NAFTA. Indeed, the Chapter gives extensive national treatment and minimum treatment rights to NAFTA investors. The investor-state dispute mechanism therein gives private investors of one country the right to commence proceedings against another country for injuries to the rights accorded private investors under the agreement. In all other cases, claims under the WTO agreements or the NAFTA must be brought by a Party's government to the agreement

In fact there is a pending NAFTA Chapter 11 dispute between Sun Belt Inc. of California and the Canadian government for $10.5 billion compensation for British Columbia's decision to prevent Sun Belt from exporting billions of liters of freshwater from BC to California. The bulk water ban was imposed under the BC Water Protection Act, which restricts shipments of water to bottled water and water in tanker trucks.[73] Some speculate that the decision of the NAFTA tribunal will wait until after expected BC and Canadian federal elections.[74]

NAFTA investment rights to national treatment ensure that once governments allow water to be used, withdrawn or removed from its natural state, as they have done on countless occasions for

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71 This dormant aspect of the Commerce Clause prohibits states from advancing their own commercial interests by curtailing the movement of articles of commerce either into or out of the state. In other words, a state may not discriminate against interstate commerce to advance the economic interests of the state or its citizens but only to advance legitimate local purposes with incidental effects on interstate commerce. Question how closely this model reflects current WTO/NAFTA practice around the legitimacy of general environmental exceptions.

72 Chapter 12 of NAFTA sets out a complete regime to govern trade and investment in the services sector. An exception to the provision of water related services is not contained in the relevant Annexes to Chapter 12. The Chapter applies to US and Mexican based water service providers operating in Canada for the purposes of also providing cross-border water services to another jurisdiction.

73 Sun Belt was allegedly involved in a joint venture with a Canadian company, Snowcap, which had received a permit authorizing bulk exports of BC water. When the government enacted a moratorium on bulk water exports, it revoked the permit, along with all others, and reached a settlement with Snowcap but not Sun Belt.

74 Mel Clark, *Control of Canada's Water yielded to the US by NAFTA*, The Canadian Centre for Policy Alternatives, *The Monitor*, August 2000. Indeed the first award of compensation under NAFTA Chapter 11 ordering Mexico to pay Metalclad Corp—a US hazardous Waste company—$16.7 million did not become public until after the recent Mexican federal elections, see New York Times, August 31, 2000.

commercial, hydroelectric and various consumptive uses, the same rights of access to water must be accorded to NAFTA investors, provided that these investors are “in like circumstances” to domestic investors in water related trade, services and investment.[75] While it might be possible that a NAFTA investment tribunal in a dispute to conclude that an out of basin claimant is not “in like circumstances” either because of geography or because it is from a jurisdiction that has not implemented the new Great Lakes Common Standard, there is no assurance of such an outcome.

Indeed the recent Pope and Talbot tribunal decision under NAFTA’s investor-state dispute mechanism offered an assessment of the NAFTA provision on expropriation which is chilling by concluding that even non-discriminatory measures concerning the trade in goods, and having no direct bearing on foreign investment, could nevertheless be considered expropriation. The company claimed the way the Canadian government implemented the softwood lumber agreement was unfair and discriminated against the company because it is only applied in four provinces but not others. Under pressure from US lumber producers, Canada agreed to limit its softwood exports to the United States in return for trade peace. The five-year agreement ends in 2001. The Agreement’s scheme of offering no export fee and reduced fee advantages for firms that stick within the quota was not considered by the Tribunal to be a prohibited performance requirement.[76] On the other hand, and despite the assurances by the Canadian government that regulatory powers in the public interest are beyond expropriation claims, the Tribunal took a very wide view of its jurisdiction. The Tribunal upheld its right to declare as a compensable expropriation, even non-discriminatory regulatory measures that affect an investment.[77]

The result of this case turned in great part because the company was still able to export some softwood lumber so that the regulatory interference’s with its investment were not seem as substantial enough to constitute an expropriation. While managed trade agreements that merely restrict trade such as the Softwood Lumber Agreement might pass the investor’s rights test, those that would prohibit trade altogether such as water and unprocessed fish export bans, may very well be found to significantly interfere with an investment. It is also disturbing that in sorting out the details of expropriation and the meaning of the term “tantamount to expropriation” that the Tribunal relied heavily on US legal sources and principles such as “creeping expropriation” and the scope of the state’s “police powers” that are not really part of the Canadian judicial lexicon with respect to expropriation.[78]

National treatment, non-discrimination and resource protection

Contrary to the evidence otherwise, the IJC maintains that trade and investment agreements do not constrain or affect the sovereign right of a government to decide whether or not it will allow natural resources within its jurisdiction to be exploited and, if a natural resource is allowed to be exploited, the pace and manner of such exploitation. Moreover, even if there were sales or diversions of water from the Great Lakes basin in the past, the IJC claims governments could still decide not to allow

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75 NAFTA Article 1102: Each Party shall accord to investors of another party treatment no less favorable than it accords, in like circumstances, to its own investors with respect to the establishment, acquisition, expansion, management, operation and sale of investments.”

76 Note this trade benefit of no or reduced fees for those producers in compliance with the export control regime of Softwood Agreement was found to be an acceptable trade preference to induce compliance with a negotiated agreement to manage trade in a sensitive sector.

77 The Tribunal said: “The Investment’s access to the US market is a property interest subject to protection under Article 1110 and the scope of that article does cover nondiscriminatory regulation that might be said to fall within an exercise of a state’s police powers.” The Tribunal specifically found creeping expropriation to be a recognized claim in Article 1110. It rejected Canada’s argument that regulations exercising police powers, if nondiscriminatory, are beyond the reach of Article 1110. The Tribunal observed: A blanket exception for regulatory measures would create a gaping loophole. Moreover, compensation does not turn on whether a state treats an expropriated property of nationals similarly to foreign investors”, copy of decision on file with author.

78 Stephen Shrybman, personal communication, July 10, 2000.

new and additional sales or diversions in the future. On the other hand the IJC did emphasize how important it was for a new Common Standard to protect the integrity of the Great Lakes basin be based on decision-making about water development that does not discriminate against individuals from other countries in the application of those measures.

National treatment and non-discrimination are the key disciplines in the goods, services and investment provisions of NAFTA. But do these standards serve environmental purposes very well? Should these standards be applied to all sectors of industry or resource development, or should some sectors be excluded from their application completely? In sustainability terms, this is a question that largely goes to the issue of scale, to promoting sustainable investments, and identifying areas where this is best done by allowing preferential access or rights to national or in the case of the Great Lakes, regional investors and service providers.[79] Indeed the right to exploit a resource is directly related to the duty to conserve it, something that is most often achieved locally. If the 1993 Statement excluding water from NAFTA obligations is reliable, there are no national treatment obligations regarding water as a good, investment or service.

In the end, the IJC recommended that the governments in Canada and the United States avoid creating undue expectations by clearly articulating their water-management policies in a fully transparent manner, by acting in a manner that is entirely consistent with their stated policy, and by limiting the time for which authorizations are valid.[80] Indeed the elements of the Great Lakes United proposal emphasize how important it is that true conservation and resource improvement be achieved of this undeniably exhaustible natural resource in order to avoid claims of discrimination and economic protectionism.[81]

It is also advisable that the Great Lakes Common Standard should clearly assert the paramountcy of its provisions should conflicts arise with other international agreements including those concerning trade, investment and services.[82] This issue was a major dispute when negotiating the Biosafety Protocol to the Biodiversity Convention. In the end the parties agreed to language in the preamble clarifying the intent was not to subordinate the Protocol to other international agreements, an indirect reference to trade agreements. Like the Biosafety Protocol, the new Common Standard can create the agreed international standard for the use and quality of the Great Lakes waters, to be recognized as such by the harmonization requirements of the NAFTA and WTO agreements on Technical Barriers to Trade and Sanitary and Phytosanitary Standards.

Listing Great Lakes Common Standard under NAFTA Article 104

In addition to relying on the 1993 Statement, the general NAFTA and GATT/WTO environmental exceptions and the hope that investment tribunals will distinguish between in- and out-of-basin water-related investors and service providers, consideration should be given to listing a new Great Lakes Common Standard to protect the Great Lakes especially from bulk water removal and exports

79 This concern for the scale of resource development is best expressed by Howard Mann, *NAFTA's Chapter 11 and the Environment*, International Institute for Sustainable Development, section 3,4, see <www.iisd.org>. Also the US Statement of Administrative Action on implementing NAFTA argues that "treatment no less favorable" does not mean that a foreign investor must be given the same treatment, or even equal treatment as all other investors, but allows them to be treated differently where the circumstances warrant.

80 IJC, Final Report, Section 10: the governments should make it clear that authorizations do not give rise to any continuing entitlement or expectation on the part of the holder of the authorization, there is no guarantee that that person would be given treatment any more favorable than any other person who might apply, and that it is within the government's jurisdiction to decide whether or not even to permit an authorization to be issued again.

81 GATT Article XX(g), the conservation exception to national treatment obligations in the WTO regime only apply "to the conservation of exhaustible natural resources if such measures are made in conjunction with restrictions on domestic production or consumption."

82 For example, see Jamie Dunn, Council of Canadians, NAFTA Effects on Water Workshop: " NAFTA cannot be said to support environmental protection as long as the environment is a second priority to trade. To be effective, environmental agreements must be on an equal footing with trade obligations under NAFTA."

under NAFTA Article 104.[83] This agreement could be added by the federal governments of Canada and the US as an executive agreement to Annex 104.1 without actually amending NAFTA itself. Such a listing could override inconsistent NAFTA obligations, including those related to national treatment and non-discrimination obligations concerning goods, investment and services.

Article 104 provides express permission to employ trade restrictions to achieve international environmental goals pursuant to specific international conservation and environmental agreements. Where there is a conflict between the trade obligations in listed environmental agreements and those of the NAFTA, those environmental agreements prevail to the extent of the inconsistency. The anticipated inclusion of further bilateral and multilateral environmental agreements via Annex 104.1 implies that efforts to conclude such agreements between the NAFTA Parties are to precede, and indeed replace, resort to unilateral trade actions.[84] In effect, Article 104 deems trade measures taken under the listed international environmental agreements to be measures relating to legitimate environmental objectives and *deems them necessary*.

Such a strategy would also facilitate the choice of forum for possible NAFTA-party disputes related to the Common Standard. As a general matter, NAFTA trade disputes may be resolved under either NAFTA or WTO auspices at the option of the complaining Party. An important exception exists, however, to this choice-of-forum option. Article 2005(3) provides that if the responding Party claims that its action is governed by the agreements listed in Article 104, and requests that the matter be resolved under NAFTA Chapter 20, the complaining Party thereafter can have recourse solely to the NAFTA dispute settlement procedures. We have already indicated a preference for CEC to provide a public forum on matters of compliance with the domestic implementation of the new Common Standard.

Although the parties fully believe that Article 104 preserves their ability to take action that would otherwise be inconsistent under the NAFTA, environmentalists fear that the “least inconsistent” language of Article 104 can be used to challenge such actions.[85] Some argue that Article 104 only protects the environmental agreement proper and not the domestic laws of the NAFTA parties implementing those agreements; the implementing laws of the parties are still required to be “least inconsistent with the other provisions of [NAFTA].” Thus, while the terms of listed environmental agreements may prevail, the law implementing the them may not.

Environmental groups have expressed concern that the requirement of unanimity to add additional environmental agreements may also unnecessarily hinder the ability of the parties to list other environmental agreements. Although the requirement of unanimous consent raises serious concerns, the parties have succeeded in adding at least two bilateral treaties to this list.[86] But because

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83 Article 104(1) provides: In the event of any inconsistency between this Agreement and the specific trade obligations set out in: (a) Convention on the International Trade in Endangered Species of Wild Fauna and Flora, (b) the Montreal Protocol on Substances that Deplete the Ozone Layer, as amended June 29, 1990; (c) Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal, upon its entry into force for Canada, Mexico and the United States; or (d) the agreements set out in Annex 104.1, such obligations shall prevail to the extent of the inconsistency, provided that where a Party has a choice among equally effective and reasonably available means of complying with such obligations, the Party chooses the alternative that is the least inconsistent. The Annex currently lists only two agreements: (1) The Agreement between the Government of Canada and the Government of the United States of America Concerning the Transboundary Movement of Hazardous Waste and (2) The Agreement between the United States of America and the United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area.

84 Bradly J. Condon. 1994. “NAFTA and the Environment: A Trade-Friendly Approach,” *Northwestern Journal of International Law & Business*, Spring, 1994.

85 Robert Housman. 1994. “NAFTA Lessons for Reconciling Trade and the Environment,” *Stanford Journal of International Law*, Summer, 379.

86 The United States has obtained commitments from Canada and Mexico to list: The Convention on the Protection of Migratory Birds, Aug. 16, 1916, US-Great Britain (on behalf of Canada) 39 Stat. 1702, T.I.A.S. No. 628 ; and The Convention Between the United States of America and the United Mexican States for the Protection of Migratory Birds and Game Mammals, Feb. 7, 1936, 50 Stat.1311, T.I.A.S. No. 912

NAFTA's accession clause does not require acceding parties to also accede to the agreements listed under Article 104, as the number of NAFTA parties grows, the requirement of unanimity could prove increasingly troublesome. In the meantime, there is the danger that listing certain treaties leaves all unlisted treaties open to challenge without any additional protection.

Despite the limitations of Article 104 to ensure the integrity of environmental agreements, the provision affirms the belief of three important nations within the world trade system that there are instances where trade restrictions are both necessary and proper to advance environmental goals. It is appropriate to test how solid this commitment is by demanding the listing of the new Great Lakes Common Standard under NAFTA Article 104.

Legislative response to NAFTA stress

According to the IJC, legislation was introduced in the US Congress in 1999 to impose a moratorium on the export of water from the US portion of the Great Lakes pending the development of agreed principles and procedures that would protect the water resources of the Great Lakes basin. To date, there has not been final congressional action on these legislative initiatives. Reliance is still placed on the Water Resources Development Act of 1986, providing federal veto power over any export, diversion or withdrawal from the lakes.

On November 22, 1999, the Canadian Minister of Foreign Affairs introduced proposed amendments to the International Boundary Waters Treaty Act (Bill 15) that, if enacted, will impose a prohibition on removals of boundary waters from their water basins, covering five very large basins. Moreover, the amendments will require persons to obtain a license from the Minister of Foreign Affairs for the use, obstruction, or diversion of boundary waters in a manner that in any way affects, or is likely to affect, the natural level or flow of boundary waters on the other side of the international boundary. This licensing requirement does not, however, apply to the ordinary use of waters for domestic or sanitary purposes or in cases for which exceptions have been established by regulations.

As part of the Canadian strategy, the Minister of the Environment seeks the endorsement by provinces and territories of a Canada-wide Accord prohibiting bulk water removals to ensure that all of Canada's "major watersheds" are protected. The Canadian Environmental Law Association generally agreed with the strategy that water in its natural state is not a good, and that the purpose of prohibiting bulk removals is to protect water basin integrity.[87] But in addition to including consumption reduction targets within the Accord, the definition of "basin" should be at the individual Great Lake or river watershed scale and include inland waters. Bill 15 has also been criticized for allowing the Minister of International Trade to issue water taking licenses, rather than the Minister of the Environment.[88]

Besides the federal government's legislative powers, it also exercises certain proprietary rights that involve a water-management role. These rights include ownership of specified public works such as canals (and connected lands and water power), public harbors, lighthouses and piers, river and lake improvements, lands set apart for general public purposes, and national parks.

Although the federal government exercises jurisdiction over water management primarily through its legislative authority under the Constitution Act, provinces also derive important

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[87] CELA, *IJC Water Uses Reference*, supra. fn 38, maintains that a non-binding accord will only set up a patchwork of inconsistent policies across the country, preferring federal legislation to clearly prohibit the bulk removal of water from Canada. Because the Accord does not directly address trade deals, it fails to be the basis of a comprehensive and effective approach to protecting Canada's water. No independent and creditable enforcement mechanisms are envisioned that could prohibit an ill-advised reversal of government policy under a different administration.

[88] In the Quebec prohibition on bulk water exports, it is the Environment Minister who issues licenses and approves projects over 75 cm per day.

authority from their proprietary rights.[89] In Quebec, the Civil Code contains provisions concerning the use of water, including the rights of riparian owners. Moreover, Quebec's Environmental Quality Act, which is concerned primarily with contamination and withdrawals that have a significant effect on the environment, imposes constraints on the use of water. In November of 1999 the Quebec National Assembly assented to a Water Resources Preservation Act, put forward as an interim measure to prevent adverse effects on the environment from water transfers outside Quebec. The Act prohibits the transfer outside Quebec of surface or groundwater taken in Quebec except for (1) water to produce electric power, (2) water to be marketed for human consumption that is packaged in Quebec in containers of 25 liters or less, (3) water to supply potable water to establishments or dwellings situated "in a bordering zone," and (4) water to supply vehicles. Moreover, the government may lift the prohibition on the grounds of urgency, for humanitarian reasons, or for any other reason considered to be in the public interest.

2.2.4 NAFTA, Water Taking and Ontario Practice

The Ontario Water Resources Act (OWRA) prohibits the withdrawal of more than 50,000 liters (13,209 gal.) of water a day from a well or from surface waters without a permit. Ontario's recently issued a Water Taking and Transfer Regulation, which took effect on April 30, 1999, and among other things, prohibits the transfer of surface and groundwater out of the Great Lakes basin and other major basins within the province, again subject to certain exceptions.[90] The exceptions carve out the regulation of water taking when used to manufacture or produce a product, for ballast waters and packaged in containers of 20 liters or less.[91]

All of these exceptions are potentially major water exports that increase the consumptive use of waters taken from the region. It is apparent that the legal fiction employed by the IJC in denying that consumptive uses of water, including water incorporated into production processes or bottled in containers and traded in North American and world markets, is somehow not a removal from or a taking of waters out of the basin, also forms the basis for the Ontario scheme.

Despite claims to the contrary, including the signing of the Federal-Provincial Water Accord in 1999, the Ontario government continues to issue water taking permits that could endanger the integrity of the Great Lakes ecosystem. In practice, water-taking permits, even where there is a requirement to obtain them, are routinely issued with almost no public scrutiny of these decisions. The formulas adopted to determine minimum in stream flow rates and "use to resource" ratios are totally inaccessible and nontransparent. Little efforts is made to keep track of the number and location of all of the permits. There is no permanent database to track permits already granted. In practice the allocation of water is on a "first come, first served" basis that rarely considers the cumulative impacts of water takings in Ontario.[92]

There have been many high profile disputes about water taking permits from groundwater supplies for removal by truck out of the country to commercial bottling operations in the US.[93]

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89 The Constitution Act provides, with limited exceptions, for provincial ownership of all public lands (including water). The legislative powers of the provinces largely buttress their proprietary powers and include authority with respect to the management and sale of public lands, local works and undertakings, property and civil rights in the province, and generally all matters of a local or private nature.

90 Ontario Natural Resources Minister Snobelen, Press Release, March 17, 2000: "Ontario supports the approach of the IJC that provinces and Great Lake states not permit any removal of water from the Great Lakes basin that would endanger the integrity of the basin ecosystem."

91 Water Transfers Ontario Regulation 285/99 made under Ontario Water Resources Act, R.S.O, 1990

92 Canadian Environmental Law Association, Submission on Water Taking and Transfers Regulation, 1999, <www.cela.ca> where evaluation of water permits using an individual watershed approach based on a hierarchy of needs, with protection of ecosystem function a the primary need is advocated.

93 Nancy Hoffman. 1995. "The Permit to Take Water Program and Commercial Water Bottling in Ontario," *Canadian Water Resources Journal,* Vol. 20, reviews the permit granted to Savarin Springs with the brand name Clearly Canadian to

There is no good evidence that water taken in bottles, in trucks and in products is not increasing dramatically. Many of the companies involved are not listed in public securities records that could provide a better insight to their production process and exporting activities.

Water-taking Case Study: The Tay River

On August 24, 2000, the Ontario Ministry of Environment issued a permit to take water despite overwhelming public objection and evidence of environmental harm to the local ecosystem.[94] Importantly the Ontario director deferred to Parks Canada, a federal agency with jurisdiction to control the water levels of the Rideau Canal, on the question whether the taking would cause significant environmental impacts to the Tay River or to the upstream watershed.

The Tay River is a small scenic river that flows into the Rideau River, into the Ottawa River and then out to the St. Lawrence River. It is part of the Great Lakes basin. OMYA (Canada) Inc, an American-owned company, mines calcium carbonate, a chalky white substance found in nearby limestone, mixes it/incorporates it with large amounts of water into a slurry, and then trucks the product to the US as a thickener in paper and paint manufacturing. For many years OMYA obtained water from groundwater sources but because of plans to substantially expand its facilities over the next decade it determined it needed more water for use in operations and in calcite slurry products. The company's projected water needs (4,500 cubic meters per day by 2009) are as high as those of the entire Town of Perth, almost a million gallons a day, and located just downstream from the operation.

The Tay River Watershed Plan is a community-based group representing residents, cottagers, landowners, businesses, interest groups, government agencies and other stakeholders throughout the watershed, with responsibility to promote and protect the Tay River system. The watershed's principal reservoir lake, Bob's Lakes, was two feet below normal this spring: the outflow is at an all-time low. There was and is wide-spread concern that OMYA's taking of large amounts of water from the Tay River would negatively impact the whole watershed, including Perth's water supplies, fish and wildlife habitats, groundwater recharge and adjacent wetlands.

The company based its proposal on an engineering report from the Glen Tay gauge; however, the gauge has not been used since 1927. Citizens filed submissions opposed to the granting of the permit until accurate and comprehensive flow data were assembled and a thorough environmental impact study on the Tay watershed was completed. Ignoring what appears to have been a reasonable request, the Ministry of Environment approved the permit.

Following consultations with Parks Canada, that controls the Rideau waterway, the Ministry of Environment determined that as long as the proposed water taking by OMAY did not cause the Tay flow rate to fall below 1 cubic meter per second, or 1.7 percent of the flow in the Tay River, the downstream uses and users of the water resources would be protected. If the rate should prove insufficient to maintain aquatic and downstream uses of the Tay, the permit conditions provided that the Ministry could amend the permit and reduce the taking. The responsibility to monitor and record Tay River flows and total daily water taking was given to the company, with data to be made available only to the government ministry and authorized agencies. The good people of Perth, together with many environmental and other public interest groups, filed an appeal of the decision but are unlikely to be successful, given the current track record of the Ontario Environmental Appeal Board.

A number of observations can be made. First, the rationale behind Parks Canada and the Ontario Ministry of Environment minimum instream flow rate at one cubic meter per second was never

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take groundwater from the Town of Formosa for processing in the US, despite public and official concerns about local water supplies, aquifer depletion and the adequacy of the groundwater studies done before the permit was granted.

94 Environmental Bill of Rights Registry Number IAOOEO427, Ref number ER-9062, see <www.ene.gov.on.ca>.

disclosed. It is just too much of a coincidence that the 1.7 percent use-to-resource ratio employed to approve the taking of the Tay flow is the same estimated consumption rate for Lake Ontario overall—said to be at 1.7 percent of Lake Ontario's outflow. We have already described how flawed the data are on current water availability, on the renewability factors and the failure of water policy and regulation to account for expected and dramatic climate change impacts to Great Lakes' water resources, including the St. Lawrence system.

Secondly, the decision recognized that data on Tay flow rates were dated. But instead of acting with caution and conducting an environmental impact assessment that might have revealed flow formula and other problems, the Ontario government approved the permit. Instead of requiring evidence that the taking will not cause harm, the taking is allowed until harm is established; effectively reversing the onus of proof from the company to the ill-equipped public.

Third, instead of equipping the public with the necessary tools to protect the watershed in which they live, the government denied them access to the information necessary in order to mount the case that the taking was causing harm. The already organized Tay River Watershed Plan was specifically excluded from reviewing the data the company is charged with providing. Given the recent history of the Ontario government's failure to correct even flagrant situations where companies are out of compliance with permitting and licensing conditions,[95] there is every reason to believe that OMYA will take as much water as it wants and the government will not stop it.

Fourth, while the decision did acknowledge the public's concern regarding the removal and export of water from the Tay River, the decision indicated that the Water Transfers regulation under OWRA does not address the removal of water that is incorporated in a product such as a slurry, even if the water is exported to the US.

Fifth, the decision relied upon the ministry's ability to amend the permit should it prove necessary without any consideration of possible NAFTA investor-state disputes that may arise should the government actually embark upon such a course of action. There was no appreciation of national treatment obligations that ensure once water is used or removed from its natural state, the same rights of access must be accorded to all other NAFTA investors and service providers in like circumstances. This failure is compounded by the fact that rarely does the government consider the cumulative impacts of water takings in Ontario.

The Tay River situation speaks to a multitude of policy failures by the Ontario and federal governments, especially relating to poor water resource management, that provides short-term commercial benefits and export opportunities. Instead of NAFTA facilitating sustainable use of water resources, its rule-making, especially relating to national treatment, proportional sharing of resources, together with rigorous investment and service obligations, contributes to the environmental stress on Great Lakes resources. We recommend the adoption of a new Common Standard to protect the Great Lakes, as improved by the suggestions of Great Lakes United, that features public access to information so that the community of the Tay watershed have the tools necessary to participate in their watershed management and monitor OMYA's takings of the Tay River. This recommendation would benefit countless watershed communities from across the province and the Great Lakes region.

The links between water stress and globalization was predicted. The Stockholm Environmental Institute in its Comprehensive Water Resource Assessment identified that one of the major drivers in throughput levels is economic globalization.[96] Water intensity (water/GDP) is said to be a

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[95] Sierra Legal Defence Fund, *Ontario Compliance Report on Water Polluters* 1999, showing that Ontario waste water pollution violations tripled from 1996 to 1998, up 200 percent in just two years, and only 4 of the 134 violations in 1996 were prosecuted, the last year that records on prosecutions were kept.

[96] Stockholm Environment Institute, *Comprehensive Assessment of Freshwater Resources: Assessing Long-term Patterns*, 1997, <www.tellus.org/seib/indext.html>.

function of structural changes in the economy and technological improvements in the efficiency in end-use water uses. Structural changes affect average water intensity as the composition of the economy changes among sectors which have very different water intensities (e.g., from manufacturing to services).

Finally, we ask the question whether the trade rules and patterns of NAFTA have shaped the water intensity of economic activity in the Great Lakes–St Lawrence River basin.[97] In the province of Ontario, we see a rise of water-intensive activity that both exports water out of the basin (withdrawals for bottling,[98] incorporation into products for slurries) and pollutes the water within (intensive livestock operations and hazardous waste treatment[99]). Water-intensive industries with related pollution are likely to increase as NAFTA is expanded into a Free Trade Agreement for the Americas.[100] And as competition rises for limited resources with expanding water use, water quality deteriorates and ecosystem maintenance is compromised. Not only has water intensity increased, the quality of water is also threatened, aggravated in part by the trend towards privatization that NAFTA facilitates.

NAFTA, Privatization and the Human Right to Water

In "Blue Gold: The Global Water Crisis and the Commodification of the World's Water Supply," the International Forum on Globalization reported that, during a drought crisis in northern Mexico in 1995, the government cut off supplies to local farmers while ensuring water supplies to the mostly US controlled industries in the region.[101] Instead of water being directed to the highest bidder, the belief of civil society is that "water is part of the earth's common heritage that must be preserved in the public domain for all time." The struggle is to ensure that access to clean water for basic needs is a fundamental human right, protected by local communities, nations and international law.

Indeed, the experience so far with the privatization of water development, delivery and testing has been negative. Whether the story is from Auckland City, where 500 families were disconnected from water service, or from Hamilton, Ontario, where private waste management results in significant sewage spills and the lay off of maintenance operators, or from Bolivia, where angry peasants rejected a World Bank-brokered sell-off of water services to British Bechtel, the news about privatizing water is all bad for public health and the environment. It is with great sadness that we offer the recent Walkerton, Ontario, water crisis as a case study of the NAFTA effects associated with declining water quality, and the withdrawal of governments from ensuring good governance, fundamental human rights, sustainable development and the ecological integrity of the Great Lakes system. The good news, however, is this example may represent the high water mark of efforts to privatize water in Canada. The rhetoric of ever more tax cuts has subsided since this failed experiment with human lives and the environment. On the other hand, private operators are actively promising to solve Walkerton's drinking water problems so it is fair to say that as the threat of water privatization persists and as it grows, so does the movement to oppose it, now deeply felt within conservative rural Ontario.

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[97] Indeed, the Great Lakes basin has seen a decline in water intensive manufacturing, with the sourthern migration of industry, see EPA, *A Changing Great Lakes Economy*, 1995, <www.epa.gov/glnpo>. But this conclusion does not hold for water dependent industries, nor account for the rise in agricultural uses of water as factory farms in the region specialize in domestic production for export, see US EPA *Liquid Assets*, 2000, <www.epa.gov/ow/liquidassets>.

[98] CELA, Fact Sheet Bottling Ontario' Groundwater: 18 Billion Liters and Counting, 1999, see <www.cela.ca>.

[99] Canadian Institute for Environmental Law and Policy, *Ontario Open for Toxics,* 2000, showing a 42 percent increase in hazardous waste shipments to the province between 1994 and 1998, a rate of growth three times that of real gross domestic products over the same time period. See <www. cielp.org>.

[100] The US EPA is concerned that streamlined tracking of hazardous and infectious wastes by customs officials will end up allowing increasing shipments, see Inside US EPA, October 28, 1999.

[101] Maude Barlow, *"Blue Gold: The Global Water Crisis*, and see forthcoming "Forum on Conservation and Human Rights," July 5-8th, 2001, Blue Planet Project at the University of British Columbia, see <www.canadians.org>.

Moreover, the promise that private capital will fill in the gaps with improved water infrastructure and quality assurance remains unfulfilled. Yet the private-public partnerships that evolve in cash starved jurisdictions open up the sector to strictly commercial considerations and foreign investors that do not adequately address water conservation and public access to clean water supplies and services. NAFTA rule changes, particularly around current and future private and state monopolies in Chapter 15 NAFTA, have increased citizen concerns about the commodification and privatization of water and water services. The NAFTA model of public works, should they persist, is based on state enterprises operating on commercial considerations alone rather than public health and environmental protection. The NAFTA ethic that state enterprises act solely in accordance with commercial considerations (Article 1502(3)(b)), do not discriminate against NAFTA investors (Article 1502(3)(c) and Article 1116(1)(b)), and service providers (Article 1503(3)), remains counter intuitive to the environmental ethic of conservation and the emerging human right to clean water supplies and to a healthy environment. The effects of these NAFTA-imposed rule changes are compounded by efforts at the global level to negotiate the free trade in services at the WTO.

Major public interest campaigns have been developing nationally in Canada, where the common concerns among environmental, labor and human rights communities have converged into a coherent whole. New so-called "Water-Watch Chapter Committees" have sprung up particularly in central and eastern Canada on the issues of privatization of water supplies and treatment. It is only a matter of time before this campaign further links up with local citizens groups engaged in Water Quantity and Quality monitoring and protection, described further below, a movement also related to the general withdrawal of government from water services, including testing.

It should also be noted that the related trend to privatize energy generation and delivery is increasing the general public awareness of hydroelectricity power impacts on water ecosystems, biodiversity and aboriginal claims.[102] But unlike the electricity sector where there are environmental gains to be made with the introduction of technologies to produce green power (e.g., wind and solar), the deregulation of water development and services to the private sector features few environmental benefits.

It is increasingly realized that costs of water quality decline are enormous.[103] Yet the renewed government rigor necessary to ensure water resource protection, pollution prevention and public health mandates is constrained by external constitutions, NAFTA among them, that are unaccountable and undemocratic. The move to expose the barriers imposed by the NAFTA, the World Bank, the Organization of American States and the WTO is gaining ground, as is the opposition to water privatization.[104]

The emerging human right to water

To emphasize the human right of access to drinking water does more than emphasize its importance. It grounds the priority on recognized international human rights, it emphasizes the obligations to ensure public access, and it identifies the obligations of state parties to provide support internationally as well as nationally to give this right practical effect.[105] This focus also helps to

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102 Even deregulation in electricity is facing a backlash, see New York Times: California's Move to Limit Power Rates Hits Resistance, Aug 2000 11.

103 US EPA Liquid Assets, <www.epa.gov/ow/liquidassets>.

104 ADES: Assoc for Democracy, Ecology and Solidarity, Grenoble, France, Press Release, March 20, 2000, <www.france-assoc.com/ades>, where after 11 years of privatized water service in Grenoble by *Lyonnaise des Eaux*, the city council brought back water service under public control. A 1997 report by the *Cour des Comptes*, France's national audit body found; "The lack of supervision and control of delegated public services, aggravated by the lack of transparency in this form of management, has led to abuses." See Public Services International, *World Water Forum Briefing*, <www.world-psi.org>.

105 Peter Gleick, *The Human Right to Water*, Pacific Institute for Studies in Development, Environment and Security, 1 (5) Water Policy, 487-503, 1999, see <www.pacinst.org>, and the references cited therein, including S. McCaffrey (1992),

relieve disputes over the use of shared water by identifying minimum water requirements and priority allocations for all basin parties. Meeting a basic water requirement for all humans, as well as ecological function should take precedence in government allocation priorities over other water management, trade and investment decisions.[106]

The debate over whether access to safe drinking water is a human right or a "need" subject to market forces of supply and demand flared up at The Hague Ministerial on Water Security in the 21st Century. A recent report of the UN Subcommission on the Promotion and Protection of Human Rights agreed that an absence or insufficiency of drinking water threatened the maintenance of international peace and security. Many conflicts are in progress due to the lack of drinking water, and more conflicts will erupt. The report also described the WTO as a "nightmare" for poor countries, as fewer people stood to gain from globalization.[107]

Public trust doctrines

In addition to a human rights dialogue, there is also an important legal tradition that has aided civil societies for over a thousand years in promoting practical divisions between public and private. Modern Courts have found the public trust doctrine to be pivotal in several water development cases. From the time of the codification of law in the Roman Empire (instituted by the Emperor Justinian, mid-sixth century), certain resources have been treated as so important to civic society that the exercise of private property rights cannot be allowed to interfere with public access and uses. These resources belong to the public but are held in trust by the sovereign for specific purposes. Over time, it has been learned that there must be very strict limits on the sovereign or these resources might be sold for private gain. While privatization may capture efficiencies in resource use, it remains to be defined for water markets just what is owned by private actors and what rights are reserved for the public.

Importantly private rights cannot vest to the detriment of the public trust without clear legislative consideration.[108] But once legislation has clearly altered the public water regime with a private component, the evidence of a remaining public trust suffers, as in the case of New Zealand.[109]

How does privatization take hold?

Private-sector involvement in providing public drinking water takes various forms ranging from outsourcing of limited services to facilities that are entirely privately owned and operated. The term "privatization" refers to any private-sector involvement in the development, ownership, and

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Georgetown International Environmental Law Review, Vol V, 1, 1-24. Although the right to water is considered a derivative right from current international human rights, it has growing recognition for example by direct reference in the UN Convention of the Rights of the Child of 1989, and in the South African Constitution.

106 See Conference, Iguacu Falls, Brazil, on November 24-29, 2000, on elements of UNICEF/WHO Global Assessment 2000 on Water Supply and Sanitation, with a focus on household-centred environmental sanitation, ecological sanitation, waste as a resource, school sanitation, social marketing, risk assessment, serving the urban poor, targets, indicators and monitoring, contact Nabil El-Khodari <khodari@yahoo.com>, and <maharoofd@who.ch>.

107 *Financial Times,* Friday, August 25, 2000, "WTO Protests to UN Over 'Nightmare' Report."

108 When water rights are transferred, there are clear questions about what exactly is being bought and what is being sold. Buyers can't be buying more than the original seller had claim to in the first place. How to divide economic benefits between temporary private holders of water rights and the public which holds title to a superior interest is difficult. As water has become much more valuable, in theory at least, a great deal of the added value really belongs to the public and is legally recognized as not capable of alienation to private parties without very specific authorization. Consider the case of the Snake River, *Ecology Law Quarterly,* 1997, vol. 24: 461, and more generally, see Michael Warburton at <cwrp@ecologycenter.org>.

109 See the Water Pressure Group at <http://www.water-pressure-group.org.nz> for details of New Zealand's program of privatization and the Supreme Court case determining if public trust survives clear legislation.

operation of entities and facilities that have historically been public enterprises.[110] Four models of operation are often advanced by the water industry:

- Public ownership with public employee operations,
- Public ownership with contracted operations,
- Sale-leaseback with public employee operations, and
- Sale with private operations.

The way forward according to the World Business Council on Sustainable Development is for "governments to remain neutral participants and be prepared to remove institutional barriers which thwart private initiative."[111] Indeed because freshwater is being recognized as an exhaustible resource, there is an emergence in the notion that water is an economic good, to which market forces and price should be attached.

When consumers are required to pay for water, either to a public utility (state or privately owned) or indirectly by way of a tax, does that activity become a service to which free trade in services obligations attach? When a public utility engages in partnerships with the water industry does the nature of that utility change, also attaching trade in services obligations? Activities of government entities that might be viewed as approximating "commercial" activities, including the exploitation, distribution, treatment and procurement of water, may well attract the application of various NAFTA, WTO/GATT and the General Agreement on Trade in Services (GATS) rules.

NAFTA contains several provisions that specifically apply to state enterprises and monopolies, both public and private. It is far from clear whether or not a state entity providing water as a service to consumers, such as a municipal water utility, can any longer be considered a state enterprise when private-public partnerships develop. Importantly when a NAFTA party designates a monopoly, as of January 1994, it must "act solely in accordance with commercial considerations in its purchase or sale of the monopoly good or service in the relevant market."[112] In other words, if a state enterprise changes its mandate by perhaps engaging in private partnerships, there may be a change in designation, opening up national treatment and non-discriminatory access to NAFTA service providers and investors. Also NAFTA says state enterprises and monopolies may be maintained and new ones designated, provided they act in a manner consistent with NAFTA's investment and services rules.[113]

Indeed the NAFTA facilitates privatization by requiring that new state enterprises be based on commercial considerations alone. Such an approach is consistent with the view that government remain neutral as to the outcome of these development. Yet beyond the complete incompetence of the local officials immediately responsible, the experience of Walkerton may demonstrate that acting on commercial considerations and competitive efficiency alone was too narrow a mandate to ensure public health or environmental protection. There is no doubt that a reshaping of public monopoly mandates from ensuring the public interest to acting on commercial terms alone has been the trend.

One need only recall the current General Agreement on Trade in Services negotiations where a Working Party on Domestic Regulation is now seeking to develop global disciplines on domestic regulations regarding services. The outcome of this project, if successful, would determine when

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110 American Water Works Association, 1998, *Privatization and Alternative Approaches to Water Facilities,* AWWA Mainstream, see <www.awwa.org>.

111 WBCSD, *Partnerships in Practice, Industry, Fresh Water and Sustainable Development,* 1998, see <www.wbcsd.org>, p. 9.

112 Article 1502.3 and note: Commercial considerations are defined as "consistent with normal business practices of privately-held enterprises," Article 1505.

113 Article 1503.

government regulation is considered necessary, legitimate and transparent. When determining whether domestic regulations contain legitimate objectives, the test of the free traders is narrowly construed to cover "financial soundness, technical capability, the notion of universal service and competitive efficiency." Despite the European Union's attempts to ensure that public health and environmental protection are considered legitimate objectives, the Canadian government, at least prior to Walkerton, was opposed, preferring to limit the scope of domestic regulations to notions of competitive efficiency.[114]

This analysis of the worrying trends is not only of academic interest. In 1996 the Province of Ontario referred the Ontario Clean Water Agency, a crown corporation operating 357 facilities, the largest holder of water plants in North America, to the Office of Privatization, with a view to privatizing the Agency. Whether there will be the political will and time to regain control of public water resources and services remains unknown, despite the Walkerton tragedy.

Markets, conservation and sustainability

There are solid reasons why some resources such as water are considered inalienable and held in trust and why some public duties are considered non-delegable. Importantly, the trend towards privatization is in many ways antithetical to conservation. In a market, private ownership and extraction of the natural resources is done by the few, to be sold to the masses (consumers) for profit by keeping the price up, provided that resources are scarce. Sustainability goes against the purveyors of water who want to keep it scarce and expensive to supply, instead of supplying from conservation or recycling. Sustainability tends to distribute resources equitably, based on the long term, and in a consumer-based economy this will increase abundance and reduce scarcity. A sustainable water plan will be a challenge in a consumer-based economy because it will tend to proportionately drive profits down. A few examples are provided below. This conflict may explain why new, sustainable technology is usually kept out of the mainstream. Consider energy companies that prefer to give you aero plan points, rather than efficient light bulbs!

Excessive water extraction

Private water merchant groups tend to engage in excessive extractions. Following the 1989 privatization of water in England and Wales, 20 water courses dried up in a few years because of over-extraction.[115]

Expansion rather than conservation

Many local initiatives such as the retention of rainfall, would increase water supply and watercourse stability to an extent that greatly increases groundwater supplies, the dilution of polluted runoff and sewage effluent.[116] But water merchants prefer to focus on the expansion of water transfer systems–centralized distribution networks—drainage facilities—budgets. Ordinary folk see the potential to avoid existing lagoon/irrigation programs that could quickly be implemented by local initiatives quickly and at relatively minor expense.

Instead, the water barons collaborate with local officials in extending sprawling water lines to rural areas. These steps are aimed at locking a majority of the public into dependence on centralized

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114 Department of Foreign Affairs and International Trade Canada, Communication from Canada, April 10, 2000, Working Party on Domestic Regulation Job 2198, on file with author.

115 In 1998 *Suez-Lyonnaise des Eaux* subsidiary Essex & Suffolk Water was convicted for illegal over-abstraction of water at five sites over a three-year period, see PSI, supra fn 104 and *Water News,* 14/08/98.

116 In addition, rebating on water bills is possible according to how well consumers build the simple, inexpensive structures that could guide water into the groundwater beneath them. Rather than penalizing people for water usage, would it not be better to see most homes proudly displaying a "Rainwater Conserving Home" plaque that means they replenish groundwater supplies, reduce flooding and eliminate polluted runoff from their homesite? See Marple at <jesl@carolina.net>, a <waterforum@egroups.com> enthusiast.

supplies. This private sector trend has progressed so quietly it has not attracted the attention of critics able to recognize the absurdity of piping recycled sewage effluent from rivers to homes whose roofs shed more “pure” water than the household uses. The centralization of water supply parallels the efforts of the electric industry to lock the public into debt for huge new generating facilities before it became obvious that home generation units can provide cheaper, cleaner and more reliable electricity. The key players hidden within major corporations are closely allied if not identical.

Profits before biological diversity

Some of the competing uses of water may not be high in the priorities of managers in government, and even less in private hands: improving biodiversity, reserves and national parks, science and research, environmental and coastal protection, keeping rivers running and healthy.

Privatization and water pricing

There are many advocates of water pricing. But there is substantial debate around how this economic instrument might pertain to water development and services.[117] Many people could accept putting a “value” on water for its own sake and for all “costs,” including externalities and ecological services, related to water use as a control on waste and to encourage water conservation. Indeed there is evidence to suggest that when the water price is based on the volume of use (the more one uses, the more one pays) water consumption diminishes by 30 to 60 percent.[118] Environment Canada studies indicate that consumption drops dramatically when charged for the actual amount of water used when metered rather than when being charged a flat rate. Low prices encourage high consumption. The continuation of low prices is taken into account in projecting water demand and the need for new projects and water system expansions. Low prices lead to more development rather than increasing supplies by conservation. It is recognized that the price would not act as an effective deterrent to overuse to some individuals and industries if it were set too low.

But if market forces, supply-and-demand, are the source of the price and industry can pay a higher price, then the price may soar up, and be outside of the low income groups. People capable of paying high prices will have wide uses of water for swimming pools, golf clubs and gardens. Water would tend to be retired from agriculture for the benefit of industry and higher earnings, thus having an impact in food production and prices. Local food producers may not be competitive to pay, causing food shortages for the most vulnerable. Government agencies might capture revenues from water taking and uses; they might have an incentive to hand out more permits.

There are many concerns around water pricing and water rights. But an important question is why we are imposing a water fee—is it to encourage water-conserving behavior or to generate money for certain projects that might restore water quality or increase water quantity? If we are imposing the fee for the latter reason only, we wouldn’t need to worry about making sure the fee was high enough on certain users to ensure/encourage water-conserving behavior.[119]

Let’s recall that the price of water is usually “free” at the source.[120] The only “cost” involved is the cost of getting it from the source to the point of use. It is at this stage that water achieves its

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[117] For examples, see Richard Connor “*North American Vision on Water, Life and the Environment*” World Water Council, <www.worldwatercouncil.org>.

[118] Peter H. Gleick. “*The Changing Water Paradigm: A Look at Twenty-first Century Water Resources Development*.” The International Water Resources Association, US, 1998.

[119] Ansley Samson, Earthjustice Legal Defense Fund, Florida, <asamson@earthjustice.org>. This is another <waterforum@egroups.com> gem.

[120] So far no one is suggesting pricing for air although there are costs to keeping it clean and the costs are either imposed on the “polluter” with mitigation measures, or on the consumer with externalized health effects, degrading the environment.

value in a commercial sense. Typically the costs relating to infrastructure are low and can be afforded by many public utilities, so the present tradition of shared cost by levy would keep water affordable to all users.[121]

Another cost of water comes when it is processed and treated after use. Costs are produced when water demand draws down an aquifer such that there is regional subsidence in the land surface causing structural damage to physical infrastructure. However, these costs are not currently being paid by the majority of users, although there is a trend towards environmental tax shifting away from income and to polluting activities.

Despite the uncertainty around "true" water costs" and pricing, it is possible to believe that an individual, a family, a watershed community, can achieve sustainability by effectively keeping these costs balanced within their particular ecosystem, provided that factors such as economic globalization, including free trade in services and investment do not distort demands on the resource, in this case water, beyond sustainable limits. This is the ethic of living within the means of one's watershed. A 1990 Ontario report noted, however, that user fees accounted for only 65 percent of expenditures on water infrastructure, and these expenditures were only half of what would be required to maintain the system in the long run.[122]

Infrastructure and capital investment

Most major cities in North America are operating with outdated water delivery systems and sewage collection systems. They will have to be replaced at great expense. The Canadian Water and Wastewater Association estimated in 1997 that it would take between $79 Billion and $90 billion invested over 15 years to maintain, rebuild and add the water and wastewater infrastructure Canada needs. Private water service providers are in the business of making profits to shareholders from water revenues at the expense of maintaining the water infrastructure—the pipes, sewage treatment plants, conservation technologies.[123]

Why not take advantage of the opportunity to make those who use water pay the "real" costs, including contributions to infrastructure and local community water quantity and quality groups to assist with the monitoring of compliance with permitted use, and require waste water from all users be treated to ensure water quality?

In summary, there are many views on the subject and all of the evidence is not in around water pricing policy and methodologies. What is clear is that the value of freshwater is increasingly high; it comes second only to air in the hierarchy of human needs. Generally speaking, preference for public control of the development, allocation and testing of water resources derives from a perception that managers shielded by a corporate structure are more likely to encourage cutting corners, gambling with slim margins of safety, and unnecessary expansion than public servants whose careers are at stake and who are more accessible to concerned citizens.

While public employees who seek to please agency managers who might serve at the whim of water profiteers tempers this view, these isolated instances do not suggest a need to restructure water

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[121] Ed Buckle, <grower@nethop.net>: Individual consumer use presents a very low treatment cost on a per capita basis. In 'organized' areas such as cities the wastestream from households should be separated from other wastestreams. This would minimize the waste treatment costs to return the water to its original state. It would also place the real cost of water for agricultural—commercial—industrial applications on those users. This would provide the incentive for these high volume users to change their management practices.

[122] Fate of the Great Lakes, supra fn. 3, p. 63-64 quoting Environment Canada, *Urban Water: Environmental Indicator Bulletin*, Sept. 1994.

[123] Reference is often made to the controversial British experience with privatization wherein 1995 Yorkshire Water PLC choose not to invest in infrastructure maintenance, was losing 30 percent of its water to leaks, while making a profit of $213.4 million in that year. Even the British Medical Association became alarmed with the health effects of privatization on children. See Fate of Great Lakes, supra fn 3, p.66.

control of essential needs and services to the private sector. Indeed we call for a rigorous not a neutral government when it comes to ensuring human rights to clean water and a healthy environment. This mandate will not be advanced where trade agreements narrow the scope of legitimate government authority to mere commercial considerations and efficiency. The building and maintenance of a local community role in developing and monitoring sustainable water plans and project development and services is a central duty of governments that hold freshwater in public trust for this and future generations.

2.3 Water Quality and NAFTA

The International Joint Commission, in its report on protecting the Great Lakes, acknowledged that the quantity and quality of water are inextricably linked. For most uses, quantity alone does not satisfy the demand. Since the signing of the Great Lakes Water Quality Agreement, significant strides have been made toward restoring and preserving the quality of water in the Great Lakes basin. However, in many areas, the restoration has not been complete and problems remain. In these situations, this poor water quality impairs the potential uses of the waters of the Great Lakes and constitutes a virtual “removal” of usable waters from the system.[124]

Indeed the 1999 *State of the Great Lakes* report finds, after initial success with toxic chemical control programs in the 1980s, “a downward trend in contaminants in fish and other biota appears to be leveling out.”[125] In addition to continuing atmospheric deposition as an explanation of this trend, the report noted in both countries “the amount of taxpayer dollars being devoted to Great Lakes environment issues is decreasing.” We have also identified water-intensive industries as causes of both water quantity and water quality stress.

Evidence of water quality stress was revealed in 1996 concerning the plight of the Beluga whales, contaminated by toxins, including mirex, found primarily in Lake Ontario and flowing out of the Great Lakes-St. Lawrence basin.[126] Most recently a McGill University study has shown the runoff of chemicals from industrial farms led to a ten-fold increase in abnormalities of amphibians over runoff from organic farms; photos of multi-limbed frogs in newspapers have graphically portrayed this story.[127]

Our approach to illustrating the water quality impacts related to NAFTA rules changes and the withdrawal of governments from environmental protection including water services, is to feature a case study on Walkerton, Ontario (Appendix 3). The good news coming from this tragedy, where this southern Ontario town’s water supply became contaminated with a virulent form of E. coli, is that it has become a warning call to other communities concerned with ensuring safe drinking water. Sierra Club, together with other groups and universities, has embarked upon a campaign of community-based water quality monitoring to help equip citizens to reclaim the water commons.

2.3.1 NAFTA, Water Quality and Walkerton: A Case Study

Appendix 3 to this paper contains the results of a study undertaken by the research team that applied the CEC Framework for testing NAFTA effects on water to the situation in Walkerton. It should be noted that the CEC Framework would not have predicted this tragedy because of, *inter alia,* the focus on NAFTA effects after the fact of NAFTA implementation.[128] The results of the case study

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124 IJC, Final Report, Section 10, supra fn 1.

125 State of the Lakes Ecosystem Conferences (SOLEC, of scientific experts from Environment Canada and US EPA). 1999, p.19, see <www.cciw.ca/solec>.

126 Pierre Beland. *Beluga: A Farewell to Whales.* New York: Lyons & Burford,.

127 William Souder. 2000. *A Plague of Frogs: the Horrifying True Story.* New York: Hyperion,.

128 See Appendix 1, Gibson and Walker, Assessing the Framework.

indicate that NAFTA is directly connected to Walkerton's drinking water contamination by facilitating intensive animal farming, the downloading of environmental responsibilities to ill-equipped municipalities and private sector water testing facilities. Moreover, in the case of intensive animal farming there has not been an upward convergence of environmental regulation led by either government or the private sector.

2.3.2 Why the Need for Citizen Monitoring?

Environmental groups in the province are receiving frantic phone calls from the public inquiring about water quality concerns in their communities. This need at the community level extends in large part due to the increasingly recognized lack of government monitoring. Following budgetary cuts experienced by the Ontario Ministry Of Environment, environmental monitoring has been scaled back considerably over the last decade. In 1991, the 226,918 lakes in Ontario were monitored at 700 stations by professional scientists and technicians under the MOE. By 1996, only 200 water monitoring stations remained. In the Great Lakes area, 80 percent of monitoring stations were eliminated and observations ceased for lakes located north of Barrie.

Water Quality and Ontario Practice

The regulation of Ontario's water quality is a patchwork of laws, guidelines and policy.[129] Despite Walkerton and the flurry of promises from the government in response, Ontarians still do not enjoy the legislative protection of their drinking water. The main regime in place to govern direct discharges to Ontario's waterways (i.e., not into sewers or groundwater) is the Environmental Protection Act and the Ontario Water Resources Act, both of which contain general language prohibiting the impairment of water quality. Exceptions to the general law are contained in conditions of approvals that permit discharges, provided that certain terms and conditions apply, including the Ontario Drinking Water Objectives that sets out concentration limits for a list of pollutants.[130] Not only are the standards of questionable robustness, especially in light of cumulative or synergistic effects of many contaminates, but they do not ensure safe drinking water at the point of consumption. Unlike laws or regulations a regime of guidelines are not enforceable per se. The reality in Ontario is that there is a "myth of standards."[131]

Another major exception to Ontario's general water quality laws are agricultural operations.[132] In fact in 1998 the Ontario government enacted the Farming and Food Production Protection Act which exempted "normal farm practices" from municipal by-laws and nuisance lawsuits from aggrieved neighbors. The ministry responsible for setting rules for factory farms is the Agriculture Ministry, whose mandate is to promote agriculture, not to protect the environment.

Ontario residents have not benefited from the upward convergence of drinking water standards. For example the US enacted safe drinking water legislation over 25 years ago.[133] New programs have developed. Moreover, as the case study describes, the US Clean Water Act requires discharge permits for beef livestock operations.

In addition to low standards, that do not take into account expected climate change impacts to water quality, the Ontario government's involvement in water quality has decreased substantially

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129 CELA. 1999. *A Sustainable Water Strategy for Ontario,* see <www.cela.ca>

130 Ontario does not list a standard for *cryptosporidium,* a known protozoan parasite, and continues to permit the use and discharge of lindane an organochlorine insecticide despite the trend to ban its use for agricultural purposes as the European Union recently did, see ENS, France Finds High Pesticide Levels in Drinking Water, August 29, 2000.

131 Bruce Davidson, Concerned Walkerton Citizens, NAFTA Effects on Water workshop, Sept. 11, 2000.

132 see Ontario Environmental Protection Act, R.S.O. 1990, c.E.19, s14(2) excludes "adverse effects" to water from animal wastes disposed of in accordance with "normal farming practices."

133 Safe Drinking Water Act, 1974.

since 1995, as described in the Walkerton case study. The environment budget has been slashed and civil servants laid off. The province's four government water-testing labs were closed and the responsibility for water and sewage was downloaded to ill-equipped municipalities. Water testing was to be done by private labs, with no requirement to report findings of potential water quality concerns directly to the province or to the local Medical Officer of Health.

The trend to cut provincial environment budgets began with cuts at the federal level, with a ripple effect on provincial budgets. Ontario went further than any other province by cutting the environment budget by 40–50 percent of what it was in 1995, one year after NAFTA came into effect.[134] Ontario was open for business. Even the OECD had to acknowledge that severe federal and provincial spending cuts have undermined the ability of governments to monitor the environment and enforce existing laws.[135]

The Ontario government's feeble response to Walkerton was to enact a Drinking Water Protection regulation allowing certain water quality parameters to be tested in private labs, provided the tests are performed in accredited facilities and notification is given to MOE, medical officers of health and municipal water facility operators of unsafe drinking water quality.[136] The requirement for lab accreditation and notification procedures should have been in place in any event. The regulation still does not create a clear statutory right to clean and safe drinking water, a provincial registry of testing results or a citizen's cause of action to enforce the regulation.[137]

A number of observations can be made concerning the Walkerton water crisis. First, water quality monitoring has been one of the areas to suffer heavily from budget cuts at both the provincial and federal levels. The drastic reduction in water quality monitoring since 1996 has had negative impacts on civil society in Ontario, both to health and to the fabric of social organization in municipalities. The events surrounding the recent E-coli related illnesses and deaths in Walkerton, Ontario exemplify both the health impacts and the other strains on civil society, especially the breakdown in communication and cooperation between civil society and government agencies.[138]

Second, the review of Ontario water policy practice indicates a clear withdrawal of government from not only water testing and monitoring but a determined withdraw of oversight concerning intensive livestock operations. The trends indicate that feedlot development is a form of industrial migration to areas of low environmental standards.

Third, despite claims otherwise, free trade has not led to upward harmonization of environmental law or practice. If the Canadian government traditionally operated with more investment in its human population than the United States (state health care, state universities, etc.), the strain of sudden direct competition with an economy so geared for unsustainable growth as that of the US calls into question the viability of any upward convergence of environmental practice and regulation, especially in light of the environmental record of the Ontario government of the past few years. If trade liberalization is truly to progress without significant damage to the environment, it is not enough to create a CEC Framework for testing NAFTA effects that can identify and perhaps even mitigate damaging processes that are already underway. The environmental impact assessment process should incorporate standards by which to judge actions that will have an effect on the environment. Given that no detailed indicators of sustainability are in place six years after the acceptance of NAFTA indicate that the general statements of desire for sustainable development in

[134] Sierra Club of Canada, Rio+8 Report Card, <www.sierraclub.ca>.

[135] OECD Condemns Canada's Environmental Policies, Toronto Star, Sept 6, 2000 and says Canada has mismanaged in particular its water resources. It should be noted that the OECD remedy that Canada design a licensing system for bulk water exports that would allow it to benefit from abundant water resources is condemned by environmentalists.

[136] Environment Bill of Rights Registry # RA000e0015 under the Ontario Water Resources Act, O.Reg. 459/00.

[137] CELA, Media Release, Environmentalists Pan Drinking Water Regulation, August 8, 2000, <www.cela.ca>.

[138] Kirsten Valentine Cadieux, Sierra Club Eastern Canada Chapter, NAFTA Effects on Water Workshop.

NAFTA are an accession to a minority of concern. The rapid degeneration of the state of water quality and assessment in Ontario should be a cautionary demonstration of the reality of the "pollution haven effect" and the "race-to-the-bottom" tendency. In an effort to speed placement of indicators of water quality and water quantity to access and avoid conflicts with free trade, and to further the objectives of other international environmental and human rights agreements, we have recommended the quick adoption of a new and improved Common Standard for Great Lakes water protection. With respect to water quality in particular, we note that the new Common Standard features the right of the public to the information necessary to effectively participate water quality assessment and monitoring.

Community-based Monitoring

Several civil society groups have been formed with the explicit objective to fill the vacuum left by the lack of water quality testing by the Ontario government, but the lack of widespread infrastructure and coordination of civil society water monitoring efforts has meant that their results are limited to local significance, in terms of science, policy and practical usefulness. The Sierra Club, with several partners, has initiated a project to collect and distribute information about water quality monitoring in Ontario, but even a simple initiative with a scope limited to contact and descriptive information about the kind of data being collected has highlighted the fractured state of awareness of actual water quality. Homeowners, naturalist and student groups are becoming a major source of information as vital as whether water is safe to drink.

These civil society groups, formed to face a perceived threat, demonstrate something important about the state of environmental research and informational transparency in the Great Lakes region that has been confirmed by the incident at Walkerton. The chains of responsibility and information have been badly damaged—not only do citizens not have access to necessary information (Ministry of the Environment water results are only available for sale), but also the government has lost access to proper lines of command and oversight where water is concerned, leading to confusion, delay and inaction.

The environmental groups are developing a province-wide Monitoring Network and Mapping Initiative with the York University Center for Applied Sustainability. Training materials and an interactive, map-based Internet database for citizen generated water quality data are being produced to monitor the health of local waters such that poor environmental quality can be detected, plotted on the map and appropriate restorative action taken. Currently, participants receive training and a binder of background information and instructions for kit use and monitor four times per year. The long-term goal of the proposed monitoring network is to improve water quality in lakes and rivers across Ontario. At all times, however, critical links to watershed health, ecosystem management, together with the effects of trade agreements and privatization are made.

The network aims to share local monitoring results (i.e., data and experiences) with government and industry; identify potential gaps in terms of where monitoring is not happening; facilitate provision of data 'checks' by government using advanced equipment in cases where poor water quality health has been identified by communities using less advanced equipment; and examine the opportunity for community action to remediate areas demonstrated as problematic by government monitoring. The Ecological Monitoring and Assessment Network (EMAN) of Environment Canada is developing 35 core variables for citizens to monitor, many of which include water quality indicators that the project will feature in its education materials and in the development of kits. These efforts should complement those at the US EPA's Adopt a Watershed program[139] and as the new Common Standard for Great Lakes protection is further refined.

[139] US EPA, supra fn 11.

Conclusion

Water from the Great Lakes is a critical resource that is essential for all forms of life and for a broad range of economic and social activities, facilitated in part by NAFTA. The Great Lakes, sometimes referred to as North America's inland sea, constitute one of the largest freshwater ecosystems in the world. Moreover, the lakes are a central feature of the natural and cultural heritage. Measures aimed at protecting and conserving the waters of the Great Lakes and the St. Lawrence River basin must cover the surface water of the lakes, connecting channels, tributaries, and groundwater if they are to be effective. A new Common Standard to protect the Great Lakes waters must not be turned into a license to export bulk water as the OECD has recently recommended.

Current decision-making around Great Lakes water levels, renewability factors, and use, together with current monitoring arrangements, are inadequate to assess the cumulative effects of water use or to support new consumptive use and removal decisions. There is a legal fiction employed that maintains water when bottled and incorporated into products, even when taken out of the basin, is somehow not removed. The federal governments, the Great Lakes states, and the provinces are underfunding data collection and management and, as a result, rely upon inadequate information in their decision-making process on water policy and water projects. This calls into question the soundness of governments' decisions, especially when the local community is so often excluded from project planning and the monitoring of impacts, as the recent Tay River taking example proved.

Our experience over the last ten years indicates that governments and water interests do not have the capacity or interest to adequately ensure good governance, transparency and the emerging human right to clean water and a healthy environment. Thus we recommend the active participation of community based oversight in water quantity and quality matters of local concern that can be fed into provincial, national and regional campaigns. Indeed there is much work to be done if efforts at a new Common Standard for Great Lakes water protection are to be successful, especially given the external pressures of economic globalization, and a thirsty planet.

Fundamentally and in any event, the governments of the Great Lakes states and Ontario and Quebec, in collaboration with local authorities, industry and community groups, should feature a coordinated basin-wide water conservation initiative. With quantified consumption reduction targets, specific target dates, and monitoring of the achievement of results, it is possible to live within the means of one's watershed. Protecting the integrity of the Great Lakes basin ecosystem also ensures opportunities to take advantage of the other economic and environmental benefits that normally flow from such measures.

The North American Commission for Environmental Cooperation has a clear and ongoing role to assess the growing pressures of trade on the environment. As governments, municipalities, industries and individuals in the basin struggle to reconcile their permitted uses of basin waters with the changing trade environment of NAFTA, it will be crucial for the CEC to assist in the development of water quantity and quality indicators of environmental health and stress to avoid the negative effects of trade in goods, services and investment, while optimizing the potential for environmental sustainability and quality in the Great Lakes basin. Moreover, given that the International Joint Commission does not have a trade-related mandate nor does it provide for public submissions on enforcement matters, as part of the design of the new Common Standard to protect Great Lakes waters, access to the CEC public submission process could be specified in implementing domestic legislation to complement local enforcement provisions. We trust this paper has contributed to this exciting development in regional environmental law.

Appendixes

1 Assessing the CEC Framework

An application of the basic principles of effective environmental assessment to a review of the CEC Analytic Framework for Assessing the Environmental Effects of the North American Free Trade Agreement

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If applied as designed, the CEC's final analytic framework should guide assessments that provide relevant and useful information about some of NAFTA's environmental effects. The framework provides a strong discussion on the linkages between NAFTA and economic change that may lead to environmental change. However, in order to achieve a higher level of environmental assessment that is credible, efficient and appropriately focused on sustainability issues, the framework needs to be strengthened

First, the purpose of the framework should be expanded to allow a realistically integrated approach centred on achieving sustainability. This entails adoption of a broader definition of "environment" that includes social, economic and ecological factors. It also requires an extension of scope so the NAFTA assessments consider not only adverse effects and how to mitigate and avoid them, but also positive steps towards greater sustainability (ecological rehabilitation, community building, fairer distribution of perils and gains, etc.). Application of the framework should also be extended to address NAFTA-wide issues of equity and wellbeing, social and ecological. Secondly, the framework should ensure consideration of alternatives. This should include not just alternative immediate responses to identified problems and opportunities, but also alternative trade arrangements that might be beneficial and less damaging in the case assessed, and that might be worthy of adoption in revisions to NAFTA or in the design of new trade arrangements for North America or elsewhere. Thirdly, the process should be more open and participative. Local knowledge should be valued and included throughout the process. A set of basic environmental assessment principles can be drawn from the last 30 years or so of environmental assessment experience and associated learning and be applied to the framework to determine whether they have been incorporated.

Respecting Uncertainty: The CEC framework does acknowledge uncertainty as a key factor in conducting environmental assessments of NAFTA's effects. It recognizes that there is limited baseline data or information on indicators and an overall lack of knowledge about relationships among influences and variables. This suggests awareness of the need for caution and humility in judgments about NAFTA's environmental effects. However, the document also includes the claim that "the framework distinguishes clearly between environmental processes that are associated with NAFTA and those that are not." Confidence in the possibility of making such a clear delineation would appear to rely on unrealistic assumptions given the current state of systemic knowledge in face of the complex interdependence of relevant environmental factors. The framework is also unclear about how it will deal with the uncertainty. The precautionary principle is recognized in the NAAEC, and may therefore be implicit in the CEC's assessment framework. But the framework document includes no explicit guidance for how precaution should influence analysis where a potential environmental risk is identified. There is, for example, no discussion of how to consider severity, reversibility, or maintenance of adaptive capacities.

Adopt Sustainability as the Central Objective: The purpose of the CEC in creating the analytic framework is to consider positive and negative environmental effects resulting from the implementation of NAFTA. The goal is not to reduce or mitigate environmental impacts, but instead "to develop an improved understanding of the linkages between trade liberalization and the environment." This understanding will be used to serve the ultimate goal of an enhanced environment in North America. However, "environment" for the CEC includes only the biophysical aspects (air, water, land and biota). It can be assumed that the information gathered from the environmental assessment process will be available for future planning processes and could help decision-makers avoid adverse environmental effects and enhance gains for the natural environment. No more specific indication of the purpose or anticipated use of the assessment work is provided. The concept of sustainable development is officially promoted by NAFTA, however, commitment to sustainability is only indirectly stated in the framework document and facilitating movement towards sustainability is not identified as being the goal of the environmental assessment process. Rather, the CEC is interested in observing how the economic forces associated with NAFTA have moved the air, water, land and biota closer towards or further from sustainability. This can hardly be described as support for sustainability objectives.

The framework also fails to support the three interconnected components of sustainability. The framework has defined "environment" and "environmental effects" very narrowly around biophysical factors. Social, political, cultural and economic factors are considered only insofar as they link the economic changes occurring through NAFTA to biophysical changes. The inattention to social, political, cultural and economic aspects of sustainability also undermines the CEC's tenuous commitment to sustainability.

Assess Needs and Alternatives: To achieve sustainability, the environmental assessment process must ensure careful evaluation of the purposes or "needs" to be served by proposed undertakings, and strive to choose, or at least reveal, the "best option" for meeting legitimate purposes and needs. This entails the consideration of alternatives. There should be an evaluation of whether environmental impacts would have been different without NAFTA, or would be different with modified trade arrangements. There is no need to assume that NAFTA as currently designed and applied is permanent. The CEC's environmental assessment results can be fed back into NAFTA through immediate adjustments to current implementation policies and practices and through eventual reconsideration of the regime itself. Moreover, NAFTA assessment findings that consider alternatives might well provide useful guidance for other and related trade liberalization initiatives. The analytic framework is not set up to consider alternatives. The baseline is established when NAFTA was introduced and the data for the environmental indicators are collected from sources that already collect them. The framework does not suggest any analyses that presume alternative trade arrangements and attempts to plot alternative effect trajectories from the baselines. However, nothing in the CEC mandate to monitor NAFTA's environmental effects appears to preclude comparative assessment of alternative trade arrangements.

Ensure Transparency and Openness and Facilitate Public Participation: Approval requirements are not an option in the NAFTA case, except insofar as anticipatory assessment may be involved prior to new NAFTA rulings and other initiatives. The CEC can, however, do much to ensure transparency and opportunity for effective public involvement in its assessment work, including the selection of cases for review as well as the actual assessment and review of the cases selected, the interpretation of specific and overall findings, and in the design and implementation of monitoring and other follow-up activities. In order to have real participation that is considered partnership and not merely consultation, stakeholders must clearly understand the process, when it is applied, what it is applied to, and how the findings will be used. The process should also "ensure public access to information; identify the factors that are to be taken into account in decision-making; and acknowledge limitations and difficulties." True partnership also often requires resources to allow citizen groups and NGOs to be involved at the same level as advocates of private and corporate interest.

The framework has been laid out in a transparent manner but the CEC does not suggest open and participative use of the framework. This is unfortunate. Environmentally related decision-making as a whole has been moving towards increasingly ecosystemic and participative processes on the grounds that these are more realistic, more rigorous and more credible. Furthermore, many of the qualitative methodologies that could be used to carry out the assessments require participation from "non-experts." Without provisions ensuring effective public involvement, the assessment work that the CEC is hoping to encourage through use of the framework may enjoy [limited success] and be unreflective of the local community or sector that is being assessed.

Monitor the Results and Apply the Lessons: The framework does not clearly address the issue of follow-up and provides no suggestions on monitoring, reporting or the end-use of the results. However, the framework document does imply that the results will be used to inform future planning decisions. The CEC hopes that the observations will provide more information on the linkage between environmental and trade policies. This information may be used to protect and enhance the environment and fulfill the ultimate goal of creating a better North American environment. But how this might happen remains undefined. Likewise, no reporting mechanism has been built into the framework. Reporting encourages environmental assessments to be completed rigorously and gives relevant decision-makers an incentive to consider the environmental implications of their choices. Reporting also allows for comparison between and within sectors and issues.

The framework needs to provide more guidance on reporting and monitoring in order to provide incentives for communities and sectors to carry out the assessments. Reporting should be presented as the last step of the framework. Likewise, monitoring should be continued after the steps of the environmental assessment are completed to ensure that negative environmental effects do not worsen and positive effects do not disappear. Reduction and mitigation of environmental impacts are not the primary goals of the assessments, but should be encouraged and addressed throughout the paper.

Be Efficient: The framework suggests that only those sectors and issues that involve significant NAFTA-related environmental effects should be considered. The criteria for both the sector and issue selection begin by specifying that they must "relate directly to major environmental media and natural resources." Major changes in the upstream and downstream sectors or issues are also considered, but only if they are a "major input into and/or consumer of the sector or issue under consideration." Significance is not defined anywhere in the text of the framework. One key is to focus assessment work on the areas of greatest significance—that is where the existing or potential effects (positive or negative), the depth or extent of public worry, the need for better understanding, and/or the possibility of substantial influence are greatest. Judgments about significance are ultimately exercises in applied values; they cannot be reduced to merely technical calculations. At the same time, we have gradually learned some things about the evaluation of significance including the importance of considering location and magnitude, frequency and duration, timing, risk, irreversibility and cumulative nature. The framework does not indicate what core assessment work the CEC itself will undertake or will ensure is undertaken by others. Making determinations of whether assessment work [can be performed] under the framework is [un]likely to be done at all, much less done efficiently.

Properly strengthened and applied, the CEC framework should provide not only illuminating insight into the effects of NAFTA but also lessons that will benefit negotiators and assessors of other trade agreements. To serve well, the framework needs to be developed further to include more of the principles for good environmental assessment.

2 A Draft Agenda for the Great Lakes Ecosystem

The Great Lakes United Water Agenda Summary

A group of environmental organizations from the Great Lakes region in both Canada and the US,[140] responded to the February 2000 report, *Protecting the Water of the Great Lakes*, issued by the International Joint Commission. The report notes that governments in the Great Lakes and St. Lawrence River basins should develop, "with full public involvement and in an open process, the standards and the procedures" for considering water removals from the basin and major new or increased consumptive uses within the basin. The IJC also says that the governments "should not authorize or permit any new removals and should exercise caution with respect to major new or increased consumptive use until such standards have been promulgated."

In a draft document entitled, *An Ecosystem Agenda for Great Lakes and St. Lawrence River Water Use Management,* these environmental nongovernmental organizations assembled their "must haves" for any new standard(s) for the protection of the Great Lakes. The core element of the draft proposal is an evaluation of all uses, in-basin or out, according to a single criterion: their affect on the ecosystem. This principle could be applied to any proposed water management program anywhere in the world because it is independent of the standard used to judge the acceptability of a given affect on the ecosystem. The draft nongovernmental proposal for the Great Lakes and St. Lawrence River water-use management contains a very high standard for the basin: "to protect and affirmatively restore the Great Lakes water system, not just fend off additional harm." But in ecosystem protection as in free trade, the devil is in the details. The draft proposal lays out several guidelines to assure that the overall goal of ecosystem protection cannot be subverted for the protection merely of use sectors or in-basin vs. out-of-basin users. These draft guidelines, still being circulated for comment among citizens of the basin and the leaders of environmental nongovernmental organizations, can be summarized as follows:

The objective must be to protect and affirmatively restore the Great Lakes water system, not just fend off additional harm. The strategy must result in dramatic reductions in basin human water use. All changes to the Great Lakes water system must be addressed: managing solely for how much water is used while neglecting how and where it moves, for example, will not protect water for the benefit of all users, including wildlife. A comprehensive strategy for the protection and restoration of the Great Lakes water system and a standard for implementing it must be developed.

The strategy must provide specific, binational protection and restoration goals for the Great Lakes water system. It must include a basin-wide standard to be applied to all decisions on proposed new water uses or alterations of the water system. It needs to be conservation-based to protect and restore the Great Lakes water system and not merely accommodate and mediate the needs of use sectors. It must set conservation targets by sectors of use and include timelines for reaching those targets. It must take a watershed approach to system protection and restoration aimed at encouraging living within the means of individual watersheds. It should embody the precautionary principle enshrining conservative approaches in the absence of perfect information about the needs of the water system.

The process for developing the strategy and standard, and for making decisions based on them, must be open and accessible to the public and subject to challenge by citizens. The process for developing and implementing the strategy and standard must be guided by the region's state, provincial and tribal governments. The process must also respect and accommodate the legitimate role of federal governments in overseeing national and international interests in protecting and restoring the Great Lakes water system. The federal governments must assure the availability of a

[140] Great Lakes United, Canadian Environmental Law Association, National Wildlife Federation, Lake Michigan Federation, and *Stratégies Saint-Laurent.*

constitutionally valid mechanism that enables vigorous international, provincial and state cooperation. Should state, local and First Nations' governments fail to create a strategy, the federal governments should step in to assure that one is created.

The onus must rest with those proposing new or increased water uses or alterations to the water system to show that they are consistent with the strategy and standard. Information on the connection between the water system and the life it supports should be continuously and aggressively gathered and assimilated into a publicly accessible, binational water information database that is understandable and useful to lay citizens.

Regional climate change should be aggressively researched and climate-change data evaluated with water data to review routinely the estimated impacts of climate change on water supplies. The effects of all approved water uses must be monitored to enable periodic evaluation of uses against the standard and strategy, and to inform future water-use decisions.

This monitoring information should be included in the binational water information database. Water-use approvals must be rescindable if evidence later arises that they are no longer, or never were, consistent with the strategy and standard. Every individual's right to water for basic human needs must be guaranteed. The waters of the Great Lakes and St. Lawrence River basin are a single ecosystem. If they are managed as such, according to the principles outlined in this document, it is highly unlikely that any diversion or bulk export of water out of the basin will ever take place.

The federal, state and provincial governments should place a moratorium on new or increased diversions into or out of the basin, and on new or increased water uses and other changes to the basin water system until a strategy has been implemented, including the listing of a new bilateral environmental and conservation agreement under NAFTA Annex 104.

3 Walkerton Case Study and NAFTA

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The issue of water quality in Canada was brought to the forefront of the public's attention in May when an outbreak of E. coli in the municipal water supply of a small agricultural community in southwestern Ontario caused illness in thousands of people and an estimated seven deaths in the community. Our thesis is that NAFTA is connected with two of the contributing causes of contaminated drinking water in rural Ontario Walkerton: downloading of responsibilities for water protection to municipalities and intensive cattle agriculture. NAFTA is broadly defined in the Final Analytical Framework, "in the spirit of environmental enhancement and the precautionary principle." Thus, NAFTA includes the following areas: NAFTA rule changes, NAFTA's institutions, trade flows, transborder investment flows and other economic conditioning forces (including deregulation and privatization).

NAFTA Rule Changes—Chapter 15 of NAFTA entitled "Competition Policy, Monopolies and State Enterprises" requires that each Party ensure that government monopolies (defined to include government agencies) act in accordance with commercial considerations in their purchase or sale of the monopoly good or service. Thus Chapter 15 encourages privatization of services traditionally offered by government such as water testing.

Tariff Schedules—With NAFTA, the Parties accelerated tariff concessions under the Free Trade Agreement for Canadian beef imported by Mexico. Currently Canadian and US beef imported by Mexico receives a rate of duty "free," compared with a 25 percent ad valorum duty on non-NAFTA frozen beef and a 20 percent ad valorum duty on non-NAFTA fresh beef. Thus the NAFTA tariff schedules encourage north-south trade in North American beef.

NAFTA's Institutions—The issue of drinking water contamination and intensive farming has been considered a number of times by NAFTA institutions.

The North American Agreement on Environmental Cooperation (NAAEC) provides that citizens can make submissions that a Party is failing to effectively enforce its environmental law. In 1997, the Commission for Environmental Cooperation (CEC) received a submission from number of nongovernmental organizations asserting that many livestock operations in the Province of Quebec are operating in violation of various environmental laws, causing significant harm to the environment and to human health. The submission was supported in part by government reports, including a 1995–96 report to the National Assembly of Quebec by the Quebec Auditor General. After considering the submission and a response from the Government of Canada, the CEC Secretariat concluded that developing a factual record was warranted. The Secretariat can only prepare a factual record if the council, comprised of representatives from each of the three parties to NAFTA, votes in favour of preparing a record. The CEC Council voted by a two-thirds vote to instruct the Secretariat not to prepare a factual record with respect to the hog farm submission.

The issue of E. coli and intensive animal farming was again brought to the attention of the CEC in [1997] when the NAFTA Effects Advisory Group commissioned a study of the environmental implications of NAFTA on feedlot production of cattle in the US and Canada. This study noted a number of complaints related to water pollution problems from cattle feeding operations. While the study identified nitrates, herbicides, nutrients, suspended solids, and a decrease in biological oxygen demand as environmental impacts, it did not identify E. coli as an environmental impact. The study also noted the stress on existing infrastructure in Alberta, but concluded that "in most respects, the level of development of these infrastructures in the United States and Canada is such that they will continue to serve as primary locations for both feed-grain production and beef-cattle feeding."

Trade Flows—Mexico represents an ever-increasing market for beef from the United Sates and Canada due to higher incomes and an increasing population in the country. In fact, it is soon expected to rival Japan as North America's primary beef market. While the devaluation of the peso is often pointed to as an explanation in the drastic rise in trade between the North American countries it is clear that NAFTA has also played a significant role. Experts have concluded that NAFTA was significant in expanding the US beef exports by 187 million pounds in its own right even after accounting for the peso devaluation. The trade flows in the market are as follows: Mexico provides feeder cattle to Canada and the US, where they are then fed and slaughtered for the Mexican market. Canadian cattle are exported to the US for processing; however, increasing numbers of cattle are being processed in Canada at large meat packing plants in Alberta. Canadian exports to the US increased from 133.6 million metric tons in 1992 to 253 metric tons in 1996. Canada's imports to the US also rose. In 1999, exports of Canadian pork exceeded that of the United States, rising from 1998 levels of 425,000 metric tons to 560,000 metric tons while US exports fell from 557,000 metric tons to 530,000. Weights cited are carcass weights.

Transborder Investment Flows—Investments in Alberta by major American meat packers, including Cargill and Iowa Beef Packers, since the FTA was signed have significantly changed the dynamics of trade in the province. Before the two plants were expanded, trade was mainly east-west. Free trade has caused a shift to north-south, and producers on both sides of the border must increase their efficiency, which means larger farms and more animals.

A. Other Economic Conditioning Forces

Downloading and Privatization of Drinking Water Responsibilities—Since signing the FTA and NAFTA, Ontario and the rest of the Canadian provinces have been pushed to focus trade north-south rather than east-west, which has been the case historically. To do so it has to be competitive with the other provinces and the US. One expert has suggested that the rational for the ongoing municipal and institutional revolution is to increase productivity in order to increase trade. Courchene further states that in order for Ontario to be competitive in the North American market, public sector productivity must increase. As a result there has been less government involvement and more private sector responsibility for drinking water in Ontario. Ontario and Quebec have no requirements for the private labs to report findings to the provincial authority. Instead, they rely on the municipalities to inform them of potential water quality concerns. This means that as the Environment Commissioner has acknowledged, no one knows the condition of Ontario's groundwater supply. There is also no system of certification for private labs in the province and no legal requirements for water testing, especially in smaller rural communities.

Increase of Unregulated High Intensity Cattle/Hog Farming—It is a reality in the agriculture sector today that farming is becoming more and more intensified with more animals being raised by fewer farms. In 1976, 18,622 Ontario farmers raised an average of 103 pigs each. By 1996, 6,777 managed an average of 418 hogs per farm. Two percent of Ontario's hog factories account for nearly one quarter of the 5.6 million hogs produced. With increased trade in the beef and hog industry these numbers are likely to increase as larger, more efficient farms grab a larger share of the market. These large operations are creating environmental challenges unlike anything that has been previously experienced by the industry and yet they remain for the most part unregulated. For example, an 80,000 hog operation like the one that is being proposed for an area outside Lethbridge is expected to create untreated waste equivalent to a city of 240,000 people.

Consider the reluctance of government to recognize these high intensity animal farms for what they are and regulate them appropriately. The Ontario ministry responsible for setting rules for factory farms is the Agriculture Ministry, whose mandate is to promote agriculture not to protect the environment. Manure management practices are voluntary in Ontario (and most of Canada) not mandatory and government has shown a reluctance to change this reality. The industry is opposed to government regulation as demonstrated by an Alberta Cattle Commission report endorsing the concept of voluntary action by producers both at the individual and industry level. In May, federal Environment Minister, David Anderson refused to back a NAFTA inquiry into large-scale pork operations in Quebec and the waste they produce, which effectively quashed the initiative.

B. Linkages to the Environment

Outputs from Agriculture—Scientifically speaking, it is still unclear what the effect of these factory farms is on the groundwater system. Miller, the Environmental Commissioner for Ontario has stated that there are no mechanisms in place to assess how manure affects drinking water. A few studies have been done on the topic but more needs to be done especially about intensive livestock operations, drinking water, and E. coli.

The one paper to address the topic specifically is a Health Canada study led by Pascal Michel. The report suggests that the importance of contact with cattle and the consumption of contaminated well water or locally produced food products may have been previously underestimated as risk factors for E. coli contamination. Spatial models indicated that in Southern Ontario, near the region where the Walkerton tragedy occurred, there is a positive and significant association between cattle density and incidences of reported E. coli infection. That means that the occurrence of E. coli is higher in areas with higher cattle or livestock densities. Rural areas demonstrated a relatively high incidence of the condition when compared to urban areas. Finally, the study stresses that while the association observed between the two factors may not be causal, the results warrant further investigation into the topic if only because of the implications to the public health and agricultural sectors. It recommends specific evaluations of the comparative risk of disease contraction between rural and urban populations. It also emphasized the benefits of using existing population based surveillance data in order to best allocate resources and efforts in regions of higher risk as well as to guide policy making in these areas.

Physical Infrastructure—As noted in the Feedlot Study commissioned by the CEC, a rapid expansion of intensive agriculture can strain physical infrastructure. In the case of rural Ontario, it appears that municipal water infrastructure is strained

Social Organization—The reality or fear of contaminated drinking water has a considerable socio-economic impact. Citizens are strained by the care of the sick and the fear of an uncertain quality of water in their taps. Citizens groups have recently formed on problems related to intensive farming and manure management. Additional groups are focussed on monitoring drinking water

Government Policy—Intensive animal farms are more akin to industry than the family farm. However, the regulation does not distinguish between traditional farms and intensive animal operations. Farms are treated as non-point sources that do not require permits or approvals related to the emission of effluent. Provincial governments have allowed the industry to self regulate. The federal government has provided agricultural research and financial support to allow operations to take advantage of Canada's position relative to NAFTA trade flows of beef

Regulatory oversight in the United States is stronger. Beef livestock operations with more than 1,000 head with no waterway present or 300 head in the presence of a waterway are considered point sources which must receive discharge permits under section 402 of the US Clean Water Act.[141] As yet Canada has not experienced an "upward harmonization" of environmental regulatory standards for intense animal farms as a result NAFTA, despite concerns expressed by nongovernmental groups.

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[141] "Issue Study 2: Feedlot Production of Cattle in the United States and Mexico: Some Environmental Implications of the North American Free Trade Agreement," CEC Analytical Framework (Commission for Environmental Cooperation 1999) at 236.

Conclusion

Contributing causes of drinking water contamination in Ontario include increased intense animal farming, downloading of responsibility to municipalities, privatization and a disruption to the chain of command in reporting the contamination to the appropriate authorities. Our brief survey indicates that NAFTA is connected to these contributing causes of drinking water contamination in rural Ontario.

In terms of the hypotheses provided to focus the Final Analytical Framework, we conclude the following:

1. With intensive animal farming there has not been an upward convergence of environmental regulation led by either government or the private sector.
2. Public pressures for regulation of intensive animal farming have not resulted in regulation.
3. The CEC citizen complaint mechanism was not able to move the government of Canada not provincial governments towards improved regulation and/or enforcement of environmental regulation of intensive animal agriculture.
4. In order to eliminate the environmental and social impacts related to an increase in intensive animal farming encouraged by NAFTA, a re-orientation in government policy is required which:
   - regulates intense animal farms in the same manner as any other industry; and
   - regulates drinking water quality through clear standards, protocols for testing, protocols for notification of the Ministry of Environment and public health officials, and protocols for follow up by environment and health officials.
   - ensures adequate resources and staffing for public monitoring and enforcement.

Please note that the full texts of the original three appendixes to this paper are available by visiting: <www.sierraclub.org/national>.

Discussant:

José Antonio Morán (*Centro Mexicano de Derecho Ambiental, A.C.*)

Mr. Morán noted that there is little evidence that trade itself is a cause of environmental degradation. Environmental problems go beyond international trade, with causes linked to structural faults in the economy, general externalities, imperfect information, market failures, the absence of clearly defined private property rights, and inappropriate intervention by governments.

Environmental problems can be *magnified* by trade, but trade in and of itself is not the root cause of environmental problems. For example, deforestation in Mexico is caused mainly by agricultural expansion, not by commercialization of forests. To improve analysis of the secondary manner in which trade may affect the environment, assessment methods need to be improved, as does information. A particular example is the environmental data that link trade expansion with rates of deforestation in Mexico. It was pointed out that only three forest inventories exist in Mexico, and they conflict with one another.

Mr. Morán said the papers by Kelly et al., and Elwell, provide good descriptions of particular cases. The problem with both is that they tend to be too specific and do not represent the whole picture. Chomo and Ferrrantino's work correctly points out that a reduction in tariffs has not been the cause, or even an important factor, in fishery depletion. Other non-trade factors, including investment patterns, changes in harvesting technology, and institutional changes, also need to be examined.

Session One Questions and Open Discussion

A certification program for sustainable forestry management—in particular, the Forestry Stewardship Council—is a voluntary scheme that is increasing international markets for sustainable forestry products. It was suggested that governments need, in addition to voluntary third-party certification schemes, to adopt mandatory labeling for sustainably produced forest products.

Turning to the question of the impact NAFTA has had on privatizing sectors like water testing and forest products, it was pointed out that NAFTA's Chapter 15 acknowledges the continued role of government monopolies and agencies, but states that, when governments redesignate a state function or enterprise—for example the public/private partnership for water testing in Ontario—the enterprise "must act on commercial considerations alone." This interpretation focuses too narrowly on commercial interests, to the exclusion of environmental protection or human rights.

An observer noted that, since 1992, forest management services in Mexico have been privatized. While there are laws intended to regulate forestry-related services, the law is not currently being enforced. More work needs to be done to hold purveyors of such services accountable.

The effect NAFTA has had on the ability of a country to enact environmental and sanitary measures was queried. One example is the case involving methyl bromide fumigation. Although no NAFTA disputes appear to have arisen thus far over Sanitary and Phytosanitary Standards (SPS) measures, the US Department of Agriculture's foreign agricultural services has been involved in disputes over measures to control pests. Mexico had proposed methyl bromide fumigation—a toxic and dangerous process—for some of its wood products, to which the US had objections. However, these objections revolved around possible delays and administrative issues, and not the issue of toxicity or environmental concerns.

Among the general comments raised by participants, several involved how environmental assessments, which tend to focus on specific case studies and questions, are equipped to identify gaps in institutional capacities to address more general environmental pressures. NAFTA and the

Free Trade Area of the Americas (FTAA) represent more than just free trade agreements, and include the integration of economic, social and political policies. Since the implication of market integration involves more than trade issues, there is a need to include a wider array of players at the negotiating table. In addition, international institutions like World Bank or the Inter-American Development Bank should be included before liberalization occurs, so regulatory infrastructures can be put in place *before* trade doors are opened.

It is difficult to isolate the environmental effects due to NAFTA alone from the environmental effects of increased world trade generally. While one person suggested that the focus on NAFTA-related environmental issues represents a shortcoming of the CEC Analytical Framework, another said that, while isolating NAFTA effects did pose analytical difficulties, it was possible to isolate NAFTA-related economic effects, and this question of NAFTA versus the WTO versus other economic policies should not be used as an excuse for sloppy analyses. Not only is it possible to distinguish different effects, but it is important to do so in a way that is useful for policy makers.

Session Two

NAFTA and Pollution Impacts

- The Industrial Pollution Impacts of NAFTA: Some Preliminary Results
- The Generation and Management of Hazardous Wastes and Transboundary Hazardous Waste Shipments between Mexico, Canada and the United States, 1990–2000

Session Chair:

John Dixon (Environmental Division, World Bank)

Mr. Dixon commented that an orthodoxy of the World Bank is that macroeconomic reform is good, and trade liberalization and economic growth will eventually translate into a general increase in *per capita* incomes across the board. A key question posed at the symposium is how economic reforms, such as free trade, affect the environment.

A useful way to think about the environmental effects of trade liberalization is to think about three factors that involve trade-related environmental change:

1. Changes in the composition of production: what is being produced and where?
2. Scale effects: how trade liberalization affects overall growth in production;
3. Development of and investment in new technologies: sometimes these can be less resource-intensive and less polluting (a possibility overlooked in many analyses).

The Industrial Pollution Impacts of NAFTA: Some Preliminary Results

Kenneth A. Reinert

David W. Roland-Holst

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Abstract

In this paper, we use a three-country trade model of the North American economy, along with data from the World Bank's Industrial Pollution Projection System (IPPS), to simulate the potential industrial pollution impacts of NAFTA. We find that the most serious industrial pollution impacts occur in the base metals sector. The Mexican petroleum sector is also a significant source of industrial pollution, particularly in the case of air pollution. For specific pollutants in specific countries, the transportation equipment sector is an important source of industrial pollution. Finally, the chemical sector is a significant source of industrial toxic pollution in the United States and Mexico, but not in Canada.

1 Introduction

The policy debates surrounding the negotiation, passage, and assessment of the North American Free Trade Area (NAFTA) has focused to a great extent on the linkages between trade and the environment.[1] To a large degree, however, this debate has been more speculative than empirical. This is unfortunate because it is well known that *a priori* reasoning alone cannot predict whether trade liberalization will have an overall positive or negative impact on the environment.[2] This paper attempts to provide some empirical evidence in the area of industrial pollution to better inform future debate.

One study that does provide some empirical evidence on NAFTA and the environment was conducted by Grossman and Krueger (1993). These authors combined the output effects of NAFTA as simulated by Brown, Deardorff and Stern (1992) with data from the US Environmental Protection Agency on toxic pollution. With regard to the *direct* impacts of trade liberalization (as opposed to liberalization-induced increases in investment), these authors found that the greatest increases in toxic pollution occur in the US chemicals sector and the Canadian base metals and rubber and plastics products sectors. Other significant trade-induced increases in toxic pollution occurred in the Mexican electrical equipment sector, the US paper products sector, and the Canadian transportation equipment sector.[3]

In this paper, we focus on the industrial pollution impacts of NAFTA. We utilize a three-country, applied equilibrium (AGE) trade model of the North American economy and make use of the World Bank's Industrial Pollution Projection System (IPPS) to generate results for a detailed set of industrial sectors and pollutants. We simulate the liberalization of tariffs and non-tariff barriers (NTBs) that have accompanied NAFTA and provide results for the changes in emissions by industrial sector and pollutant. The results allow us to identify where some of the major environmental impacts of NAFTA might be found.

2 The Trade Model

We employ a standard applied general equilibrium (AGE) trade model used to simulate the industrial pollution effects of North American trade liberalization in 17 industrial sectors of Canada, the United States, and Mexico.[4] The trade specification follows that of de Melo and Robinson (1989). In each sector of each country, domestic demand is constituted of goods that are differentiated by origin (domestic good, imports from each North American trading partner, and imports from the rest of the world). Also in each sector of each country, domestic production is allocated among differentiated destinations (domestic good, exports to each North American trading partner, and exports to the rest of the world). World prices outside of North America are assumed to remain constant, exchange rates are assumed to be flexible, and trade balances are fixed.

Production in each sector of each country utilizes physical capital and labor. These factors are assumed to be perfectly mobile among the sectors of each country but immobile among countries. Production takes place under constant returns to scale and intermediate goods are utilized in fixed proportions to value added. All markets are perfectly competitive.

The trade-liberalizing experiments we conduct use observed tariff rates for our base year 1991. In addition, we consider very rough estimates of non-tariff barriers using UNCTAD data on trade control measures. As is general practice (e.g., Gaston and Trefler, 1994), we use NTB coverage

1 For a definitive review, see Johnson and Beaulieu (1996).

2 See Runge (1994), Beghin and Potier (1997), and Beghin, Roland-Holst, and van der Mensbrugghe (1997).

3 See also Abler and Pick (1993) for a focus on the Mexican horticultural sector.

4 Model equations are presented in the Appendix.

ratios as *ad valorem* equivalents. For this reason, our simulations must be interpreted as merely *suggestive* of the impacts of NAFTA on trade, production, and pollution.[5]

The three-country trade model is calibrated to a 1991 base year data set.[6] The IPPS effluent data are used to create satellite environmental accounts to this data set as suggested by Barker (1992), United Nations (1993a,b), and de Haan and Keuning (1996). As is recommended by their compilers, IPPS effluent data are utilized in their per-employee form. Table 1 describes the IPPS pollutants. [7] In the case of air pollution, the IPPS data include particulates, carbon monoxide, sulfur dioxide, nitrogen dioxide, and volatile organic compounds. In the case of industrial bio-accumulative metals and toxics, the data distinguish among transmission to air, water, and land. Finally, in the case of water pollution, the data distinguish between biological oxygen demand and total suspended solids.

3 Simulation Results

For the purposes of this paper, we focus on a simulation exercise closest to that considered by Brown, Deardorff and Stern (1992) and, therefore, by Grossman and Krueger (1993).[8] We consider the removal of both tariffs as measured by their observed values and NTBs as measured by coverage ratios. We assume that each North American trading partner maintains its existing protection with respect to the rest of the world. Additionally, as is standard practice in most trade policy models, we assume that total labor supply is fixed in each country. The results of these simulations for each industrial sector and IPPS pollutant are presented in Tables 2 through 5. For comparison purposes, estimated base-level emissions are presented in Tables 6 through 9.

Table 2 presents the changes in industrial air pollution caused by trade liberalization in North America for each industrial sector of the model. The evidence presented in this table suggests that the industrial air pollution generated as a result of NAFTA will be concentrated in a few particular sectors. These are petroleum, base metals, and transportation equipment. For particulates, carbon monoxide, sulfur dioxide, and nitrogen dioxide, the greatest increases occur in the US base metals sector and in the Mexican petroleum sector.[9] In the case of volatile organic compounds, however, the transportation equipment sectors of Canada and the United States are large sources. In terms of total air pollution emissions, the greatest increases are of carbon monoxide and sulfur dioxide in the United States and sulfur dioxide in Mexico. Significant reductions in air pollution occur in the Canadian and Mexican paper sectors and in the Canadian chemicals sector.

Table 3 addresses industrial bio-accumulative metals pollution. Here, the petroleum sector plays a less important role than base metals and transportation equipment. The largest emissions are to land, and these occur in the Canadian and US base metals and transportation equipment sectors and in the Mexican base metals sector. In terms of total emissions, the United States leads both Canada and Mexico, primarily as a result of changes in its base metals sector. Again the Canadian chemicals sector registers improvement in emissions, although these are slight.

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5 The NTB measures are discussed in Roland-Holst, Reinert, and Shiells (1994).

6 The base year data set is in the form of a social accounting matrix (SAM) described in a document available from the corresponding author and (for Spanish speakers) in Reinert, Ricaurte, and Roland-Holst (1998). The calibration of the model also requires a set of behavior parameters described in Reinert and Roland-Holst (1998), and these behavioral parameters can be varied to conduct sensitivity analyses.

7 On the IPPS, see Hettige, Lucas and Wheeler (1992) and the references therein. See also the web-site listed in our data sources at the end of the paper.

8 As with all AGE simulations, the results are not forecasts. Rather they simulate a *counterfactual* economy, namely, North America in 1991 with the NAFTA trade liberalization agreements fully in place.

9 Pollution associated with the petroleum sector in Mexico has been a significant part of the debate over NAFTA and the environment. See Commission for Environmental Cooperation (1996).

Table 4 presents the changes in industrial toxic pollution. Here, transmission to air is important along with transmission to land. This is especially the case for the transportation equipment sector in Canada. The base metals sector is also important for the transmission of toxics to land in this country.[10] In the United States and Mexico, the chemical sector appears as significant sources of toxics. Importantly, this is *not* the case for Canada where this is a *reduction* of toxic emissions in the chemical sector.[11] This reflects the comparative advantage of the US and Mexican chemical sectors over their Canadian counterpart. The US base metals and transportation equipment sectors and the Mexican petroleum sector are also significant sources of toxics,[12] and in terms of total emissions, the US leads with toxic emissions to land and air.

Finally, Table 5 presents the simulation results for water pollution. The base metals sector is again a crucial source of effluents. This is particularly the case for total suspended solids in all three countries. In the case of biological oxygen demand, there is actually an overall decrease in Canada due to the contraction of the paper products sector. The Mexican petroleum sector is a significant source of total suspended solids, but this is an order of magnitude less than in its base metals sector. By far, the greatest concern with regard to water pollution as a result of NAFTA trade liberalization is the increase in total suspended solids from the base metals sector of the United States.

4 Conclusions

The most serious industrial pollution impacts of NAFTA occur in the base metals sector. In terms of magnitude, the greatest impacts are in the United States and Canada, and this is the case for most of the pollutants considered. As alleged in the debate over NAFTA and the environment, however, the Mexican petroleum sector is a significant source of industrial pollution, particularly in the case of air pollution. For specific industrial pollutants in specific countries, the transportation equipment sector is also an important source of industrial pollution. This is the case for both volatile organic compounds and toxics released into the air in Canada and the United States. Finally, as suggested by Grossman and Krueger's (1993) results, the chemical sector is a significant source of toxic industrial pollution in the United States and Mexico, but not in Canada.

It is hoped that the results of this paper will contribute to the ongoing discussions of the impacts of NAFTA on the environment in general and to the work of the Commission for Environmental Cooperation (CEC) in particular.

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10 Qualitatively, these results for Canada agree with those of Grossman and Krueger (1993).

11 Grossman and Krueger (1993) show a decrease in toxic pollution from the Mexican chemicals sector in their trade-liberalization alone case, but an increase in the trade and investment liberalization case.

12 Here, our results are in contradiction to those of Grossman and Krueger (1993). This is most likely due to the different way we model NTBs compared to Brown, Deardorff and Stern (1992).

Table 1. The IPPS Pollutants

Name	Symbol	Description
Particulates	PT	Fine airborne particles that can damage respiratory systems.
Carbon Monoxide	CO	A poisonous gas that inhibits the ability of blood to carry oxygen.
Sulfur Dioxide	SO_2	A gas that can contribute to respiratory disease and acid rain.
Nitrogen Dioxide	NO_2	A gas that contributes to both respiratory disease and to the formation of acid rain and ozone.
Volatile Organic Compounds	VOC	A class of chemicals associated with skin reactions, nervous system effects, sick-building syndrome, and multiple chemical sensitivity. Many are also suspected carcinogens.
Bio-accumulative Metals	MetAir, MetWat, MetLand	Metals, including mercury, lead, arsenic, chromium, nickel, copper, zinc, and cadmium. They contribute to mental and physical birth defects.
Toxic Pollutants	ToxAir, ToxWat, ToxLand	A class of chemicals that can damage internal organs and neurological functions, cause reproductive problems and birth defects. Many are also suspected carcinogens.
Biological Oxygen Demand	BOD	Organic water pollutants that remove dissolved oxygen. They can damage aquatic species and promote the growth of algae and pathogens.
Total Suspended Solids	TSS	Fine airborne particles that can damage respiratory systems.

Source: World Bank Industrial Pollution Projection System.

Table 2. Effects of NAFTA on industrial air pollution (Thousands of pounds)

Sector	Canada				
	PT	CO	SO_2	NO_2	VOC
Petrol	4,384	14,077	27,710	16,248	12,220
Foodpr	325	97	354	355	92
Bever	25	20	383	244	414
Tobac	2	10	123	74	24
Textl	-55	-48	-261	-343	-157
Cloth	0	0	3	1	1
Leath	11	1	20	5	35
Paper	-1,821	-10,609	-9,323	-5,141	-2,044
Chem.	-293	-2,630	-1,552	-1,516	-1,279
Rubber	99	37	856	294	1,123
Nmtmn	-476	-119	-688	-541	-64
Bsmetl	5,016	30,825	40,248	5,759	2,543
Wdmetl	637	1,159	253	493	1,325
Nelcmc	1	9	9	4	10
Elcmc	33	168	305	150	204
Trnseq	3,266	5,561	7,908	4,109	29,531
Othmn	2	1	3	3	18
Total	**11,156**	**38,558**	**66,352**	**20,199**	**43,997**

Sector	United States				
	PT	CO	SO_2	NO_2	VOC
Petrol	1,067	3,426	6,743	3,954	2,974
Foodpr	2,782	828	3,035	3,042	791
Bever	-37	-30	-570	-363	-616
Tobac	-4	-19	-239	-145	-48
Textl	180	158	857	1,126	515
Cloth	0	0	-3	-1	-1
Leath	140	18	254	64	442
Paper	33	192	169	93	37
Chem.	1,276	11,472	6,770	6,614	5,581
Rubber	137	51	1,188	408	1,559
Nmtmn	-111	-28	-160	-126	-15
Bsmetl	12,374	76,052	99,301	14,209	6,275
Wdmetl	2,920	5,314	1,162	2,261	6,077
Nelcmc	71	518	479	215	545
Elcmc	-10	-53	-96	-47	-64
Trnseq	3,531	6,013	8,550	4,443	31,930
Othmn	1	0	2	1	9
Total	**24,349**	**103,913**	**127,442**	**35,750**	**55,991**

Sector	Mexico				
	PT	CO	SO_2	NO_2	VOC
Petrol	15,322	49,196	96,840	56,783	42,705
Foodpr	341	101	372	372	97
Bever	39	31	598	381	646
Tobac	0	2	19	12	4
Textl	351	309	1,674	2,199	1,007
Cloth	0	0	1	0	0
Leath	8	1	14	3	24
Paper	-197	-1,149	-1,009	-557	-221
Chem.	845	7,598	4,484	4,381	3,696
Rubber	11	4	94	32	124
Nmtmn	1,892	475	2,735	2,150	253
Bsmetl	1,344	8,261	10,786	1,543	682
Wdmetl	763	1,388	304	591	1,588
Nelcmc	25	184	170	76	193
Elcmc	36	185	337	166	226
Trnseq	294	500	711	370	2,656
Othmn	3	1	6	6	37
Total	**21,076**	**67,088**	**118,136**	**68,509**	**53,716**

Sectors are: petroleum; food processing; beverages; tobacco; textiles; clothing; leather; paper; chemicals; rubber; non-metallic mineral products; base metals; wood and metal products; non-electrical machinery; electrical machinery; transportation equipment; and other manufactures.

Pollutants are: PT-particulates; CO-carbon monoxide; SO_2-sulfur dioxide; NO_2-nitrogen dioxide; VOC-volatile organic compounds.

Table 3. Effects of NAFTA on industrial bio-accumulative metals pollution (Thousands of pounds)

	Canada		
Sector	**MetAir**	**MetWat**	**MetLand**
Petrol	8	3	84
Foodpr	0	0	1
Bever	0	0	3
Tobac	0	0	0
Textl	0	0	-6
Cloth	0	0	0
Leath	0	0	12
Paper	-2	-3	-9
Chem	-3	-3	-99
Rubber	2	0	95
Nmtmn	-1	0	-8
Bsmetl	261	19	7,482
Wdmetl	2	0	53
Nelcmc	0	0	2
Elcmc	2	0	68
Trnseq	93	2	1,142
Othmn	0	0	3
Total	**362**	**19**	**8,821**

	United States		
Sector	**MetAir**	**MetWat**	**MetLand**
Petrol	2	1	20
Foodpr	0	0	5
Bever	0	0	-5
Tobac	0	0	0
Textl	1	0	21
Cloth	0	0	0
Leath	0	0	151
Paper	0	0	0
Chem	13	12	432
Rubber	2	1	132
Nmtmn	0	0	-2
Bsmetl	644	47	18,459
Wdmetl	9	2	243
Nelcmc	5	0	94
Elcmc	-1	0	-22
Trnseq	101	2	1,234
Othmn	0	0	1
Total	**776**	**65**	**20,765**

	Mexico		
Sector	**MetAir**	**MetWat**	**MetLand**
Petrol	30	12	292
Foodpr	0	0	1
Bever	0	0	5
Tobac	0	0	0
Textl	3	0	41
Cloth	0	0	0
Leath	0	0	8
Paper	0	0	-1
Chem	8	8	286
Rubber	0	0	10
Nmtmn	4	0	31
Bsmetl	70	5	2,005
Wdmetl	2	0	63
Nelcmc	2	0	33
Elcmc	2	0	76
Trnseq	8	0	103
Othmn	0	0	6
Total	**130**	**26**	**2,960**

Sectors are: petroleum; food processing; beverages; tobacco; textiles; clothing; leather; paper; chemicals; rubber; non-metallic mineral products; base metals; wood and metal products; non-electrical machinery; electrical machinery; transportation equipment; and other manufacturers.

Pollutants are: Metals to air, water, and land.

Table 4. Effects of NAFTA on industrial toxic pollution (Thousands of pounds)

Sector	Canada		
	ToxAir	ToxWat	ToxLand
Petrol	1,140	80	4,334
Foodpr	14	4	54
Bever	15	2	11
Tobac	26	0	3
Textl	-106	-20	-63
Cloth	1	0	1
Leath	46	2	89
Paper	-1,906	-437	-726
Chem	-967	-287	-2,230
Rubber	899	2	331
Nmtmn	-28	-1	-37
Bsmetl	2,867	305	9,479
Wdmetl	364	8	189
Nelcmc	6	0	4
Elcmc	284	3	284
Trnseq	15,861	61	6,843
Othmn	31	0	15
Total	**18,549**	**-277**	**18,581**

Sector	United States		
	ToxAir	ToxWat	ToxLand
Petrol	277	20	1,055
Foodpr	122	34	467
Bever	-22	-3	-17
Tobac	-51	0	-5
Textl	349	65	208
Cloth	-1	0	-1
Leath	589	20	1,125
Paper	35	8	13
Chem	4,217	1,253	9,729
Rubber	1,247	3	459
Nmtmn	-6	0	-9
Bsmetl	7,072	752	23,388
Wdmetl	1,669	37	867
Nelcmc	348	9	230
Elcmc	-90	-1	-90
Trnseq	17,149	66	7,399
Othmn	15	0	7
Total	**32,920**	**2,261**	**44,826**

Sector	Mexico		
	ToxAir	ToxWat	ToxLand
Petrol	3,984	280	15,147
Foodpr	15	4	57
Bever	23	3	18
Tobac	4	0	0
Textl	682	126	406
Cloth	0	0	0
Leath	32	1	60
Paper	-206	-47	-79
Chem	2,793	830	6,443
Rubber	99	0	36
Nmtmn	110	3	145
Bsmetl	768	82	2,540
Wdmetl	436	10	227
Nelcmc	124	3	82
Elcmc	315	3	315
Trnseq	1,427	5	615
Othmn	62	1	29
Total	**10,668**	**1,304**	**26,044**

Sectors are: petroleum; food processing; beverages; tobacco; textiles; clothing; leather; paper; chemicals; rubber; non-metallic mineral products; base metals; wood and metal products; non-electrical machinery; electrical machinery; transportation equipment; and other manufacturers.

Pollutants are: Toxics to air, water, and land.

Table 5. Effects of NAFTA on industrial water pollution (Thousands of pounds)

Sector	Canada	
	BOD	**TSS**
Petrol	271	1,335
Foodpr	483	120
Bever	164	297
Tobac	0	0
Textl	0	0
Cloth	0	0
Leath	8	17
Paper	-5,004	-16,838
Chem	-365	-1,224
Rubber	170	466
Nmtmn	-1	-13
Bsmetl	2,245	152,998
Wdmetl	18	140
Nelcmc	0	1
Elcmc	12	17
Trnseq	14	102
Othmn	0	414
Total	**-1,986**	**137,832**

Sector	United States	
	BOD	**TSS**
Petrol	66	325
Foodpr	4,136	1,032
Bever	-245	-441
Tobac	0	0
Textl	0	0
Cloth	0	0
Leath	104	216
Paper	91	305
Chem	1,594	5,341
Rubber	236	647
Nmtmn	0	-3
Bsmetl	5,540	377,481
Wdmetl	81	642
Nelcmc	2	38
Elcmc	-4	-5
Trnseq	15	110
Othmn	0	204
Total	**11,615**	**385,891**

Sector	Mexico	
	BOD	**TSS**
Petrol	948	4,664
Foodpr	506	126
Bever	257	463
Tobac	0	0
Textl	0	0
Cloth	0	0
Leath	6	12
Paper	-542	-1,823
Chem	1,056	3,537
Rubber	19	51
Nmtmn	6	51
Bsmetl	602	41,003
Wdmetl	21	168
Nelcmc	1	13
Elcmc	13	19
Trnseq	1	9
Othmn	0	825
Total	**2,893**	**49,120**

Sectors are: petroleum; food processing; beverages; tobacco; textiles; clothing; leather; paper; chemicals; rubber; non-metallic mineral products; base metals; wood and metal products; non-electrical machinery; electrical machinery; transportation equipment; and other manufacturers.

Pollutants are: BOD-biological oxygen demand; and TSS-total suspended solids.

Table 6. 1991 Estimated base levels of industrial air pollution (Thousands of pounds)

	Canada				
Sector	**PT**	**CO**	**SO_2**	**NO_2**	**VOC**
Petrol	103,945	333,744	656,969	385,220	289,713
Foodpr	48,243	14,351	52,634	52,759	13,710
Bever	1,705	1,377	26,221	16,695	28,342
Tobac	61	256	3,242	1,962	645
Textl	1,502	1,321	7,163	9,409	4,307
Cloth	9	21	202	76	51
Leath	367	48	666	167	1,159
Paper	53,670	312,633	274,722	151,488	60,222
Chem.	28,058	252,279	148,870	145,448	122,733
Rubber	1,218	457	10,582	3,635	13,889
Nmtmn	34,815	8,746	50,343	39,565	4,661
Bsmetl	69,283	425,809	555,978	79,558	35,134
Wdmetl	44,343	80,697	17,641	34,345	92,287
Nelcmc	679	4,966	4,592	2,063	5,221
Elcmc	1,060	5,410	9,841	4,838	6,585
Trnseq	4,766	8,115	11,539	5,996	43,092
Othmn	139	59	269	251	1,534
Total	**393,863**	**1,450,291**	**1,831,476**	**933,475**	**723,283**

	United States				
Sector	**PT**	**CO**	**SO_2**	**NO_2**	**VOC**
Petrol	1,111,409	3,568,484	7,024,484	4,118,871	3,097,688
Foodpr	318,667	94,796	347,671	348,493	90,558
Bever	13,690	11,055	210,503	134,028	227,529
Tobac	852	3,594	45,596	27,593	9,069
Textl	17,607	15,478	83,951	110,274	50,481
Cloth	85	192	1,825	687	456
Leath	2,593	341	4,712	1,178	8,193
Paper	454,619	2,648,228	2,327,094	1,283,212	510,122
Chem.	281,119	2,527,650	1,491,567	1,457,283	1,229,692
Rubber	14,897	5,591	129,397	44,452	169,833
Nmtmn	367,819	92,407	531,874	418,008	49,243
Bsmetl	477,490	2,934,602	3,831,708	548,297	242,140
Wdmetl	335,018	609,684	133,284	259,487	697,249
Nelcmc	9,763	71,365	65,991	29,643	75,032
Elcmc	21,645	110,505	201,019	98,825	134,507
Trnseq	41,693	70,993	100,952	52,457	376,985
Othmn	1,826	780	3,535	3,301	20,164
Total	**3,470,792**	**12,765,745**	**16,535,164**	**8,936,091**	**6,988,943**

	Mexico				
Sector	**PT**	**CO**	**SO_2**	**NO_2**	**VOC**
Petrol	189,263	607,682	1,196,209	701,408	527,510
Foodpr	129,617	38,558	141,415	141,749	36,834
Bever	6,066	4,898	93,269	59,385	100,813
Tobac	99	418	5,304	3,210	1,055
Textl	4,399	3,867	20,974	27,550	12,612
Cloth	8	18	166	62	41
Leath	2,264	298	4,115	1,029	7,154
Paper	25,978	151,327	132,977	73,326	29,150
Chem.	54,009	485,620	286,564	279,978	236,252
Rubber	1,000	375	8,686	2,984	11,401
Nmtmn	99,717	25,052	144,193	113,324	13,350
Bsmetl	57,376	352,625	460,422	65,884	29,096
Wdmetl	12,615	22,957	5,019	9,771	26,254
Nelcmc	702	5,130	4,743	2,131	5,393
Elcmc	1,150	5,870	10,677	5,249	7,144
Trnseq	5,081	8,652	12,303	6,393	45,942
Othmn	114	49	221	206	1,260
Total	**589,458**	**1,713,395**	**2,527,258**	**1,493,639**	**1,091,262**

Sectors are: petroleum; food processing; beverages; tobacco; textiles; clothing; leather; paper; chemicals; rubber; non-metallic mineral products; base metals; wood and metal products; non-electrical machinery; electrical machinery; transportation equipment; and other manufacturers.

Pollutants are: PT-particulates; CO-carbon monoxide; SO_2-sulfur dioxide; NO_2-nitrogen dioxide; VOC-volatile organic compounds.

Table 7. 1991 Estimated base levels of industrial bio-accumulative metals pollution (Thousands of pounds)

Sector	Canada		
	MetAir	MetWat	MetLand
Petrol	201	79	1,983
Foodpr	1	6	84
Bever	1	0	221
Tobac	0	0	0
Textl	11	1	175
Cloth	0	0	5
Leath	1	0	397
Paper	65	86	278
Chem	278	266	9,491
Rubber	22	5	1,176
Nmtmn	71	1	577
Bsmetl	3,604	262	103,352
Wdmetl	137	27	3,683
Nelcmc	46	1	903
Elcmc	70	6	2,206
Trnseq	136	3	1,666
Othmn	16	1	242
Total	**4,658**	**744**	**126,440**

Sector	United States		
	MetAir	MetWat	MetLand
Petrol	2,152	850	21,207
Foodpr	4	40	554
Bever	5	1	1,771
Tobac	0	0	0
Textl	129	7	2,056
Cloth	1	0	49
Leath	4	3	2,804
Paper	554	727	2,351
Chem	2,781	2,662	95,089
Rubber	271	62	14,385
Nmtmn	747	11	6,098
Bsmetl	24,836	1,804	712,286
Wdmetl	1,032	206	27,829
Nelcmc	664	17	12,980
Elcmc	1,420	121	45,069
Trnseq	1,190	23	14,573
Othmn	207	13	3,179
Total	**35,998**	**6,547**	**962,280**

Sector	Mexico		
	MetAir	MetWat	MetLand
Petrol	366	145	3,611
Foodpr	2	16	225
Bever	2	0	785
Tobac	0	0	0
Textl	32	2	514
Cloth	0	0	4
Leath	3	2	2,449
Paper	32	42	134
Chem	534	511	18,269
Rubber	18	4	966
Nmtmn	202	3	1,653
Bsmetl	2,984	217	85,589
Wdmetl	39	8	1,048
Nelcmc	48	1	933
Elcmc	75	6	2,394
Trnseq	145	3	1,776
Othmn	13	1	199
Total	**4,497**	**961**	**120,549**

Sectors are: petroleum; food processing; beverages; tobacco; textiles; clothing; leather; paper; chemicals; rubber; non-metallic mineral products; base metals; wood and metal products; non-electrical machinery; electrical machinery; transportation equipment; and other manufacturers.

Pollutants are: Metals to air, water, and land.

Table 8. 1991 Estimated base levels of industrial toxic pollution (Thousands of pounds)

Sector	Canada		
	ToxAir	ToxWat	ToxLand
Petrol	27,031	1,901	102,761
Foodpr	2,110	594	8,098
Bever	1,010	150	785
Tobac	696	5	69
Textl	2,918	540	1,736
Cloth	81	0	31
Leath	1,545	53	2,950
Paper	56,159	12,865	21,405
Chem	92,731	27,548	213,945
Rubber	11,116	27	4,093
Nmtmn	2,031	57	2,676
Bsmetl	39,598	4,208	130,946
Wdmetl	25,354	557	13,168
Nelcmc	3,335	83	2,207
Elcmc	9,181	95	9,181
Trnseq	23,144	89	9,986
Othmn	2,609	22	1,214
Total	**300,650**	**48,794**	**525,250**

Sector	United States		
	ToxAir	ToxWat	ToxLand
Petrol	289,020	20,329	1,098,744
Foodpr	13,936	3,925	53,489
Bever	8,108	1,201	6,305
Tobac	9,795	67	971
Textl	34,198	6,326	20,349
Cloth	735	0	277
Leath	10,929	376	20,864
Paper	475,704	108,972	181,315
Chem	929,097	276,014	2,143,566
Rubber	135,926	334	50,043
Nmtmn	21,452	603	28,274
Bsmetl	272,904	28,998	902,456
Wdmetl	191,559	4,212	99,484
Nelcmc	47,929	1,196	31,719
Elcmc	187,540	1,946	187,540
Trnseq	202,476	778	87,358
Othmn	34,303	285	15,959
Total	**2,865,609**	**455,563**	**4,928,712**

Sector	Mexico		
	ToxAir	ToxWat	ToxLand
Petrol	49,218	3,462	187,107
Foodpr	5,669	1,597	21,757
Bever	3,592	532	2,794
Tobac	1,139	8	113
Textl	8,544	1,580	5,084
Cloth	67	0	25
Leath	9,543	329	18,219
Paper	27,183	6,227	10,361
Chem	178,501	53,029	411,828
Rubber	9,124	22	3,359
Nmtmn	5,816	164	7,665
Bsmetl	32,792	3,484	108,440
Wdmetl	7,213	159	3,746
Nelcmc	3,445	86	2,280
Elcmc	9,961	103	9,961
Trnseq	24,675	95	10,646
Othmn	2,144	18	997
Total	**378,627**	**70,894**	**804,383**

Sectors are: petroleum; food processing; beverages; tobacco; textiles; clothing; leather; paper; chemicals; rubber; non-metallic mineral products; base metals; wood and metal products; non-electrical machinery; electrical machinery; transportation equipment; and other manufacturers.

Pollutants are: Toxics to air, water, and land.

Table 9. 1991 Estimated base levels of industrial water pollution (Thousands of pounds)

	Canada	
Sector	**BOD**	**TSS**
Petrol	6,429	31,644
Foodpr	71,723	17,901
Bever	11,260	20,306
Tobac	4	5
Textl	0	0
Cloth	0	0
Leath	272	566
Paper	147,473	496,180
Chem	35,046	117,452
Rubber	2,103	5,763
Nmtmn	105	944
Bsmetl	31,016	2,113,480
Wdmetl	1,235	9,753
Nelcmc	17	364
Elcmc	382	545
Trnseq	20	149
Othmn	3	34,463
Total	**307,088**	**2,849,513**

	United States	
Sector	**BOD**	**TSS**
Petrol	68,740	338,343
Foodpr	473,763	118,243
Bever	90,393	163,019
Tobac	55	67
Textl	0	0
Cloth	0	0
Leath	1,923	4,001
Paper	1,249,198	4,202,995
Chem	351,139	1,176,778
Rubber	25,715	70,471
Nmtmn	1,112	9,969
Bsmetl	213,755	14,565,745
Wdmetl	9,330	73,684
Nelcmc	244	5,232
Elcmc	7,812	11,131
Trnseq	175	1,302
Othmn	36	453,135
Total	**2,493,391**	**21,194,116**

	Mexico	
Sector	**BOD**	**TSS**
Petrol	11,706	57,617
Foodpr	192,703	48,095
Bever	40,051	72,230
Tobac	6	8
Textl	0	0
Cloth	0	0
Leath	1,680	3,494
Paper	71,383	240,171
Chem	67,462	226,086
Rubber	1,726	4,731
Nmtmn	302	2,703
Bsmetl	25,685	1,750,237
Wdmetl	351	2,774
Nelcmc	18	376
Elcmc	415	591
Trnseq	21	159
Othmn	2	28,322
Total	**413,510**	**2,437,594**

Sectors are: petroleum; food processing; beverages; tobacco; textiles; clothing; leather; paper; chemicals; rubber; non-metallic mineral products; base metals; wood and metal products; non-electrical machinery; electrical machinery; transportation equipment; and other manufactures.

Pollutants are: BOD-biological oxygen demand; and TSS-total suspended solids.

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Appendix

Trade Model Equations

This appendix presents the equation structure for a simple, multi-region applied general equilibrium model of trade policy. The equations of the model are presented first, and these are followed by a description of the variables and parameters. The equation that determines each variable is given in parentheses after its definition. To simplify the model, all markets are perfectly competitive, there are constant returns to scale in production, quota rents accrue to domestic importers, and supplies of labor and physical capital are fixed in each region.

Some definitions:

LES (Linear Expenditure System): a function for modeling household demand

CES (Constant Elasticity of Substitution): a function for modeling imports

CET (Constant Elasticity of Transformation): a function for modeling exports

share parameters: mathematical terms in the many functions of the model that are estimated from the social accounting matrix

Consumer Behavior (LES)

$$P_{ij}^{Q} C_{ij} = P_{ij}^{Q} \mu_{ij} + s_{ij} \left(Y_j - \sum_h P_{hj}^{Q} \mu_{hj} \right) \qquad \forall i, j \tag{1}$$

Cost Equations and Production (CES with Leontief Intermediates)

$$V_{ij} = \left(\frac{X_{ij}}{a_{ij}} \right) \left[b_{ij}^{\phi_{ij}} w_j^{(1-\phi_{ij})} + \left(1 - b_{ij}^{\phi_{ij}}\right) r_j^{(1-\phi_{ij})} \right]^{\frac{1}{(1-\phi_{ij})}} \qquad \forall i, j \tag{2}$$

$$T_{ij} = V_{ij} + \sum_h P_{hj}^{Q} io_{hij} X_{ij} \qquad \forall i, j \tag{3}$$

Factor Markets (CES Demands and Full Employment)

$$L_{ij} = V_{ij}^{\phi_{ij}} X_{ij}^{(1-\phi_{ij})} b_{ij}^{\phi_{ij}} w_j^{-\phi_{ij}} a_{ij}^{(\phi_{ij}-1)} \qquad \forall i, j \tag{4}$$

$$K_{ij} = V_{ij}^{\phi_{ij}} X_{ij}^{(1-\phi_{ij})} \left(1 - b_{ij}\right)^{\phi_{ij}} r_j^{-\phi_{ij}} a_{ij}^{(\phi_{ij}-1)} \qquad \forall i, j \tag{5}$$

$$\sum_i L_{ij} = L_j \qquad \forall j \tag{6}$$

$$\sum_i K_{ij} = K_j \qquad \forall j \tag{7}$$

Commodity Demands, Supplies, and Allocation of Traded Goods (CES and CET)

$$Q_{ij} = \alpha_{ij}\left[\sum_k \beta_{ijk} D_{ijk}^{\frac{(\sigma_{ij}-1)}{\sigma_{ij}}}\right]^{\frac{\sigma_{ij}}{(\sigma_{ij}-1)}} \qquad \forall i,j \tag{8}$$

$$\left(\frac{D_{ijk}}{D_{ijj}}\right) = \left[\left(\frac{\beta_{ijk}}{\beta_{ijj}}\right)\left(\frac{P_{ijj}}{P_{ijk}}\right)\right]^{\sigma_{ij}} \qquad \forall i,j,k,j \neq k \tag{9}$$

$$X_{ij} = \gamma_{ij}\left[\sum_k \delta_{ijk} S_{ijk}^{\frac{(\tau_{ij}+1)}{\tau_{ij}}}\right]^{\frac{\tau_{ij}}{(\tau_{ij}+1)}} \qquad \forall i,j \tag{10}$$

$$\left(\frac{S_{ijk}}{S_{ijj}}\right) = \left[\left(\frac{\delta_{ijk}}{\delta_{ijj}}\right)\left(\frac{P_{ijj}}{P_{ijk}}\right)\right]^{\sigma_{ij}} \qquad \forall i,j,k,j \neq k \tag{11}$$

Commodity Prices

$$P_{ij}^{Q} Q_{ij} = \sum_k P_{ijk} D_{ijk} \qquad \forall i,j \tag{12}$$

$$P_{ij}^{X} X_{ij} = \sum_k P_{ijk} S_{ijk} \qquad \forall i,j \tag{13}$$

$$P_{ijj} = \frac{T_{ij}}{X_{ij}} \qquad \forall i,j \tag{14}$$

$$P_{ijk} = \left(1 + t_{ijk}\right)\left(1 + \rho_{ijk}\right) e_j PW_{ijk} \qquad \forall i,j,k,j \neq k \tag{15}$$

Commodity Market Equilibrium

$$Q_{ij} = C_{ij} + \sum_h io_{ihj} X_{hj} \qquad \forall i,j \tag{16}$$

$$D_{ijk} = S_{ijk} \qquad \forall i,j,k \tag{17}$$

Income and Revenue

$$RT_j = \sum_i \sum_k t_{ijk} e_j PW_{ijk} D_{ijk} \qquad \forall j \tag{18}$$

$$RQ_j = \sum_i \sum_k \rho_{ijk} e_j PW_{ijk} D_{ijk} \qquad \forall j \tag{19}$$

$$Y_j = w_j L_j + r_j K_j + RT_j + RQ_j \qquad \forall j \tag{20}$$

Foreign Balance

$$\sum_{k \neq j} \sum_i PW_{ijk} S_{ijk} = \sum_{k \neq j} \sum_i PW_{ijk} D_{ijk} \qquad \forall j \tag{21}$$

Sets and Indices

$h, i \in I$ sectors

$j, k \in J$ regions

Quantity Variables

C_{ij} = final demand for composite consumption good *i* in region *j* (1)

D_{ijk} = demand for good i in region j from source region *k* (8, 9)

K_{ij} = input of physical capital in sector *i* of region *j* (5)

L_{ij} = input of labor in sector *i* of region *j* (4)

Q_{ij} = demand for composite consumption good *i* in region *j* (16)

S_{ijk} = supply of good *i* from region *j* to region *k* (10, 11)

X_{ij} = output of sector *i* in region *j* (14)

Price Variables

e_j = exchange rate for region *j* (21)

P_{ijk} = domestic price of good *i* in region *j* demanded from region *k* (15, 17)

P_{ij}^{Q} = domestic purchaser price of composite consumption good *i* in region *j* (12)

P_{ij}^{X} = domestic producer price of composite good *i* in region *j* (13)

PW_{ijk} = world price of good *i* demanded in region *j* from region *k* (17)

r_j = rental rate on physical capital in region *j* (7)

w_j = wage rate in region *j* (6)

Nominal Variables

RQ_j = quota rents in region *j* (19)

RT_j = tariff revenue in region *j* (18)

T_{ij} = total costs in sector *i* of region *j* (3)

V_{ij} = value added in sector *i* in region *j* (2)

Y_j = income in region *j* (20)

Parameters

a_{ij} = intercept parameter in CES production function in sector *i* of region *j*

b_{ij} = share parameter in CES production function in sector *i* of region *j*

io_{hij} = input of good *h* needed per unit of sector *i* output in region *j*

K_j = total physical capital stock in region *j*

L_j = total labor force in region *j*

s_{ij} = consumption share for composite good *i* in region *j*

t_{ijk} = ad valorem tariff on imports of good *i* into region *j* from region *k*

α_{ij} = intercept parameter in CES product aggregation function for sector *i* of region *j*

β_{ijk} = share parameter in CES product aggregation function for product *i* in region *j* from source region *k*

δ_{ij} = share parameter in CET allocation function for sector *i* in region *j*

γ_{ij} = intercept parameter in CET allocation function for sector *i* in region *j*

μ_{ij} = subsistence minimum for composite consumption good *i* in region *j*

ϕ_{ij} = elasticity of substitution between labor and capital in sector *i* of region *j*

ρ_{ijk} = ad valorem equivalent quota on imorts of good *i* into region *j* from region *k*

σ_{ij} = elasticity of substitution among sources of product *i* in region *j*

τ_{ij} = elasticity of transformation among destinations for sector *i* of region *j*

The Generation and Management of Hazardous Wastes and Transboundary Hazardous Waste Shipments between Mexico, Canada and the United States, 1990–2000

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Abstract

The paper examines the impacts of NAFTA and trade liberalization on the generation, management and shipments of industrial hazardous wastes in Mexico, Canada and the US. The paper looks at whether economic activity in the manufacturing and hazardous waste management industry have become more concentrated in the US-Canada and US–Mexico border regions. In addition, the paper considers whether hazardous waste is being shipped from one country to another or whether companies are investing in hazardous waste facilities in any country to take advantage of less stringent hazardous waste regulations and enforcement.

The paper finds that the available data indicate an ongoing concentration of economic activity, including hazardous waste generation and management in the US-Mexico border region. In the Canada-US border region, waste generation in Ontario and Quebec has been increasing significantly, particularly in the steel and chemical industries, which are concentrated in the border region, although waste generation in states such as Michigan, Pennsylvania and Wisconsin has declined. In addition, despite the decline in waste generation among the US border states, there has been a dramatic growth in US waste exports to Ontario and Quebec and, in the context of a weakened regulatory environment, a significant increase in disposal capacity in those provinces.

Differences in regulatory requirements related to hazardous waste disposal, specifically the existence of less stringent standards in Ontario and Quebec, have been the key factor in the increase in US hazardous waste exports to Canada. Similarly, the expansion of disposal capacity in these provinces is in part intended to serve the US market, although the bulk of the investment in this capacity is Canadian in origin.

The ban on imports of hazardous wastes for final disposal into Mexico limits the economic incentive for the establishment of disposal capacity to deal with imported wastes to take advantage of differences in the regulatory and enforcement regime between Mexico and the US. However, there has been significant US investment through joint ventures in Mexican capacity for the treatment, incineration and disposal of domestically generated wastes, with the market for these services being driven by stronger disposal requirements in Mexico in some cases, as well as "temporary" authorizations without publicly-approved standards in others. In addition, hazardous waste exports of electric arc furnace dust from the US to Mexico have increased due to both price differentials and technological changes in the US which have increased the volume of this particular wastestream.

Significant gaps exist in the systems for tracking hazardous waste generation and disposal in all three countries. Reliable data on waste generation in Canada and Mexico are extremely limited, and the reliability of the data regarding transboundary waste movements among the three countries has been seriously questioned. Tracking transboundary waste movements from "cradle to grave," when the "cradle" is in one country and the "grave" in another, is almost impossible.

While many of these changes have occurred outside of the NAFTA framework, the NAFTA trade rules have also been identified as a constraint on the ability of countries to adopt higher standards to protect human health and the environment. The outcomes of NAFTA Chapter 11 complaints seen in such cases at the ban on MMT in Canada and the Metalclad case in Mexico seem likely to reinforce these directions to the detriment of the health, safety and environment of the citizens of all three NAFTA countries.

1 Introduction/Context

The generation and management of hazardous wastes in NAFTA-party countries has been a major concern for decades. This paper applies CEC's *Final Analytic Framework for Assessing the Environment Effects of NAFTA* to the issue of transboundary shipments of industrial hazardous waste between the NAFTA countries and to the commercial hazardous waste management "sector" of the North American economy.[1] The paper focuses on two major hypotheses contained in the Framework, often referred to as the "pollution haven" and "race-to-the bottom" hypothesis:

- Is trade and investment liberalization concentrating economic activity (in both manufacturing and the hazardous waste management industry) in areas where it takes place more efficiently, or conversely, where ecological stress is already acute, such as the US-Mexico and US-Canada border regions?
- Are companies in the manufacturing or hazardous waste management sectors relocating or are they sending hazardous wastes to other areas to take advantage of less stringent hazardous waste regulations or enforcement?

These are essentially questions of whether there has been a scale effect (whether more hazardous waste is produced and shipped simply because there is a greater amount of economic activity) or a composition effect (whether there has been a shift in where hazardous waste is generated and ultimately sent) or, indeed, both. Finally, the paper also examines to what extent the parties to NAFTA have established effective mechanisms to monitor and control the generation, transboundary movement and disposal of hazardous wastes in North America.

The paper approaches issue of impacts of trade liberalization in four steps. First, a pre-NAFTA 'base case" with respect to government policies, the roles of nongovernmental actors, disposal capacity, waste generation and disposal, and transboundary waste traffic is established. Secondly, the changes introduced through NAFTA and its institutions are described. Third, the changes with respect to government policies, societal interests, disposal capacity, waste generation and disposal and transboundary traffic since 1994 are outlined. Fourth, possible explanations for these changes, including the impacts of trade liberalization and other factors are reviewed and assessed. Conclusions and recommendations for action by the NAFTA members, both collectively and individually, follow.

2 The Pre-Liberalization Base Case (pre-1994)

Note: A summary of the base cases is presented here. For a full analysis see Appendix A, available from the Texas Center for Policy Studies. Appendix B, also available from the Texas Center for Policy Studies, contains descriptions of recent cases regarding hazardous wastes before NAFTA-related arbitration.

2.1 United States

In the United States, a comprehensive federal regulatory regime for domestic generation, handling and disposal was established in the 1970s and significantly strengthened between the mid-1980s and mid-1990s. There were some gaps in the regulatory structure as cement and other industries burning hazardous wastes enjoyed significant advantages over other hazardous waste management facilities.

[1] This paper looks only at the generation, management and shipment of industrial hazardous wastes and does not consider to any great extent other hazardous wastes, such as those generated in mining, petroleum exploration, agriculture, silviculture and—except to some extent in Mexico—medical wastes. Hazardous wastes are defined differently in all three countries, although there is significant overlap.

Data on total hazardous waste generation prior to 1994 are difficult to assess, due to changes in reporting regime, but the US EPA believes there was a downward trend between 1989 and 1993. Transboundary waste traffic was almost exclusively with Canada and Mexico, although very limited data on waste imports and exports are available for the period prior to the mid-1990s.

Hazardous waste was generated throughout the country with significant concentrations in both border regions. A few companies, who by 1994 had constructed more than sufficient capacity to treat hazardous waste commercially, dominated the hazardous waste industry. Citizens actively opposed new facilities, stopping several proposed landfills along the US–Mexico border.

2.2 Mexico

In Mexico, the 1988 LGEEPA established a basic legislative framework for the management of hazardous wastes. This included a ban on imports of such wastes for storage or final disposal and a requirement that hazardous wastes generated from raw materials temporarily imported into the country through the "maquiladora" or other similar export-promotion programs be exported back to the country of the input's origin. This provision was also included in the 1983 La Paz Agreement between the US and Mexico and a subsequent agreement in 1986. Some regulations to implement other LGEEPA hazardous waste provisions were adopted in 1993. Little data are available on hazardous waste generation and disposal or transboundary movement of wastes prior to the mid-1990s, although it is thought that waste generation was increasing, both in the border region and nationally. The compliance of maquiladora facilities with requirements to return hazardous wastes which they generated to the their owners' country of origin was generally thought to be poor, although actual data are lacking.

At the same time, foreign companies as well as national companies were beginning to explore investment opportunities in Mexico, both for the incineration and disposal of hazardous wastes. Citizens began to become involved in campaigns to pressure government to enforce environmental laws and to prevent the opening of new hazardous waste facilities, but had few legal remedies under Mexican law.

2.3 Canada

In Canada, a basic regulatory regime for the management of hazardous wastes was established in 1970s and 1980s by all of the provinces. The role of the federal government was limited to the regulation of hazardous waste imports and exports. The available data on domestic hazardous waste generation and disposal are very limited, but generally indicate that waste generation tracked the overall level of economic activity closely. Until the mid-1990s, hazardous waste imports were relatively stable, while exports increased significantly in the late 80s and early 1990s. Hazardous waste imports and exports were almost entirely limited to traffic between the provinces of Ontario and Quebec and the United States.

Hazardous waste disposal capacity in Canada was very limited, with only a few commercial facilities operating in Ontario and Quebec. Various provincial efforts to establish additional disposal capacity in the 1980s met with mixed results in face of strong public opposition, although new facilities were established in Swan Hills, Alberta, and Blainville, Quebec.

3 Connection to NAFTA

3.1 NAFTA Rule Changes

3.1.1 General Provisions of NAFTA

Chapter 3 of NAFTA sets out requirements for the "national treatment" of goods. Article 309 specifically provides:

> "1. Except as otherwise provided in this agreement, no Party may adopt or maintain any prohibition or restriction on the importation of any good of another Party—except in accordance with Art. XI of the GATT."

Article 415 of NAFTA defines good to include "waste and scrap derived from (1) production in the territory of one or more of the Parties." Therefore hazardous wastes are likely to be considered a good for the purposes of the Agreement, and the right of Parties to prohibit or restrict their import—or for that matter their export—may therefore be limited.

Article XI of the GATT permits countries to impose restrictions or bans on imports of goods, via Article XX, where such measures are "necessary to protect human, animal or plant life or health." The term "necessary" has been interpreted to mean that the country maintaining the ban must show: (1) there is no reasonable available alternative measure consistent with the GATT to achieve the desired end and (2) the measure taken is the least trade restrictive measure available. Thus, by incorporating Article XI, NAFTA allows countries to ban or restrict exports and imports of hazardous wastes only to the extent that they can show there is no alternative and that it is the least restrictive trade measure.

3.1.2 Hazardous Waste and NAFTA

NAFTA declares that major multilateral conventions on hazardous waste disposal, as well as bilateral agreement on hazardous waste shipments and disposal, take precedence over NAFTA itself. Specifically, Article 104 provides that:

> In the event of any inconsistency between this agreement (NAFTA) and the specific trade obligations set out in:
> (c) the Basel Convention on the Transboundary Movement of Hazardous Wastes, on its entry into force for Canada, Mexico and the US, such obligations shall prevail to the extent of the inconsistency, provided that where a Party has a choice among equally effective and reasonably available means of complying with such obligations, the Party choose the alternative that is least inconsistent with the other provisions of (NAFTA).
> (d) the agreements set out in Annex 104.1 [these are the 1986 *US-Canada Agreement on Transboundary Movement of Hazardous Waste* and the 1983 *US-Mexico Agreement on Cooperation for the Protection and Improvement of the Environment in the Border Area* (the La Paz Agreement)].

Article 4 of the Basel Convention permits countries to ban or restrict imports of hazardous waste if they have reason to believe that the wastes will not be managed in an "environmentally sound manner." While both Canada and Mexico have ratified the Basel Convention, the US has not, making the two binational agreements currently more relevant to NAFTA. Both of these agreements establish the mechanisms for imports and exports between the countries. Of particular importance is Annex III of the La Paz Agreement, which states that as long as applicable hazardous waste regulations are met, either country must accept the return of hazardous waste generated by production from raw materials that were imported under a temporary import regime. In practice, this requirement, along with Mexican regulations adopted under the LGEEPA, has meant that most maquiladoras are required to send their hazardous wastes back to the US.

In addition, while NAFTA does not address the maquiladora program wholesale, several provisions of NAFTA do change some unique features that have fostered their export orientation. On the one hand, under Article 303, NAFTA continues to allow the duty drawback (repayment of the in-bond) on NAFTA-originating inputs to the extent tariffs still remain, while phasing out requirements on the percent of sales that must be exported outside of Mexico and other export performance requirements by January 1, 2001 (NAFTA, Article 304). These changes lessen the advantages between being a maquiladora and being a national Mexican company. Some have suggested that maquiladoras might increasingly choose to nationalize, at least partly to escape the repatriation of hazardous waste required under the La Paz Agreement.

Other articles of NAFTA may also impact management of hazardous wastes and shipments between the three Parties. Article 1114(2) of NAFTA declares that Parties should not waive or relax environmental measures in an attempt to attract foreign investment. Article 1110, on the other hand, states that no Party may directly or indirectly nationalize or expropriate an investment of an investor in another Party in its territory or take a measure tantamount to nationalization or expropriation of such an investment without compensation. The article allows companies which believe such an measure to have taken place to initiate a "Chapter 11" case against the government through the World Bank's International Center for the Settlement of Investment Disputes.

In recent years, measures intended to restrict the import or export of substances believed to be harmful to human health have been challenged under these Chapter 11 provisions. Examples of such actions include:

- Ethyl Corporation's challenge of Canada's ban on the import and interprovincial trade in MMT;
- Methanex Corporation, a Canadian Company, filing a US$970 million claim for California's ban of imports of a gasoline additive (MBET),
- the claim recently won by Metalclad in August of 2000 that Mexico violated its investor rights by not allowing it to open a hazardous waste landfill in the state of San Luis Potosí;
- the claim recently won by S.D. Myers, an Ohio company, in November 2000 for damages related to lost business when Canada banned the export of PCB waste from November 1995 to February 1997 in an attempt to meet obligations under the Basel Convention.

Finally, in August 2000, the Spanish company Tecmed filed a claim under Chapter 11 that the closing of its hazardous waste landfill near Hermosillo, Sonora, violated its investor rights.

3.1.3 The North American Agreement on Environmental Cooperation

The North American Agreement on Environmental Cooperation (NAAEC), sometimes referred to as the environmental side agreement to NAFTA, came into effect at the same time as the trade agreement itself. Articles 5,6,7, 10(4), 12 (2) collectively impose obligations on parties to effectively enforce laws; to pursue avenues of cooperation to this end; to effect specified private enforcement rights and opportunities; and to provide an annual public report on the enforcement of environmental laws. The Agreement also provided for the creation of the North American Commission for Environmental Cooperation (CEC).

Articles 14 and 15 of NAAEC establish a mechanism through which any resident of a NAFTA country may file a submission that assert that a NAFTA country "is failing to effectively enforce its environmental law." To date, three cases directly related to hazardous waste mismanagement have been brought forward under the Article 14/15 process, one of which will lead to preparation of a factual record (see Section 4.2 for details).

3.2 NAFTA's Institutions related to Hazardous Wastes

3.2.1 North American Commission for Environmental Cooperation

In 1995, the law and policy program of the North American Commission for Environmental Cooperation (CEC) initiated an ongoing project for enhancing regional cooperation for improved tracking and enforcement of North American Laws regulating the transboundary movement of hazardous wastes and chlorofluorocarbons (CFCs). A report published in 1999 under the auspices of the law and policy program concluded that the hazardous waste tracking systems in all three countries were deficient with respect to the quality, quantity and timing of information (CEC 1999: ix).

3.2.2 Land Transportation Standards Subcommittee and Transportation Consultative Group

The Land Transportation Standards Subcommittee (LTSS) is a subcommittee of the Committee on Standards-Related Measures and was expressly authorized by NAFTA under Article 913 (5) (a) (I) and Annex 913. The primary purpose of the LTSS is to make the Parties' relevant standards-related measures on bus, truck and rail operations, including the transportation of dangerous goods, compatible. The three countries have substantially "harmonized" regulations regarding hazardous materials transport although significant challenges remain, notably Mexico's continued implementation of standards related to "1993 Regulations for Domestic Transport of Hazardous Wastes and Materials."[2]

4 Post-Liberalization? 1994-Onwards

4.1 The United States

4.1.1 Government Policy

Federal Laws and Regulations

At the federal level, the US government significantly tightened regulation of hazardous wastes between 1994 and 2000, while loosening some reporting requirements (Table 1). Among the most important measures taken since 1994 were the new Land Disposal Restrictions Phase II, III and IV (LDR) Rules, the listing of petroleum refinery list, limitations on the "Bevill" exclusion waste, and new Maximum Achievable Control Technology regulations for incinerators and industrial furnaces—including cement kilns—authorized under RCRA and the Federal Clean Air Act. These regulations—particularly the LDR IV rules—significantly raised the treatment levels required for waste generated in the US. Among RCRA rules which lessened regulations was a change in the 1997 form for reporting generation and management of hazardous wastes and the Hazardous Waste Identification Rule (HWIR), much of which still has not gone into effect.

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2 For example, Mexico has still not finished adopting common labeling and transport requirements for land, sea and air (LTSS 1999).

Table 1. Major new rules adopted by US EPA under RCRA and CAA, 1994–2000

Name of Rule	Date	Description	Impact on waste
Phase III Land Disposal Restrictions Carbamate Wastes	April 8, 1996 November 1, 1996 Court of Appeals vacated several standards September 4, 1998 Final Rule	Required concentration-based treatment standards for waste associated with production of some carbamate pesticides; However, court case threw out treatment standards for eight constituents; Final rule includes treatment standards for seven constituents.	Pesticide generators given choice of specified treatment methods or meeting concentration levels. Ultimately impacted few generators.
Phase III Land Disposal Restrictions Aluminum Spent Potliners	April 1996 September 1998 Final Rule	Required new concentration-based and treatment standards for aluminum spent potliners; However, litigation caused delay and changes in final rule.	Will require a small percentage of aluminum spent potliner waste containing arsenic to be treated through vitrification; other aluminum spent potliner waste must be treated through combustion or stabilization.
Phase IV Land Disposal Restrictions Wood Preserving Wastes	May 12, 1997	Established treatment-based standards for wood preserving wastes, requiring combustion for organics, including dioxins and furans; stabilization for chromium standards; and vitrification for arsenic constituents.	Expected to shift some waste managed on-site to off-site facilities, including incinerators, cement kilns, landfills and a vitrification facility in Arkansas (Reynolds Metals Company).
Phase IV Land Disposal Restrictions Toxicity Characteristic Metal Wastes	May 26, 1998	(1)Requires metal wastes characterized hazardous by the TCLP but not the Extraction Procedure to undergo stabilization or metal recovery before landfilling; (2) Requires underlying hazardous constituents in metal wastes to be treated, as well as establishing stricter treatment standards for 12 metal constituents.	Expected to shift some waste off-site to incinerators, cement kilns, stabilization and commercial landfills following treatment.
Phase IV Land Disposal Restrictions Mineral Processing Wastes	May 26, 1998	Wastes excluded from treatment under Bevill Amendment forced to treat wastes prior to land disposal.	Expected to cause 71,000 tons (64,400 tonnes) of mineral waste to require stabilization treatment.
Newly Listed Wastes Petroleum Refining Wastes	August 8, 1998 Wastes Listed; February 9, 1999 Went Into Effect	Required concentration-based treatment standards for four petroleum refining wastes	Expected to shift onsite wastes to off-site commercial facilities, most of which will be stabilized, incinerated or fuel blended for combustion.
Newly Listed Wastes-Organobromine Waste	1997 – currently in litigation.	Required treatment standards for organobromine.	Only affects Great Lakes Chemical Corporation.
Emission Limits for Hazardous Waste Combustion Facilities	April 19,1996—Rules proposed; September 30, 1999—Rules finalized; Facilities have three years to meet standards.	Establishes more stringent Maximum Achievable Control Technology (MACT) emission standards for hazardous waste incinerators, waste burning cement kilns and lightweight aggregate kilns.	EPA estimates at least 90 percent of facilities will have to make substantial investments to meet standards. Likely result will be less on-site burning of hazardous wastes in incinerators and kilns, with larger commercial incinerators and cement kilns burning wastes.
Hazardous Waste Identification Rule – Contaminated Media	Proposed rule published December 21, 1995; Final rule published November 2, 1998; Final rule not expected until April 30, 2001	Exempts from hazardous waste regulations, including treatment standards, some waste at low constituent concentrations. Only applies to cleanup activities, not process waste.	Will reduce off-site management of some hazardous wastes from Superfund sites and other RCRA cleanup.
Hazardous Waste Identification Rule – Process Waste	Proposed rule published December 21, 1995; Final rule not expected until April 30, 2001	Would exempt from hazardous waste regulations and treatment standards certain process waste at low concentrations of toxicity.	Impact will depend upon concentration levels specified in final rule.

Source: TNRCC, March 2000: 14-23.

Federal Enforcement

In FY 1999, EPA and state agencies inspected about 63 percent of all treatment, storage and disposal (TSD) facilities for compliance with RCRA and state regulations in the entire United States

(Table 2). That same year, about 11 percent of all TSD facilities were considered to be in significant noncompliance (SNC) with RCRA rules, again in the United States as a whole (Table 3). In general, inspection rates in the US–Canada border states have been slightly higher than the national average, while inspection rates in the US–Mexico border region have been lower than the national average. These difference seem to reflect lower budgets in general in southern states—particularly in Texas—for environmental protection and enforcement as well as the higher number of TSDs concentrated in California and Texas. California rates were surprisingly low during this period, although care should be taken in interpreting these numbers, since EPA-reported and state figures differ.[3] While rates of inspection and formal actions declined in the mid-1990s, however, there has been an upswing in inspections since 1997, although formal actions against violators have continued to decline in both regions.

Table 2. RCRA treatment, storage and disposal facilities, FY 1995–1999

	1995	1996	1997	1998	1999
Region			**Percent TSDs Inspected**		
Texas	61	34	33	48	50
California	53	29	24	33	34
US/Mexico Border States	59	34	29	42	44
US/Canadian Border States	69	34	33	68	74
National totals	**65**	**21**	**33**	**59**	**63**
			Percent TSDs in SNC		
Texas	18	10	9	16	15
California	7	2	1	1	0
US/Mexico border states	15	7	5	10	8
US/Canadian border states	13	5	6	16	14
National totals	**4**	**7**	**6**	**14**	**13**
			# Formal Enforcement Actions		
Texas	45	12	29	21	16
California	8	7	0	2	1
US/Mexico border states	61	30	30	28	17
US/Canadian border states	57	38	49	32	25
National totals	**305**	**229**	**205**	**172**	**180**

Note: US-Mexico border states include Arizona, California, New Mexico and Texas;

US-Canadian border states include Idaho, Maine, Michigan, Minnesota, Montana, New Hampshire, New York, North Dakota, Ohio, Pennsylvania, Vermont and Washington.

Source: FY95–FY97: US EPA, State-by-State Enforcement Data Summaries, FY95–FY97 and FY 1998 and FY1999 Program Status Reports

In recent years, EPA has placed greater emphasis on enforcing RCRA transportation regulations on hazardous waste imports and exports through financial support to state programs and use of the Haztraks database. Utilizing Haztraks, EPA filed 17 administrative enforcement actions against transport and TSD companies that did not comply with export or import regulations between 1996 and 1998, with penalties totaling US$482,000 (Cooke, October 98). In 2000, the US EPA for the first time fined a Mexican maquiladora facility—Maquiladora Chambers Belt Co.—as well as its parent company and a storage facility a total of US$50,000 for illegally shipping hazardous wastes to facilities not authorized to receive the waste, as well as improperly labeling, packaging and completing the manifests for the waste (US EPA July 24, 2000).

[3] The rates reported are directly from EPA's Office of Enforcement and Compliance and Assistance. State figures differ from national figures. For example, California reported it inspected 103 facilities rather than 83 during FY 99. For this reason, these figures should be used only to show general trends over time rather than as an accurate reflection of inspection and compliance rates.

Table 3. RCRA treatment, storage and disposal facilities: Percent inspected and percent in significant noncompliance within 100 kilometers of US–Mexican border, FY 99

State	# Facilities	# Facilities Inspected	% Facilities Inspected	#Facilities in Significant Noncompliance	% Facilities in Noncompliance
Arizona	8	6	75	1	13
California	16	7	44	0	0
New Mexico	4	4	100	0	0
Texas	34	18	53	7	21
Total in 100-kilometer zone	62	35	56	8	13
National totals	**3,096**	**1,961**	**63**	**354**	**11**

State Laws and Regulations

There has been a movement in some states toward voluntary pollution prevention program compliance assistance, rather than strict enforcement. Thus, Texas passed the Waste Reduction Policy Act of 1991 to require industries to submit waste reduction and waste minimization plans and annual progress reports, and began a “Clean Industries Program” to assist and recognize businesses for their efforts. This may have led to significant pollution reduction, estimated by TNRCC officials at approximately 12.5 million tons (11.3 million tonnes) over five years.

In addition, the Texas Natural Resource Conservation Commission adopted a number of “regulatory flexibility measures”—some required by Texas legislation—during the mid-1990s, including:

- The 1995 Environmental Audit program allowing industries to audit their facility in order to comply with regulations, in return for immunity from civil and administrative penalties;
- A 1995 policy of no surprise inspections of industries in most cases;
- Flexible Permits (1995), allowing industries to change or increase production without a permit amendment;
- 1997 Regulatory Flexibility Orders, exempting industries from state statute or rules in return from alternative “as protective” of public health and the environment (Sunset Advisory Commission 2000, 32).

Finally, in recent years, the TNRCC has adopted a more rigorous definition of “affected party” when considering standing for citizens opposed to hazardous waste and other environmental permits. With these changes, Texas moved away from stricter regulation and toward a voluntary compliance philosophy, as well as limiting public participation in permit hearings.

State Enforcement

While EPA is ultimately responsible for overseeing the enforcement of RCRA and other laws pertaining to hazardous wastes, because most states have been delegated authority, the actual inspections and enforcement activities occur primarily at the state level. In Texas, about 12,000 facilities are subject to industrial or hazardous waste regulations. Under the TNRCC, the state agency in charge of conducting inspections, issuing notices of violations and issuing penalties, either through an Agreed Order or other means, the total number of notices of violations, agreed orders and penalties has declined in recent years. Still, comparisons between the nation and the zone within the 100 kilometers of the US–Mexico border do not support a conclusion that there has been less effective enforcement and inspections against TSDs in the border region since NAFTA.

Both Texas and California have increased inspections at Points of Entry in recent years, although the percentage of trucks that are actually inspected is minuscule (see Tables 4 and 5). Recently, the Arizona Department of Environmental Quality began the Hazardous Waste Border Surveillance, Compliance and Enforcement Program (Border SCEP) using EPA funds (Mendoza 2000). The new program has allowed the state agency to conduct training with US Customs officials and officials from the Pima County Department of Environmental Quality on RCRA regulations, sampling procedures and proper inspections. It is not, however, allowed for the state to make more than a rudimentary visit of Points of Entry crossings. In fact, in some ports in all four border states, there is an assurance that no environmental officials will be inspecting ports of entry for compliance with hazardous waste regulations. Some analysts believe this has led to greater traffic at some ports as truckers seek to avoid compliance with manifest and other hazardous waste requirements.[4]

Table 4. Total trucks entering the United States on US-Mexico border, 1991–1999

Ports	1993	1994	1995	1996	1997	1998	1999
Brownsville	224,147	264,345	233,615	224,537	238,175	273,087	294,938
Del Rio	32,672	32,719	36,601	39,107	43,530	50,949	58,881
Eagle Pass	45,318	55,046	54,779	54,269	68,385	85,974	98,755
El Paso	563,413	580,200	610,177	539,650	596,538	591,258	657,664
Fabens	3,199	700	269	141	178	181	191
Hidalgo/Pharr	147,492	158,405	174,049	198,260	225,337	261,322	62,482
Laredo	473,480	659,924	733,783	899,754	1,162,419	1,340,653	1,455,597
Presidio	5,606	4,764	5,291	2,987	3,823	6,683	8,370
Progreso	23,760	22,711	22,962	21,978	17,963	17,298	17,800
Rio Grande City	15,649	15,655	14,936	11,937	16,867	18,658	20,103
Roma	14,110	12,273	11,426	12,630	12,019	13,140	15,753
Texas Total	**1,548,846**	**1,806,742**	**1,897,888**	**2,005,250**	**2,385,234**	**2,659,203**	**2,690,534**
Colombus	1,345	1,351	2,087	2,426	1,997	4,004	5,189
Santa Teresa	n/a	4,554	5,360	13,611	31,788	31,093	28,294
New Mexico Total	**1,345**	**5,905**	**7,447**	**16,037**	**33,785**	**35,097**	**33,483**
Douglas	18,300	47,522	38,242	34,585	41,802	35,561	33,288
Lukeville	2,278	2,419	2,665	2,766	3,254	3,723	4,355
Naco	4,521	5,043	5,789	5,610	6,578	7,650	8,126
Nogales	185,107	187,423	203,298	225,274	236,425	256,494	255,412
San Luis	36,620	43,356	44,214	44,377	45,175	42,472	39,974
Sasabe	1,691	1,308	1,180	1,512	1,393	1,844	2,381
Arizona Total	**248,517**	**287,071**	**295,388**	**314,124**	**334,627**	**347,744**	**343,536**
Andrade	1,420	3,114	3,818	3,935	3,078	2,137	2,072
Calexico	156,381	176,825	176,420	169,403	190,160	222,105	250,083
Otay Mesa	384,615	428,086	477,390	475,427	558,383	599,001	638,210
San Isidro	0	0	0	0	0	0	0
Tecate	36,710	34,674	41,064	45,932	64,262	57,914	59,647
California Total	**579,126**	**642,699**	**698,692**	**694,697**	**815,883**	**881,157**	**950,012**
Grand Ttotal	**2,377,834**	**2,742,417**	**2,899,415**	**3,030,108**	**3,569,529**	**3,923,201**	**4,017,565**

Source: US Customs Service 2000.

[4] Both Texas and California plan to increase funding and presence in the border in future years. TNRCC plans to conduct coordinated investigations with EPA in Laredo at approximately 300 warehouse and transfer facilities in FY 01. California's Department of Toxic Substances Control will use additional state funds in FY 00-01 to hire two new inspectors to add to the existing two on the border. This is the first time that state funds have gone directly to border activities. New Mexico had planned to hire a full-time inspector in the border area, but the hired person refused to be relocated to the border. Arizona is currently seeking three full-time border employees (TNRCC, August 3, 2000, Mendoza 2000, and Le Pen 2000).

Table 5. Estimated number of Port of Entry (POE) investigations and other statistics in US–Mexico border states, FY 98–00

	El Paso Office, Texas	Harlingen Regional Office, Texas	Laredo Regional Office, Texas	San Diego County, CA (3)	Imperial County, CA	New Mexico (2 ports)	Arizona (6 Ports)
Number of POE inspections (1), FY 99	67	45	0	52 (est.)	52 (est.)	1/month	1/month
Number of POE inspections (1), FY 00	26	36	0	52 (est.)	52 (est.)	1/month	1/month
Number of RCRA investigators with emphasis on border crossings	2	3	0.5	1	1	0(4)	0(4)
Notice of violations issued	0	0	0	NA	NA	0	
Warehouse investigations, FY 99	21	7	0	NA	NA		
Warehouse investigations, FY 00 (2)	13	13	0	NA	NA		
NOVs for warehouse investigations, FY 99-00 (2)	2	2	0	NA	NA		
Investigations of transporter/ transfer facilities, FY 99	3	70	11	NA	NA		33 /2 Notice of violations issued

(1) Inspection is defined as a full day at the bridge, or 10 hours.

(2) Through July 31, 00

(3) California's Department of Toxic Substances Control contracts with the Department of Environmental Health, County of San Diego to monitor import and export of hazardous wastes and assist with other border activities. In Fiscal Years 99/00, DTSC provided the County of San Diego $143,515.00 to hire one inspector, as well as support staff and materials.

(4) Once a month, the State of New Mexico sends inspectors from Santa Fe to conduct a "Border Check," in which US Customs Inspectors are interviewed. At least once a month, two inspectors from the Arizona Department of Environmental Quality visit the six POEs in Arizona.

Source: TNRCC August 2000; Le Pen 2000; Mendoza 2000.

4.1.2 Social Organization

Citizens' and Community Organizations

Citizen groups continue to use citizen-suit provisions in both RCRA and EPCRA to attempt to improve waste management practices. However, one recent 1998 Supreme Court decision in Steel Company v. Citizens for a Better Environment curtailed the ability of citizen groups to be granted standing on cases involving past violations of EPCRA. Instead, future citizen suits will only be practical in cases of continuing violations or credible future threats.

Citizens continued to actively oppose new proposed landfills, incinerators and deep well injection facilities, as well as the continued practice of burning hazardous waste in cement kilns. In general, citizens were successful in preventing new hazardous waste facilities from opening, although many existing "interim" facilities were able to obtain permits, such as the TXI cement plant which burns hazardous wastes in Midlothian, Texas, despite citizen opposition.

Citizens are beginning to negotiate directly with companies over pollution prevention, emission reductions and safety issues at the facilities themselves through "Good Neighbor Agreements." Still, there have been other cases where these committees and agreements have not been effective. The key factors are the ability of the citizens to receive accurate and timely information, and the will of the companies to actually implement changes. Government involvement and oversight is also important in carrying out the agreements.

Hazardous Waste Management Industry

Since 1994, there has been a consolidation of the hazardous waste management industry in the US. For example, in 1998, Chemical Waste Management, which was renamed Waste Management Inc, merged with USA Waste Services Inc., and later divested itself of several international subsidiaries, while keeping its core North American businesses. In addition, the company—which operated eight commercial landfills and three deep well injection facilities in 1994—operated only five commercial landfills and two deep well injection facilities at the end of 1999 (Table 6) (Waste Management Inc. 2000: 7).

Table 6. Major commercial hazardous waste combustion and disposal facilities operating in the US, 1999

Treatment Technique	Company	Number of Facilities
Landfills	Safety Kleen	6
	Waste Management	5
Total landfills in US		21
Incinerators	Safety Kleen	6
Total		20
Deep well injection facilities	Waste Management	2
Total		11
Cement kilns burning hazardous wastes		18

Sources: US EPA 1999; Waste Management 2000; Safety Kleen 2000.

In terms of hazardous waste management, since 1994, a series of mergers led four companies—USPCI, Laidlaw Environmental Services, Rollins Environmental Services and Safety Kleen—to become, at least for a time, a single company—Safety Kleen. Currently, the company operates four general commercial incinerators, a landfill at one of the incinerators to depose of ash, as well as two specialty incinerators in the US and two liquid hazardous waste incinerators in Canada. There are currently 20 commercial incinerators operating in the US (US EPA, July 1999, Exhibit 2-2). During 1997 and 1998, Safety Kleen closed three commercial incinerators. Safety Kleen also operates eight hazardous waste landfills, including six in the US and two in Canada. Safety Kleen estimated it controls 22 percent of the off-site industrial waste services industry in North America, generating revenues of nearly \$7.4 billion in FY 1999 (Safety Kleen 2000, 13).

In addition, fewer cement kilns are believed to be burning hazardous wastes in 1999 than in 1994. By 1999, EPA was reporting that only 18 cement kilns were permitted to burn hazardous wastes either under RCRA B permit or interim status (US EPA, July 1999, Exhibit 2-2). It is believed that the new MACT standard will decrease the number of incinerators and cement kilns burning hazardous wastes, but overall capacity is not expected to change much as those able to meet stricter standards will increase their management of hazardous wastes.

4.1.3 Waste Disposal Capacity

The US EPA has not required states to conduct Capacity Assurance Plans since 1994. Nonetheless, both the US EPA and most analysts believe that sufficient, and in fact, excess capacity exists in the US to commercially treat hazardous wastes in part because generation of hazardous waste has declined as companies have enacted source-reduction plans (Waste Management Inc. 2000, 7).

In addition, most states have also concluded they have sufficient commercial capacity to manage hazardous wastes. The only major category of waste management where Texas lacks capacity is in zinc recovery (TNRCC March 2000, xiii). Currently, most of these wastes generated in Texas are sent to Mexico for recycling.

4.1.4 Waste Generation

In 1997, some 20,305 Large Quantity Generators (LQGs) generated a total of 40,676,075 tons (36,893,200 tonnes) of hazardous waste, a decrease of approximately 500 generators and almost 170 millions tons (154 million tonnes) from the 1995 report (Table 7) (US EPA September 1999, i). Nonetheless, because EPA streamlined reporting requirements, eliminating all wastewaters that are managed in systems regulated by the Clean Water Act rather than RCRA, it is not possible to compare these figures. If such wastewaters are discounted from the 1993 and 1995 report, hazardous waste generation declined between 1993 and 1997, despite an economic boom and higher production in the US. In all three years, the top 50 waste generators generated about 80 percent of total wastes, although the percentage of the total declined slightly over time, indicating significant reductions at some of the largest generators of hazardous waste.

The total amount of waste managed off-site differed little between 1993 and 1997 when wastewater is not included, while the number of companies treating waste off-site declined. Nonetheless, the management methods, again when discounting wastewater treatment, did change between 1993 and 1997, with a decline in the amount of waste going to both landfills and deep well injection, and an increase in the amount of waste recovered in metal recovery (Table 8). Incineration, fuel blending and energy recovery went up in 1995 and then declined in 1997, remaining overall relatively stable. The declines in landfill and deep well injection are probably the result of regulations, which limited the types of waste that could be landfilled or disposed of within land units.

Table 7. Hazardous waste generated and generators in the US, 1993–1997

	1993	1995	1997
LQGs*	24,350	20,853	20,305
Tonnes of hazardous waste	234,413,324	194,181,902	36,893,200
Tonnes of hazardous waste generated by top 50 LQGs	192,077,721 (82%)	161,690,641 (83%)	29,119,593 (79%)
Approximate tonnes of hazardous waste generated, not including wastewater, except for deep well injection (1)	58,500,000	39,500,000	36,900,000

* LQGs = Large Quantity Generators

Notes: (1) To calculate this row, the following management categories were eliminated from the 1993 and 1995 on-site and off-site management totals: Aqueous Inorganic Treatment, Aqueous Organic Treatment, Aqueous Inorganic and Organic Treatment and Other Treatment. The EPA reported in its 1997 biennial report that hazardous waste actually increased from 36.3 million to 40.6 million tons (33 million to 37 million tonnes) between 1995 and 1997. Whatever the methodology, total waste generated differed little between 1995 and 1997.

Source: US EPA, *The National Biennial RCRA Hazardous Waste Report* (based upon 1993, 1995 and 1997 data).

There was an increasing concentration of waste generated and managed in the US states bordering Mexico, while there was a decline in waste generated and managed in the US states bordering Canada (Table 9). This may represent the general shift in industrial production within the US as states like New York and Michigan lose industry and states such as Texas continue to maintain industrial production. Other states such as New Jersey and California also witnessed a decline in the percentage of hazardous waste generated significantly over the time period, which may also be the result of state legislation designed to encourage pollution prevention. However, in terms of waste managed in off-site facilities, California actually led the nation in 1997, as its commercial facilities increased their receipt of hazardous wastes, while off-site management of hazardous waste at Texas facilities declined slightly (Table 10) (US EPA, September 1999, Exhibit 3.11). In addition, the states bordering Canada actually managed more hazardous waste—about 30 percent—than did the states bordering Mexico, which managed about 25 percent, due in large part to a few large facilities in Michigan, Pennsylvania and Ohio.

Table 8. Hazardous waste managed in the US, 1993–1997

Category	1993	1995	1997
Number of TSDs*	2,584	1,983	2,025
Number of non-storage TSDs*	1,032	900	626
Number of off-site TSDs*	432	732	310
Tonnes of hazardous waste managed	213,021,677	188,899,026	34,214,878
Tonnes of non-wastewater managed	13,556,776	9,264,584	10,467,523
Tonnes of hazardous waste managed off-site	7,536,412	7,911,205	6,177,505
Tonnes of hazardous waste managed off-site, not including wastewater, except for deep well injection	5,990,525	6,368,396	6,177,505

*TSDs = RCRA-permitted, treatment, storage, and disposal facilities

Source: US EPA, *The National Biennial RCRA Hazardous Waste Report* (based upon 1993, 1995 and 1997 data).

Table 9. Percentage of hazardous waste managed and generated by state and region, 1993–1997

State or Region	% Generated 1993	% Generated 1995	% Generated 1997	% Managed 1993	% Managed 1995	% Managed 1997
Texas	24.6	32	46.6	22.4	36	46
California	5.4	5.2	1.7	5.4	6.5	3.1
All states bordering Mexico (1)	30.2	37.3	48.6	27.9	42.6	49.6
Michigan	8.1	6.3	2.4	8.8	6.9	2.9
Washington	5.6	1.4	0.3	4.3	0.8	0.1
New York	0.6	1.1	1	0.5	0.2	1.1
Ohio	0.7	0.9	4.2	0.7	0.8	4.6
Pennsylvania	3.7	3.0	0.9	3.9	3.0	1.3
All states bordering Canada (2)	21.9	13.6	12.8	21.5	12.6	13.4

(1) Includes Arizona, California, New Mexico and Texas;

(2) Includes Idaho, New Hampshire, Maine, Michigan, Minnesota, Montana, New York, New Hampshire, North Dakota, Ohio, Pennsylvania, Vermont and Washington.

Source: US EPA, *The National Biennial RCRA Hazardous Waste Report* (based on 1993, 1995 and 1997 data), August 95, August 97, August 99.

Table 10. Quantity of hazardous wastes received off-site in selected states, 1995–1997 (Tonnes)

State	1995	% 1995	1997	% 1997
Texas	751,519	10.5	464,945	6.4
California	289,504	4.0	1,393,144	19.2
All states bordering Mexico (1)	1,054,930	14.7	1,866,686	25.7
Michigan	976,091	13.6	664,507	9.2
Washington	11,356	0.2	33,341	0.5
New York	173,989	2.4	237,160	3.3
Ohio	523,899	7.3	628,588	8.7
Pennsylvania	390,929	5.4	405,370	5.6
All states bordering Canada (2)	2,199,793	30.7	2,187,103	30.3
New Jersey	989,103	13.8	41,856	0.6
Indiana	455,359	6.3	554,592	7.6

(1) Includes Arizona, California, New Mexico and Texas;

(2) Includes Idaho, Maine, Michigan, Minnesota, Montana, New York, New Hampshire, North Dakota, Ohio, Pennsylvania, Vermont and Washington.

Source: US EPA, *The National Biennial RCRA Hazardous Waste Report* (based on 1997 data), Exhibit B.4 and 3.11.

4.1.5 Transboundary Waste Flows

Exports

While record keeping of exports and imports of hazardous waste from the US to Canada and Mexico improved since the passage of NAFTA, there are still significant gaps in records. For example, because of a lack of resources and difficulty with the Exports database, the EPA only conducted annual assessments of exports from 1993 to 1995 (see Table 11). This assessment shows that exports increased substantially to both Mexico and Canada, particularly waste going to landfills in Canada. Because manifests for lead batteries are not required under RCRA, batteries going to Mexico are not included in these totals.

The waste that was reported as being shipped to Mexico was electric arc furnace (EAF) dust generated by specialized steel operators. About 100,000 tons (90,700 tonnes) of this material was exported to Mexico in 1995. All of this waste is sent to a single zinc recycling facility in Monterrey, Mexico. An analysis of the Biennial RCRA database reveals that this wastestream increased substantially between 1993 and 1997. For example, four Texas steel generators which ship electric arc furnace (EAF) dust to Mexico increased exports of hazardous waste to *Zinc Nacional, S.A.*, in Mexico from 28,459 to 38,193 tons (25,812 to 34,641 tonnes) between 1993 and 1997, believed to be the result of increased production (Corson, 2000). About 90,000 tons (81,630 tonnes) of EAF dust were believed to have been sent to Mexico in 1997. [5]

A similar story is told by looking at the number of export wastestreams and waste notices, which have increased over time to both Mexico and Canada (Table 12). Between 1993 and 1999, the total number of notice of exports increased from 526 to 816 and the total number of wastestreams increased from 1085 to 4901. Virtually all of this increase was due to increased notices to export to Canada.

In 1997 and 1998, information provided by US exporters showed that 21 facilities in Canada received US hazardous waste, while only one TSD facility in Mexico—*Zinc Nacional, S.A.*—received US hazardous waste. US officials believe that two other firms in Mexico—Accumex and *Metales Potosí*—are receiving spent lead batteries for recycling.

Table 11. Exports from the US to Canada, Mexico and the rest of the world, 1993–1995

Country	Management Method	Quantity in tonnes, 1993	Quantity in tonnes, 1994	Quantity in tonnes, 1995
Canada	Reclaimed/recycled, including fuel blending	15,211	24,487	27,376
	Incineration	12,640	7,981	10,174
	Treatment and landfilled	35,909	55,700	46,288
	Total	63,760	104,426	109,760
Mexico	Metal reclamation (emission control dust from electric arc furnace steel mills)	64,938	68,797	94,698
Other Countries	Metal reclamation	738	429	880
Totals		**129,436**	**173,652**	**205,339**

Source: Information provided to authors by US EPA from EXPORTS database.

5 The figures for Electric Arc Furnace Dust, Waste Code K061, are derived from a query run online of EPA's Biennial Hazardous Waste Database. These figures might not represent all KO61 waste going to Mexico, as it is possible that such waste is sent to a storage facility before being exported to Mexico.

Table 12. Number of wastestreams and waste notices of exports, 1993–1999

Country	1993	1994	1995	1996	1997	1998	1999
Canada–Notices	489	477	580	720	675	768	772
Canada–Wastestreams	1,042	1,398	2,144	2,709	3,333	3,580	4,856
Mexico–Notices	15	22	30	22	27	28	28
Mexico–Wastestreams	15	22	30	22	27	28	35
Other–Notices	22	20	28	12	9	10	16
Other–Wastestreams	28	20	30	12	10	23	17
Totals–Notices	**526**	**519**	**638**	**754**	**711**	**806**	**816**
Totals–Wastestreams	**1,085**	**1,440**	**2,204**	**2,833**	**3,370**	**3,631**	**4,901**

Source: Information provided by US EPA, 2000 from Exports and WITS database.

Imports

Limited information on imports of hazardous waste from Canada and Mexico from the WITS database shows a general decline in the number of notices of imports from both Canada and Mexico (Table 13). These numbers do not reflect, however, imports from maquiladoras.

Table 13. Number of wastestreams and waste notices of imports, 1995–1999

	1995	1996	1997	1998	1999
Canada–Import Notices	660	682	784	536	519
Wastestreams	2,650	2,170	1,597	1,530	1,735
Mexico–Import Notices	NA	28	53	2	6
Wastestreams	NA	28	53	6	15
All Countries–Import Notices	**823**	**864**	**1,162**	**824**	**745**
All Countries–Wastestreams	**2,813**	**2,354**	**1,975**	**1,819**	**1,971**

Source: Information provided by US EPA to authors from WITS database.

According to Haztraks (Table 14), imports of RCRA hazardous waste from Mexico increased slightly from 9,437 tons to 11,057 (8,559 to 10,029 tonnes) between 1993 and 1997, while imports of total industrial wastes, including both RCRA and non-RCRA wastes, increased from 21,768 tons to 31,709 tons (19,744 to 28,760 tonnes), a significant increase (TNRCC, December 1998, 2). Some 3,000 tons (2,721 tonnes) were imported to two landfills in California owned at the time by Laidlaw and Chemical Waste Management. Using its state tracking system, Texas reported that most waste from Mexico went to a Waste Management incineration facility (2,730 tonnes) or was fuel blended (787 tonnes) for later combustion in cement kilns in 1997 (Corson 2000).

There are a significant number of maquiladoras reporting waste return to the US in the Haztraks database. For example, only 789 companies, or about 40% of all 2,002 maquilas operating in 1997 in the border states are reported as having shipped solid wastes—which could either be non-hazardous or hazardous—from Mexico to the US sometime during 1997.[6] However, most of the maquiladoras—536 in all—in the database are from two cities, Ciudad Juárez and Tijuana, and the

6 Query run on US Environmental Protection Agency Haztraks database, 1998.

vast majority of waste from these two cities comes from a handful of maquilas. Not surprisingly, the Ports of Entry at these two cities have the highest amount of inspection and enforcement activity by state government and the best working relations between US Customs and state and EPA officials. Other Ports of Entry across from cities like Reynosa, Nuevo Laredo, Piedras Negras and Agua Prieta have very limited reporting by maquiladoras there in Haztraks. In addition, because of funding problems, Haztraks is two years behind schedule, and currently only data through 1997 have been entered into the system, although 1998 and 1999 information is now being entered as funding has been restored.

Table 14. RCRA hazardous waste, solid waste and number of RCRA hazardous waste manifests received from Mexico, 1993–1997 (Tonnes)

Category	1993	1994	1995	1996	1997
RCRA hazardous waste	8,559	9,191	7,718	6,252	10,029
Number of RCRA manifests	2,208	2,857	2,594	2,609	4,303
Total solid waste	19,744				28,760
RCRA waste managed at Texas TSD facilities	2,946	NA	3,486	NA	5,135

Source: US EPA, Haztraks database, 1998 and TNRCC, TRACS database.

4.2 Mexico

4.2.1 Government Policy

Federal Laws and Regulations

In 1996, Mexico’s Congress approved revisions to the LGEEPA. The revisions to the General Law state that the policy of Mexico is to prevent the generation of hazardous waste, emphasizing minimization policies, recycling and secondary materials recovery.

Major revisions to the LGEEPA related to hazardous waste management include:

- Establishing a system to differentiate the hazardousness of wastes into “high,” “medium” and “low,” through NOMs (*Normas Oficiales Mexicanas),* to make them easier to manage.
- Allowing importers and exporters of hazardous waste to obtain a single authorization for the year for shipments of hazardous waste, rather than an authorization for each individual shipment.
- Establishing the possibility of transferring control of management of some “low” hazardous wastes to state governments (non-hazardous wastes have always been subject to state government regulation);
- Allowing disposal of hazardous waste in landfills ONLY in those cases where recycling or secondary materials recovery is not technically or economically feasible and prohibiting the disposal of liquid hazardous wastes in landfills; and
- Prohibiting the import of hazardous materials or wastes that have been banned from production or use in the country of origin.

The Amendments kept the major provisions of the General Law regarding export and import of hazardous wastes, including Article 153—prohibiting import for final disposal or storage, and Article 55—mandating return of hazardous waste by maquiladoras (Table 15).

Other important new regulations passed between 1994 and 1999 included:

- creation of a standard involving the management of medical waste;
- an agreement with the cement industry allowing for incineration of hazardous wastes;
- creation of a new hazardous waste tracking system; new regulations on reporting industrial accidents; and
- creation of a voluntary hazardous waste and toxic release reporting program.

Still, there are major gaps in Mexico's environmental regulations and several proposed standards have yet to be approved, including incineration standards, requirements for used lubricant treatment and PCB management, among others.

Table 15. Mexican government regulations and actions regarding hazardous waste since 1994

Regulation or Action	Description	Outcome
NOM-087-ECOL-95	Establishes requirements for separation, packaging, storage, collection, transport, treatment and final disposal of medical hazardous waste.	Has led to over 3,000 medical facilities having to manage their wastes as well as an increase in incinerators and other medical waste management facilities.
March 1996 agreement with cement industry	Allowed for temporary authorization for incineration in cement kilns.	Despite lack of official standard, has allowed virtually all cement plants in Mexico to burn liquid and solid hazardous waste.
November 1998 *Aviso de Retorno* system and creation of SIRREP database	Mexico announced that maquiladoras no longer needed to obtain *Guías Ecológicas* but could instead simply tell the authorities when they were returning hazardous wastes.	Has led to a more accurate count of hazardous waste from Mexico but has decreased obligations and oversight.
Environmental Emergencies Branch (DGEA)	As per 1996 amendments, created a government entity and center to provide information and gather statistics on industrial accidents, and enforce rules.	Led to much better statistical information on industrial accidents as well as governmental response.
NMX-XXX-SCFI-1999 Voluntary pollutant release and transfer registry, list of substances and reporting	Industries must report information to INE about air emissions; however, information about hazardous waste and toxic emissions is strictly voluntary.	Led to Mexico's first PRTR report, but only 5% of the participating industries supplied any voluntary data, and many industries did not participate at all.

As a response to the perceived lack of available landfills, Mexico has began promoting the establishment of a series of CIMARIs—Integrated Centers for Handling, Recycling and Disposal of Hazardous Waste. According to INE, the development of CIMARIs is intended to alleviate the country's lack of disposal facilities, and provide a full range of possibilities for waste treatment and recycling in a few central locations. As of 1998, eight Mexican companies—most of whom have a US partner—had been approved by INE as meeting the technological requirements to set up a CIMARI, though the standards have yet to be approved. However, the first company to attempt to open a "CIMARI" failed, due to citizen opposition and irregularities in the approval of an Environmental Impact Assessment.

As part of the process of promoting CIMARIs, INE has also created a "vulnerability atlas" for all of Mexico, including the entire length of the US-Mexico border. The idea was to determine the most appropriate sites for the management, treatment, storage and disposal of hazardous waste. Although the atlas is reported to be complete and was originally intended to produce social consensus on appropriate sites for CIMARIs, it never underwent public review and is only being used as "an instrument of support (Border XXI Working Group, 2000, 3)."

Federal Enforcement

Profepa continued to inspect, levy fines and close industries; on the other hand, it attempted to bring more industries into its National Environmental Auditing Program to correct problems through voluntary action rather than traditional enforcement. While the total number of inspections decreased slightly over the time period, the number of industries with major violations also decreased, while the number of minor violations increased slightly (Table 16). It is difficult to surmise whether this suggests better overall compliance with environmental regulations or simply that some companies with major violations were never inspected. The amount of inspections and compliance rates do not differ significantly between the border and the nation as a whole, whether looking at maquiladoras only or all border industries (Table 17). Total fines levied against companies totaled $100 million pesos between 1992 and 1997, including $50 million between 1995 and 1997 (Profepa 1998, Figure 5). These fines are small by US enforcement standards.

Table 16. Number of industrial inspections and environmental compliance rates over time, 1994–1999

Year	1994	1995	1996	1997	1998	1999
Inspections	12,902	12,881	13,224	11,761	9,590	8,671
% without violations	20.6	27.6	25.1	20.6	21.7	20.2
% with minor violations	75.7	70.3	72.9	77.4	76.7	78.1
% with major violations	4.1	2.1	1.9	2.0	1.6	1.7

Source: Profepa, *Indices de Cumplimiento de la Normatividad en México* (January 1999), Graphic 4.

Similarly, the number of companies participating in the auditing program increased during the 1994–1999 period, which Profepa cites as one of its rationales for reducing the universe of industries it has inspected in recent years. In all, Profepa reports that 1,439 facilities have undergone environmental audits, 133 of which have been certified as “Clean Industries.”

Beginning in 1996, Profepa also began promoting a system known as ICNA designed to measure actual compliance with environmental regulations. Preliminary data from 1998 to 2000 show that there was significant noncompliance with regulations for both hazardous waste generators as well as for hazardous waste service providers and medical management facilities (Table 18). Profepa points out that when data from the environmental auditing program are added, compliance rates improve. Still, the data clearly demonstrate that despite significant efforts to better enforce hazardous waste regulations both through inspections and auditing programs, compliance remains low in Mexico, particularly for basic reporting requirements.

Finally, Mexican authorities also began the task of identifying illegal waste sites contaminated with hazardous substances. Between 1995 and 1997, Profepa identified 166 contaminated sites, more than a third of which were located along the border (Table 19). Unfortunately, while authorities could order clean-up of several of these sites where existing operators were still in existence, Mexico has no environmental regulations similar to the Comprehensive Environmental Response, Compensation and Liability Act (the ‘Superfund’ Law), no specific soil clean-up standards and has no public funds expressly committed to clean-up functions.

Similarly, Profepa also keeps information on the number of industrial accidents. The number of accidents between 1994 and 1999 has remained fairly constant over these six years, with most accidents occurring outside the border region in the Gulf where its oil and gas operations occur.

Table 17. Inspections and compliance rates, border states versus nation, August 1992–June 2000

Category	All Border Facilities	Maquiladoras	Entire Nation
Total number of industrial inspections	20,768	6,911	91,879
Total shutdowns	200	29	571
% shutdowns	1.0	0.4	0.6
Partial shutdowns	519	172	2,104
% partial shutdowns	2.5	2.5	2.2
Total with minor violations	16,238	5,154	69,700
% with minor violations	78.1	74.5	75.9
Total without violation	3,811	1,556	19,504
% without violations	18.3	22.5	21.2

Source: Subprocuraduría de Verificación Industrial, Profepa web site.

Table 18. Average compliance rates (ICNA) in Mexico for hazardous waste generators and management companies, 1998–2000

Category	# of Facilities Assessed	Average Rate of All Facilities (%)	Average Rate of Large Facilities (%)	Average Rate of Medium Facilities (%)	Average Rate of Small Facilities (%)	Average Rate of Micro Facilities (%)
Hazardous waste generator	4,077	52.1	61.8	59.0	54.9	35.3
Hazardous waste management company	259	43.9	NR	NR	NR	NR
Medical waste management company	1,165	60.0	60.5	59.8	61.6	59.1

Source: Profepa 1999: Figures 7 and 8.

Table 19. Abandoned and illegal hazardous waste sites, 1995–1997

State	No. of Sites	Principal Wastes
Baja California	8	Solvents, heavy metals, foundry dust, oils
Chihuahua	13	Hydrocarbons, chemical compounds, used oils
Coahuila	15	Heavy metals, tailings, used oil, hydrocarbons, biological/infectious, chemical compounds
Nuevo León	22	Foundry slag, aluminum, lead, cadmium, nickel, oil, cyanides, hydrocarbons
Tamaulipas	8	Foundry slag, sand silica oils, phenols, chemical compounds, empty containers
National total	**166**	

Source: Profepa, Triannual Report, 1995–1997, 1998, Chapter V, Table 1.

4.2.2 Social Organizations

Citizens' and Community Organizations

Since NAFTA, Mexican citizens, community organizations and environmental organizations have increased their participation and input into decisions regarding management of hazardous wastes. They have also consistently demanded better environmental information from Mexican authorities.

Revisions to the new General Law addressed the possibility for social participation and access to environmental information. For example, under Article 159 bis-3 "Right to Environmental Information," the Secretary of Environment, Natural Resources and Fishing (Semarnap) is required to develop a publicly accessible environmental information system. In addition, one of the newest aspects is the obligation of any state, local or federal environmental authority to answer each and every request for environmental information within 20 days, as well as the community's right to present an administrative appeal should their request be denied. However, the law allows the environmental authorities to deny the request for a number of rationales. In the experience of communities and organizations, the ability to both obtain information and win an administrative appeal has been extremely difficult since NAFTA, although access to some types of information has improved.

Community groups and local leaders continued to oppose new landfills in Mexico. For example, in Hermosillo, community groups protested the removal of the waste from the abandoned "Alco Pacifico" battery-smelting operator near Tijuana to a Spanish-owned landfill in Hermosillo called "CYTRAR," which was closed in 1998 by Mexican authorities. Similarly, Mexican groups, citizens and some political leaders were instrumental in opposing a proposed hazardous waste landfill between Torreón and Saltillo in the State of Coahuila, which has not been approved.

Citizens have also continued to take advantage of provisions in the General Law to register complaints, or *denuncias populares* with Profepa. Many of these have been in the border region. Between 1995 and 1997, citizens filed 17,200 environmental complaints with Profepa's state and central offices, a significant increase since 1994. Nevertheless, only one percent of these complaints were related to management of hazardous wastes, with the majority involving air emissions and improper forest management (Profepa1998, Chapter IV).

Finally, some groups have begun to take advantage of the NAFTA side agreement provisions through the North American Commission on Environmental Cooperation. In 1998, the Environmental Health Coalition, a US NGO, and the *Comité Ciudadano de Tijuana* filed a complaint against the Mexican government for failing to enforce its laws against *Metales y Derivados S.A.,* an abandoned battery smelter which has sat outside Tijuana for six years after Mexican authorities shut it down. In May of 2000, the CEC Council instructed the Secretariat to proceed with a factual record of the case. Similarly, separate human rights organizations in Sonora have submitted claims with the CEC, alleging that Mexico has failed to enforce environmental laws against a company called Molymex, which processes residues from both US and Mexican companies, as well as against Mexican authorities for allowing operation of the CYTRAR landfill in Hermosillo without an Environmental Impact Assessment, among other charges.

The Waste Management Industry

The hazardous waste management sector grew tremendously between 1992 and 2000 as INE, Mexico's permitting authority, continued to permit a number of treatment, recycling and incineration facilities for both medical hazardous and industrial hazardous waste (see section on Waste Disposal Capacity).

Much of this increase was spurred by the adoption of new policies and standards in Mexico. In 1995, Mexico approved regulations for the treatment and incineration of medical hazardous wastes, which forced hospitals and other medical facilities generating hazardous waste to characterize and treat their wastes or send them off-site to disposal facilities. Many private companies established autoclave and incineration facilities to offer medical waste management services.

In addition, the Mexican government actively promoted the fuel blending of liquid—and, in some cases, solid—wastes and the subsequent incineration in cement kilns as a means to reuse and manage hazardous wastes in Mexico. Toward this end, Mexican federal authorities began granting cement kilns temporary authorizations back in 1991. In March of 1996, authorities signed an agreement with the cement industry to allow burning of hazardous wastes through temporary permits. Thus, all 26 authorizations for cement kilns and in some cases, electrical plants, to burn hazardous wastes are based upon test burns and temporary authorizations, not upon a standard approved by the Mexican government through a public process (Table 20). In fact, a proposed incineration standard specifically excludes the burning of hazardous wastes in cement kilns.[7]

These openings in the hazardous waste industry have led foreign companies to become involved in the Mexican market. As detailed in Appendix A, the leading cement manufacturers in Mexico sought outside technical and financial help from US-based companies to open fuel blending facilities and begin burning hazardous wastes in their kilns. In addition, Chemical Waste Management began providing technical assistance and support for the construction of a new fuel blending plant at RIMSA's hazardous waste landfill in Nuevo León in 1994. The association between the largest hazardous waste management company in Mexico and the largest in the US shows the opportunity that foreign companies see in the Mexican market. Under their agreement, RIMSA also collects and exports wastes contaminated with PCBs to Waste Management Inc. facilities in the US.

Table 20. Cement plants which burned hazardous waste in Mexico, 1997

Cement Company	No. of Plants	No. of Plants Burning Hazardous Wastes	Amount Burned in Tonnes, 1997
Cemex	18	5	23,000
Apasco	6	6	20,000
Cruz Azul	2	2	17,000
Moctezuma	2	1	11,000
Cementos de Chihuahua	3	0	0
Total	**31**	**14**	**71,000**

Notes: Each plant receives its "alternative waste" from different sources. *Cementos de Chihuahua* currently does not burn hazardous wastes or tires, but does have a permit to test burn hazardous wastes and recently was granted a permit to blend fuels at its plant in Samalayuca.

Source: Dr. Ramón Farías, Director of Energy, CEMEX, Speech Given at US-Mexican Foundation for Science Conference, Monterrey, Mexico, September 11, 1998.

Foreign and domestic companies have also attempted to open hazardous waste landfills in Mexico since NAFTA, with limited success (Table 21). In addition to the Rimsa facility, until the end of 1998 a hazardous waste landfill had been operating just seven kilometers outside Hermosillo, Sonora. Originally built by the Ford Corporation to dispose of their own hazardous wastes, the Spanish firm Tecmed purchased and began operating the hazardous waste landfill in 1994. In 1998, the landfill began receiving shipments from Alco-Pacífico, an abandoned lead smelter located just outside of Tijuana. However, after citizen opposition and protest and a lawsuit, INE revoked the licensing permit of Cytrar, ordering the company—owned by the Spanish company Tecmed—to cease operations by November 20 (Jacott 2000, 42). The company is currently not operating in Mexico but has filed a Chapter 11 complaint with the International Center for the Settlement of Investment Disputes (Nauman 2000).

Table 21. Hazardous waste landfills which had operating permits in Mexico, 1998

Facility Name	Location
Ciba-Geigy	Atotonilquillo, Jalisco
Confin (1)	Guadalcazar, San Luis Potosí
Rimsa	Mina, Nuevo León
Cytrar (1)	Hermosillo, Sonora

Notes: (1) Not in operation.

Source: *Instituto Ecológico de México,* Information from web page <http://www.ine.gob.mx/dgmrar/ri/list-ea/rubro7.htm>, April 1999.

[7] PROY-NOM-098-ECOL-2000 "Inciso 2" specifically excludes cement kilns from having to meet the standards established in the proposed NOM.

Similarly, Metalclad subsidiaries attempted to open hazardous waste landfills in Aguascalientes and San Luis Potosí, but met stiff opposition, including from local and state regulators. In January 1997, Metalclad Corporation filed a Chapter 11 complaint in October 1997, through the International Center for the Settlement of Investment Disputes, alleging that the Mexican state of San Luis Potosí violated NAFTA's investor rights provisions when it prevented the company from opening its 360,000 tonne-per-year hazardous waste disposal landfill, in essence "expropriating" its property. The company sought US$90 million in damages.

On August 30, 2000, the three-member tribunal ruled in Metalclad's favor, ordering Mexico to pay US$16.7 million in damages for failing to protect the company's rights as an investor. The Chapter 11 decision occurred behind closed doors. In the meantime, however, the company decided to divest itself of its Mexican operations, including its two San Luis Potosí-based companies, *Ecosistemas del Potosí* and *Confinamiento Técnico de Residuos Industriales* (Metalclad 2000, 10).

Finally, in 1997—*Servicios Ambientales de Coahuila*—proposed building a "CIMARI" just north of the town of General Cepada, Coahuila, between Saltillo and Torreón, near an important water reservoir and migratory bird sanctuary, the Presa de Tulillo. A $70 million joint venture between RACT, a Utah-based management company, and CleanMex, a Tamaulipas company, the landfill and recycling facility now appears stalled due to opposition from farmers, ranchers, residents of Saltillo and Torreón and Mexico's political opposition parties. The site was supported and approved in virtual secrecy by the local municipality and a "preventative study" was approved by INE. After plans for the facility became public, INE declared that a more rigorous environmental impact statement (EIS) would be required in order for a permit to be issued (Jacott 2000, 44).

4.2.3 Disposal Capacity

Public capital and operating investment in all solid waste management declined slightly between 1990 and 1996, in large part of the contraction of the economy, although parastatal companies like CFE and PEMEX did invest significant amounts of money in managing hazardous wastes. Overall, total public environmental investment rose slightly over the period, mainly in water and wastewater infrastructure.[8] Similarly, the total amount of money spent by the public sector in environmental protection also declined slightly from 1990 to 1998, from 0.38% to 0.25% of the total Gross Domestic Product (INEGI 2000).

However, since 1996, there has been significant investment in new private hazardous waste facilities. By 2000, INE reports that there were more than 500 facilities which had authorizations to collect, store, recycle, treat, incinerate or landfill hazardous wastes, a huge increase since 1994 (Table 22). About 40 percent of these facilities were located in one of the six border states, indicating there is substantial infrastructure in this part of the country. In addition, since the 1995 standards requiring treatment and/or incineration of medical waste were adopted, more than 56 facilities have been authorized. There has also been a large increase in authorizations to incinerate hazardous wastes in cement kilns (Table 23). Unfortunately, the Mexican government has not conducted a public capacity assessment detailing the total capacity or current hazardous waste management of these industries. Under the nation's first attempt at a national pollutant release and transfer register—known as the RETC in Mexico—only six hazardous waste management companies reported any information to Mexican federal authorities (Semarnap 1999, Appendix).

[8] Figures prepared by Semarnap for a report to the OECD on investment in pollution abatement and control.

Table 22. Geographic distribution of hazardous waste collection, storage and management facilities in Mexico

State or Region	Collection and Transport	Storage	Reuse	Recycling	Treatment	Burning (1)	Landfills	Total
	Number of Permits or Authorizations							
Baja California	25	9	0	8	0	2	0	44
Coahuila	12	0	0	5	1	2	0	20
Chihuahua	17	6	0	2	0	0	0	25
Nuevo León	61	14	0	17	4	1	1	98
Sonora	3	2	0	3	0	0	0	8
Tamaulipas	16	8	0	1	4	0	0	29
Border Total	**134**	**39**	**0**	**36**	**9**	**5**	**1**	**229**
National Total	**262**	**82**	**4**	**119**	**40**	**37**	**2**	**546**

Note; Burning includes incinerators, cement kilns and aggregate kilns. Fuel blending is considered in treatment.

Source: INE, as reported in web site <http://www.ine.gob.mx/dgmrar/ri/infra-rip.htm> with some information updated.

Table 23. Increase in authorized facilities for hazardous waste management, including medical waste, 1992–1999

Permits and/or Authorizations	1992	1993	1994	1995	1996	1997	1998	1999	20000	Total
Reuse of used solvents	0	1	0	0	0	0	1	3	0	5
Recycling of used drums	0	1	3	0	0	1	16	13	5	39
Recycling of dirty solvents	0	4	5	1	1	1	7	2	3	24
Recycling of photographic fixing liquid	0	0	0	0	0	0	1	3	1	5
Recycling of used lubricants	0	2	2	2	1	3	1	4	0	15
Recycling of metals	0	0	3	1	0	2	5	5	2	18
All Recycling and Reuse Facilities	**0**	**8**	**13**	**4**	**2**	**7**	**31**	**30**	**11**	**101**
Fuel blending plants	0	1	2	0	0	0	5	9	2	19
Treatment of PCB contaminated materials	0	0	0	2	1	2	1	0	0	6
Treatment of remnants on-site	0	1	11	1	0	0	4	16	2	35
Treatment of infectious biological remnants	0	0	0	0	0	0	8	11	4	23
Treatment of dangerous remnants	0	1	0	0	1	1	3	5	5	16
All Treatment Facilities	**0**	**2**	**11**	**3**	**2**	**3**	**16**	**32**	**11**	**80**
Incineration of alternative fuel	1	0	0	0	1	1	7	16	0	26
Incineration of dangerous remnants	0	1	0	0	0	0	3	3	2	9
Incineration of biologically infectious remnants	0	0	0	0	0	0	1	8	5	14
All Incineration Facilities	**1**	**1**	**0**	**0**	**1**	**1**	**11**	**27**	**7**	**49**
Final disposal	0	3	0	0	0	0	0	0	0	3
Totals	**1**	**15**	**26**	**7**	**5**	**11**	**63**	**98**	**31**	**252**

Note: Because some facilities perform more than one type of hazardous waste management, the total number of facilities is less than the total number of permits.

Source: INE, information from web site.

4.2.4 Waste Generation

Between 1994 and 1999 the number of companies which had the potential to generate hazardous wastes increased substantially. For example, the chemical, petrochemical, plastics and rubber sector increased its value-added production from 36.2 billion to 43.4 billion pesos (set at 1993 levels), while the metal, iron and steel industries increased their value from 20.5 billion to 29.4 billion over the same period (INEGI 2000). Similarly, the number of maquiladoras also rose, both along the border and more rapidly in Mexico's interior (Table 24). Not only did the total number of plants and employees increase during this period, but the use of raw materials and foreign inputs also increased, meaning that the wastes generated from these inputs had to be exported back to the country of origin as per Mexican law (Table 25).

Despite the increase in production in facilities believed to produce large amounts of hazardous waste in Mexico, public data on the amount of hazardous waste generated are extremely poor. INE reported that in 1999, only 13,245 companies in all of Mexico actually reported generating hazardous waste, even though officials believed that more than 100,000 companies have the potential to do so. These industries reported generating 3.3 million tonnes of hazardous waste in 1999, a total which is far below the 1994 estimate of 8.0 million and the 1997 estimate of 10.0 million (Table 26). Interestingly, some states actually reported totals above 1994 estimates, showing how compliance with reporting requirements vary widely by state and indicating that INE's estimates may actually be very conservative.

In 1998, Profepa estimated that there were 28,077 industries in Mexico with the potential to produce hazardous wastes which come under federal jurisdiction (Profepa 1998: Table 1), meaning the figures provided by INE in 1999 represent less than half of those who should be reporting hazardous waste generation to federal authorities.

Table 24. Number of active maquiladora plants by state and year, 1990–2000

Year	National Total	Total Border States	Baja California	Coahuila	Chihuahua	Nuevo León	Sonora	Tamaulipas
1990	1,703	1,527	640	133	311	65	155	225
1991	1,914	1,820	708	151	336	79	161	259
1992	2,075	1,828	775	172	351	82	170	278
1993	2,114	1,850	804	176	337	84	168	279
1994	2,085	1,801	761	177	304	83	179	297
1995	2,130	1,776	729	184	322	84	176	281
1996	2,411	1,973	793	212	371	99	192	307
1997	2,717	2,204	904	244	402	110	222	323
1998	2,983	2,367	1,018	261	383	119	245	342
1999	3,297	2,552	1,125	272	401	131	263	360
2000	3,506	2,694	1,174	278	448	150	277	367

Source: INEGI. *Industria Maquiladora de Exportación. Estadísticas Económicas.* April 2000.

According to an analysis conducted by the Mexican government in 1996, the leading categories of hazardous waste in Mexico are solids (498,000 tonnes), liquid residuals (361,000 tonnes), spent solvents (249,000 tonnes) and used oils (319,000 tonnes) (INE October 1999). The same analysis found that the leading industrial producers of hazardous wastes were the chemical, petro-chemical, rubber and plastic subsector (37 percent), the metal products, machinery and equipment subsector (15 percent), the mineral products industry (7.98 percent) and the basic metal industry (7.4 percent) (INE October 1999).

Table 25. Average monthly value-added production and imported inputs of maquiladora plants in Mexican border states (Millions of constant 1994 pesos, percent)

Year	Average Monthly Value-Added Production	Monthly Value of Imported Inputs	Inputs that were Imported (%)
1994	1,516	5,594	99.1
1995	1,704	11,243	98.9
1996	1,857	17,124	99.6
1997	2,268	22,146	98.6
1998	2,637	26,401	98.3
1999	3,000	40,450	98.2
2000	3,074	33,916	98.4

Source: INEGI, *Industria Maquiladora de Exportacion. Estadísticas Económicas*. April 2000.

Table 26. Variation between 1994 estimate of hazardous waste generated in Mexico and 1999 reported hazardous waste generated in Mexico (Tonnes)

	1994	Sep. 1999	Sep. 1999	Variation (1994–1999)	
State	Estimated Hazardous Waste Generation (tonnes/year)	No. of Companies Reporting	Reported Hazardous Waste Generation	Reduction in Tonnes	Increase in Tonnes
Baja California	160,000	75	29,508.47	130,491.53	-
Coahuila	300,000	1,020	2,359.34	297,640.66	-
Chihuahua	210,000	203	779,223.06	-	569,223.06
Nuevo León	800,000	950	47,788.35	752,211.65	
Sonora	145,000	545	4,082.00	140,918.00	
Tamaulipas	150,000	409	218,576.20		68,576.20
All Border States	1,765,000	3,202	1,081,537.47	683,463	
National Total	**8,000,000**	**13,245**	**3,328,045.29**	**4,671,954.8**	

Source: For 1994: INE, *Programa para la Minimización y el Manejo Integral de los Residuos Industriales Peligrosos en México*. 1996–2000 and INE, web site <http://www.ine.gob.mx/dgmrar/ri/generacion.htm>, 2000. As cited in: *Indicadores de Desarrollo Sustentable en México*. INEGI/Semarnap 2000.

4.2.5 Transboundary Waste Flows

Imports

According to information from Mexico's *Guías Ecológicas,* hazardous wastes imported from the US increased from 1995 to 1999 (Table 27).[9] While detailed information is not available, the majority of these wastes are electric arc dust containing zinc and other metals recycled in Monterrey at *Zinc Nacional*. Other imported wastes include empty hazardous waste containers, lead batteries and accumulators.

Currently, Mexico has not authorized the import of hazardous wastes solvents, oils and paints that can be blended and burned at cement kilns. However, if Mexico were to allow such an import, as some companies have requested, it could significantly increase the import of hazardous wastes into Mexico for their eventual incineration.

[9] Since 1995, the Mexican government has been reporting the import and export of hazardous waste through a computer database that incorporates all of its *Guías Ecológicas.* However, there is no public information available on where these wastes are actually generated, where the wastes go, what transport companies are used, and which companies comply adequately with import and export regulations.

Table 27. Imports of hazardous wastes from the US to Mexico, 1995–1999

Year	Tonnes of Hazardous Waste
1995	158,543
1996	230,417
1997	223,713
1998	284,921
1999	254,537

Source: INE, web site and as cited in Binational Solid and Hazardous Waste Working Group Border XXI, Progress Report, unpublished, Figure 7.

Exports

There are two sources of the export of hazardous wastes from Mexico to the US. On the one hand, under Article 153, Fraction VI, maquiladoras and other industries that import raw materials under temporary import rules must re-export the resulting wastes to the country of origin. On the other, some national Mexican companies have also exported hazardous wastes into the US, in part because of the lack of capacity to treat hazardous wastes in Mexico.

According to information from Mexico's *Guías Ecológicas,* maquiladoras exported 33,187 tonnes of hazardous wastes in 1995, a total that increased to 83,469 tonnes in 1998 (Table 28). In 1999, INE reported that total declined to 51,704 tonnes. Nonetheless, this decrease is largely a paper reduction. Mexico developed its new "SIRREP" hazardous waste tracking computer system and changed the reporting requirement for maquiladoras from *Guías Ecológicas* to an *Aviso de Retorno* or literally, a "Return Warning," in which maquiladoras report their shipments of hazardous wastes five days before they actually ship the waste. Non-maquiladora companies continue to use the *Guía Ecológica.* INE reported that plastic recipients, inorganic acids, pigments, paints and resins were the leading hazardous wastes exported.

Table 28. Exports of Hazardous Wastes by Maquiladoras and National Industry, 1995–1999

Year	Tonnes of Hazardous Waste Exported by Maquiladoras to US	Tonnes of Hazardous Waste Exported by National Industry to US	Total Hazardous Waste Exported Mexico to US
1995	33,187	5,753	38,940
1996	72,982	5,079	78,061
1997	77,692	9,950	87,642
1998	83,469	21,282	104,751
1999	51,704*	31,828	83,532

Note: * This number was generated by a new computer tracking system known as SIRREP, which reports actual shipments rather than the amount permitted to be shipped.

Source: INE, web site and as cited in Binational Solid and Hazardous Waste Working Group Border XXI, Progress Report, unpublished, Figure 4.

In addition, INE reports that its national industry exported an additional 31,828 tonnes in 1999, a significant increase from 1995. INE reports that the leading wastes exported were solids containing vanadium pentoxide—a catalyst used in the production of acids—used acid batteries and used catalyzers, wastes for which Mexico lacks treatment capacity.

4.3 Canada

4.3.1 Government Policy

Federal Laws and Regulations

The federal government has been gradually moving towards strengthening its role in the international and interprovincial movements of hazardous wastes. This has largely been a result of the need to implement obligations under the Basel Convention, ratified in 1992, and its amendments.

Revisions to the Canadian Environmental Protection Act (CEPA) adopted in 1999, grant the federal Minister of the Environment explicit authority to refuse to authorize waste import or export, even where a province agrees to it, if he or she believes that the waste in question will not be managed in manner that will protect the environment and human health against adverse effects (CEPA 1999, s.185(2)). The Act also permits the Minister to require that waste exporters to develop and implement plans to reduce or phase-out their export of wastes for final disposal (CEPA 1999, s. 188).

The revised CEPA permits the federal government to make regulations regarding emergency prevention, preparedness, response and recovery (CEPA 1999, s. 200). However, no regulations have been made under these provisions. The Act also permits emergency plans to be required from facilities manufacturing, processing or otherwise using substances that have been found to be ‘toxic’ for the purposes of the Act (CEPA 1999, s.199). Similarly, the Act permits the Minister of the Environment to require the development of pollution prevention plans by facilities that process, manufacture or otherwise use substances that are declared ‘toxic” for the purposes of the Act (CEPA 1999, s. 56). However, no emergency planning or pollution prevention planning requirements have been established to date.

The federal Minister of the Environment has indicated that the development of national standards for “environmentally sound management” for purposes of the implementation of Canada’s Basel Convention commitments through CEPA will occur through the Canadian Council of Ministers of the Environment (Anderson, March 2000). The Council is made up of the federal, provincial and territorial Ministers of the Environment, and operates on a consensus-based decision-making model.

Federal Enforcement

The level of enforcement activity by Environment Canada related to the CEPA hazardous waste import/export regulations remained stable between 1994/95 and 1996/97 (Table 29). In October 1997, the Auditor-General of Canada tabled a report in Parliament that raised serious questions about the effectiveness of the federal government’s controls on the transboundary movement of hazardous wastes (Auditor-General of Canada 1997). The report focused on imports and exports of wastes to and from Canada.

The federal government departments and agencies identified in the Audit were reported as having agreed to implement the Auditor-General’s recommendations. There was a doubling of the number of inspections related to the regulations between 1996/97 and 1997/98.

However, in a follow-up report tabled in May 2000, the Commissioner for Environment and Sustainable Development stated that he was “not satisfied” with the progress that federal departments had made in addressing the 1997 findings. The Commissioner concluded that Canada was still not in a position to know the extent to which it was fulfilling its international obligations to prevent illegal traffic of hazardous waste at the border, and that there still was no comprehensive plan to address long-standing and significant gaps in the enforcement of the transboundary hazardous waste movement regulations (Commissioner for Environment and Sustainable Development, May 2000, 9-9 – 9-11).

Table 29. Environment Canada enforcement of CEPA hazardous waste import/export regulations

Year	Inspections	Investigations	Warnings	Prosecutions	Convictions	Acquittals
1994/1995	170	11	8	1	1	
1995/1996	158	15	4	9	1	
1996/1997	153		4	2		
1997/1998	362	7	4	2	1	

Source: CEPA Annual Reports, 1994–98.

Provincial Laws and Regulations

Following the 1995 provincial election, the Ontario Ministry of the Environment suffered a 40 percent cut to its operating budget, and a 42 percent reduction in staff.[10] In addition the provincial government advanced proposals for the significant weakening of the regulatory regime for hazardous waste in July 1996, January 1997 and November 1998, especially with respect to the "recycling" of hazardous wastes (Ontario Ministry of the Environment and Red Tape Commission). The bulk of these proposed changes have not been implemented to date, largely as a result of a number of incidents occurring at waste handling facilities in the province in the late 1990s (Office of the Fire Marshall 1997).[11]

However, major 'reforms' to the approvals' process for waste disposal sites have been implemented. Changes to the *Environmental Assessment Act* adopted in 1996 removed requirements from the Act that the need for proposed facilities, and the availability of alternative ways of meeting those needs be considered in the environmental assessment process. The amendments also granted the Minister of the Environment much wider discretion to refuse to grant public hearings with respect to environmental assessments. At the same time, legislation which had provided funding to *bona fide* public interest intervenors in the environmental approvals' process was permitted to expire and not renewed.

In addition, specifically with respect to hazardous waste imports, the provincial Minister of the Environment wrote to his federal counterpart in February 1997, waiving the province's right to review proposed imports under CEPA Hazardous Waste Import/Export Regulations. In effect this meant that the province would accept any waste import without review (Lindgren, August 1, 1999).

Provincial Enforcement

Provincial environmental law enforcement efforts have been in general decline since the mid-1990s due to the loss of capacity resulting from budgetary reductions. In Ontario, for example, fines for environmental offences fell from over $3 million in 1995 to $864,000 in 1998 (Winfield, Figure 1.3). In addition, the province ceased publication of its annual reports on enforcement activities in 1995.

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[10] These figures are for the end of the 1999/00 fiscal year, based on a 1994/95 base year. See CIELAP *Ontario's Environment and the 'Common Sense Revolution' A Fifth Year Report (*Toronto: Canadian Institute for Environmental Law and Policy, October 2000).

[11] The most prominent of these was a fire at the Plastimet PVC recycling facility in Hamilton, Ontario, in July 1997.

4.3.2 Social Organization

Citizens' and Community Organizations

The ability of community groups and public interest organizations to influence the approvals' process for hazardous waste disposal facilities has been significantly weakened by the combination of the elimination of intervenor funding, and the 'streamlined' approvals' process.

Since 1995 in Ontario for example, major expansions of existing disposal facilities,[12] and the establishment of new facilities[13] have been approved without public hearings. In other cases, authorities approved new disposal capacity without review under environmental assessment legislation.[14] This has severely limited the scope of public interventions where hearings have been held.

In addition, in some more remote locations, local government and public support for new disposal capacity has emerged. Examples of such developments have included Swan Hills, Alberta, and Kirkland Lake, Ontario. New or expanded hazardous waste disposal facilities have been seen as development opportunities in these economically distressed communities.[15]

4.3.3 The Waste Management Industry

The regulatory 'reform' initiatives undertaken by provincial governments from the mid-1990s onwards were clearly intended to address the concerns of industry, including the hazardous waste disposal sector. The Ontario Red Tape Commission, for example, has described its proposals to significantly weaken regulatory controls on hazardous waste management as seeking to:

> "address the concerns of business that waste regulations be overhauled to provide consistency and clarity, remove barriers to recycling, and to implement a risk-based approach." (RTC , 65).

Similarly, the Ontario Ministry of the environment's July 1996 *Responsive Environmental Protection* regulatory reform white paper spoke of:

> "providing flexibility and certainty industry needs to ensure jobs and economic growth" (Ontario Ministry of the Environment 1996, 15) and providing "less red tape for the regulated community" (Ontario Ministry of the Environment 1996, 46).

The ability of the industry to influence public policy in this area position may be further strengthened by impact of NAFTA investor-state provisions. In September 1998, S.D. Myers Ltd., a US firm brought forward a case under Chapter 11 of the Agreement seeking compensation for the a ban on the export of Canadian PCBs to the United States for disposal put in place by the Canadian Government between November 1995 and February 1997 (Scoffield, September 1, 1998). The company had sought to import Canadian PCBs for destruction during that period.

In November of 2000, the tribunal ruled in S.D. Myers' favor, finding that by enacting the ban Canada treated US investors less favorably than its own and that the ban was not the least trade restrictive measure available to protect public health and the environment (McArthur, November 14, 2000). In this case, NAFTA's investor protection rules were used to seek compensation even though the "investor's" facilities were not located in the country from which it sought damages.

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12 Laidlaw Landfill, Sarnia, September 1997.

13 Taro "non-hazardous" industrial waste landfill in Stoney Creek

14 For example, the Gary Steacy Dismantling Ltd., low-level PCB incinerator in Northumberland County, Ontario, December 1997, and SRBP high-level PCB incinerator in Cornwall, Ontario, December 1999.

15 On Kirkland Lake see "Bennett files application" (editorial), *Northern Daily News*, March 30, 2000.

4.3.4 Disposal Capacity

The situation with respect to hazardous waste disposal capacity has changed dramatically in Canada since the early 1990s. This began with an expansion of the ASWMC facility in Swan Hills, 1992, followed by the opening of the facility to out of province wastes in November 1994 (Feschuk, November 23, 1994).

The relaxed approvals environment has also facilitated the bringing of new disposal capacity on-line in Ontario and Quebec and additional expansions are being planned.

New facilities approved in Ontario since 1995 include the following:

- July 1996: Philip Environmental Services Corporation's Taro East Landfill in Stoney Creek, approved to receive up to 10 million tonnes of "industrial non-hazardous" waste over a period of 20 years. The facility was subsequently used to dispose of hazardous waste rendered "non-hazardous" through a solidification process at various facilities in Hamilton and Toronto.
- September 1997: A 1.9–million-tonne expansion of the Laidlaw/Safety-Kleen commercial hazardous waste landfill in Corunna approved.
- November 1997: The use of a scrap metal smelting furnace by Gary Steacy Dismantling Ltd. approved for the destruction of low-level PCB wastes in Northumberland County, with a capacity of up to 1.8 million liters of transformer fluids and 700 tonnes of waste fluorescent light ballast (Environmental Assessment Board, December 1997).
- May 1998: A facility to remove PCBs from electrical equipment operated by the US based firm Trans-Cycle Industries Ltd. approved in Kirkland Lake, Ontario, with an approved capacity of 101,000 tonnes of waste per year. The facility is approved to receive wastes from all provinces. The facility applied for a permit to receive wastes from Basel [Convention] and OCED countries, which was denied in December 1999.[16]
- November 1999: The use of a modified scrap metal smelting furnace by SRBP Resource Recovery approved for high level PCB incineration in Cornwall. The facility is approved to receive up to 130 tonnes of liquid mercaptan residues, 1,250 tonnes of other mercaptan wastes, and up to 4,380 tonnes of PCB wastes per year with no restrictions on sources (Environmental Assessment Board, November 1, 1999). The approval is currently under appeal to the Ontario cabinet.

Bennett Environmental Inc. announced the development of an incineration facility for the treatment of up to 200,000 tonnes per year of soil contaminated with chlorinated and non-chlorinated organic compounds in Kirkland Lake in November 1999. The facility, which would receive both Ontario and out of province and out of country wastes, is currently in the approvals' process.

New disposal capacity in Quebec approved in the past few years has included:

- October 1997: An incineration facility for the treatment of soil contaminated with chlorinated and non-chlorinated organic compounds to be operated by Bennett Environmental Inc. in St. Ambroise approved. The facility, with a capacity of 60,000 tonnes per year, commenced operations in 1998, and receives waste from Canadian and US sources.
- Stablex: recent permit revisions will allow the facility to increase its waste intake from 100,000 to 125,000 tonnes per year. The facility reports a 49 percent increase in waste

[16] EBR Registry No.IA0E0790.

volumes since 1995, with 40 percent of the wastes handled currently originating in the United States (Stablex Canada 2000).

4.3.5 Waste Generation

No reliable data on total waste hazardous waste in Canada are available. The only available estimates are for Ontario from 1986 to 1991, with waste generation closely following overall levels of economic activity.

The only other national data available on waste generation are through the National Pollutant Release Inventory (NPRI). The NPRI showed a significant overall increase of 22.6 percent in total waste transfers to disposal from 1995–1997. Indeed, reductions in total releases being reported through NPRI are being overwhelmed by these increases in transfers, with the implication that no progress is being made on reducing total waste generation (Environment Canada 1999, Table 3 and CEC 2000, Table 5-29).

More reliable data for off-site transfers of hazardous waste are available through the provincial hazardous waste manifesting systems. However, detailed analyses of these data have only been performed for Ontario. This shows a dramatic growth (41.8 percent) in off-site transfers between 1994 and 1998, the most recent year for which data are available (Yacoumides, June 2000, Table 1). This follows period of a close relationship between overall economic activity and waste seen between 1987 and 1993 (Winfield 1999, Figure 2).

Although a portion of this increase can be accounted for by changes in disposal practices for landfill leachates, the data show a 23.8 percent growth in the generation of wastes from industrial sources. This is consistent with NPRI data on off-site transfers in Ontario, showing a 26.1 percent increase in transfers to treatment/disposal between 1995–97 (Environment Canada 1999, Table 29). The growth in transfers from industrial sources has been concentrated in the steel and chemical industries (CEC 2000, Table 4-52).

The limited data available through the NPRI show similar trends for Quebec, with a 28 percent increase in off-site transfers to disposal or treatment reported between 1995–1997 (Environment Canada 1999, Table 31).

4.3.6 Transboundary Waste Flows

Imports

Data gathered by Environment Canada regarding transboundary waste movements from 1987 to 1999 indicate a dramatic growth in hazardous waste imports, from 129,476 in 1987 to more than 660,000 tonnes in 1999 (Table 30). Imports had remained stable until 1993 and then began to accelerate rapidly from 1994 onwards. Nearly 99 percent of imports are to the provinces of Ontario and Quebec, and are almost entirely from the US.

Environment Canada data indicate that waste imports to Ontario grew from 52,510 tonnes in 1991 to 325,000 tonnes in 1999, with a rapid acceleration occurring after 1993. Analysis of Ontario hazardous waste management manifest data for the 1994–1998 period indicate that the key waste classes involved in the growth are other specified organics (+460 percent) other specified inorganics (+333 percent) and aromatic solvents (+265 percent) (Yacoumides, June 2000, Table 37). The largest increases in imports have been to landfill (+257 percent), processing (e.g., solidification) (+129 percent) and incineration (+113 percent) (Yacoumides, June 2000, Table 38). The leading sources of exports to Ontario are the states of Michigan, New York and Ohio (Yacoumides, June 2000, Table 30).

Table 30. Imports of hazardous waste to Canada by province, 1993–1999 (Tonnes)

		AB	BC	MB	NB	NS	ON	PQ	SK	Canada
1993	Recycling									
	Disposal									
	Total						**56,439**	**71,727**		**132,992**
1994	Recycling									246,359
	Disposal									95,806
	Total						**129,118**	**205,587**		**342,165**
1995	Recycling									272,025
	Disposal									111,109
	Total							**229,497**		**383,134**
1996	Recycling	287	11,364		258		95,691	203,593	389	247,305
	Disposal	0	46		0		94,726	60,260	0	219,309
	Total	**287**	**11,410**		**258**		**190,417**	**263,853**	**389**	**466,614**
1997	Recycling						88,365	176,952		272,917
	Disposal						158,000	56,434		214,434
	Total	**343**	**6,669**		**589**		**246,365**	**233,386**	**0**	**487,351**
1998	Recycling	415	1,696		311		114,543	194,289	2,997	314,252
	Disposal	0	329		0		173,511	57,281	0	231,120
	Total	**415**	**2,025**		**311**		**288,054**	**251,570**	**2,997**	**545,372**
1999	Recycling	226	2,241	0	1,621		84,642	181,958		270,688
	Disposal	0	1,029	75	0		239,912	151,189		392,205
	Total	**226**	**3,270**	**75**	**1,621**		**324,554**	**333,147**		**662,893**

The key facilities receiving imports include the Laidlaw/Safety-Kleen landfill and incineration facility in Corunna, the Safety-Kleen oil and solvent recovery facility in Breslau, and the Philip Environmental Services facilities in Hamilton and Toronto (CEC 2000, Tables 4-59 and 4-60 and Yacoumides, June 2000, Table 31).

Imports to Quebec grew from only 75,000 tonnes in 1993 to 333,000 by 1999. While in past years, more than 70 percent of the waste has gone to recycling facilities, in 1999, more than 45 percent went to disposal facilities, indicating a significant growth in landfilling and incineration. The key facilities receiving imports include the Stablex solidification facility in Blainville and the Laidlaw/Safety-Kleen incineration facility in Mercier (CEC 2000, Tables 4-59 and 4-60).

Exports

Hazardous waste exports from Canada stabilized at approximately the same time that waste imports began to accelerate, after a period of growth in the late 1980s and early 1990s. Exports grew from 230,000 to 280,000 tonnes between 1993 and 1998, before declining to about 270,000 tonnes in 1999 (Table 31). Hazardous exports from Canada originate mainly from Ontario and Quebec, although Manitoba and British Colombia also export significant amounts. Virtually all of the waste exported from Canada is sent to the US.

Table 31. Exports of hazardous waste from Canada by province, 1993–1999 (Tonnes)

		AB	BC	MB	NB	NS	ON	PQ	SK	Canada
1993	Recycling									
	Disposal									
	Total						**156,945**	**29,387**		**229,648**
1994	Recycling									94,211
	Disposal									74,023
	Total									**168,234**
1995	Recycling									126,554
	Disposal									99,435
	Total	**4,520**	**27,797**	**16,045**	**6,780**	**452**	**98,305**	**71,413**	**678**	**225,989**
1996	Recycling									93,009
	Disposal									104,882
	Total									**197,891**
1997	Recycling									153,294
	Disposal									98,008
	Total	**5,934**	**53,935**	**18,483**	**17,746**	**776**	**110,846**	**43,565**	**17**	**251,302**
1998	Recycling	11,968	13,843	25,708	21,000	841	83,783	49,527	1,143	207,813
	Disposal	460	5,309	3,492	0	71	40,640	25,025	0	74,997
	Total	**12,428**	**19,152**	**29,200**	**21,000**	**912**	**124,423**	**74,552**	**1,143**	**282,810**
1999	Recycling	8,089	11,130	18,440	9,759	179	96,267	61,188	910	205,962
	Disposal	63	2,346	1751	0	0	27,592	30,217	0	61,969
	Total	**8,152**	**13,476**	**20,191**	**9,759**	**179**	**123,859**	**91,405**	**910**	**267,931**

5 Assessment/Explanation

5.1 Overview

The previous section showed significant change within each country in terms of the generation, management and shipments of hazardous waste since 1994. The following discussion attempts to analyze the data presented in light of the two questions posed at the outset of the paper:

- Are companies in the manufacturing or hazardous waste management sectors relocating or are they sending hazardous wastes to other areas to take advantage of less stringent hazardous waste regulations or enforcement?
- Is trade and investment liberalization concentrating economic activity (in both manufacturing and the hazardous waste management industry) in areas where it takes place more efficiently, or conversely, where ecological stress is already acute such as the US-Mexico border region and the US-Canada border region?

In other words, has there been a "race to the bottom,"or, conversely, a "race to the top"? Have pollution havens been created in any of the three NAFTA countries?

5.2 Explanation of Changes in Waste Flows

There have been significant increases in US hazardous waste exports to Canada and Mexico and from Mexico to the US. Exports from Canada to the US have remained relatively stable. The following discussion examines a number of potential explanations for these shifts in waste flows.

5.2.1 US to Canada

Shifts in Exchange Rates

It has been suggested that the increase in waste flows into Canada for disposal can be explained as a result of the decline of the value of the Canadian dollar relative to the US dollar, making disposal in Canada a less expensive option.

An examination of waste imports relative to the value of the Canadian and US dollars, as shown in Table 32, and plotted in Figure 1, indicates that the point at which waste imports began to grow dramatically (1993/94) correlates weakly with a decline in the value of the Canadian dollar relative to the US dollar between 1991 and 1994. However subsequent increases in the value of the Canadian dollar to not appear to have affected waste imports. Furthermore, earlier rises (1987–89) in imports to Canada correlate weakly with increases in the value of the Canadian dollar.

Changes in the relative values of the US and Canadian dollars do not appear to have had any noticeable impact on Canadian waste exports. These figures lead to the conclusion that there is no clear relationship between the relative values of the Canadian and US dollars and the rise in waste imports to Canada. At best there is a weak correlation with decline in dollar and take-off in waste imports, but the available data are inconsistent.

Although specific data on waste disposal pricing are difficult to obtain, it has been suggested anecdotally that hazardous waste disposal costs in Canada may be between one half and one-tenth those in the US. This is thought to be due to higher US treatment standards (Lindgren, August 1, 1999). Such differences in prices for disposal are likely sufficiently large to be unaffected by shifts in exchange rates.

Economic Growth in the United States

Real GDP in the United States has undergone steady growth at a rate of approximately 2.3 percent per year since the early 1990s (US Department of Commerce 1998). This is not sufficient to account for the increase in waste exports to Canada from the early 1990s and the present.

Growth in US Waste Generation

Data are available through the RCRA biennial reporting program for total US hazardous waste generation by state. However, these data suffer from some significant limitations, particularly due to changes to reporting requirements for the 1997-reporting year. With the exception of Ohio, which shows a slight increase, total waste generation in the key exporting states to Canada (Michigan, New York and Ohio), reported under the RCRA program declined. Therefore increases in waste generation by US sources cannot account for the increase in waste imports into Canada.

Domestic Policy Changes in the United States (RCRA Rule Implementation)

Following amendments to the *Resource Conservation and Recovery Act* in 1984, US EPA has been moving to implement new standards for hazardous waste generators and treatment, storage and disposal facilities. This has included biennial registration and reporting requirements, storage and emergency preparedness requirements, a ban on the land disposal of untreated hazardous wastes, and legal standards for waste containers, storage tanks, containment buildings, land treatment units, surface impoundments and waste piles. In addition, new emission and operating standards for hazardous waste incinerators, boilers and industrial furnaces, were adopted under RCRA and the *Clean Air Act* in July 1999, although the impacts are only beginning to be felt by the industry.

Table 32. Hazardous waste management regulation in Ontario and the United States

Environmental Protection Requirement Companies that produce or generate hazardous wastes must	US	Ontario
register with environmental protection authorities	Yes	Yes
report annually or biannually to environmental protection authorities	Yes	No
follow strict and detailed on-site hazardous waste identification and storage requirements (including emergency planning requirements for large quantity generators)	Yes	No
Companies that transport hazardous wastes must		
complete a manifest detailing materials being transported and destination	Yes	Yes
immediately take measures to contain an accidental spill and report accidental spills to authorities	Yes	Yes
Companies that store, treat, and dispose of hazardous wastes must		
apply for permission (by permit or certificate of approval) to operate	Yes	Yes
provide financial assurance against environmental harm as part of permitting process	Yes	Yes
have insurance against accidental liability	Yes	No
analyze all incoming waste to ensure that it conforms both to the description on the waste manifest and to the categories of waste the site is permitted to receive	Yes	Yes
make biennial reports on quantities and kinds of wastes received	Yes	No
provide for groundwater quality monitoring in the area of the site	Yes	No
have a plan in place to deal with emergencies	Yes	No
control all dispersion by wind and rainwater of hazardous materials	Yes	No
Environmental protection authorities require by law that		
no permit is issued without full and ongoing public involvement in decision-making about the placement and operations of hazardous waste treatment storage and disposal sites	Yes	No*
hazardous wastes are treated before they are disposed in landfill	Yes	No
financial assurances reflect the cost of ‘most expensive closure’	Yes	No
information received from waste generators and waste treatment facilities is published in publicly-available documents every two years	Yes	No
The environmental protection authority has legal standards for		
hazardous waste containers	Yes	No
hazardous waste storage tanks	Yes	No
hazardous waste containment buildings	Yes	No
hazardous waste land treatment units	Yes	No
hazardous waste surface impoundments and waste piles	Yes	No
hazardous waste incinerators, boilers and industrial furnaces	Yes	No

* Public involvement in Ontario is limited to what rights may be available under environmental assessment legislation and/or the Environmental Bill of Rights.

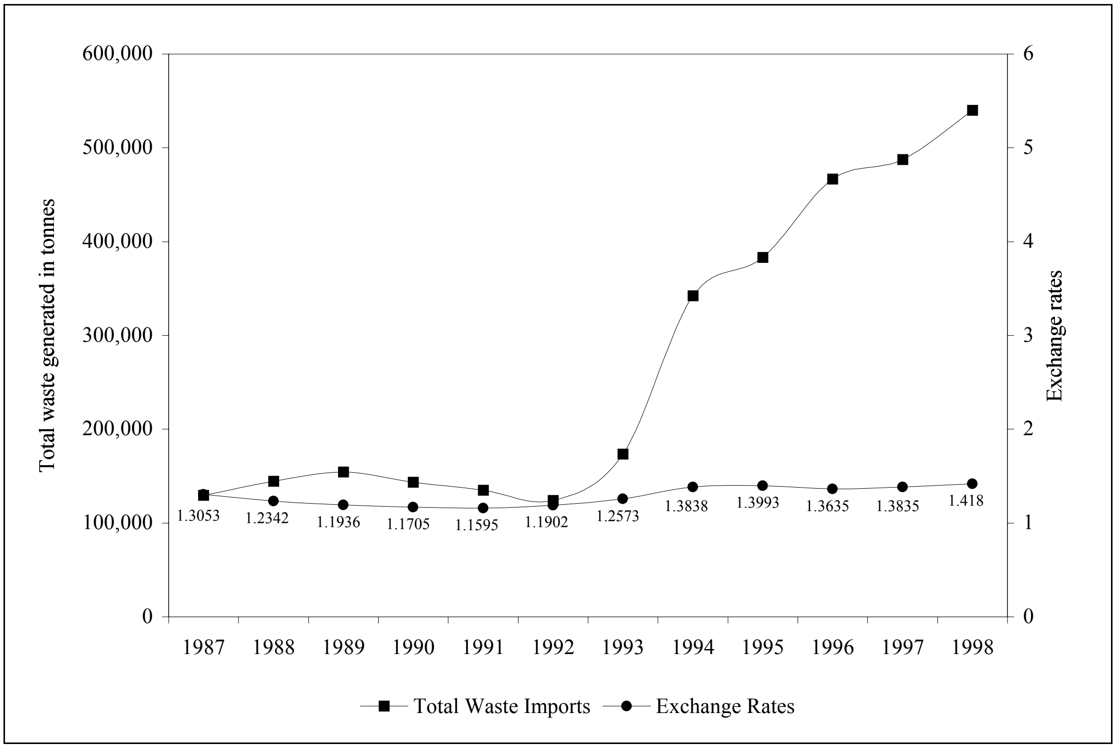
No comparable standards for hazardous waste generators, and treatment, storage and disposal facilities exist in Canada at either the federal or provincial levels. The existing provincial regimes were largely implemented prior to the adoption of the post-1984 RCRA rules and the federal requirements related to transboundary waste movements are procedural rather than substantive in character.

Differences in Canadian and US rules in this area have been consistently identified by US waste generators, treatment and disposal service providers and regulators in commentary on the growth in waste imports (Mittelstaedt, September 27, 1999). The Ontario (Mittelstaedt, September 18, 1999) and Canadian federal Ministers of the Environment (Mittelstaedt, March 22, 2000) and the Canadian Environmental Industry Association (Mittelstaedt, February 28, 2000) have acknowledged the gap between Canadian and US standards as a significant factor in the growth in waste imports as well.

Trade Liberalization Direct Impacts

The direct impact of the provisions of NAFTA and trade liberalization on waste flows and government policies in this area has been limited. However, three Chapter 11 cases have been brought forward with respect to hazardous waste management, the S.D. Myers PCB export restrictions case in Canada, and the Metalclad and Tecmed cases in Mexico. The recent rulings favorable to Metalclad and S.D. Myers against the governments of Mexico and Canada respectively may have a chilling effect on new regulations and the enforcement of existing regulations, particularly at the provincial (or state) and local level.

Figure 1. Hazardous waste imports to Canada and Canadian/US dollar exchange rates



Issues related to potential restrictions on governments' freedom of action with respect to hazardous waste policy as a result of the provisions of NAFTA were raised during the Government of Canada's deliberations regarding its 1995 PCB export ban (Scoffield, October 31, 1998). In addition, when data showing the dramatic growth in hazardous waste imports into Ontario were first released to the public in March 1999, the Ontario Minister of the Environment stated that he could do nothing to reduce the flow as "we have a free trade agreement (NAFTA) that limits us."(The Hon. N. Sterling, Ontario Minister of the Environment, as cited in B. McAndrew, April 18, 1999). Similarly, his successor stated in August 1999 that he was "handcuffed" by NAFTA with respect to waste imports (The Hon. T. Clement, Ontario Minister of the Environment, as cited in Lindgren, August 1, 1999).

Trade Liberalization Indirect Impacts

Trade liberalization has been both identified by Canadian governments as a barrier to the strengthening of environmental protection requirements, and as a driver of policy initiatives which have had the effect of weakening environmental laws and regulations. Ontario's Red Tape Commission, for example, has stated that:

- "In today's global environment, business must minimize their expenditures in order to remain competitive with our trading partners."
- "These (regulatory) requirements simply increase the costs of doing business. Therefore getting rid of and avoiding unnecessary and duplicative regulatory requirements can create a

> competitive advantage, particularly in an open economy such as Ontario's that depends on exports" (Red Tape Commission, 3).

The Ontario Ministry of the Environment cast its regulatory 'reform' proposals in a similar light:

- "As capital becomes increasingly mobile and reliant on high technology infrastructure, we must continually find new ways to make environmental management clear, flexible and predictable."
- "current regulatory requirements that may function as non-tariff barriers need to be brought into line with current practices."
- "a reformed system of environmental regulation will contribute to a competitive business climate." (Ontario Ministry of the Environment, July 1996, 13).

5.2.2 Increased US Waste Exports to Mexico

Although problematic, data from Texas, the US and the Mexican government all show that hazardous waste exports from the US to Mexico have increased significantly since NAFTA, perhaps nearly doubling. The majority of the waste exported by the US to Mexico is electric arc dust (EAD) containing zinc and other metals from the US steel and metal-making industry. There are therefore several possibilities as to why exports to Mexico have increased since NAFTA:

- Changes in technology in steel industry;
- Changes in regulations and land disposal requirements;
- Lack of capacity/price differentials for metal recovery in the US;
- Trade liberalization

Changes in Technology in Steel Industry

The most likely explanation for an increase in hazardous waste being exported to Mexico is changes within the steel industry itself. Since the early 1990s, large integrated steel mills like Integrated Steel, USX and Bethlehem Steel have decreased their share of production in the US and the world. At the same time companies like Nucor, which use electric arc furnaces to produce specialized steel from recycled metals, have increased production. However, these mini-mills produce high amounts of electric arc furnace dust (EAD) in their production process.

Analysis of EPA databases shows that EAD waste increased from slightly less than 320,000 tonnes in 1993 to more 725,000 tonnes in 1997. Given the choice of sending it to landfills or high temperature recovery units in the US or to *Zinc Nacional* in Mexico, some steel manufacturers sent waste to Mexico for the first time in 1993 (Table 33).

Changes in US Regulations

While the simple increase in the amount of EAD is the driving force for more EAD being sent off-site, it does not by itself explain why some generators began to send more to Mexico. New regulations adopted in the US favor treatment technologies over landfilling. All of the waste being sent to Mexico is to battery reclamation and high temperature metal recovery plants with technologies similar to those offered in the US. In the US, electric arc furnace dust is either recovered in high-temperature metal recovery plants or sent to landfills, where the dust undergoes some treatment before final disposal. Between 1993 and 1997, an analysis of electric arc furnace dust shows there was a shift in management of EAD from high temperature recovery units to landfills (Table 34). It is important to note, however, that this was before Phase IV Land Disposal Restriction rules for metal wastes went into effect.

Table 33. Electric arc dust hazardous waste (Code K061), produced by selected steel mills and shipped to Mexico, 1993–1997 (Tonnes)

Company		1993 Total	1995 Total	1997 Total
Nucor Yamato Steel, Arkansas	Total	21,545	30,814	46,096
	Sent to Mexico	0	0	4,375
Nucor Steel, Texas	Total	6,708	9,650	10,818
	Sent to Mexico	6,303	8,201	10,422
Bethlehem Steel, Pennsylvania	Total	10,233	12,652	15,442
	Sent to Mexico	0	0	0
Chaparral Steel, Texas	Total	19,317	19,877	18,614
	Sent to Mexico	8,939	11,827	11,113

Source: US EPA, Biennial Reporting System, Query Run in September 2000.

Table 34. Leading facilities which managed electric arc furnace dust in 1993 and 1997

Company Name	Type of Management	Tonnes Managed in 1993	Tonnes Managed in 1997
Zinc Nacional, Mexico	High Temperature Metals Recovery	56,140	83,809
Horsehead, Pennsylvania	High Temperature Metals Recovery	201,816	98,959
INMETCO, Pennsylvania	High Temperature Metals Recovery	17,539	20,154
Horsehead, Tennessee	High Temperature Metals Recovery	NR	66,358
Great Lakes Carbon, Illinois	High Temperature Metals Recovery	NR	122,246
Chem Waste, Indiana	Landfill	7,606	71,776
Envirosafe, Ohio	Landfill	114	158,740
Envirosafe, Idaho	Landfill	43	50,038
Michigan Disposal	Landfill	2,638	16,883
Peoria Disposal	Landfill	9,778	35,557

Source: US EPA, Biennial Reporting System, Query Run in September 2000.

These Phase IV rules might increase the cost of sending such wastes to landfills, providing an impetus to send the wastes to Mexico. It is also important to note that environmental controls for high temperature recovery units like *Zinc Nacional* are significantly less than in the US. For example, there are no financial assurance requirements associated with opening a metal recycling plant and liability costs are much lower. These differing regulations may give *Zinc Nacional* a cost advantage. Thus, increasing regulations in the US could be at least a factor, if not necessarily a leading cause, of increased exports of wastes to Mexico.

Lack of Capacity and Price Differentials

According to the 1994 CAP report, there was plenty of capacity in 1994 for the US to treat and recycle off-site metal wastes nationwide. In fact, throughout the 1990s, firms like Horsehead Resource Development in Pennsylvania and INMETCO, also in Pennsylvania, have continued to operate high temperature metal recovery facilities to treat and recover thousands of tons of electric arc dust (EAD). Facilities that treat then dispose of EAD in landfills, such as Envirosafe in Idaho and Ohio, and Waste Management in Indiana, are also disposing thousands of tons of EAD each year. Nonetheless, in certain states such as Texas, analysis has shown there is a lack of capacity for the treatment and recycling of metal wastes, with 2002 demand outstripping available capacity by

130,000 tons (118,000 tonnes) (TNRCC 2000, xiii). This lack of local capacity may have led firms like Chaparral Steel in Texas to export a large amount of their waste to Mexico during the 1990s, particularly since major metal recovery facilities in the US are located in Pennsylvania and South Carolina.

Although specific data on waste disposal pricing are difficult to obtain in Mexico, a 1996 study found that costs were between one-half and one-fourth as much in Mexico to commercially dispose of hazardous wastes as in the US (Semarnap 1996: Chapter 2). Again, given a choice between sending wastes to US facilities or Mexican facilities for similar treatment, price differentials, combined with transport costs, could have been a factor in the increased exports of hazardous waste to Mexico over the 1990s.

Trade Liberalization

The waste being exported to Mexico has gone to the same firms in Mexico over the last six years. However, certain firms that began to export for the first time to Mexico in 1997 may have felt more comfortable sending hazardous wastes abroad due to Mexico's new image as a "free trade" country. Still, because NAFTA simply reaffirms the prominence of the La Paz Agreement and its annexes and Mexican law continues to prohibit the import of hazardous wastes for disposal, NAFTA and "trade liberalization" itself does not explain the increase in exports from the US to Mexico.

Mexico to US Hazardous Waste Flow

There are significant differences between the US and Mexico in terms of how much waste they report as flowing from Mexico to the US over the 1990s. However, the total amount does appear to be increasing. There are three possible reasons for this increase. First, as detailed extensively in this report and elsewhere there are simply more maquiladoras and more industrial production in Mexico. Second, a lack of capacity in Mexico for certain types of treatment such as landfilling and recycling of catalytic converters makes export to the US the best option. Finally, there may be better compliance with hazardous waste repatriation requirements as Profepa has increased oversight through inspections and its national auditing program. Nonetheless, because the number of maquiladoras near the border has nearly doubled since 1994, and the percentage of foreign inputs has remained constant, the total amount of wastes reported as being imported still suggests a lack of compliance with Mexican regulations. In fact, hazardous waste exports should be considerably higher than reported.

Trade liberalization itself does not appear to be directly influencing the flow—except in the sense that investment in Mexico has increased—and is instead most directly related to the requirements under the La Paz Agreement and Mexican environmental law that maquiladoras return hazardous wastes to the country from which raw materials were imported. However, because of changes introduced under NAFTA's Articles 303 and 304, which reduce the benefits of being a maquiladora, it is possible that many maquiladoras may decide to nationalize in order to escape the repatriation requirements. Thus, both inadequate compliance with reporting and repatriation requirements—and perhaps inadequate enforcement on the part of Mexican authorities—as well as the future possibility of a nationalization of the maquiladora industry, could allow many companies to escape these regulations in a "liberalized" free trade zone. This might have the effect of actually decreasing exports from Mexico to the US, even as hazardous waste capacity and generation in Mexico increases.

5.3 Economic Concentration

5.3.1 US-Mexico Border Region

This report found that there is an ongoing concentration of economic activity, including hazardous waste generation, in both the northern Mexico and southern US border regions. In terms of national percentage, the percentage of waste being generated and managed both on-site and off-site at commercial facilities has grown in US border states, like Texas and California. In the US, in general, enforcement rates of on and off-site facilities were superior in the northern border region, compared with the southern region during the 1990s, suggesting a regional advantage to treating wastes in the South.

In Mexico, the number of hazardous waste management facilities in the border states has increased more rapidly than in the nation as a whole. In addition, while the percentage of maquiladoras located in the northern border states declined overall, the total number continued to increase at an exponential rate, nearly doubling over six years. There was no evidence that any of these maquilas were using more local inputs, meaning hazardous waste was still being generated from US raw materials. While low reporting by hazardous waste generators make it difficult to assess how much hazardous waste is being generated, the report found it very likely that the generation of hazardous waste is increasing in the northern border states. The increased waste would appear to be more the result of a scale effect (simply more industrialization) rather than a change in composition (a shift in production).

While ecological stresses continue to plague the Mexican northern border region because of this economic concentration whether it is “efficient” for more TSDs to locate in the northern border to more adequately handle this waste or whether it leads to increased stress—a kind of pollution haven—is difficult to judge given the limited information. The Mexican government has promoted the creation of an off-site hazardous waste management infrastructure as the means to solve Mexico’s mismanagement problems. It has done this in some cases through policies such as authorizations to burn hazardous wastes at cement kilns without adequate standards, spurred on by significant pressure and influence by national and international companies as well as by announcing the need to develop CIMARIs, although it still has not developed a specific standard for such facilities. This open courting of the hazardous waste management industry has led to a number of companies attempting to open landfills in Mexico, all of which have failed due to failure to meet basic environmental assurances and citizen opposition. The recent Chapter 11 ruling in favor of Metalclad, however, may impede the desire for further regulations at the state or federal level.

There is significant concern that the presence of this new infrastructure in the context of free trade will increase the incentive for US companies to export hazardous wastes to TSDs in Mexico, where costs are cheaper and regulations, reporting requirements and enforcement are less strict. In particular, depending upon how “reuse” and “recycle” is interpreted, significant amounts of US liquid hazardous waste could be exported to Mexico for incineration in cement kilns under a less rigid regulatory framework. This would significantly increase stress on this region.

5.3.2 US–Canada Border Region

While hazardous waste generation declined and commercial management of hazardous wastes remained stable in the U.S northern region, in Canada both generation and disposal capacity increased in border provinces like Ontario and Quebec since the early 1990s. The new and expanded disposal facilities in Ontario and Quebec receive significant amounts of hazardous waste from the US. The availability of inexpensive disposal options in Canada may undermine efforts to manage and reduce hazardous wastes on-site in the US and Canada.

6 Summary and Conclusions

This paper has approached the issue of the impacts of trade liberalization on hazardous waste management in North America in four steps. First, a pre-NAFTA 'base case" with respect to government policies, the roles of nongovernmental actors, disposal capacity, waste generation and disposal, and transboundary waste traffic was established for each country. The full base case is available from Texas Center for Policy Studies as Appendix A. Secondly, the changes introduced through NAFTA and its institutions were described. Third, the changes with respect to government policies, waste generation, transboundary movement and disposal in each NAFTA country since 1994 were outlined. Fourth, possible explanations for these changes, including the impacts of trade liberalization, and other factors were reviewed and assessed.

This paper sought to answer two questions on the environmental effects of NAFTA with respect to the management of hazardous wastes:

- Is trade and investment liberalization concentrating economic activity in the hazardous waste management industry in areas where it takes place more efficiently, or conversely, where ecological stress is already acute such as the US-Mexico border region and the US-Canada border region?
- Are companies in the manufacturing or hazardous waste management sectors relocating or are they sending hazardous wastes to other areas to take advantage of less stringent hazardous waste regulations or enforcement?

With respect to the first question, the available data indicate an ongoing concentration of economic activity, including hazardous waste generation and management in the US-Mexico border region. This is evidenced by the continued concentration of generation and increase in off-site waste management activities in US border states, the concentration of waste collection, storage and management facilities in Mexican border states, and steady growth of active maquiladora plants in the border region. While it has not been possible in this report to affirm that this concentration has increased "stress" over "efficiency"—particularly as hazardous waste data are limited in Mexico—there is significant concern that off-site management of US and Mexican wastes in Mexico will increase ecological stress over time.

The situation with respect to the Canada-US border region is less clear. Waste generation in key US border states has been in decline. However, waste generation in Ontario and Quebec has been increasing significantly, particularly in the steel and chemical industries, which are concentrated in the border region. In addition, despite the decline in waste generation among the US border states, there has been a dramatic growth in US waste exports to Ontario and Quebec and, in the context of a weakened regulatory environment, a significant increase in disposal capacity in those provinces.

Differences in regulatory requirements related to hazardous waste disposal, specifically the existence of less stringent standards in Ontario and Quebec have been the key factor in the increase in US hazardous waste exports to Canada. Similarly, the expansion of disposal capacity in these provinces is largely intended to serve the US market, although the bulk of the investment in this capacity is Canadian in origin.

The ban on imports of hazardous wastes for final disposal into Mexico limits the economic incentive for the establishment of disposal capacity to deal with imported wastes to take advantage of differences in the regulatory and enforcement regime between Mexico and the US, although exports of some wastes to domestic Mexican firms have increased. In addition, there has been significant US investment in Mexican capacity for the disposal of domestically generated wastes, with the market for these services being driven by stronger disposal requirements in Mexico in some cases, as well as "temporary" authorizations without publicly-approved standards in others.

Significant gaps exist in the systems for tracking hazardous waste generation and disposal in all three countries. Reliable data on waste generation in Canada and Mexico are extremely limited, and the reliability of the data regarding transboundary waste movements among the three countries has been seriously questioned. Tracking transboundary waste movements from "cradle to grave," when the "cradle" is in one country and the "grave" in another, is almost impossible.

More broadly, while the process of trade liberalization may initially have been a driver for the establishment of a more stringent regulatory regime in Mexico, it has also been explicitly referenced as a factor in the weakening of environmental protection regimes by Canadian governments undertaking such "reforms." The NAFTA trade rules have also been identified as a constraint on their ability to adopt higher standards to protect human health and the environment. The outcomes of NAFTA Chapter 11 complaints seen in such cases as the ban on PCB exports from Canada and the Metalclad case in Mexico seem likely to reinforce these directions to the detriment of the health, safety and environment of the citizens of all three NAFTA countries.

7 Recommendations

The authors make the following recommendations on how to improve the climate for better management of hazardous wastes in the three NAFTA countries.

7.1 Recommendations for Collective Action by the Parties

- In light of the recent Chapter 11 decisions regarding S.D. Myers and Metalclad, which we believe ultimately undermine the right of Parties to enforce their own environmental standards rules, the three Parties must revisit NAFTA's Chapter 11 provisions. Appropriate changes must be made to safeguard the ability of Parties to set and maintain environmental standards and make environmental policy decisions which they regarding as necessary to protect the health and environment of their citizens.
- Through the CEC, the three parties should reopen negotiations on transboundary environmental impact assessments, as mandated by NAFTA.
- The difficulty in tracking hazardous wastes across borders is a serious concern. All three countries should work to improve reporting and tracking of hazardous waste generation and disposal and strengthen the compatibility of their hazardous waste tracking systems.
- Mexico and the US should continue to update, coordinate and improve the SIRREP/Haztraks system so that it includes both hazardous waste imports and exports between the two countries. Canada and the US should discuss creating a similar system to track wastes between the two countries.

7.2 Mexico

- Mexico should make its Pollutant Release and Transfer Register—known in Mexico as the RETC—obligatory, particularly Sections I and IV that detail both toxic releases and hazardous waste generation.
- Mexico should increase enforcement—including through more resources and penalties—to assure that companies meet their hazardous waste reporting requirements under Mexican law.

- Mexico should issue a definitive ruling that incineration and use of hazardous wastes as a fuel in cement kilns and other industrial furnaces is a disposal technology and therefore importation of hazardous wastes to such facilities is not permitted under Mexican law.
- Mexico should conduct a full needs assessment of hazardous waste management capacity and shortages, including opportunities for source reduction and reuse. The CEC could play a role in coordinating this effort.

7.3 Canada

- Canada needs to establish regular waste generation and disposal reporting requirements for hazardous waste generators, as well as a system to make the resulting information publicly available and accessible.
- Canada should adopt standards for "environmentally sound disposal" of hazardous wastes, as per its obligations under the Basel Convention. These standards should be at least comparable to the US RCRA standards for land disposal, and the RCRA/Clean Air Act MACT standards for hazardous waste incinerators and other facilities burning hazardous wastes as 'fuel.'

7.4 The United States

- The US should rescind RCRA regulations which exclude used batteries from export notification requirements to accurately track exports from the US to Mexico.
- The US should increase resources to border states to adequately inspect Ports of Entry for compliance with hazardous waste handling, transport and reporting requirements and increase cooperation between Customs and environmental authorities to track hazardous waste in a timely manner.

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Discussants:

Kevin Gallagher (Global Development and Environment Institute, Cabot Center, Tufts University)

Mr. Gallagher's comments focused on the different methodologies used in the two papers presented at this session. The Reinert/Roland-Holst paper is theory-driven, using a CGE model of the economy and then inserting NAFTA data to derive predictions. The strengths of such a model are that it is rigorous, it is able to predict rather than just analyze retrospectively, and—most importantly—it can analyze secondary effects (that is, the effect of changes in one industry on another). The weakness of many quantitative economic models is that they are not user-friendly; they are not sensitive, especially when trying to pinpoint causation; and such models require numerous assumptions.

For example, the Reinert/Roland-Holst paper assumes perfect competition, full employment, trade policies and levels of protection that remain constant throughout the period of study, and a constant level of pollution per employee in Canada, Mexico and the United States. In contrast to these assumptions, 77 percent of the sectors examined in the study are monopolistic, there was high unemployment in all three countries in the early part of the study period, several trade liberalization agreements were signed during the study period, and pollution levels are highly variable across North America.

The Reinert/Roland-Holst analysis found major increases in sulfur pollution over the study period. However, multiplying the pollution coefficients by the actual levels of employment in 1997 gives a decrease in sulfur levels in Mexico and Canada, and only a slight increase in the US.

Mr. Gallagher recommended that the CEC do more to address issues related to the enforcement of environmental laws, as well as identify ways in which to improve environmental regulation.

Will Martin (Development Economics Research Group, World Bank)

Mr. Martin focused on the work of Reinert/Roland-Holst, saying it provides a useful demonstration of CGE applications. Current CGE models can measure composition effects, scale effects, and technology effects. The model is supposed to provide a partial analysis—isolate the effects of increased trade *alone*—whereas the actual decreases Gallagher noted are likely due to technological advances adopted in Mexico. One effect that has not been incorporated into the model is the possibility that higher incomes may lead to greater demand for improved environmental quality.

Martin remarked that some of the data included in the Reinert/Roland/Holst paper are striking. In particular, Canadian carbon monoxide emissions seem to have increased by 2.7 percent because of NAFTA. So far, this type of model has been used to determine the effects of a given trade policy, and the costs of achieving particular pollution targets using trade reforms.

In looking at trade policies alone, Martin quoted the adage, "when all you have is a hammer, all problems look like nails." There are other important questions that tend to be neglected in the trade-environment debate, including: what are the costs created by environmental policy failures? What are the effects of abatement policies? How do environmental policy choices respond? How do the costs of dealing with environmental market failures through trade policies compare with those of managing them through environmental policies?

Economists could also focus more on the benefits of using a particular policy, rather than always focusing on the cost. Sometimes economists are guilty of knowing the cost of everything and the value of nothing.

Session Two Questions and Open Discussion

Discussion began with reference to CGE models. Such models begin with a base year, during which policy changes are introduced, and then estimate the effects of that policy *in that year.* Thus, the models are usually static and are not intended to be predictive, but are indicative of probable changes brought about by trade policy reform. CGE models also do not provide estimates of statistical significance. Martin suggested, however, that they could and should be used to estimate the costs of achieving particular pollution targets.

Considerable attention focused on the Winfield-Reed-Jacott paper on hazardous wastes. It was noted that the single most important explanation for the increase in international trade in hazardous wastes is the differential in disposal pricing. This difference in the cost of disposal is, in turn, driven by a difference in disposal regulations. Disposal regulations and their enforcement are practically nonexistent in Canada. An additional explanation for the increase in trade of waste into Canada from the US is the likelihood of significantly lower liability exposure and related costs in Canada.

It was remarked that there is a paucity of hard data showing which environmental regulations are being adhered to and which are not. There has been a huge increase in hazardous waste in the maquilladoras, while the increase in imports is comparatively small. A second case—similar to Metalclad—is under dispute consideration, raising concerns that it will make developing and enforcing land disposal regulations in Mexico more difficult.

There was discussion of the NAFTA Chapter 11 MMT-Ethyl case in Canada, in which a domestic regulation was found to be inconsistent with trade rules. While some argued that this case has created a regulatory “chill” in Canada, others held that the ban was inconsistent with Canadian laws *per se*, and not with NAFTA obligations. In the Metalclad case, there is a difference of opinion between federal and local officials on jurisdiction—and the company had already built the facility before being challenged by local authorities. While the ability of governments to regulate activities *is* preserved in NAFTA Chapter 11 disputes, there was repeated concern that these rules have the potential to undermine domestic environmental regulations.

It was argued that the implications of these NAFTA cases go beyond the mere process of Chapter 11 dispute settlement, as governments now question their own ability to protect the public good.

Session Three

Relationships between Trade Policies and Environmental Policies

- Assessing the Impact of NAFTA on Environmental Law and Management Processes
- Is there a Race to the Bottom in Environmental Policies? The Effects of NAFTA
- The Relocation of El Paso's Stonewashing Industry and its Implications for Trade and the Environment

Session Chair:

Charles Caccia (House of Commons Standing Committee on Environment and Sustainable Development)

Assessing the Impact of NAFTA on Environmental Law and Management Processes

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Executive Summary

Through the combination of its substantive provisions, adjudicative processes and enforcement mechanisms, trade law has a significant impact on how governments can take environmental decisions and enact environmental measures.

This paper undertakes a survey of the application of trade law rules to environmental management and decision making by governments. It correlates five generic stages of environmental management against seven major trade law disciplines that are particularly relevant to measures for the protection of the national environment.

The initial assessment that results from this analysis suggests that most existing and many future environmental measures would not survive trade law challenges since the increase in independent disciplines under NAFTA and the 1994 WTO Agreements. For older measures, the risks of an environmental measure being found inconsistent with trade law in the event of a challenge are high, as most trade requirements simply appear not to have been considered in the course of environmental law-making in the 1970s–early 1990s. However, the risks of a challenge coming about are not high, based on current levels of challenges and the politically constraining fact they must be initiated by governments. In addition, in the event a measure is found inconsistent with trade law, at least under the World Trade Organization process, there is an opportunity to rectify whatever specific failures may be found, and to revise the measure as appropriate.

For new measures, the primary concern is the human and technical capacity to meet the trade requirements in a manner that is also consistent with the environmental management requirements. If the interpretations of the trade disciplines set forth in the paper are accurate, there are no inherent inconsistencies between them and environmental law-making to protect one's own environment. However, meeting all the requirements does require significant expertise sensitive to both the environmental and trade issues. This capacity is currently often lacking. This in turn poses risks of new measures falling afoul of trade disciplines, as well as of proposed measures being stalled in the policy making process due to either a lack of sensitivity to the environmental dimensions of the issues being raised or addressed by trade experts, or a related fear of trade challenges down the road. This dynamic creates a "hidden" risk to environmental protection. In addition, there is a risk that trade disciplines will not respond well to new developments in environmental policy, in particular new approaches to implementing pollution prevention strategies at the product source.

The risks in relation to the investment obligations in Chapter 11 of NAFTA are of a different order. The disciplines are different and have now been given a wide meaning by the first arbitral panels to consider them. The dispute resolution process is also initiated by private corporations, without regard for other national perspectives or constraints. Consequently, Chapter 11, if current interpretations continue in future cases, poses significant risks to environmental law making across North America. The NAFTA Parties do, however, have mechanisms other than amendments to NAFTA available to address these risks, if they choose to exercise them.

1 Introduction

The relationship between trade agreements and the environment has numerous dimensions. As evidenced in *Assessing Environmental Effects of the North American Free Trade Agreement* (CEC 1999), the highest degree of attention is generally paid to the physical environmental impacts of trade liberalization and globalization on local, regional or global eco-systems, and to related impacts on human health and welfare. The reason for this is obvious: it is the physical impacts of changing trade and investment flows that, when they occur, are of most immediate concern to citizens, communities and governments.

That increased trade and investment flows can lead to significant development opportunities and resulting welfare gains is beyond doubt. However, a recent World Bank study suggests that maintaining net welfare gains from such development opportunities requires high levels of environmental management capacity to be developed and/or maintained in countries that actually receive such investments. Among the policy conclusions drawn by the authors of the study, a key one is that "the ambiguity of environmental effects of trade liberalization places heavy demands on existing institutions charged with environmental policy formulation and implementation—to prevent potential problems and respond as negative effects appear" (Fredriksson 1999, 11).

Whether the physical environmental impacts of trade liberalization in general or NAFTA in particular are clear or ambiguous is to be debated elsewhere in this symposium. What this paper is concerned with is the impact of the trade and investment disciplines themselves on the ability of governments to meet the "heavy demands" for environmental policy formulation and implementation trade and investment liberalization can create. Further, as the trade and investment disciplines apply to all environmental laws and policies, not just those developed in response to trade and investment-related stresses, and apply retroactively in many cases, the question must be expanded to include the potential impact of these rules on all environmental policy making and implementation.

This concern is equally relevant for developing and developed countries. The focus of this paper is not on the issue of using trade measures to address environmental problems beyond one's borders, a form of environmental regulation that has frequently polarized the debate on the appropriate relationship between trade disciplines and environmental law-making.[1] Rather, the focus of this paper is the legal impact of trade and investment disciplines on the ability of a country to protect its own environment and citizens. The question, in simple terms is: *what impact, if any, do trade and investment disciplines have on the ability of governments to protect their environment?*

At least one recent governmental analysis argues that developments in international trade law through the World Trade Organization do "not question the right of each WTO member to establish and implement environmental policies that are appropriate for its domestic context. They require only that the measures applied in pursuit of those policies must be consistent with the obligations assumed under the …Agreements" (DFAIT 1999). Given the consistency of rules between the WTO and NAFTA, this statement would seem equally directed at the latter. It is the questions that arise from this statement that frame the discussion that follows:

- In a legal sense, why is it important for environmental management to be consistent with trade law obligations?
- What is the nature and scope of the trade and investment obligations assumed as they relate to environmental management decisions?

[1] For a superb review of this issue see Howse and Regan 2000.

- Are these obligations generally consistent with the environmental management processes in the three NAFTA parties, do they require significant changes in those practices, or do they ultimately impinge on those practices?
- Given an understanding of the legal issues, what are the likely risks trade law poses to environmental management and decision-making?
- What different considerations arise in relation to international investment obligations, such as those in Chapter 11 of NAFTA, as opposed to the more traditional domain of trade rules?
- What recommendations might flow from the analysis of the preceding questions?

As a final introductory note, it is important to recognize that the NAFTA *trade* (as opposed to investment) disciplines have yet to be used to base an environment-related trade law case between any of the three NAFTA Parties. Indeed, since the adoption of NAFTA, there have been no trade and environment cases initiated between the three Parties. Consequently, one must turn to the World Trade Organization cases for additional guidance as to the scope of the obligations contained in NAFTA. This cross referencing is pertinent not just from an analytical perspective, but also because Parties to the NAFTA have a choice as to whether or not to use NAFTA or the WTO agreements in the event of any challenge to an environmental measure they may wish to launch (NAFTA, Article 2005). However, as it relates to *investment* disciplines, as opposed to trade disciplines, one does find a number of challenges to environmental measures over the past four years, and a growing body of law emerging directly from the NAFTA.

2 The Constitutionalization of Trade Law: Why Trade Agreements Have Become So Important

Elsewhere, the present author has considered the legal reasons why trade agreements and the obligations (disciplines) they contain have become so critical today (Mann 2000, 389–392). In summary form, the reason lies in the emerging constitutional nature of trade agreements. Constitutional laws can be understood to have three basic elements:

1. Constitutions tell governments what they can do and how they can do it, especially vis-à-vis the rights of others;
2. Constitutions contain processes to adjudicate these restrictions on governments; and
3. Constitutions generally provide processes for sanctioning a failure to abide by the law imposed and/or judicial determinations in relation to them.

There is little doubt that trade agreements today tell governments what they can and cannot do, and how they can or cannot do things, in a wide range of areas. What began largely as a tariff regulation process in 1948 now covers virtually every form of regulation that might impact on trade, including environmental, health and safety, government procurement, cultural protection, and other areas of government activity. This is part of what is included in the process of broadening and deepening the trade disciplines.

Trade law provides for mandatory adjudication of state actions when a complaint is raised by another state party to the agreement, or in the case of investment laws by a foreign investor acting in their own right. Under the World Trade Organization and NAFTA (including Chapter 11 on investment), these processes are now binding in law. This is different from the pre-NAFTA period, when disputes under the General Agreement on Tariffs and Trade (GATT) agreements had to be adopted on a unanimous basis, including by the Party "losing" the dispute.

Finally, trade law has a sanctioning process, through tariff adjustments or other financial penalties in the form of "damages." Despite the difficulties that surround enforcement issues today—which are not surprising given the process is just five years old—there is no denying that the addition of this element completes a legal picture that gives trade law real legal impact today.[2]

Because trade law addresses governmental activities (with some exceptions), this combination of features can be understood as creating a new constitutional structure directly applicable to governments that are party to the regimes. In this regard, trade law is arguably the most successful branch of international law in place today. Before decrying the success of trade law as a massive breach of state sovereignty, it should be considered that the ability to set and enforce global rules is the goal of every branch of international law, only few of these other branches have begun to approach the level of success of the trade system measured in terms of breadth of rules and their enforceability.[3] At the same time, it is this very success as an international process that gives trade law (and associated investment rules) its critical importance for environmental decision-making and management.

Recognizing the importance of trade law is but the first step in understanding its impacts. Equally important as its legal status is its content: the substantive and procedural obligations that are imposed. In sections 3 and 4, the nature and scope of these obligations is described and co-related to different stages of the environmental management process. An overall "risk assessment" is then undertaken as to whether the obligations pose a significant "threat" to environmental management. Additional considerations relating specifically to the environmental impacts of investment rules under Chapter 11 of NAFTA are then addressed is a separate section. Finally, some "risk management" recommendations aimed at the cooperative, trilateral level are suggested by way of a conclusion.

3 The Nature and Scope of the Trade Obligations in an Environmental Management Context

3.1 The General Approach of Trade Law to Environmental Issues

Before considering some specific issues, it is important to understand the overall context in which trade rules have considered environmental issues. First and foremost, trade law, including NAFTA, is oriented to the protection of trade and market access, in particular the right of exporters to access markets. As such, rules for protecting market access have considered environmental and other regulatory measures from the perspective of preventing "non-tariff barriers to trade" (Fried 1997, 262–265). Non-tariff barriers can be understood as legal or other barriers to trade that might replace the tariffs that are reduced or eliminated under trade agreements. For this reason, and because the trade fora are not intended to and do not have the capacity to generate environmental standards, trade bodies have essentially had a one-dimensional, trade-impact focus on environmental management issues.

At the same time, trade agreements have recognized the need for Parties to be able to effectively address environmental issues. This is seen increasingly in preambular paragraphs such as those in NAFTA that expressly recognize the need to proceed "in a manner consistent with environmental protection and conservation" and to "Strengthen the development and enforcement of environmental laws and regulations" (NAFTA, Preamble). It is also seen in specific provisions of trade agreements

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2 This impact now occurs regardless of the legal status of an international agreement under domestic constitutional law, for example, in the United States and Canada, where different legal approaches to the internal status of an international agreement prevail. Because the adjudication and enforcement takes place directly under the international regimes, the domestic status of the agreement is not an impediment to the conclusion that trade law has achieved a constitutional status through its international level of application and implementation. (See also Schneiderman 1996 on this issue.)

3 It should be noted that this discussion in itself does not negate the sovereignty of states. The debate on sovereignty and trade law is not the subject of this paper.

that recognize, for example, the right to achieve "legitimate objectives" of environmental protection [NAFTA, Article 904(2)]. The achievement of these legitimate objectives is tied, however, to acting in accordance with the Agreements in question, thereby raising precisely the types of questions this paper has already noted [e.g., NAFTA, Article 904(1)].

Beyond that, other provisions do create specific exceptions whereby trade rules can be breached for environmental protection purposes. However, according to the Appellate Body (AB) of the World Trade Organization, the right to rely on the environmental exceptions in the WTO context is "a *limited and conditional* exception from the substantive obligations contained in the other provisions of the GATT 1994" (Shrimp-Turtle case 1998, para. 157). It is the AB that highlighted the words "limited and conditional" in this passage. There is little to suggest that the exception provisions in the NAFTA would be approached in any different manner in a trade dispute context.

3.2 Identifying Environmental Management Processes in a Trade Relevant Manner

To the best of this author's knowledge, there is no existing comparative analysis between the environmental management systems of the three NAFTA Parties. Indeed, such an analysis, given the myriad of responsible agencies and jurisdictions at the federal, state and provincial levels, may well be an impossible task. This being said, it is possible to identify for analytical purposes different stages of the environmental management process in generic terms that can be transposed in further, more specific empirical analysis to the actual systems used in different jurisdictions and agencies. Five key stages of environmental management can be suggested for this purpose:

- ***Identification of a potential environmental problem:*** Preliminary information on potential problems may arise from a range of sources. Once drawn to the attention of government officials, an initial assessment must be made to determine whether the information suggests an existing or potential problem may exist.
- ***Risk assessment of the problem:*** If it is determined that a problem may indeed exist or have the potential to occur, then a proper evaluation of the risk of the problem materializing, increasing and/or generating an environmental or human health impact is likely to be undertaken as part of an environmental management process, as is an assessment of the magnitude of any potential impacts.
- ***Identification of the appropriate environmental objective to address the risk:*** An environmental objective states what the environmental goal is in relation to the existing or potential problem. It can be defined in general terms or in specific technical terms, or both. For example, ensuring air emissions do not exceed the capacity of the receiving environment to absorb and neutralize them is an objective which can also be translated into specific parts per million emission levels. The elimination of toxic substances from ambient air may be another goal, one that can be translated into zero emissions levels.
- ***Choosing an appropriate environmental management tool to achieve the objective:*** This can involve a review of several potential management options, ranging from voluntary codes to legislation and regulation. The application of different principles of environmental management, such as pollution prevention and the polluter pays principle, may be relevant in the choice of management tools. The nature and substance of a management option should be geared to the effective and timely achievement of the environmental objective.
- ***Implementing and enforcing the management tool:*** Once chosen, the management tool must be adopted, implemented and enforced.

3.3 Identifying the Most Relevant Trade Law Disciplines

Under trade law, each of these stages of environmental management is subject to specific rules or disciplines. The most relevant of these disciplines are described below in plain, non-technical language. This approach runs the risk of losing some legal accuracy, or at least subtlety. However, the objective here is a general survey of the relationship between the trade law rules and environmental management and decision-making by governments, rather than a comprehensive legal analysis. Thus, it is hoped that any loss of legal specificity is made up for by allowing a more comprehensive picture to be described in the space available.

The disciplines themselves can be divided into two distinct categories. The first can be defined as "negative obligations." These are the most traditional forms of trade law disciplines and define what a state *cannot do* when regulating. The two most central disciplines in this category are the national treatment (non-discrimination) and no disguised barrier to trade disciplines. These have been a core part of trade law since the GATT was completed in 1948:

- ***National treatment and most-favored nation treatment (non discrimination):*** The essence of the principle of non-discrimination is that Parties to trade agreements should not treat imported products any less favorably than domestically produced products. The objective is to maintain equal opportunities for foreign producers to access foreign markets, or, in the reverse sense, to prevent protectionist measures from being adopted.
- ***No disguised barriers to trade:*** Under trade law, measures cannot be adopted under the guise of environmental protection in order to achieve trade or market-related objectives. This is known as a disguised barrier to trade and is not permitted. Several of the other disciplines described below are relevant to assessing whether a measure may be a disguised barrier to trade, including basing a measure on sound science, the use of risk assessment, and comparisons with products having similar risk levels.

The second category of disciplines can be understood as creating "positive obligations." These define what states *must do* in the course of enacting and applying laws and regulations in any context where they may have a trade impact. There are five disciplines in this category, all of which have been added as central obligations by the NAFTA and the Agreements of the World Trade Organization that were concluded in 1994:

- ***Basing measures on sound science:*** Express requirements to base environmental protection measures on sound science differ as between sanitary and phytosanitary measures[4] and measures related to protection of the physical environment falling under the technical barriers to trade rules. Under the Agreement on Sanitary and Phytosanitary Measures of the WTO (SPS Agreement), and the similar provisions in Chapter 7 of NAFTA, sound science is a fundamental requirement for taking legislative or regulatory initiatives. Under the WTO Agreement on Technical Barriers to Trade (TBT Agreement) and the similar provisions in Chapter 9 of NAFTA, which cover the great majority of environmental measures,[5] it is not expressly required. However, as Prof. Worth points out, the absence of a demonstrable sound science basis can be interpreted as a sign that a measure is either discriminatory, is not designed to achieve a legitimate environmental objective, or may be more trade restrictive than necessary (Worth 1994, 1–3). Hence, even where not specifically required, development of a sound scientific basis may be an indirect requirement.

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[4] An SPS measure is one designed to protect animal or plant life or health from risks arising from the establishment or spread of a pest or disease, or to protect human or animal life from risks associated with food carried pests or chemicals to treat pests, and other food-related treatments. See Article 724 of NAFTA for a full definition.

[5] This is subject to the very recent WTO decisions in the *Asbestos* case, which is not factored into this analysis as it is now subject to appeal. In this ruling, the WTO panel held that product bans for environmental reasons fall under general GATT, 1994, provisions, and not the TBT Agreement. This could alter certain conclusions if upheld (Asbestos case 2000).

Basing measures on sound science also provides a trade law structure for linking three different stages of environmental management into a continuum, risk assessment, identification of an environmental objective, and choosing a risk management tool.

- ***Undertaking risk assessments:*** Risk assessments are required in the sanitary and phytosanitary measures context, including the use of internationally recognized assessment processes or scientific protocols for this purpose. But risk assessments are not mandatory for the bulk of environmental measures that would otherwise be addressed under the technical barriers provisions of NAFTA or the WTO. However, under TBT provisions, once a risk assessment is undertaken a failure to apply sound scientific principles and protocols does lead to the potential implication that the process was a "mask" for other non-environmental purposes, or a disguised barrier to trade. Hence, where a risk assessment is employed, there is an implied need to ensure it reflects appropriate standards.
- ***The use of international standards in both procedures and final decisions:*** Under trade law today, the use of international standards in relation to specific environmental measures carries with it an assumption of consistency with trade rules. While this does not mean that the use of a different standard is necessarily inconsistent with trade law, it does mean that the use of a different standard will carry with it the burden of proof to establish why a different standard was used. This will often carry with it the requirement to provide the scientific basis for such differentiation. The use of international procedures and protocols for conducting risk assessments is addressed under the risk assessment heading.
- ***Acting in a non-discriminatory manner as between similar types of risks:*** Comparisons for purposes of assessing whether a measure is discriminatory have been extended under trade law today to include comparisons between toxic and non-toxic products having similar uses, and to products carrying similar potential risks but which may have no direct commercial substitution relationships (Australian Salmon 1998). The intent here is to assess consistency of treatment of risks in order to determine whether the identification of an acceptable level of risk or an environmental objective in any given case may reflect a "hidden" market-related or protectionist objective that is contrary to trade law.
- ***Applying least trade restrictive measures:*** This is a classic part of trade law as it relates to environmental issues. In the application of environmental measures, in particular under the environmental exception rules of Article XX of the GATT, 1994 (which are also incorporated into the NAFTA, per Article 2101), the obligation is not to have no trade impacts but rather to have the least restrictive impact on trade consistent with achieving the environmental objective. Here, the disciplines require an assessment of potentially effective tools or measures against each other to determine which, from among those capable of effectively achieving the required result, is least trade restrictive. The discipline does not require the elimination from consideration of any given measure because it does have a trade impact. The risk management capacity of a Party is one relevant factor here. (See, e.g., Asbestos 2000.)

Under NAFTA and the WTO Agreements, each of these disciplines now operates independently of each other. Where the previous GATT law first required a breach of the non-discrimination or no disguised barrier to trade disciplines (i.e., the negative obligations) before any other issues arose, now a complaining Party may base a complaint on any or all of the disciplines. Hence, all the disciplines have to be met for a measure to be consistent with trade law. In short, the obligations are now independent and cumulative.

The disciplines noted above apply to all stages of the environmental management process, from the underlying evaluation of a problem to the design and implementation of a measure. This is inherent in the nature of the disciplines, and their relevance to the different aspects of policy making and implementation.

Of major importance is the fact that the disciplines also apply retroactively to measures adopted prior to the NAFTA or WTO Agreements coming into force. This is seen, for example, in the language of the provisions of NAFTA that reference "maintaining" measures subject to the disciplines (e.g., NAFTA Article 904).

Trade law has also established that the trade disciplines apply not just where there is an actual impact of a measure on trade, but where there is a potential impact on trade. The purpose of this is to protect the right of market access free of discriminatory barriers. If for example, a measure prevents or restricts access to a market, it cannot be saved because there is no established trade in that product that is demonstrably reduced or eliminated.

4 Are Trade Obligations Generally Consistent With Environmental Management Processes?

Table 1 below provides an assessment of the consistency of the trade disciplines with the different stages of environmental management and decision-making by governments described above.

As regards the initial stage of ***identification of an environmental problem***, the principle objectives of the relevant trade disciplines are to avoid political distortions in identifying existing or potential issues for further work due to other market-related issues. In short, environment problems should be identified and made subject to initial assessment on their own merits, not on the basis of trade issues. Here, there is no apparent conflict between the two areas. Indeed, the application of the disciplines may actually be useful for environmental managers to avoid political pressures that can distort environmental priority setting based solely on actual or potential environmental risks, and associated human health risks.

In the ***risk assessment*** stage, it is noted above that the requirement to perform a risk assessment only applies to measures falling under the SPS provisions of trade law. However, the absence of a risk assessment can be seen in a disadvantageous light in relation to other disciplines, such as whether an environmental objective is discriminatory or creates a disguised barrier to trade.

There is nothing inherently conflictual between trade and environmental regimes here. Indeed, a sound risk assessment can help inform decision-making. However, there are legitimate concerns that risk assessments have significant capacity requirements associated with them, which may strain environmental resources. This includes the ability to identify sources of risks, sampling and testing methods, data management, etc. In addition, several trade cases have argued that risk assessments themselves need to apply accepted international standards and processes in order to be seen as "legitimate" (e.g., Australia Salmon 1998, Beef Hormones 1998). Consequently, while there are no legal conflicts or conflicts in objectives, the practical consequences, especially in relation to capacity requirements, can be significant.

A related factor is the ability, in the absence of a substantial and comprehensive risk assessment capacity, to apply different types of assessment processes to different potential problems. Inconsistency between levels of assessment can be used as "evidence" of other motivations. Here, the availability of international assessment or assessments from other countries can reduce the burden. However, if the subsequent risk management measures differ from those associated with the risk assessment used, this can raise significant issues requiring further scientific and technical justification.

To the extent that transparency is an emerging process requirement at the international level for risk assessment, this can be a constructive contribution to the environmental management process as long as it is applied to all stakeholders equally, and not so as to delay or distort an independent assessment process or result.

Table 1. Relationships between environmental management stages and trade disciplines

Environmental Management Stage	Trade Disciplines Applicable	Nature of Requirements/Impacts
Identification of environmental problem	National treatment	Avoid politicization or distortion of issues based on domestic economic factors
	No disguised barrier to trade	Cannot "invent" a problem to create and environmental measure with a trade impact
	International standards and actions of other countries	Consider issues addressed at the international level or by other countries to minimize trade distortions, but does not limit problem identification to those recognized internationally
Risk assessment	Basing measures on sound science	Risk assessment is a scientific function, requiring the utilization of sound scientific principles and practices; major impact is capacity requirements
	Applying international standards and processes	International processes and protocols should be applied when possible; major impact is capacity requirements; transparency and peer review of assessments are an increasing part of acceptable international process standards
	Comparison of risks among different products	Risk assessments should be equally triggered for anticipated similar risks, and conducted in an equivalent way
Identification of environmental objective	National treatment	The objective must not be aimed at setting a standard that leads to de facto discrimination between states
	Disguised barrier to trade	The objective must not set (just) so as to create a disguised barrier to trade by reflecting what the enacting state can achieve but not other trade partners
	Basing measures on sound science	Linkages to the risk assessment; creates the need to balance precautionary principle with the scientific basis for a measure
	Risk assessment	The measure must be based on the findings of the risk assessment
	International standards and processes	Use of international standards creates presumption of consistency with trade law; non-use creates potential burden to justify any differences
	Comparison of risks among different products	Consistency in identification of objective compared to levels of risk; non-discrimination based on country of origin of product/risk
Identification of appropriate environmental management tool	National treatment	Non-discrimination in measures and standards based on country of origin
	No disguised barrier to trade	Measure cannot exceed what is necessary to achieve the objective
	Basing measures on sound science and risk assessment	The measure must be based on the findings of the risk assessment and designed to achieve the directly related environmental objective
	Use of international standards and processes	Presumption of trade consistency when used; raises need to justify differences when not used; capacity required to identify such standards
	Comparison of risk management among products with similar risk levels	Consistency in applicable measure compared to levels of risk and environmental objectives; non-discrimination based on origin of risk; capacity requirement, though perhaps less given internal access to comparable regulations and decisions
	Least trade restrictive	Trade impacts cannot exceed what is necessary to achieve the objective; creates significant environmental economics and trade capacity requirement to compare potential measures in advance of taking one
Implementation and enforcement of management tool	National treatment	Non-discrimination in application of measures
	No disguised barrier to trade	Application of trade provisions not to exceed implementation of other aspects of measure if present; equality of application between trade partners
	Arbitrary or unjustifiable discrimination	Applies process related tests such as equal access to decision-making, rights of appeal of decisions, equal application of the measures compared to others, etc.; may create additional capacity requirements

Setting the environmental objective is a critical linking stage for trade law purposes. In simplistic terms, the environmental risk assessment tells what the risks are and why an environmental objective needs to be set. Setting an environmental objective tells officials and stakeholders in clear terms what needs to be achieved. And the risk management decision tells how the objective is to be achieved. Thus, setting the environmental objective becomes the link between the assessment and management processes. Trade law cases have now clearly established this conceptual and practical chain (e.g., Australian Salmon 1999), thus making it especially relevant for environmental managers to consider how this is done.

For trade law, the environmental objective provides a fundamental point for comparison among commercially substitutable, products and between differing products having similar levels of risk. Consistency in identifying comparable environmental objectives in relation to comparable risks supports the bona-fides of a measure. Conversely, significant differences in the nature of the environmental objectives for similar risk levels can be used to suggest trade-related motives behind a measure. Understanding the environmental objective is also the critical touchstone for comparing the trade impacts of different tools that might notionally be available to achieve the objective, as seen in the next stage.

Trade law makes it clear that states are entitled to choose their environmental objectives, as long as they are not chosen for protectionist purposes. This serves to highlight the linkage noted above between the risk assessment/sound science disciplines and the setting of the objective. Once chosen, states are entitled to take the steps, including trade restrictive steps, necessary to achieve the objective [NAFTA Article 904(2)]. In an important statement, the relationship between the objective and the measures taken was summarized in 1994 by the OECD:

> The ultimate goal of trade examinations, reviews and follow-up of environmental policies would be to ensure the achievement of environmental objectives in ways that minimize undesirable trade effects, by identifying, if necessary, less trade restrictive options that would *equally satisfy the environmental objective* (OECD 1994, 19, emphasis added).

Choosing an appropriate environmental objective is clearly not inconsistent with environmental management processes. One area where important legal questions do arise, however, is the appropriate application of the precautionary principle to this stage. Here, the link with the sound science and risk assessment disciplines is important. How to assess the weight of scientific uncertainty against an acceptable level of risk and establish an appropriate standard in response is the critical issue, and one which trade lawyers are increasingly recognizing does not belong solely in the hands of scientists (Fraiberg and Trebilcock 1998). Here, trade law may well face increased challenges, in particular if precautionary measures are limited to temporary measures, as suggested by some articles in NAFTA [e.g., Article 907(3)] and elsewhere (Beef Hormones 1998). One limitation on the role of the precautionary principle from trade law that is clear is that it should not be used to "invent" risks, but rather to weigh the importance of uncertainty surrounding risks. If seen in this way, the relationship may be less conflictual than otherwise, as long as precautionary measures are not limited under trade law to temporary measures.

The ***choice of environmental measures*** brings into play virtually all of the environment-related trade disciplines. This should not be surprising, as the chosen measure is the most visible manifestation of the management process, and the one with the most legal and trade consequences. In addition to the basic rules on non-discrimination, both as between the source of origin of a product and products having similar risks, perhaps the most critical disciplines are those relating to not creating a disguised barrier to trade and the least trade restrictive tests. It is also important to recall the linkages between the setting of the environmental objective and the choice of risk management tool.

While different management tools may raise different issues, simply because a trade issue is raised does not mean the measure is necessarily a breach of trade law. Many trade measures can be taken that are fully consistent with trade law. Import bans, for example, may not be GATT inconsistent when they are non-discriminatory, i.e., when they are accompanied by domestic restrictions of equal impact. Similarly, many measures that are not trade measures per se but have an impact on traded products (for example if a ban on computer equipment containing lead solder were to be imposed) are also not necessarily breaches of trade law despite the obvious trade impacts they may have. Further, even if a mechanism would be a breach of trade law, it may fall within the environmental exceptions that allow for breaches to be justified. What trade law does require is an assessment to be made of these potential impacts in each given case, based on a comparison of potential management options. Like the risk assessment discipline, this can create significant resource requirements, often beyond the capacity of agencies to fully meet the requirements.

As a reflection of the key disciplines noted above, the choice of an environmental risk management tool is expected to have as small an impact on trade and market access as is possible to achieve the environmental objective. However, the trade disciplines do not require that the achievement of the environmental objective be compromised in order to minimize trade effects. This is a critical interpretational point which, if applied not just in state-to-state disputes but also in internal government decision-making processes, minimizes the actual substantive impact trade law might otherwise have on environmental management tools. Appropriate internal capacity in different departments is likely required to ensure this understanding is consistently applied. These capacity requirements remain a significant concern, given the need to have expertise in a combination of environmental and economic fields.

A new issue that is emerging due to the growing levels of industrial concentration is the need to regulate products with hazardous characteristics that are only sourced in foreign countries. Here, the ability to establish domestic comparisons may be limited, or even non-existent. As a result, a premium may be placed on the science/risk assessment disciplines noted previously. References for comparative purposes between different products with similar risk levels may also be important in this regard.

Finally, the stage of ***implementation and enforcement*** arises. This is critical, in particular given the ruling in the 1998 *Shrimp-Turtle* case, where the Appellate Body of the World Trade Organization made it clear that both the substance of a measure and its implementation are subject to review under trade law (Shrimp-Turtle 1998). The critical thread that runs through the disciplines here is one of non-discrimination in terms of access to the decision-making process, to rights of appeal of decisions, in the process of enforcement, and so on. Due process issues have also been signaled in this area, such as actually having rights of appeal of a decision applicable against foreign producers.

In general, these issues should not pose significant problems in the NAFTA context, though capacity requirements are again an important issue. However, if extended globally, significant resource and potentially cultural problems may well arise.

5 Risk Assessment: What are the Likely Risks Trade Law poses to Environmental Management and Decision-making?

An initial assessment of the relationships set out in Table 1 and supplemented by the discussion in section 4, above, suggests that most existing and many future environmental measures would not survive trade law challenges since the increase in independent disciplines under NAFTA and the 1994 WTO Agreements. This assessment needs to be divided into measures adopted prior to the agreements coming into force, or shortly thereafter, and new measures adopted more recently or that may be adopted. *And, importantly, it must also be considered in the light of factors that mitigate the risk of actual challenges and the consequences of such challenges in order to reach an appropriate assessment of the risk posed by trade law to environmental management decisions.* (Note that the issues more specific to investment obligations are considered in the following section.)

The risks of an environmental measure losing a trade law challenge are significantly higher for older measures, due to the basic reality that trade law factors were usually not considered in the course of developing environmental measures.[6] Hence, the specific requirements in trade law today cannot be met because the types of comparisons and processes now required were, for the most part, simply not addressed and hence not undertaken. Given the independent and cumulative nature of all the disciplines, and their retroactive application to all preceding measures that are maintained, the chances of most older measures meeting all the requirements are very low.

However, the risk of losing a trade-based challenge does not mean all environmental laws are now jeopardized. First, trade law challenges (excluding the investment rules discussed below) must be brought by other states. This imposes an inherent political constraint on the idea that all laws are at risk. Still, those measures that have a significant impact on export opportunities for a party may well be at risk. Here, the second mitigating factor arises. Under the WTO dispute resolution process the consequence of losing a challenge is the requirement to bring the measure into consistency with the full range of obligations. This allows additional processes to be undertaken and/or adjustments to measures to be made. In other words, the measure must not automatically be withdrawn. (See, e.g., Australian Salmon 2000, for an example of this response process in action.) This is not as clear in the NAFTA context, where the dispute resolution provisions indicate that the normal resolution after a loss will be the "non-implementation or removal" of a measure (NAFTA Article 2018). However, this does not inherently preclude the adoption of a replacement measure in due course, though additional issues would undoubtedly arise and complicate such a process.[7]

In short, while the risks of losing a challenge to an older environmental measure are likely high, the risks of such challenges arising are not high, and other avenues beside the full withdrawal of a measure may also be available in the event of a loss. There are clearly risks to existing measures, but these should not be exaggerated in view of the other relevant factors.

For the adoption of new measures, the risks arise from somewhat different concerns. With the higher profile of trade law issues in internal government processes today, it is difficult to adopt new measures without considering the applicable trade disciplines. This in itself is not, of course, inappropriate. What is of concern is the manner in which such considerations are developed and assessed. Here, a significant capacity issue arises. Extensive human resources are required with the technical, scientific, economic and legal expertise to meet effectively the full range of trade disciplines. Importantly, these human resources must have not just the capacity to address the trade issues, but the experience and capacity to address the combined trade and environment issues in a complementary and integrated manner. In Mexico, the indications are these resources are not widely available. This lack of capacity extends into the environmental management agencies in Canada and the United States as well, though likely to a lesser and, at least in some cases, diminishing extent.[8] Consequently, trade law can be seen as putting in place requirements that all Parties to the agreements do not have the capacity to meet. When trade law is considered not just in the NAFTA context but also in the broader global arena, this situation takes on additional dimensions and risks to the environment of developing countries. Significant capacity development will be required to fully compensate for the additional requirements imposed by trade law on environmental law-making.

This situation has also led to the apparent development of a new dynamic within governments: the potential jeopardizing of environmental measures prior to their adoption. Inter-departmental

[6] This assessment is based on personal discussions with environmental regulators. As these discussions concerned the actual consistency of their work with trade law, they were conducted on a strictly confidential and not-for-citation basis. Hence, this "empirical" evidence may be less than a more extensive and detailed analysis on a jurisdiction-by-jurisdiction basis would require, and is certainly not applicable to any specific instance where a trade challenge may occur. However, the present author believes the information received is both credible and sufficiently representative of past practice to establish a general level of risk.

[7] One can, for example, expect subsequent challenges to the new measure, as well as a claim for non-violation nullification and impairment of benefits, another legal avenue for claims to be made under NAFTA.

[8] See note 6, *supra*, re sources.

processes in all three countries can place a significant strain of the ability of environment departments to achieve their objectives in the face of trade law objections raised by other departments. If these objections are not equally balanced by relevant environmental considerations when brought forward, and environmental agencies frequently lack the capacity to address them internally to create such a balance, environmental protection measures can be lost or significantly delayed as a result. The response that would seem appropriate here is both an increase in capacity for environment departments to manage the application of the disciplines, as well as an increased awareness and sensitivity to the environmental issues by those providing other trade law inputs.

Closely related to the additional disciplines is the ability to apply those disciplines in the context of changing and advancing environmental protection strategies. Perhaps most important in this context is a potential conflict between pollution prevention as a policy direction of choice and the application of the least trade restrictive discipline to the choice of environmental risk management tools. Pollution prevention approaches are very closely tied to product life-cycle management, and seek to prevent pollution problems before they arise rather than mange the risks they pose after the fact. This is not only sound environmental practice, but also reflects the polluter pays concept—often through product redesign or other process changes. Examples of such pollution prevention processes include extended producer responsibility, extended product responsibility and integrated product policy. The common linkage among these approaches is that it is producers who are made responsible either to eliminate the cause of the potential pollution or to manage it themselves. Efforts in Europe to eliminate the use of lead solder in electric circuit boards are an example of this, and one that poses serious trade challenges. But there are hundreds of other possible examples of products containing toxic material that could be subject to input substitutions as part of pollution prevention policies.

As trade law and resulting changes in investment promote the consolidation of manufacturing facilities and intra-company manufacturing processes, increased conflicts between pollution prevention as an optimal environmental policy and the goals of trade liberalization may well occur. Initial indications are that trade law can adapt to this, as seen in the result if not the reasoning of the most recent *Asbestos* case (Asbestos 2000). However, Canada has announced it is appealing this decision, arguing in part that the ability to manage the environmental and human health risks after they are created is a less trade restrictive option that can achieve the same objectives. If this argument is accepted by the Appellate Body, it would create significant conflicts between trade disciplines and the development of new environmental policies.

One solution repeatedly suggested by the WTO is for bilateral or multilateral negotiation of such issues. As product content issues become more directly involved in environmental management, however, it is unlikely the capacity exists for negotiations on a product-by-product basis. Thus, this area may well be a subject of some importance in the near future, and one where the capacity of trade practitioners to understand and adapt to new environmental management strategies will be essential to prevent trade law generating significant constraints on environmental management strategies.

6 The Different Challenges and Risks of Investment Rules: Chapter 11 and the Environment

Chapter 11 of NAFTA, on investment, was developed for two main purposes: to promote investment into Mexico as part of the NAFTA process by providing enhanced guarantees for Canadian and US investors concerning the safety of their investment; and to help protect those foreign investors from capricious action against them or their investments.

To do this, Chapter 11 provides a series of obligations on governments that in some ways parallel those of trade law, but in other critical ways also exceed trade law. Tied to the obligations is the right of individual investors to initiate an international arbitration proceeding against Canada, Mexico or the US if the investor is of the view that one of the obligations has been breached. Chapter 11 has been described as containing, in practice, the most extensive rights and remedies for foreign investors ever set out in an international agreement (Mann and Von Moltke 1999; Horlick and Marti 1997).

Unfortunately, Chapter 11 provides little guidance on the application of these obligations in the context of environmental management and regulation. This has led to a number of challenges over new environmental laws or administrative decisions. Indeed, to date the exercise of these rights and remedies have been initiated approximately 20 times, with about half of these addressing adopted or proposed environmental laws. (See Mann and Von Moltke 1999, Annex 1, for a summary of the first thirteen cases.) The main obligations in Chapter 11 are noted in Table 2 below, with a note on the associated uncertainties.

Table 2. Chapter 11 obligations and uncertainties

NAFTA Source	International Obligation	Uncertainties
Article 1102/1103	National treatment, most favored nation (treat companies in like circumstances the same way)	How to apply this to individual cases, to continued ratcheting up of environmental standards, to possible liability issues that do differ for foreign companies, etc; what does "in like circumstances" mean in changing environmental and corporate structure contexts in light of recent cases
Article 1105	Minimum standard of treatment (basic fairness and due process)	Appears to duplicate national treatment and expropriation issues in some respects; recently extended to procedural due process, right to be heard, right of appeal, legal duties on potential host government, etc.; full scope unclear
Article 1106	Performance requirements (cannot require an investor to purchase inputs in Canada or sell outputs in Canada or outside Canada as a condition of investment)	Cases have argued that imposing a trade ban or standards having an import restricting effect creates a performance requirement that is illegal; argument supported in some cases to date, rejected in one but with a dissent; would make every trade measure subject to private challenge
Article 1110	Expropriation (no expropriation without compensation)	Cases have argued that new environmental laws, especially with a higher effect on one or a few companies, creates an expropriation of their business that requires compensation; *Metalclad* decision suggests that any incidental interference with use of property for business can found an expropriation claim, and that motive for the measure is not relevant

What is emerging from the first group of decisions in the Chapter 11 arbitrations must be seen as particularly concerning from an environmental management perspective. In essence, the uncertainties noted in Table 2 are being consistently resolved in favor of industry positions over environmental management requirements. Given the space constraints here, perhaps the easiest illustration of these concerns can be seen in the recent decision in the *Metalclad v. Mexico* case, released in August 2000.

A key part of this ruling was the reference to only four NAFTA objectives as underpinnings for the interpretation of Chapter 11. These are transparency in government regulations and activity, the substantial increase in investment opportunities, ensuring the successful implementation of investment initiatives, and to ensure a predictable commercial framework for investors (Metalclad 2000, paras. 70–75). What was completely absent was any reference to other objectives concerning sustainable development, the protection of the environment, and the promotion of sound environmental laws. It is difficult to assess the extent to which the entire ruling in Metalclad is predicated on this one-dimensional allocution of underlying principles for Chapter 11.

The tribunal then considered the issue of minimum international standards of treatment, Article 1105 of NAFTA, and ruled that Mexico breached its obligation, in essence, by failing to provide a transparent, predictable framework for business planning and investment, and demonstrating a lack of orderly process and timely disposition in relation to an investor. The tribunal noted, in particular, that the investor had received conflicting assurances from government officials, and the government was under a duty under NAFTA to address any legal confusion the investor had and ensure it properly understood the law. The tribunal then ruled, despite contrary views officially put forward by Mexico, that the local municipality whose acts were in question in this case exceeded their constitutional authority, creating an additional breach of the minimum standards protection. This Tribunal ruling on the constitutional authority of a municipal body, and its compliance with local law, is also of concern for a body intended to deal with the international law obligations arising from Chapter 11 (Metalclad 2000, paras. 74–101).

Perhaps the most crucial finding is in relation to the protections against expropriation. Here the tribunal ruled that the same actions that led to the finding of a breach of Article 1105 also lead to a breach of the rules on expropriation, given that no compensation was paid. This is the first time breaches of law-making process have been analogized to expropriation, and makes the scope of what constitutes an expropriation very unclear. The Tribunal's apparent determination that an act outside the scope of authority of the municipality could itself found an expropriation complaint also raises questions about what limits are applicable here.

Even more critically, the tribunal defined expropriation to include a "covert or incidental interference with the use of property". This is an almost limitless legal notion, encompassing any potential impact of an environmental law on the operation of a business. This expansive scope is enhanced by the Tribunal's statement that it "need not decide or consider the motivation or intent of the adoption" of a measure. If this combination of statements holds in future cases, it effectively means the end of the concept of "police powers" as a legal counter-weight to the scope of what constitutes expropriation, whereby government activity to protect its population was legally excluded from the notion of expropriation. Consequently, any environmental law that interferes with the use of an investment to generate profit could fall within the scope of Article 1110, and require compensation (Metalclad 2000, paras. 103–111).

Finally, and paradoxically given its focus on transparency in the NAFTA as a fundamental objective, the tribunal expressly limited transparency in its own proceedings to disclosures required by national law applicable to the litigating parties, despite its express recognition that there was no legal provisions requiring them to impose such limits. This view is now being directly challenged in the proceedings in the Methanex case.

It must be noted that the interpretations in the Metalclad case are not necessarily correct (Mann and Von Moltke 1999, s. 3), and remain to be confirmed or rejected by other, ongoing arbitration processes. Still, the risks now generated by this type of expansive reading of the expropriation and other disciplines in Chapter 11 are such as to make new environmental law making extremely difficult. Unlike trade rules per se, the adjudication and enforcement of investment rules can be triggered directly by private companies, thus eliminating the political constraint associated with state initiated actions. In addition, Chapter 11 has its own retroactivity: it applies to all foreign investments and investors of the three Parties prior to the entry into force of NAFTA in 1994, and its operation can be triggered by any new changes in the law impacting any of these investments. In that the breach of any of these disciplines leads to monetary damages rather than an order to rescind the offending measure, what is emerging is a substantial impact that significantly constrains the opportunities for new environmental law-making or other decisions impacting on industrial sectors with any foreign investors. In addition, this impact would, if continued, overturn the central principle of the polluter pays and establish Chapter 11 as an instrument requiring governments to pay the polluter. Further, the risk that this result might occur is beginning to have a substantial chilling effect on agencies charged with environmental protection functions, and has already led to the withdrawal of at least one measure following the initiation of a Chapter 11 proceeding to avoid higher damage awards.[9]

Overturning these initial interpretations, if it can be done, will now take additional time and thus create additional risks and delays for environmental protection processes. The NAFTA Parties, do, however, have mechanisms other than future case law and amendments to NAFTA available to address these risks, if they choose to exercise them. In particular, the adoption of an interpretive statement under Article 1131(2) of NAFTA is available at any time the Parties may wish to do so, with such a statement legally binding on all pending and future arbitration panels.

7 Risk Management: Recommendations for Addressing Likely Risks of the Impacts of Trade Law on Environmental Management

A balanced assessment or the risks posed to environmental management and law-making by governments as a result of NAFTA and the WTO Agreements suggests a clear need to address capacity requirements in all countries to harmonize trade disciplines with environmental practices. Based on the interpretations of the key disciplines set out above, and assuming that the Canadian positions relating to pollution prevention strategies in the *Asbestos* appeal at the WTO are rejected by the Appellate Body, there would not appear to be any inherent conflict between the regimes. But ensuring this in practice will require sensitivity and awareness from practitioners and officials in both areas of practice.

What may be useful in this regard is a coordinated effort between the Free Trade Commission and the Commission for Environmental Cooperation to assess the trade disciplines against environmental management practices in the three Parties, and arrive at a common understanding concerning the relative concordance between these two areas. This would also assist in ensuring a common understanding of the applicable disciplines, improve mutual awareness and expand opportunities for directed capacity building in all three countries. In the absence of a coordinated trilateral approach, there is no impediment to each NAFTA Party initiating its own process to review its practices against trade disciplines and establish its understandings of how they mesh.

As regards Chapter 11, the challenge for trade ministers to respond to the interpretations of the obligations set out therein should be understood as a subject of major importance. This challenge includes the substantive obligations, but also the process issues that have generated and maintained an unnecessarily secretive approach to addressing issues of critical national significance.

[9] Again, see note 6, *supra*.

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Appendix

Summary Table. Correlation of Trade and Investment Rules and Environmental Management Stages

	Identification of Problem	Assessment of Risk	Environmental Objective	Choosing Measure	Implementation
National Treatment	✓		✓	✓	✓
Disguised barriers	✓		✓	✓	✓
Science Based		✓	✓	✓	
Risk Ass't		✓	✓	✓	
International Standards	✓	✓	✓	✓	
Non-discrimination of risks		✓	✓	✓	
Least trade restrictive				✓	✓
Investment disciplines (national treatment, minimum international standards, performance requirements, expropriation)	✓	✓	✓	✓	✓

Traditional "negative" disciplines: no new disciplines
New "positive" disciplines: impose new mandatory disciplines often requiring significant scientific, technical, economic and legal resources; high human capacity requirements and associated costs
Issues raising significant interpretational concerns

Is there a Race to the Bottom in Environmental Policies? The Effects of NAFTA

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Abstract

We address the question whether NAFTA altered the nature of strategic environmental policymaking across US states. Specifically, we extend previous research that has documented a race to the top between US states in environmental policymaking, by examining interstate environmental relationships in the time leading up to and beyond the ratification of NAFTA. By focusing on states which border Mexico or Canada, we test the hypothesis that if NAFTA is contributing to a race to the bottom in terms of environmental quality and protection then states which border the NAFTA neighbors should be less responsive to changes in environmental policies in neighboring US states. For sulfur dioxide emissions, we find some evidence that states bordering Mexico give less weight to their US neighbors, indicating a concern for firm flight to Mexico. However, around the time of the NAFTA negotiations, it appears that this concern declined. For other measures of environmental quality, and for states bordering Canada, no significant effects are detected.

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Executive Summary

We explore the effect of NAFTA on the determinants of environmental quality and policy in US states by differentiating interior states from those bordering Mexico and Canada. We seek to answer whether US states that border either of these countries act differently than interior states and if their behavior changed during the time surrounding the ratification of NAFTA. The idea is to test the existence of strategic interaction among states in the determination of environmental policy and, in particular, see if this interaction differs in border and interior states. In other words, to what extent do state policymakers maintain an eye on environmental policy in neighboring states? For instance, policymakers in US border states may have a stronger concern with capital flight. If this fear plays a role in determining policy, US border states should be less responsive to changes in environmental policy in neighboring US states. In addition, if NAFTA increased fears of capital flight, then states along the border should have been even less responsive to their US neighbors immediately before and after the treaty's ratification.

Using three different measures of environmental quality and policy—per capita sulfur dioxide emissions, Levinson's (1999) index of relative state compliance costs, and per capita toxic chemical releases—we reach three important conclusions. First, all three measures indicate that environmental quality and protection improved for all US states leading up to the ratification of NAFTA and continued to improve beyond ratification for toxic releases as well. Second, we find some evidence that US states along the Mexican and Canadian borders respond differentially to environmental changes in neighboring US states in terms of sulfur dioxide emissions and environmental compliance costs, but not toxic releases. States bordering Mexico are less responsive to changes in neighboring sulfur dioxide levels, while states on the Canadian border are more responsive to changes in neighboring states.

In terms of compliance costs, states on either border are less responsive to changes in neighboring US states than interior states. This finding may indicate a fear by border states of capital flight to Canada or Mexico. However, around the time of the NAFTA negotiations, this concern may have actually declined. For toxic releases (the only measure of environmental quality available beyond 1994) there was no change in the determination of pollution levels during the 1990s. Finally, we fail to find any evidence of a change in the manner in which environmental quality and protection was determined around the time of NAFTA's ratification. When this is combined with the fact that our three measures of environmental quality improved during the 1990s, we conclude from this analysis that NAFTA has not had a detrimental impact on the environment in the US.

1 Introduction

In connection with the NAFTA negotiations and ratification in the early 1990s, capital flight became an important issue of debate.[1] The hypothesis we test in this paper is whether US states bordering either Mexico or Canada altered the manner in which they decided upon their environmental policies during the 1990s.[2] If such states were more or less concerned with the possible loss of firms to Mexico or Canada after the ratification of NAFTA, then one might expect the determinants of environmental policy in border states to have changed. Specifically, whereas prior to NAFTA negotiations and the treaty's ultimate ratification, US environmental policies were determined at the state level with a watchful eye on the policies enacted by neighboring states, in the NAFTA era US states now must (may) be more cognizant of the environmental policies of Mexico and Canada. In addition, if any US state governments are to be fearful of losing jobs to either border country, it should be those on the border. Within such border states, firms incur lower costs from moving over the border, there may be fewer cultural barriers impeding relocation, and firms may possess better information about the business conditions in the neighboring country. Thus, one method of testing for an adverse effect of NAFTA on environmental protection in the US is to examine if the environmental policies of bordering states became less responsive to the policies of neighboring US states during the 1990s. If so, this would provide some evidence that NAFTA might be having a detrimental impact on the US environment.

It should be noted that the above hypothesis relies on the mindset of policymakers, as well as voters and political pressure groups, in US states bordering Mexico or Canada. In other words, if policymakers and others *believe* firms might move from the US to Mexico or Canada, then they may be less responsive to changes in environmental policies in neighboring US states. However, this belief may or may not be accurate. Thus, we might detect an adverse effect from NAFTA on US environmental policy even though the policy response would be misguided. Alternatively, if policymakers naively believe that firms will not move to either Mexico or Canada, when in fact they will, we will detect no adverse environmental effects of NAFTA. One must be cautious, therefore, in that the results presented do not provide support either for or against claims of capital flight as a result of the free trade agreement.

Using three different measures of environmental quality (per capita sulfur dioxide emissions, per capita toxic chemical releases, and Levinson's (1999) index of relative state compliance costs), we find no evidence that border states altered the manner in which they determined their levels of environmental protection during the early 1990s. When this is combined with the fact that our three measures of environmental quality improved during the 1990s, we conclude that NAFTA has not had a detrimental impact on the environment. However, we find some evidence that US states bordering Mexico have historically paid less attention to their US neighbors; thus indicating a concern for policy activities in Mexico. However, this effect appears to have disappeared *before* the arrival of NAFTA.

There is some previous empirical evidence on the relationship between economic integration, the stringency of environmental protection, and environmental quality. List and Gerking (2000) used US state-level data to show that environmental quality did not deteriorate after President Reagan's decentralization of environmental policymaking in the 1980s. The authors concluded that no race to the bottom materialized. In a cross-country study of the agricultural sector, Eliste and Fredriksson

[1] A survey by Jaffe *et al*. (1995) turns up weak evidence that firm location has been affected by environmental regulations in the US. However, List and Co (2000) do find some evidence of this sort.

[2] Alternatively, we could have examined other classes of states in the US to test for changes as a result of NAFTA. For example, some evidence exists that firms may have re-located away from the Rust Belt states after NAFTA came into effect. While this may be true, we chose to focus on border states since much of the concern surrounding the possible loss of jobs originated from, in particular, states bordering Mexico. We will leave a more comprehensive analysis of Rust Belt states to future research.

(2001) have found some evidence of strategic interaction across countries in the environmental arena. The degree of regulatory interaction was found to depend on geographical distance and the degree of openness to trade between trade partners. Since agricultural production is highly immobile, Eliste and Fredriksson did not address the issue of capital competition, however. Fredriksson and Gaston (1999) investigated empirically the "regulatory chill" hypothesis, i.e., whether openness to trade affects the propensity for governments to undertake environmental policy. They found no evidence that more open countries were less prone to cooperate on the global climate change issue. Damania *et al*. (2000) found that countries with more open trade set stricter levels for the amount of lead allowed in gasoline, and that this effect of openness is more pronounced in countries with highly corrupt governments (where environmental policy tends to be particularly distorted). Dean (1999) found that in China, increased openness to trade has induced greater environmental damage due to China's comparative advantage in polluting sectors. However, increased income levels (due to more open trade) have in turn had a negative effect on emissions growth, reducing pollution levels. Hettige *et al*. (1992) and Grossman and Krueger (1993) found evidence that more open countries tend to have lower pollution levels.

The remainder of the paper is organized as follows: section 2 presents the basic empirical model, the data, as well as extensions to the basic model; section 3 discusses our findings; and section 4 provides some concluding remarks.

2 Empirical Analysis

2.1 Specifications

The econometric models used to test the impact of NAFTA interstate interaction in the determination of environmental quality build on Fredriksson and Millimet (2000). The basic regression equation is

$$E_{it} = \alpha_i + \gamma_t + (\delta_o + \delta_m D_{1i} + \delta_c D_{2i})\sum_{j=1}^{48} \omega_{ijt} E_{jt} + x_{it}\beta + \varepsilon_{it}, \quad i = 1,\ldots, 48, \tag{1}$$

where E_{it} is a measure of environmental quality in state i at time t, α_i are state-fixed effects,[3] γ_t are time-fixed effects,[4] ω_{ijt} is the weight assigned to state j by state i at time t ($j \neq i$), where some of the weights may be zero, E_{jt} is the measure of environmental quality in state j at time t, δ_k ($k = o, m, c$) are the parameters of interest, D_{1i} (D_{2i}) is an indicator variable equal to one if the state borders Mexico (or Canada) and zero otherwise, x_{it} is a vector of state characteristics, and ε_{it} represents idiosyncratic shocks uncorrelated across states and over time.[5] Thus, the impact of environmental quality in neighboring states on own environmental quality is δ_o if the state does not border either Canada or Mexico, $\delta_o + \delta_m$ if it borders Mexico, and $\delta_o + \delta_c$ if it borders Canada. The measures of environmental quality, E (discussed below), include: per capita sulfur dioxide emissions, Levinson's (1999) industry-adjusted measure of relative state environmental compliance costs, and total toxic chemical releases.

3 State-fixed effects—refers to a statistical method whereby one includes a different intercept for each US state in the equation being estimated. The interpretation of the intercept is the (conditional) mean pollution level or level of environmental compliance costs observed in that state over the many years we observe the state (i.e., 1977–1994 for most of the work in this paper).

4 Time-fixed effects—refers to a statistical method whereby one includes a different intercept for each year that the data spans. When both state and time FEs are included in the same model, the interpretation of the time effects are the average deviation in a given year of the 48 US states from their individual means (i.e., the state effects).

5 The analysis considers only the 48 contiguous states, excluding Alaska and Hawaii (discussed below).

The variables included in x_{it} are other state attributes that may also affect environmental regulations and environmental quality. By controlling for these other characteristics we are able to identify the effect of neighboring state environmental policy *net* of the impacts of these other variables. The characteristics we control for are per capita state income, population, population density, and the percent of population residing in urban areas.

In (1), δ_k, where $k = c, m$, represents the *average* annual deviation in strategic environmental policymaking of bordering states from interior states over the span of the data. To assess the impact of NAFTA, however, we must ascertain if the behavior of bordering states differed (from their historical norm) during the 1990s. Thus, we estimate several variants of (1). First, we estimate (1) separately for each year of data—rather than pooling all years together—to obtain a unique estimate of δ for each time period. Plotting the resulting estimates over time allows examination for structural breaks in the way in which environmental information is used strategically by bordering and interior states. Note, however, since we no longer have a panel,[6] state- and time-fixed effects cannot be included in the cross-sectional regressions.

Second, we explicitly incorporate a structural break into (1) and estimate the following specification:

$$E_{it} = \alpha_i + \gamma_t + \left[(\delta_o^{pre} + \delta_m^{pre} D_{1i} + \delta_c^{pre} D_{2i}) * I_t + (\delta_o^{post} + \delta_m^{post} D_{1i} + \delta_c^{post} D_{2i}) * (1 - I_t)\right] \sum_{j=1}^{48} \omega_{ijt} E_{jt} + x_{it}\beta + \varepsilon_{it},$$

$$i = 1, \ldots, 48, \qquad (2)$$

where I_t is an indicator variable which takes the value one if the year is 1993 or earlier ("pre-NAFTA") and zero otherwise ("post-NAFTA"). Thus, comparison of δ_k^{post} and δ_k^{pre}, $k = c, m$, provides insight into changes which occurred after the ratification of NAFTA. The benefit of the structural break model in (2) is that we may still include the state- and time-fixed effects, whereas the fixed effects are not identified in (1) estimated separately by year. The drawback is that we must specify the year of the structural break. Because states may have altered their behavior while negotiations were still ongoing, we estimate several versions of (2) using different years for the structural break (e.g., 1993 and 1992).

There are two econometric issues to be addressed when estimating equations such as (1) and (2). The first issue is the choice of weights, ω. The simplest weighting scheme is to assign a weight of zero to non-contiguous states and then assign equal weights to all contiguous states. In other words, $\sum_j \omega_{ijt} E_{jt}$ simplifies to the mean of environmental quality in neighboring states. In this case, the weights for each state are time invariant. An alternative weighting scheme also assigns a weight of zero to non-contiguous states, but weights each contiguous state by its per capita income. Specifically, $\omega_{ijt} = y_{jt} / \sum_{j \in J_i} y_{jt}$, where y is per capita income and J_i is the set of states neighboring state i. This scheme assigns a weight to each state equal to its share of total per capita income of all neighboring states. Unlike the previous weighting scheme that simply averaged over neighboring states, the weights assigned by this scheme will vary by year.

The second issue of concern in the estimation of (1) pertains to the potential endogeneity of the environmental quality of other states. If there is strategic interaction among the states, then states are choosing their environmental policies simultaneously and incorporating their expectations about the

6 A "panel" refers to a "panel data set," which includes multiple observations from multiple time periods; i.e., our data set contains data on the 48 US states over many years. In contrast, "cross-sectional data" would refer to data on the 48 states, but only during one year; "time-series data" would refer to data on only one state, but over many years. Thus, a panel is a combined cross-sectional, time-series data set.

decisions of other states into their own decision-making process. This may give rise to concerns about the direction of causation. In addition, there may be unobservable regional or national shocks that may be correlated with the decisions of multiple states.

To address these concerns, we include state- and time-fixed effects (α_i and γ_t respectively) when identified. As a result, even if there exist time invariant unobservable state or regional attributes that affect environmental quality in several or more states, we still obtain consistent estimates of the parameters of interest, δ_k , $k = o, c, m$.[7]

However, the inclusion of state- and time-fixed effects will not circumvent the reverse causation story alluded to earlier. One solution is to instrument for the measure of neighboring environmental quality. The instruments used are the attributes included in x_{it} in (1) and (2) for neighboring states, employing the same weighting scheme for the instruments as we do for environmental quality. State characteristics such as per capita income, population, population density, and the degree of urbanization are assumed to affect own environmental quality, but not environmental decisions in neighboring states *conditional* on the environmental quality in neighboring states. In other words, once a given state either knows or forms an expectation about the environmental quality in a neighboring state, that is the only information used to decide its environmental response; other characteristics of the neighboring state are ignored. Thus, these attributes represent valid exclusion restrictions.

2.2 Data

To test for the presence of strategic environmental policymaking and an effect of NAFTA on strategic nature of policymaking in border states, we require an adequate measure of state environmental regulations. Unfortunately, the existence of such a measure is questionable. Previous research has typically used pollution abatement costs and expenditures (PACE) per unit of manufacturing output to proxy for environmental stringency. However, this measure has been shown to offer a poor approximation of environmental stringency due to the non-uniform distribution of industries across the US. This problem is potentially even more serious in the present study since industry composition is highly correlated within regions. Other potential measures of environmental stringency are varying “green indices” offered by conservation groups, typically based on the voting records of policymakers. Such measures are also of suspect quality given their inherent subjectivity. In addition, such measures may not capture the end result of environmental policies since passage of various rules and regulations may not translate into higher industry compliance costs if the policies are not adequately enforced. Finally, recent work has used county-level attainment status under the Clean Air Act to proxy for regulatory stringency. However, attainment status focuses on a highly detailed area of environmental policymaking. Thus, while interesting, attainment status is not broad enough for the questions we seek to answer.

As a result, multiple measures of environmental quality across US states are used to test for the effects of NAFTA. The first measure most closely proxies environmental regulation. The measure is a recently developed index purporting to capture the stringency of environmental regulation within each state. The index is developed in Levinson (1999) and spans the years 1977–1994, except 1987. The measure accounts for differences in state industrial composition and is defined as

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[7] Such region-specific unobservables may include religious attitudes or the degree of political activism, for example. The time-fixed effects will control for national events that occur in a given period and may impact all states through a reshaping of attitudes. Well-known environmental disasters such as the Exxon Valdez or the reactor meltdown at Chernobyl are prime examples. The time-fixed effects will also capture changes in federal environmental regulations such as the Clean Air Act and the later passage of its Amendments.

$$S_{it}^{*}=\frac{S_{it}}{\hat{S}_{it}}, \tag{3}$$

where S_{it} is the actual pollution abatement cost, $PACE_{it}$, per dollar of output, Y_{it}, produced in state i at time t and is given by

$$S_{it}=\frac{PACE_{it}}{Y_{it}}, \tag{4}$$

and $\hat{S}_{it}$ is the predicted pollution abatement cost per dollar of output and is calculated as

$$\hat{S}_{it}=\frac{1}{Y_{it}}\sum_{m=20}^{39}\left(\frac{Y_{imt}}{Y_{mt}}\right)PACE_{mt}, \tag{5}$$

where $m = 20,...,39$ indexes the two-digit SIC manufacturing sectors, Y_{imt} is total output in state i at time t from sector m, Y_{mt} is total national output (GDP) from sector m, and $PACE_{mt}$ is total national pollution abatement costs spent by industries in sector m.

Equation (5) gives the average pollution abatement costs per dollar of state output that would exist in state i at time t if each firm conformed to the national average for its industry. Consequently, the index (3) expresses the ratio of *actual* pollution costs per dollar of output to *predicted* pollution costs per dollar of output. A value greater than one indicates that industries in the state spent relatively more per dollar of output on pollution abatement than identical industries located in other states. If S_{it} is less than one, industries in the state spent relatively less on pollution abatement. The reader is referred to Levinson (1999) for further details.

Our second measure is per capita sulfur dioxide emissions. The data come from the US Environmental Protection Agency's (EPA) *National Air Pollutant Emission Trends, 1900–1994* and span 1929–1994. Admittedly, this is a less appropriate measure of environmental quality for the present study for two reasons. First, sulfur dioxide is regulated heavily under the Clean Air Act—especially in the Northeast—because of its role in acid rain. Second, the primary emitters of sulfur dioxide are power plants which are not mobile. Nonetheless, it is a criteria pollutant and worth examining.

Because the first two measures of environmental quality are only available through 1994, they do not allow us to examine changes after ratification of NAFTA. Thus, we turn to the third measure of environmental quality, releases of toxic chemicals, available through the US EPA's Toxics Release Inventory (TRI).[8] With the passage of the Emergency Planning and Community Right-to-Know Act (EPCRA) in 1986, all manufacturing facilities are required to release information on the emission of over 650 toxic chemicals.[9] Any facility that produces or processes more than 25,000 pounds or uses more than 10,000 pounds of any of the listed toxic chemicals must submit a TRI report (US EPA (1992)). While data are available at the chemical level, for the present purpose the data are aggregated together. Although the aggregation gives equal weight to each chemical, as reported by the EPA, most of the widely used chemicals do not vary significantly in their toxicity and many of the less toxic chemicals have not been assigned risk scores by the EPA (Arora and Cason (1999); US EPA (1989)). The data are currently available from 1988–1997.

[8] While the initial motivation for the public release of the TRI data was to encourage voluntary reductions in emissions by firms, it has nonetheless been used in many empirical studies analyzing pollution levels (see, e.g., Arora and Cason (1999)).

[9] Manufacturing facilities are defined as those falling under Standard Industrial Classification (SIC) 20–39.

State-level data on income as well as other attributes are obtained from the US Census Bureau. Summary statistics are given in Table 1. In addition, Figure 1 plots the values (weighted by state population) for the three measures of environmental quality, along with PACE per unit of manufacturing output, over time for interior states as well as for states bordering Canada or Mexico. According to the top two panels in Figure 1, not only have per capita sulfur dioxide emissions been decreasing since the 1970s and toxic chemical releases declining over from 1988–1997, but emissions of both types are significantly higher in interior states relative to states bordering Mexico or Canada. In addition, the downward trend in per capita toxic chemical releases in all three types of states remains unaltered in the post-NAFTA world.[10]

Table 1. Summary statistics

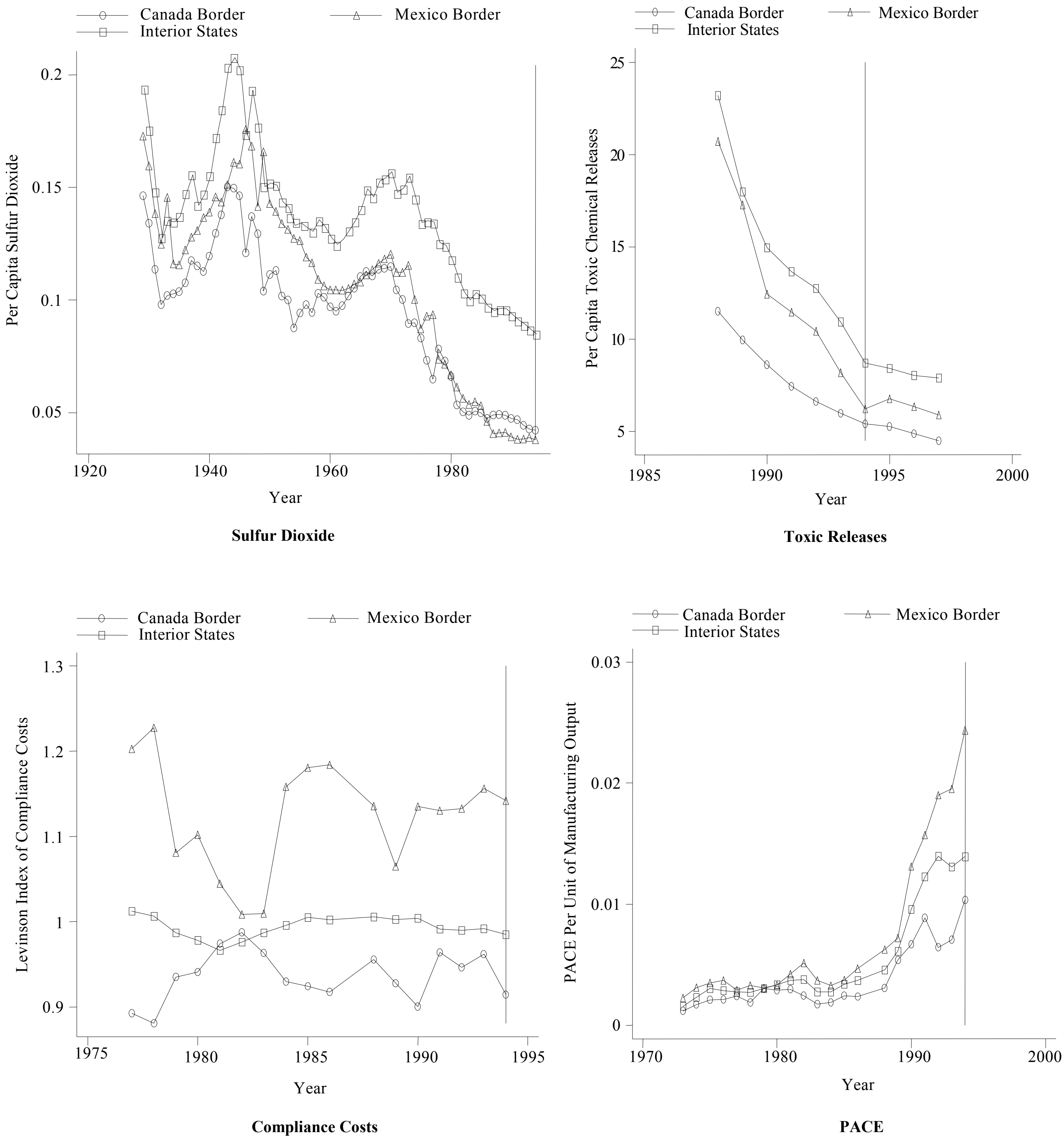
Variable	Years	Mean	Std Dev	Minimum	Maximum
Per capita sulfur dioxide emissions	1929–1994	0.16	0.21	0.00	1.62
Levinson index of environmental compliance costs	1977–1994 (except '87)	1.02	0.37	0.23	2.59
Per capita pollution abatement and control (PACE) expenditures ($1000s)	1973–1994 (except '87)	0.02	0.02	0.00	0.25
Per capita toxic chemical releases	1988–1997	15.57	19.60	0.69	220.93
Per capita state income ($1000s)	1929–1994	9.09	4.24	1.16	22.46
Population (1,000,000s)	1929–1994	3.79	4.06	0.09	31.40
Population density (per sq. Km)	1929–1994	50.96	76.30	0.32	411.72
Urban population (percent)	1929–1994	0.59	0.18	0.16	0.93

The bottom two panels of Figure 1, displaying the average value of the Levinson index and PACE per unit of manufacturing output, yield a slightly different picture, however, at least with regard to states bordering Canada. Specifically, while the value of the Levinson index is highest (indicating greater environmental stringency) in states along the Mexican border over the entire range of the data (1977–1994), states bordering Canada have the lowest level of all US states in terms of relative compliance costs [the level of compliance costs in a given state relative to the national average] since the early 1980s. Since the Levinson index is a relative measure, it has an overall mean of roughly one in each year. To examine the historical trend of abatement expenditures by states, the final panel examines PACE per unit of manufacturing output. Consistent with the ranking of states using the Levinson index, states bordering Canada have the lowest expenditure on pollution abatement per unit of manufacturing output; states bordering Mexico have the highest. Nonetheless, expenditures on abatement have increased in all three types of states since the mid-1980s and display no signs of slowing down as the ratification of NAFTA approached.

It is interesting to note that while states bordering Canada have the lowest level of abatement expenditure per unit of manufacturing output, they have the lowest level of per capita releases of toxic chemicals. One possible explanation is that northern states utilize more efficient types of abatement technology.

[10] This could of course also depend on significant firm relocation away from the US; however, there is little evidence that this has taken place.

Figure 1. Emissions, compliance costs, and pace by year and type of state



Notes: Values are population-weighted averages across all states. Vertical line drawn for 1994.

3 Results

The econometric results are presented in Tables 2–6 along with Figure 2. The estimates of the parameters of interest (i.e., δ_o, δ_c, and δ_m from equation (2)) are presented after taking the log transformation of own and neighboring environmental quality. Thus, the coefficients are the elasticities of own environmental quality with respect to neighboring environmental quality. In other words, given a 10% increase (decrease) in neighboring environmental quality, own environmental quality will increase (decrease), on average, by $(10*\delta_k)\%$, $k = o, c, m$. We report the estimates obtained by ordinary least squares (OLS) as well as two-staged least squares (denoted IV).

In all regressions, state- and time-fixed effects are included in addition to controls for per capita income (and higher order terms), population, population density, and the share of the population living in urban areas (although the results are not presented). The coefficients on the other control variables are of the expected sign and magnitude, particularly for per capita income where we observe the typical inverted U-shaped relationship between emissions and income associated with the environmental Kuznets curve. The full set of results is available from the authors upon request.

Before discussing the specific results, we note two things. First, the point estimates throughout are qualitatively similar, regardless if neighboring states are weighted equally or by income. Second, while the OLS-FE results (OLS including state- and time-fixed effects) are presented for completeness, only the IV-FE (IV including state- and time-fixed effects)[11] provide statistically consistent estimates of the strategic interaction effects (to the extent that the instruments represent valid exclusion restrictions). Thus, in the interest of brevity, we focus the remaining discussion on the IV-FE results, weighting neighboring states by income.

3.1 Sulfur Dioxide

Table 2 presents the results using the full data set without allowing for any type of structural break during the time of the NAFTA ratification or negotiations. For per capita sulfur dioxide emissions, weighting neighboring states by income, and using the IV-FE results, the elasticity for interior states is 0.988, but falls to 0.644 for states bordering Mexico and increases to 1.199 for states on the Canadian border. Therefore, a 10% decline in per capita sulfur dioxide emissions in a state's neighbors leads to, on average, a 9.6% decline in interior states, a 6.4% decline in states bordering Mexico, and a 12.0% decline in states bordering Canada. These results indicate that improvements in per capita levels of sulfur dioxide emissions by one's neighbors are matched nearly one-for-one in interior states and greater than one-for-one in states bordering Canada. However, states bordering Mexico are less likely to match reductions in sulfur dioxide emissions by their neighbors.

While per capita sulfur dioxide levels in states bordering Mexico are historically less responsive to changes in emission levels in neighboring states, we are mainly interested in whether this relationship changed as NAFTA approached. To do so, equation (1) is estimated separately for each year, weighting neighboring states by income and using the IV-FE estimation method. Panel A in Figure 2 plots the parameter estimates for interior states along with the *total* coefficients for states bordering Mexico or Canada by year (i.e., $\delta_o + \delta_m$ and $\delta_o + \delta_d$) from the equation for sulfur dioxide. While the data for sulfur dioxide emissions does not, unfortunately, extend post-NAFTA, we are able to look for changes preceding actual ratification.

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[11] FE refers to results from statistical models that include state- and time-fixed effects. IV-FE refers to the results from models including fixed effects where the estimation procedure is known as "Instrumental Variables."

Table 2. Strategic interaction elasticities by type of state*

		Weighting Scheme: Contiguous States					
		Equal Weight			Income Weight		
Dependent Variable	Estimation Method	Coefficient (δ_o)	Mexico Effect (δ_m)	Canada Effect (δ_c)	Coefficient (δ_o)	Mexico Effect (δ_m)	Canada Effet (δ_c)
Sulfur dioxide	OLS-FE	0.613	-0.194	-0.563	0.600	-0.180	-0.543
		(25.646)	(-4.007)	(-11.615)	(24.813)	(-3.787)	(-11.290)
			[p=0.00]	[p=0.28]		[p=0.00]	[p=0.21]
	IV-FE	0.964	-0.320	0.199	0.988	-0.344	0.211
		(20.828)	(-4.937)	(2.236)	(20.669)	(-5.366)	(2.427)
			[p=0.00]	[p=0.00]		[p=0.00]	[p=0.00]
Levinson index	OLS-FE	0.382	-0.125	-0.671	0.380	-0.183	-0.685
		(4.009)	(-0.544)	(-4.167)	(3.950)	(-0.800)	(-4.226)
			[p=0.23]	[p=0.03]		[p=0.35]	[p=0.02]
	IV-FE	1.913	-0.711	-1.300	1.924	-0.843	-1.374
		(6.153)	(-1.514)	(-2.651)	(6.097)	(-1.750)	(-2.801)
			[p=0.01]	[p=0.12]		[p=0.02]	[p=0.16]
Toxic releases	OLS-FE	0.260	0.029	-0.009	0.266	0.020	-0.015
		(3.173)	(0.219)	(-0.128)	(3.181)	(0.150)	(-0.211)
			[p=0.04]	[p=0.00]		[p=0.04]	[p=0.00]
	IV-FE	0.830	-0.010	-0.025	0.860	-0.013	-0.039
		(6.203)	(-0.065)	(-0.286)	(6.283)	(-0.082)	(-0.455)
			[p=0.00]	[p=0.00]		[p=0.00]	[p=0.00]

* NOTES: t-statistics in parentheses. p-values[12] associated with the test that $\delta_o + \delta_k = 0$ ($k = c, m$) in brackets. Each regression also includes state- and time-fixed effects, per capita state income (along with higher order terms), population, population density, and percentage of state population living in urban areas. IV results use per capita state income (along with higher order terms), population, population density, and percentage of state population living in urban areas from neighboring states as instruments along with these same variables interacted with the dummy variables for bordering Mexico or Canada.

Two interesting results emerge. First, in every year the elasticity is largest for states bordering Canada and smallest for states bordering Mexico. While the differences may not be statistically significant in any one year, taken cumulatively the results point to a significant fear of firms leaving the country on the part of states bordering Mexico but not Canada. Second, there has been a sharp increase in the degree of strategic interaction for all three types of states since 1960; however, there has been little change since the early 1980s. Thus, there is no change in the level of interaction conditional on type of state during NAFTA negotiations and ratification.

The final set of results, presented in Tables 3–6, allow for a structural break at different points in time. In other words, the models allow for the elasticity to change at some set point in time. However, unlike in the model presented in Figure 2, the elasticity is restricted to be the same each year prior to the break and the same again after the break, yet possibly at a different value. If NAFTA did cause a structural break in the manner in which states interact with one another, the break might have occurred at the time of ratification, or during the negotiation period, assuming that states are not overly myopic. Thus, Table 3 tests for a break in 1994, Table 4 in 1993, and Table 5 in 1992. Table 6 then presents the results from statistical tests of the equality of the elasticity before and after the break. If the elasticities do not differ before and after the break, this provides some indication that NAFTA had little effect on the determinants of environmental quality in the US.

12 p-values - refer to statistical tests, testing the probability that the coefficient we estimate is significantly different than zero. If p=0.00, e.g., then there is 0% chance that the coefficient we estimate could actually be zero. Typically, if p<0.05, then economists say that the coefficient is statistically significant (i.e., not zero).

Table 3. Strategic interaction elasticities by type of state: Structural break, 1994*

		Estimation Method: IV-FE					
		Pre-Break			Post Break		
Dependent Variable	Weighting Scheme	Coefficient (δ_O^{pre})	Mexico Effect (δ_m^{pre})	Canada Effect (δ_c^{pre})	Coefficient (δ_O^{post})	Mexico Effect (δ_m^{post})	Canada Effect (δ_c^{post})
Sulfur dioxide	Equal	0.953	-0.316	0.183	-0.177	0.028	0.025
		(21.240)	(-4.876)	(2.034)	(-0.934)	(0.285)	(0.346)
			[p=0.00]	[p=0.00]		[p=0.01]	[p=0.00]
	Income	0.974	-0.339	0.194	-0.158	0.029	0.018
		(21.072)	(-5.293)	(2.203)	(-0.835)	(0.295)	(0.255)
			[p=0.00]	[p=0.00]		[p=0.01]	[p=0.00]
Levinson index	Equal	1.730	-0.690	-1.114	-0.072	0.892	0.267
		(6.150)	(-1.582)	(-2.481)	(-0.184)	(0.873)	(0.360)
			[p=0.01]	[p=0.08]		[p=0.04]	[p=0.29]
	Income	1.739	-0.802	-1.174	-0.100	0.850	0.273
		(6.116)	(-1.811)	(-2.616)	(-0.260)	(0.913)	(0.370)
			[p=0.02]	[p=0.11]		[p=0.04]	[p=0.34]
Toxic releases	Equal	0.716	0.038	-0.087	0.027	0.012	-0.017
		(4.464)	(0.170)	(-0.810)	(0.582)	(0.208)	(-0.446)
			[p=0.00]	[p=0.00]		[p=0.00]	[p=0.00]
	Income	0.737	0.097	-0.098	0.034	0.034	-0.016
		(4.550)	(0.411)	(-0.909)	(0.738)	(0.553)	(-0.406)
			[p=0.00]	[p=0.00]		[p=0.00]	[p=0.00]

* NOTES: p-values associated with the test that $\delta_o^{pre} + \delta_k^{pre} = 0$ and $\delta_o^{pre} + \delta_k^{pre} + \delta_o^{post} + \delta_k^{post} = 0$ ($k = c, m$) in brackets. For other explanations, refer to the notes beneath Table 2.

Table 4. Strategic interaction elasticities by type of state: Structural break, 1993*

		Estimation Method: IV-FE					
		Pre-Break			Post Break		
Dependent Variable	Weighting Scheme	Coefficient (δ_O^{pre})	Mexico Effect (δ_m^{pre})	Canada Effect (δ_c^{pre})	Coefficient (δ_O^{post})	Mexico Effect (δ_m^{post})	Canada Effect (δ_c^{post})
Sulfur dioxide	Equal	0.939	-0.313	0.170	-0.136	0.025	0.025
		(21.477)	(-4.816)	(1.869)	(-1.004)	(0.339)	(0.470)
			[p=0.00]	[p=0.00]		[p=0.00]	[p=0.00]
	Income	0.958	-0.335	0.178	-0.115	0.026	0.019
		(21.302)	(-5.222)	(2.003)	(-0.846)	(0.353)	(0.369)
			[p=0.00]	[p=0.00]		[p=0.00]	[p=0.00]
Levinson index	Equal	1.672	-0.693	-1.034	-0.182	1.045	0.060
		(6.291)	(-1.651)	(-2.333)	(-0.729)	(1.361)	(0.124)
			[p=0.01]	[p=0.08]		[p=0.01]	[p=0.77]
	Income	1.682	-0.870	-1.100	-0.189	1.145	0.051
		(6.263)	(-2.061)	(-2.490)	(-0.759)	(1.615)	(0.106)
			[p=0.04]	[p=0.10]		[p=0.01]	[p=0.46]
Toxic releases	Equal	0.764	-0.461	-0.131	0.046	-0.144	-0.037
		(4.587)	(-1.882)	(-1.174)	(0.980)	(-2.423)	(-0.957)
			[p=0.24]	[p=0.00]		[p=0.49]	[p=0.00]
	Income	0.776	-0.445	-0.142	0.056	-0.137	-0.036
		(4.637)	(-1.764)	(-1.272)	(1.193)	(-2.217)	(-0.914)
			[p=0.21]	[p=0.00]		[p=0.42]	[p=0.00]

* NOTES: Refer to the notes beneath Table 3.

Table 5. Strategic interaction elasticities by type of state: Structural break, 1992*

		Estimation Method: IV-FE					
		Pre-Break			Post Break		
Dependent Variable	Weighting Scheme	Coefficient (δ_O^{pre})	Mexico Effect (δ_m^{pre})	Canada Effect (δ_c^{pre})	Coefficient (δ_O^{post})	Mexico Effect (δ_m^{post})	Canada Effect (δ_c^{post})
Sulfur dioxide	Equal	0.925	-0.313	0.154	-0.133	0.031	0.031
		(21.527)	(-4.774)	(1.688)	(-1.174)	(0.493)	(0.708)
			[p=0.00]	[p=0.00]		[p=0.00]	[p=0.00]
	Income	0.942	-0.333	0.159	-0.112	0.032	0.027
		(21.341)	(-5.163)	(1.782)	(-0.989)	(0.513)	(0.617)
			[p=0.00]	[p=0.00]		[p=0.00]	[p=0.00]
Levinson index	Equal	1.716	-0.766	-1.349	-0.094	0.913	-0.263
		(6.780)	(-1.886)	(-3.224)	(-0.451)	(1.316)	(-0.732)
			[p=0.01]	[p=0.27]		[p=0.01]	[p=0.98]
	Income	1.734	-0.994	-1.418	-0.093	1.106	-0.264
		(6.727)	(-2.454)	(-3.391)	(-0.444)	(1.706)	(-0.734)
			[p=0.05]	[p=0.34]		[p=0.00]	[p=0.92]
Toxic releases	Equal	0.815	-0.277	-0.124	0.038	-0.103	0.041
		(5.078)	(-1.197)	(-1.131)	(0.751)	(-1.867)	(-1.097)
			[p=0.03]	[p=0.00]		[p=0.09]	[p=0.00]
	Income	0.836	-0.251	-0.135	0.045	-0.095	-0.040
		(5.165)	(-1.054)	(-1.235)	(0.899)	(-1.646)	(-1.056)
			[p=0.02]	[p=0.00]		[p=0.07]	[p=0.00]

* NOTES: Refer to the notes beneath Table 3.

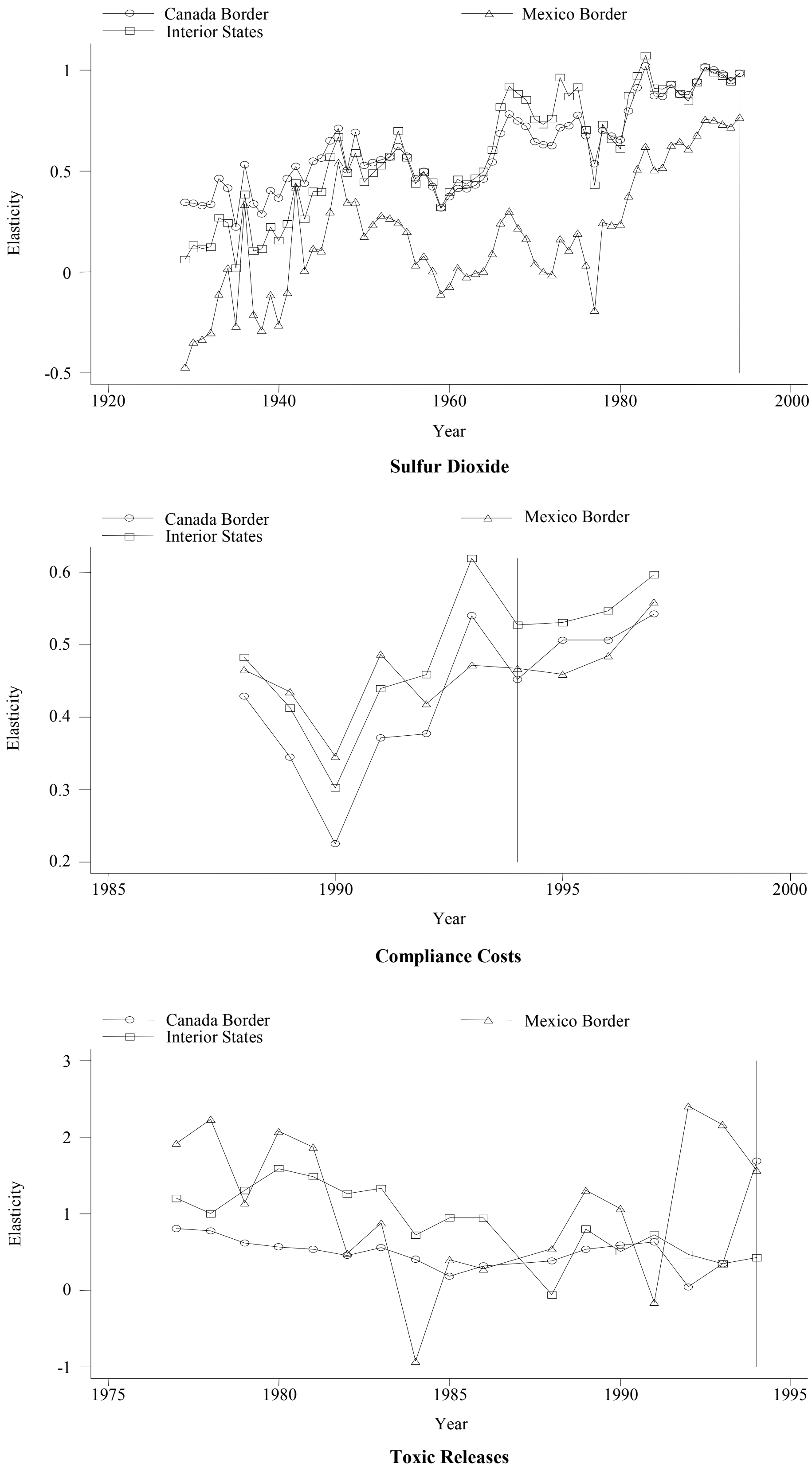
Table 6. Tests for equality of elasticities pre- and post-NAFTA*

		Year of Structural Break					
		1992		1993		1994	
Dependent Variable	Weighting Scheme	Mexico	Canada	Mexico	Canada	Mexico	Canada
Sulfur dioxide	Equal	p=0.35	p=0.10	p=0.40	p=0.15	p=0.42	p=0.39
	Income	p=0.33	p=0.21	p=0.38	p=0.74	p=0.38	p=0.78
Levinson index	Equal	p=0.47	p=0.34	p=0.50	p=0.18	p=0.48	p=0.58
	Income	p=0.42	p=0.96	p=0.45	p=0.88	p=0.43	p=0.87
Toxic releases	Equal	p=0.22	p=0.48	p=0.24	p=0.27	p=0.39	p=0.37
	Income	p=0.21	p=0.95	p=0.77	p=0.75	p=0.75	p=0.75

NOTES: p-values reported for the test that the elasticities are equal for states bordering Mexico and Canada before and after the structural break, i.e., the null hypothesis is H_o: $\delta_o^{pre} + \delta_k^{pre} = \delta_o^{pre} + \delta_k^{pre} + \delta_o^{post} + \delta_k^{post}$, or $\delta_o^{post} + \delta_k^{post} = 0$ ($k = c, m$).

Using the IV-FE results weighting neighboring states by income, Table 3 reveals that the elasticity of per capita sulfur dioxide emissions in interior states with respect to neighboring levels is 0.974 on average from 1929–1993 and 0.816 in 1994, although this difference is not statistically significant. For states bordering Canada (Mexico), the elasticity prior to 1994 is 1.168 (0.635). This is consistent with the findings from Table 2 and Figure 2; namely, the elasticity is highest for states bordering Canada and lowest for states bordering Mexico. In 1994, the elasticity is 1.028 (0.506), neither of which is statistically different from the pre-break elasticity. From Table 6, we see that p-values associated with the test that elasticities are equal across the break are well above the range used to determine statistical significance. For Canada (Mexico), the p-value is 0.43 (0.48).

Figure 2. Coefficients by year and type of state: Elasticities



Notes: Estimation method is IV-FE. Weighting scheme is contiguous states weighted by income.

One possible explanation for the lack of a break in 1994 may be that the break occurred during the negotiation period, prior to 1994. According to Table 4, the elasticity for interior states prior to 1993 is 0.958; 0.843 in 1993–1994. Again, this difference is not statistically significant. For states bordering Canada (Mexico), the elasticity for sulfur dioxide emissions is 1.136 (0.623) prior to 1993 and 1.040 (0.534) after 1993. While the elasticities decreased slightly after the structural break, the differences are again statistically insignificant (p-values of 0.45 (0.50) in Table 6). Thus, we reject the idea that a structural break occurred in 1993 as well.

Lastly, we test for a possible break in 1992. The results are no different. For interior states, the elasticity for per capita sulfur dioxide emissions is 0.942 prior to 1992 and 0.830 from 1992–1994; the difference not being statistically significant. For states bordering Canada (Mexico), the elasticities are 1.101 (0.609) before the break and 1.016 (0.529) afterwards. The p-values associated with the hypothesis that the elasticities are equal before and after the break are 0.42 for states bordering Canada and 0.47 for states bordering Mexico. Thus, we cannot reject the hypothesis of no structural break at conventional levels of statistical significance. In the end, then, while states behave differently depending on whether they are located in the interior of the US or on the Mexican or Canadian border, there is no indication that the behavior of states with respect to sulfur dioxide levels changed during critical times during the ratification process.

3.2 Compliance Costs

We next turn our focus to a measure of environmental compliance costs within each state. Compliance costs may be a better indicator of the effect of NAFTA since compliance costs are directly affected by state legislation and/or enforcement activity, whereas pollution levels are only indirectly controlled by policymakers.

Table 2 presents the results without allowing for any structural breaks. Using the IV-FE results weighting neighbors by income, the elasticity for interior states is 1.924. The elasticity falls, however, to 0.550 (1.081) for states on the Canadian (Mexican) border. Both of these differences are statistically significant (Mexico only at the 10% level of significance). In fact, one cannot even reject the hypothesis that the elasticity for states bordering Canada is zero at conventional levels of significance (the p-value is 0.16). Thus, a 10% increase in regulatory compliance costs in neighboring states implies a 19.2% increase in interior states, but only a 10.8% increase in states bordering Mexico and a 5.5% increase in states bordering Canada (although it is not statistically significant). It is interesting to note the dichotomy for states along the Canadian border; they are the most responsive states with respect to neighboring pollution levels, but least responsive states with respect to neighboring compliance costs.

Figure 2 examines the elasticities by year in order to determine if there were any changes prior to NAFTA. For interior states, the elasticity remained fairly constant from 1977–1994. The elasticities are more volatile for states bordering Canada and particularly Mexico. For states on the Canadian border, the elasticity was very stable from 1977–1992, but then increased fairly dramatically in 1993 and 1994. For states bordering Mexico, the elasticity is roughly U-shaped; peaking in 1977 and 1992 and reaching a low in 1984. However, the elasticity declined in 1993 and 1994, prior to the ratification of NAFTA. While the results may indicate a change in the determination of environmental compliance costs, particularly for states on the Canadian border, as 1994 approached, one must be cautious. Because the elasticities are based on cross-sections of data, the sample size is small for each year. Thus, large swings in the point estimates of the elasticities are not necessarily indicative of a statistically significant change.

To determine whether there is an actual structural break, we turn to Tables 3–6. First, we present the results testing for a break in 1994 in Table 3. Using the IV-FE results and weighting neighbors by income, we find the elasticity for interior states to be 1.739 for the period 1977–1993 and 1.639

in 1994. The difference is not statistically significant at conventional levels. For states bordering Canada (Mexico), the elasticity is 0.565 (0.937) before the break and 0.738 (1.687) afterwards. While the difference is large in magnitude for states bordering Mexico, it is not statistically significant (the p-value is 0.39); neither is the difference significant for states on the Canadian border (the p-value 0.78). However, even if the difference was significant, the fact that the elasticities increased after the break is contrary to the hypothesis of NAFTA having a detrimental effect on environmental protection in the US. If US border states were concerned about capital flight to Canada or Mexico post-NAFTA, one should expect the elasticities to be smaller after the break as states were less concerned with changes in neighboring US states and more concerned with changes across the border. This is clearly not the case.

To examine the possibility of a structural break while negotiations were still underway, we allow for the possibility of a structural break in 1993 (Table 4) and 1992 (Table 5). According to Table 4, the elasticity for interior states is 1.682 prior to 1993 and 1.493 thereafter, and the difference is not statistically significant. Along the Canadian (Mexican) border, the elasticity is 0.582 (0.812) on average from 1977–1992 and 0.444 (1.768) from 1993 on. While the difference is even larger than above in magnitude for states bordering Mexico, it is still not statistically significant at conventional levels (the p-value is 0.15) and neither is the difference for states bordering Canada (the p-value 0.74). Again, note that while the difference is not significant, the point estimate of the elasticity is greater after the break than prior.

Finally, we test for a break in 1992. For interior states and states bordering Canada, the conclusions from Tables 3 and 4 are unaltered. Specifically, the elasticity for interior states is 1.734 on average over the period 1977–1991 and 1.641 thereafter, with the difference not being statistically significant at conventional levels. For states bordering Canada, the pre-break elasticity is 0.316 and -0.041 from 1992–1994. However, we cannot reject the hypothesis that the elasticities are equal before and after the break (the p-value is 0.21). In addition, we cannot reject the hypothesis that both the pre-break and post-break elasticities are both zero. For states bordering Mexico, on the other hand, the elasticity prior to 1992 is 0.740 and 1.753 from 1992–1994. In addition, we do reject the hypothesis that the two elasticities are equal at the 10% level of significance. Thus, there is mild evidence of a structural break in 1992 with regard to compliance costs. However, the fact that the elasticity is larger after the break is, as stated previously, contrary to the notion of NAFTA lowering environmental protection in states on the US-Mexico border. Combining this fact with the plots in Figure 1 which document an increase in pollution abatement expenditures in the early 1990s in states bordering Mexico provides further evidence that environmental protection did not erode during this time.

3.3 Toxic Releases

Our last measure of environmental quality is the release of toxic chemicals. The benefit of this measure is that the data are available through 1997 and, unlike sulfur dioxide emissions, they cover releases of pollutants to all media (e.g., air, water, land, and underground injections). In addition, the fact that the data are collected from self-reports by firms rather than monitoring stations means that there is no issue of spillover effects driving our results.

Table 2 presents the first set of results from the model pooling all years of data together. Using the IV-FE results weighting neighbors by income, the elasticity for interior states is 0.860. The elasticity declines to 0.847 (0.821) for states on the Canadian (Mexican) border; however, neither of the differences are statistically significant. Relative to the results discussed previously for per capita sulfur dioxide levels, the elasticities for toxic releases are lower for states in the interior of the US and on the Canadian border. The elasticity is higher for states along the Mexican border. The fact that one would expect lower elasticities for toxic releases, since the data are based on self-reporting by firms (as opposed to EPA monitoring of local air quality conditions), makes it all the more surprising that elasticity is higher for states on the Mexican border. Nonetheless, a 10% decrease in per capita toxic releases in neighboring states implies approximately an 8.6% decrease in all US states, regardless of proximity to either border.

Figure 2 examines the elasticities by year. Two observations emerge. First, the elasticities for all three state types are fairly similar in each year. Second, the elasticities increased, beginning in 1990 and, after peaking in 1993, have been slightly increasing each year from 1994 through 1997. Thus, during and after the NAFTA negotiations, states become increasingly responsive to toxic release levels in neighboring states. At the time of ratification, the elasticity fell for all states; however, the drop lasted only the single year. Thus, the data is conceivably consistent with the idea that states were concerned about the possible adverse effects of NAFTA at the time of implementation. However, after a year of states realizing that such fears were not coming to fruition, policymaking returned to usual and states have slowly begun to turn their attention away from Mexico and Canada and back to their US neighbors.

For completeness, we test for a structural break and report the results in Tables 3–6. Table 3 contains the results looking for a break in 1994. Using the IV-FE results and weighting neighbors by income, the elasticity for interior states is 0.737 for the period 1988–1993 and 0.771 from 1994–1997. The difference is not statistically significant at conventional levels. For states bordering Canada (Mexico), the elasticity is 0.639 (0.834) before the break and 0.657 (0.902) afterwards. As shown in Table 6, the differences are not statistically significant for either states bordering Canada (the p-value is 0.75) or Mexico (the p-value 0.37). In addition, as found previously with regard to the elasticity for compliance costs, the elasticity for states bordering Mexico is higher (although the change is not statistically significant) after the break, contrary to the notion of NAFTA adversely impacting toxic releases in border states.

To examine the possibility of a structural break during the negotiation period, we test for a structural break in 1993 (Table 4) and 1992 (Table 5). According to Table 4, the elasticity for interior states is 0.776 prior to 1993 and 0.720 thereafter, and the difference is not statistically significant. Along the Canadian (Mexican) border, the elasticity is 0.634 (0.331) during the pre-NAFTA period and 0.654 (0.250) from 1993 on. The differences are still not statistically significant (the p-value is 0.75 for Canada; 0.27 for Mexico). Moreover, the elasticities for states bordering Mexico are not significantly different from zero statistically either before or after the break.

Finally, we test for a break in 1992. The conclusions from Tables 3 and 4 are for the most part unaltered. Specifically, the elasticity for interior states is 0.836 on average over the pre-NAFTA period and 0.791 thereafter, with the difference not being statistically significant at conventional levels. For states bordering Canada (Mexico), the elasticity is 0.701 (0.585) and 0.706 (0.535) from 1992–1997. We cannot reject the hypothesis that the elasticities are equal before and after the break (the p-value is 0.95 for Canada; 0.48 for Mexico). However, the elasticity for states bordering Mexico is now significant both before and after the break (though only at the 10% level of significance in the post-break period).

4 Conclusion

This paper explored the effect of NAFTA on the determinants of environmental quality in US states, differentiating interior states from those bordering Mexico and Canada. We sought to discover if states bordering either of these countries have acted differently than interior states and if their behavior changed during critical times surrounding the ratification of NAFTA. Our working hypothesis relied on the notion of strategic interaction among states in the determination of environmental policy. In other words, state policymakers maintain an eye on environmental policy in neighboring states for political (e.g., voters may form opinions on a government's effectiveness by making comparisons to neighboring states) and economic (e.g., firms may move to neighboring states if environmental regulations are more lax) reasons. However, for states bordering Canada or Mexico, policymakers may have an additional (or stronger) concern: international capital flight. If this fear plays a role in the mind of policymakers, environmental policy in border states should be less responsive to changes in neighboring US states. In addition, if NAFTA increased fears of capital flight, then states along the border should be even less responsive immediately before as well as after its ratification. This hypothesis formed the basis of our empirical tests.

Using three different measures of environmental quality—per capita sulfur dioxide emissions, Levinson's (1999) index of relative state compliance costs, and per capita toxic chemical releases—we reached three important conclusions. First, all three measures indicate that environmental quality and protection improved for all US states leading up to the ratification of NAFTA and continued to improve beyond ratification for toxic releases as well. Second, we found some evidence that states along the Mexican and Canadian borders have responded differentially to environmental changes in neighboring US states in terms of sulfur dioxide emissions and environmental compliance costs, but not toxic releases. Specifically, states bordering Mexico have been less responsive to changes in neighboring sulfur dioxide levels, while states on the Canadian border have been more responsive to changes in neighboring states. In terms of compliance costs, states on either border have been less responsive to changes in neighboring states than interior US states. This finding, in particular, may indicate a fear by border states of capital flight to Canada or Mexico. However, around the time of the NAFTA negotiations, this concern may actually have declined. For toxic releases—the only measure of environmental quality available beyond 1994—there was no change in the determination of pollution levels during the 1990s. Finally, we failed to find any evidence of a structural break in the determination of environmental quality and protection around the time NAFTA was ratified. When this is combined with the fact that our three measures of environmental quality improved during the 1990s, we conclude (at least from this analysis) that NAFTA has not had a detrimental impact on the environment in the US.

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The Relocation of El Paso's Stonewashing Industry and its Implications for Trade and the Environment

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Research Note

The authors were able to conduct interviews with three industry representatives, all of whom represented operations with facilities in El Paso and in Mexico. Additional information was gathered through interviews with an EPWU employee who formerly worked for a now closed stonewashing operation in El Paso. Original plans were to conduct up to six interviews, however, a number of industry representatives were unwilling to grant interviews. The authors did not have access to wastewater discharge violation records for El Paso. Water usage and wastewater discharge information for Mexico was unavailable to the authors outside of personal interviews with industry and government representatives.

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Executive Summary

El Paso, Texas once was considered the denim stonewashing capital of North America. With its abundant, relatively unskilled, and low-wage workforce, El Paso long had attracted labor-intensive industries, especially the apparel industry. With the invention and rise in popularity of stonewashed denim clothing in the late 1980s, El Paso's apparel industry diversified to include stonewashing, a water-intensive activity, as part of the garment-finishing process. As the industry scrambled to develop stonewashing technology, some large denim apparel companies implemented vertically integrated "package" operations to include stonewashing, while others contracted with smaller independent operations for finishing work. After the industry's meteoric rise, an exodus of finishers from El Paso took place in the late 1990s, going from a peak of over two dozen facilities in 1993 to only a few garment-finishers today. At its peak, the garment-finishing industry employed thousands of people and consumed immense quantities of water for stonewashing.

The apparel industry has been undergoing profound changes. It is often termed a "sunset industry" in the United States, and globalization has made its mark on the industry. Beginning in the 1970s, members of the industry began to look for locations affording a competitive edge, such as the Pacific Rim and Latin America. The advent of the North American Free Trade Agreement (NAFTA) in 1994 put the spotlight on Mexico for an industry already on the move. Among others, the sister cities of Torreón, Coahuila, and Ciudad Lerdo and Gómez Palacios, Durango began to attract more garment-finishing operations. Facing increasing price competition, El Paso's garment finishers were eager to reduce costs, particularly labor costs, making relocation to Mexico an attractive option. As finishers left, they relieved pressure on El Paso's water supply. They were often forced to secure their own water supply for their new facilities in Mexico, and provided varying degrees of wastewater pretreatment.

No matter where the stonewashing industry is located, it remains highly water-intensive. As populations grow in North America, competition for water resources increases, particularly in arid regions of the southwestern United States and northern Mexico. During the debate over NAFTA, several observers argued that the agreement would encourage a movement of industry away from the United States-Mexico border and that accompanying infrastructure development would deconcentrate industry throughout Mexico, relieving pressure on border environmental resources.

This study examines the expansion and contraction of the stonewashing industry and the environmental impact of the industry in El Paso and its relocation sites. The examination revolves around four hypotheses. First, several factors contributed to the stonewashing firms' decisions to relocate, including rule changes under NAFTA, imposition of water reuse requirements in El Paso, international relocation trends in the apparel industry, and the future availability of water in El Paso. Second, the departure of the stonewashing industry from El Paso alleviated pressure on border water resources, particularly the Hueco Bolson aquifer. Third, as the industry relocated, it incorporated water-saving processes into construction of new facilities. Finally, water-saving processes incorporated into new foreign locations constituted a beneficial environmental impact relative to practices previously employed at US locations. Based on the four hypotheses, the study's goals were to:

- Identify the factors involved in companies' decisions to relocate operations, including specific NAFTA components.
- Analyze the net environmental impact of industry out-migration on water resources in El Paso and in the relocated sites, and if relocation alleviated pressure on border environmental resources.
- Determine what, if any, changes companies made in water-use efficiency and discharge practices as they built facilities in their new locations.

Research for the study was carried out from May to September 2000. During this period, interviews were conducted with representatives of three garment-finishing operations with stonewashing facilities remaining in El Paso. All three also had sewing or stonewashing facilities in Mexico. Additional interviews were conducted with representatives of the municipal water utility in El Paso, city officials, and state and federal environmental agency representatives. El Paso water consumption records from 1990 to 2000 were analyzed for 27 garment-finisher water utility accounts. In addition, regional and federal water officials in Mexico were interviewed. Related literature and research findings provided additional information.

1 The Stonewashing Process

The stonewashing process gives denim garments a "worn in" look. Stonewashed blue jeans, lighter in color and softer in feel than unwashed denim, became popular with consumers in the 1980s. Consumers demanded greater variety than the original, stiff, indigo-colored jeans. Jeans manufacturers responded with new finishing processes, such as stonewashing and acidwashing, as well as overdying, which produced bold new colors for denim products. Some processes fell victim to the fickle tastes of the fashion market. Stonewashed denim products, however, especially blue jeans, remain a staple of clothing stores around the world.

The apparel industry changes seasonally and annually based on fashion trends. Fashion usually dictates changes in the cut and style of clothes, but in the case of stonewashing, it added a new technological layer to the industry. As the stonewashed fashion trend emerged, the apparel industry already-established in El Paso scrambled to develop the technology to produce the sought-after garments, and in the process became an industry leader.

Large industrial washing machines were modified to process the stiff, indigo-laden denim. A mixture of chemicals, pumice stones, and water were added to the machines as the garments went through a series of washes. Municipal water utility officials and the industry were learning as they went along to develop mechanisms to filter out pumice stones and to remove remaining dye and chemicals. Different wastewater pretreatment mechanisms had to be developed each time the industry tried a different type of process to create the stonewashed look dictated by current fashion.

Undyed denim is nearly white in color. For production of blue jeans it is dyed with an indigo-based dye, coloring the fabric dark blue. The faded and "worn in" look of stonewashed denim is produced by the abrasion of pumice stones against the fabric during the stonewashing process. The abrasion of the stones removes the surface-bound indigo dye, revealing the much lighter interior of the fabric. The random movement of stones during washing ensures that the indigo dye is not completely removed, providing the slightly faded look of stonewashed jeans. The abrasion of the fabric during stonewashing also reduces the life of the garment, which contributes to maintaining consumer demand for the denim products.

The pumice stones used in the process originally came from Mexico or the southwestern United States. They varied in size over time, but typically have been no larger than half a fist. Along with the product, the stones are worn down by the process. The abrasion of the stones creates a sediment that passes along with the used wash water after completion of the process. Pumice stones used in stonewashing have a finite lifetime that varies according to the product being washed.

Finishing processes vary. Some garment-finishers use cellulase enzymes in the stonewashing process. The enzymes facilitate the abrasion of the fabric during stonewashing, reducing the amount of pumice stones required. Additionally, some finishers use pellets or perlite to produce the stonewashed look. Perlite is made from sand. Acidwashing was a popular process in which pumice stones were impregnated with a bleaching agent, often potassium permanganate, before stonewashing to give garments a distressed look. Each process required a different mix of chemical inputs and different ways to treat the wastewater. Recently, denim finishers have begun to produce sandblasted jeans. Sandblasting is a dry process that is performed before stonewashing and produces a uniform fade in targeted areas.

Stonewashing is a water-intensive process. It is achieved through a series of washings, with each requiring fresh water. Most garment-finishers in El Paso used drinking-quality water from the city's municipal water supply in the stonewashing process. In relation to overall water demand in El Paso, the quantity of water consumed by garment-finishers was significant. Among tens of thousands of municipal and industrial water customers, just 25 garment-finishers accounted for five percent of El

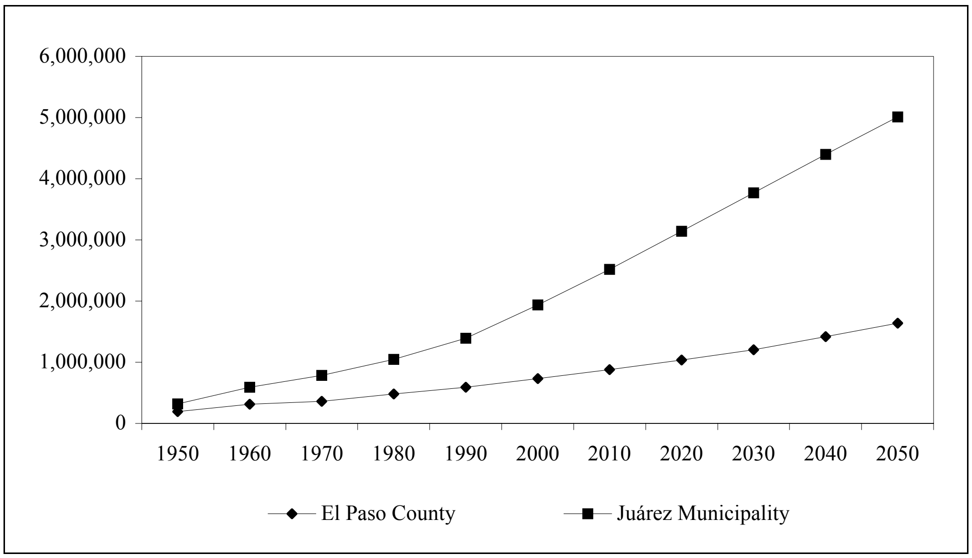
Paso's average daily water demand in 1993.[1] In an arid region with a growing population and dwindling water supply, El Paso's garment-finishing industry was consuming a significant portion of municipal drinking water to produce stonewashed blue jeans.

2 El Paso

El Paso is located in the far western tip of Texas, at the crossroads of the international border with Mexico and the state borders of New Mexico and Texas. It is a city with a heritage born of two countries. El Paso lies just across the Rio Grande river valley from Ciudad Juárez, its Mexican sister city. Geographically separated only by the river's seasonally-shifting flows, the economic and social links between the cities are conduits for international relationships across a much broader region. This bustling cross-border metropolis, in fact, forms the world's largest international border community.

The main population centers in the region, El Paso and Ciudad Juárez, are growing rapidly. El Paso County's population was estimated to be 732,000 in 2000, a 24 percent increase since 1990 (Hamlyn 1997). Estimates put the population of Juárez Municipio at 1,204,000 in 2000, an increase of nearly 44 percent since 1990 (Hamlyn 1997). The combined population of the two cities is projected to reach over 5 million in 2050 (Figure 1).

Figure 1. El Paso County and Juárez Municipio population projection, 1950–2050



Source: Hamlyn, 1997.

El Paso sits at the foot of the Franklin Mountains. Across the river valley are Ciudad Juárez and the Cerro Cristo del Rey mountains. The pass between these two mountain ranges, through which the Rio Grande flows, gives the city its name. The Rio Grande, fed by snowmelt from the southern Rockies, approaches El Paso from the northwest and flows southeasterly to the Gulf of Mexico.

The region is in the northern portion of the Chihuahuan Desert. Vegetation is generally "desert scrub, including creosote bush and tarbush, pinyon-oak-juniper woodlands, and desert grasslands" (El-Hage and Moulton 1998, 1). Average annual rainfall is less than 9 inches (22.9 cm), while the

[1] In 1993, the stonewashing accounts analyzed were drawing approximately 5.2 million GPD, average daily water demand was 105.9 million GPD. See note 25.

average annual evaporation rate exceeds 150 inches (381 cm) per year (El-Hage and Moulton 1998, 4). Most of the precipitation falls during brief but occasionally intense summer thunderstorms. During the summertime, daytime temperature hovers in the 90–100° F (32–38°C) range, but temperatures exceeding this range are not uncommon. Winters are mild. January and February are the coolest months with average temperatures in the mid-40°s F (around 7°C).

2.1 Water Resources

Although El Paso sits on the banks of the Rio Grande, historically most of its municipal and industrial water supply has come from underground aquifers. Since early in the 20th century, river water from the Rio Grande has been diverted primarily for agriculture. These two resources, groundwater and surface water, are precious commodities in a region of scant rainfall (Schmandt, Stolp, Ward, and Rhodes 1999).

El Paso's groundwater is supplied by two underground aquifers, the Hueco Bolson and Mesilla Bolson. El Paso Water Utility (EPWU) operates numerous wells in both, which pump groundwater to quench the thirst of a rapidly growing city. Consequently, freshwater from these aquifers is being withdrawn faster than it can be replenished. Depletion of freshwater reserves is projected to occur before 2050:

> The probable 'life' of the aquifers in the region [will likely] vary, but most forecasts anticipate that the freshwater within the Hueco Bolson, principal aquifer serving the cities of El Paso and Juárez, will be depleted during the first half of the next [current] century. (Hamlyn 1997, 6)

On the eastern side of the Franklin Mountains, the Hueco Bolson is beneath most of El Paso and extends south and southeasterly into Mexico and along the Rio Grande. The Mesilla Bolson is on the western side of the Franklin Mountains and generally is beneath Mexico and the state of New Mexico, although a portion of the aquifer falls within the Texas border.

In 1999, El Paso pumped over 51,000 acre-feet[2] of water from the Hueco Bolson, accounting for 39% of the city's water supply.[3] Wells in the Mesilla Bolson provided over 22,000 acre-feet, 17% of the city water supply.[4] Groundwater supplies are further taxed by Ciudad Juárez, which draws 100% of its municipal and industrial water supply from the Hueco Bolson. Unfortunately, annual recharge lags far behind the rate of withdrawal. The Hueco Bolson has been estimated to recharge at a rate of 6,000 acre-feet per year and the Mesilla Bolson at a rate of 18,000 acre-feet per year (Preston, Coker, and Mathews 1998).

One estimate predicts exhaustion of freshwater in the Hueco Bolson by 2025 (EPWU 1999).[5] Facing such projections, El Paso has looked to the surface water of the Rio Grande as well as water conservation and reuse measures to help meet its water demand.

In 1999, El Paso withdrew over 57,000 acre-feet of water from the Rio Grande, accounting for approximately 44% of its water supply.[6] The amount of water flow in the Rio Grande fluctuates according to the season. River water is impeded upstream from El Paso at Elephant Butte and Caballo Reservoirs in New Mexico, where its release is determined by the irrigation season. Surface water quality is better in El Paso during the growing season when river flow is higher (IBWC 1998;

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2 An acre-foot denotes the volume necessary to cover an acre with water standing one-foot deep.

3 See El Paso Water Utilities (EPWU), *Water Resources: Present And Future Sources Of Water Supply*, <http://www.epwu.org>.

4 Ibid.

5 See also EPWU, *Water Resources*.

6 Ibid.

Schmandt, Stolp, Ward, and Rhodes 1999). During the winter months, the Rio Grande at El Paso is primarily irrigation return flow. Increased salinity levels in the river water from bank return flow exceed Texas' maximum permissible levels for potable water production.[7] Consequently, surface water treatment plants in El Paso operate only during the seven or eight months per year when the river water is of sufficient quality for treatment. Water quality in the Rio Grande is too poor for treatment during the remainder of the year.[8]

2.2 Economy

Business and social linkages tie together the economies of El Paso and Ciudad Juárez. El Paso is the second busiest international port of entry for truck crossings from Mexico (Texas Perspectives 1999: 4). Citizens often cross the border daily, commuting to work in El Paso from their homes in Ciudad Juárez and vice versa.

Twin-plant "maquiladora" production has characterized the El Paso/Ciudad Juárez economy in recent decades and is symbolic of the region's economic integration.[9] Juárez is home to one-third of the maquiladoras along the United States-Mexico border. The approximately 330 maquiladoras in Ciudad Juárez employ nearly 200,000 people (Fullerton 1998). Many maquiladora executives and upper management live in El Paso and commute to Ciudad Juárez. Maquiladora facilities attracted companion operations to El Paso, such as warehousing and distribution centers. It is estimated that maquiladora production created over 25,000 jobs in support industries, such as retail sales, banking, and transportation in El Paso (Fullerton 1998).

Unemployment rates in El Paso have been higher than in Texas as a whole, and than the rest of the nation since 1993. There is some evidence that El Paso is shifting toward a more service-based economy, however. The services sector was El Paso's largest employment sector in 1998, followed by wholesale and retail trade, government, and manufacturing.[10] The services sector added 12,000 jobs from 1994 to 1999, a 25% increase. Wholesale and retail trade and government sectors grew less than 10 percent during the time period, while employment in the manufacturing sector declined 11 percent (Fullerton 1998).

Wages in El Paso are lower than in the rest of Texas. According to one study, "El Paso's average wage is 73 percent that of Texas and has fallen by 3 percentage points since 1990" (Texas Perspectives 1999, 8). In 1997, per capita income was $15,216 for El Paso and $23,707 for the State of Texas (Texas Perspectives 1999, 8). Per capita income in the United States was $19,541 in 1997 (US Census Bureau 1999, xii).

As the apparel and stonewashing industries left El Paso, the city looked to attract other businesses. Efforts were made to lure industries that were not heavy water users. Corporate call centers, in particular, are one of the clean, yet labor intensive, industries that have moved to El Paso. Seeking a bilingual work force, it would appear that the call centers were able to employ many of the workers displaced by the garment industry. However, according to Roberto Franco, El Paso's

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7 First, sulfate concentration climbs above 300mg/l, then Total Dissolved Solids (TDS) increases to over 1000mg/l. These are maximum permissible levels under Texas' regulations for potable water production, see Texas Administrative Code, Title 30, Rule 290.113.

8 See EPWU, *Water Resources.*

9 The 1965 Border Industrialization Program encouraged US companies to build assembly plants in northern Mexico. Under the program, US border communities economically benefited by providing supporting industries such as equipment suppliers, distribution facilities, etc. See a more amplified description of the Border Industrialization Program in the next section, "Factors Contributing to Relocation."

10 Services accounted for 24.13% of employment, wholesale and retail trade (23.93%), government (20.74%), manufacturing (16.50%) (Fullerton 1998).

Director of Economic Development, many of the new jobs coming into El Paso required a generally high set of skills.[11]

3. Factors Contributing to Relocation

Several factors may have contributed to El Paso garment-finishers' decisions to relocate their facilities. Globalization has deeply affected the entire apparel industry, resulting in a significant trend toward international relocation among all facets of the industry. Additionally, rule changes under NAFTA altered previous tariff restrictions on reimportation of finished garments from Mexico, allowing finishing work to be performed in Mexico. Changes in El Paso's water and wastewater regulations also may have played a role in the stonewashing industry's relocation. It is also possible that shifts in market demand affected finishers' relocation decisions. This section of the study reviews these factors.

3.1 Globalization and the Apparel Industry

Globalization has deeply affected the apparel industry. Technological advancements in communication and transportation have brought areas of the world closer together, allowing multinational firms to operate production facilities all over the world. Trade liberalization as well as relaxation of foreign investment restrictions also have facilitated international production. Low barriers to entry in the apparel industry, its heavy reliance on unskilled labor, and the frequency of arms-length contract relationships have put it in the forefront of globalized industries. The apparel industry stands out as, "one of the most globalized industries in the world today" (Bonacich, Cheng, Chinchilla, Hamilton, and Ong 1994, 13).

Competitive pressures in the apparel industry have increased.[12] The growth of discount retail and mass-market stores with low overhead and low prices have increased price competition among apparel manufacturers. As retailers have moved from making large seasonal orders to nearly continuous restocking, manufacturers have had to be prepared to quickly meet unexpected inventory demands. Additionally, the increase in the number of new style lines introduced as well as the number of lines retired indicates an increase in new fashion products with shorter life-spans, forcing manufacturers to implement production systems able to respond quickly to product changes.

Increased competitive pressures in the apparel industry have placed a high priority on reducing production costs. In the labor-intensive apparel industry, reduction of labor costs can produce significant savings. According to Mark Mittelhauser, an economist in the US Bureau of Labor Statistics, the apparel industry has sought out international locations with economic conditions conducive to such cost savings:

> The search for lower production costs has led to rapidly growing textile and apparel production in less developed countries such as China, Mexico, and Indonesia. According to the US International Trade Commission, roughly half of the total productive capacity in the apparel industry has shifted from developed countries to less developed countries over the past three decades. . . The primary advantage these nations have over the United States is the lower costs of labor. (Mittelhauser 1996, 18)

[11] Roberto Franco, interview by authors, El Paso, Texas. 27 July 2000

[12] The following paragraph draws from US Dept. of Labor, "Dynamic Change in the Garment Industry," <http://www.dol.gov/dol/esa/public/forum/report.htm>.

El Paso garment finishers acknowledged the trend toward production in developing nations. One finisher asserted that "the whole world is opening up" and saw the stonewashing industry's departure from El Paso as "inevitable."[13]

3.2 Connection to NAFTA

El Paso's garment-finishing industry was part of a coproduction relationship between the United States and Mexico. Coproduction is "a system whereby part of the manufacturing process is performed in the United States and part in another country" (Voldez 1988, 393). Mexico's coproduction relationship with the United States dates back to 1965 when the Government of Mexico instituted its Border Industrialization Plan (Baerresen 1971). The plan aimed to foster economic development in Mexico, largely by attracting foreign investment in manufacturing facilities. It allowed 100 percent foreign ownership of coproduction facilities in Mexico and duty-free importation of materials and equipment necessary for establishing operations with the requirement that the finished products could not be sold in Mexico. These facilities, called maquiladoras or maquilas, essentially function as assembly plants for products ranging from electronics and automobiles to toys and apparel. Under the program, hazardous waste produced during production is required to be returned to its country of origin.

Capital investment and job growth increased in northern Mexico as US companies built maquiladoras. According to March 2000 figures from an industry journal, 3,521 maquiladoras in northern Mexico employed 1,242,779 workers (Twin Plant News 2000, 54–55). The maquiladoras have contributed new physical infrastructure, such as roads, housing, and industrial parks, income for workers, and a multiplier effect throughout the border economy (Herzog 1999, 5). This growth, however, has not been without environmental repercussions (Herzog 1999, 6–7).

For labor-intensive industries, such as the apparel industry, coproduction in Mexico was particularly enticing. Mexico's minimum wage rates were competitive with wages in many Asian nations, making it attractive to United States apparel industry firms under pressure from global competition. Apparel producers could reduce labor costs by utilizing maquiladora production facilities in Mexico. An additional advantage of production in Mexico relative to Asia or other parts of Latin America was its greater proximity to facilities in the United States, reducing turn-around time and transportation costs.

Preferential tariff treatment under United States customs laws provided additional incentives for coproduction in Mexico. Under Item 807 of the Tariff Schedules of the United States (TSUS), goods assembled in Mexico from source materials made in the United States were subject to duties only on the portion of the product's value added during assembly abroad. The duty was assessed upon "the full value of the imported article, less the cost or value of such products of the United States" (U.S.C. §1202). Thus, import duties were assessed only upon the amount of value added to the product during manufacturing operations performed in Mexico.

For apparel manufacturers engaged in coproduction, this meant that fabrics had to be entirely formed and cut in the United States before they were shipped to Mexico for assembly. In the case of blue jeans, cotton from the United States was woven into denim, dyed, and cut into components for assembly before shipping to Mexico. The cut components were then exported to Mexico, where they were allowed temporary duty-free entry. In Mexican maquiladoras, the cut denim was assembled into jeans. After assembly, the jeans were ready for reimportation to the United States for finishing.

Prior to 1987, the assembled jeans were reimported to the United States under TSUS Item 807. However, with the United States' adoption of the Harmonized Tariff Schedule (HTS) in 1987,

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[13] Interview no. 1, interview by authors, 26 July 2000, El Paso, Texas.

TSUS Item Number 807 became HTS Heading 9802.00.80 (US Customs Service 1997).[14] Qualifications for preferential tariff treatment remained the same under the new heading. Articles qualifying for 807, and subsequently 9802, treatment were defined as:

> Articles assembled abroad in whole or in part of fabricated components, the product of the United States, which (a) were exported in condition ready for assembly without further fabrication, (b) have not lost their physical identity in such articles by change in form, shape or otherwise, and (c) have not been improved in condition abroad except by being assembled and except by operations incidental to the assembly process such as cleaning, lubricating and painting. (U.S.C. §1202; HTSUS 9802.00.80)

Articles qualifying for preferential tariff treatment under the 807 or 9802 program were subject to an import quota.[15] In addition, articles that had undergone finishing processes in Mexico were not eligible for preferential tariff treatment under 807 or 9802. As a consequence, after assembly in Mexico, jeans were reimported to the United States for stonewashing before being shipped for sale. Many garment-finishers in El Paso performed stonewashing work on jeans reimported under the 807 or 9802 program.

The passage of the North American Free Trade Agreement (NAFTA) in 1994 altered the rules that had governed the coproduction of stonewashed goods. It did away with the previous provisions, under 807 and 9802, which had required finishing processes, such as stonewashing, to be performed in the United States in order for goods to receive preferential tariff treatment. NAFTA also eliminated duties and quotas on reimported goods that had undergone assembly, as well as stonewashing and other finishing processes in Mexico (US Customs Service 1997, 31).

Box 1. NAFTA's Rule change

Trade between Mexico and the United States

[…]

In addition, on January 1, 1994, the United States shall eliminate restrictions or consultation levels on textile and apparel goods that are assembled in Mexico from fabrics wholly formed and cut in the United States and exported from and reimported into the United States under:

a) US tariff item 9802.00.80.10; or

b) Chapter 61, 62 or 63 if, after such assembly, those goods that would have qualified for treatment under 9802.00.80.10 have been subject to bleaching, garment dyeing, stonewashing, acidwashing or permapressing.[16]

Thereafter, notwithstanding Section 5, the United States shall not adopt or maintain prohibitions, restrictions or consultation levels on textile and apparel goods of Mexico that satisfy the requirements of subparagraph (a) or (b) or the requirements of any successor provision to US tariff item 9802.00.80.10.

Source: NAFTA, Annex 300-B, Appendix 3.1, B, 10.

The removal of restrictions requiring finishing work to be performed in the United States in order to receive preferential tariff treatment opened up Mexico as a viable location for stonewashing

[14] Under the Harmonized Tariff Schedule, the first six digits of the ten digit HTS number are harmonized among countries participating in international trade. For instance, denim cloth falls under HTS code 5209.42 regardless of its origin or destination. Each nation determines its import duties for the HTS headings. Countries are free to further specify products and duties using the remaining four digits of the HTS code.

[15] One of the finishers referred to import quotas as being a "big problem." If finishers contracted with a Mexican facility that depleted its quota limit by year-end, the finisher was forced to pay full import duties on the remainder of goods imported from the facility for the year. This led finishers to contract with multiple suppliers in Mexico to ensure back up if a particular supplier hit their quota limit. Interview no. 3, interview by authors, telephone, Austin, Texas, 28 July 2000.

[16] Chapters 61, 62, and 63 in refer to USTS chapters encompassing articles of apparel and clothing accessories, as well as other made up textile articles.

operations. For the United States apparel industry, the elimination of duties and removal of import quotas highlighted Mexico as an advantageous site to locate operations. With the passage of NAFTA, producers of stonewashed garments were free to carry out or contract for stonewashing work in Mexico without being subject to import duties upon reimportation. In this manner, rule changes under NAFTA may have shifted a competitive advantage in the apparel industry between the United States and Mexico, affecting relocation decisions by El Paso stonewashing firms.

3.3 Local Regulatory Change

In recognition of the region's need to develop more sustainable water use, El Paso passed a water conservation ordinance in 1991 for large and very large water users. The thrust of the ordinance was to encourage water conservation through reduction, reuse, and recycling. Large water users were considered, "any person who uses an average of ten thousand gallons per day or more from the water supply system" (El Paso Municipal Code 15.13.050-A). Those using an average of 100,000 gallons per day (GPD) [3.78×10^5 liters] or more were considered very large water users. Most garment-finishers in El Paso fell into these categories. From a sample of 24 garment-finishers operating in El Paso in 1991, eight met the conditions for large water users, 14 met the conditions for very large water users, and two used an average of less than 10,000 GPD.[17]

The ordinance required all new very large water users and existing very large water users seeking new service or expansion of service to submit a water conservation plan before connection or expansion of service. Existing very large water users not seeking expansion of service were effectively "grandfathered" from this requirement. The plan had to demonstrate that "reasonable diligence" would be used to avoid waste and achieve water conservation. Additionally, the plan had to include a report relating water consumption to recycling potential, including, "techniques and technologies that will reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water" (El Paso Municipal Code 15.13.050-B). Based upon the plan, El Paso's Public Service Board (PSB) would approve, deny, or take other action on the application for connection or expansion of service.

Large water users were required to submit a water conservation plan regardless of whether or not they were applying for new service or expansion of service. Large water users consuming an average of more than 25,000 GPD (more than 87,000 liters per day) were required to submit a water conservation plan within six months of April 1, 1991. Large water users consuming an average of more than 10,000 and less than 25,000 GPD were required to submit a water conservation plan within a year of April 1, 1991. All approved water conservation plans were to be revised every five years. After approval, water users had five years to implement water conservation plans.

Most garment-finishers submitted plans by the deadline and completed implementation by 1997. According to EPWU's Environmental Compliance Manager, John Balliew, it is unlikely that El Paso garment-finishers would have implemented water conservation practices without passage of the 1991 ordinance.[18] At the time, conservation equipment was unavailable for direct purchase by the industry. Garment-finishers were forced to pay for development of their own water conservation systems.

Water prices for very large water users in El Paso changed during the 1990s. In 1995, the PSB instituted a block-rate pricing structure for very large water users (Table 1).[19] Water prices were

[17] Water use in 1991 among finishing operations using 100,000 gallons per day (GPD) or greater was 306,697 GPD. Water use among finishing operations using between 10,000 and 100,000 GPD was 27,113 GPD. See note 25

[18] John Balliew, interview by authors, El Paso, Texas. 26 July 2000

[19] The PSB adopted increasing block rates for very large users on 14 June 1995. However, increasing block rates for other categories of users have been in existence since the 1970s.

assessed according to the user's water consumption during each month. Depending upon consumption, the user fell into the first through fourth block. Water rates increased with each block.

Table 1. El Paso block rate pricing structure

Block	Consumption	Price per ccf [20]
Block 1	0 ccf to 5,000 ccf	$0.86
Block 2	5,001 ccf to 15,000 ccf	$1.06
Block 3	15,001 ccf to 30,000 ccf	$1.21
Block 4	Over 30,000 ccf	$1.98

Source: Public Service Board of the City of El Paso, Rules and Regulations No. 5, Section 1(G), 8 December 1999.

The block rate pricing structure increased water costs overall for garment finishers in El Paso and discouraged high water usage by increasing the per unit cost along with consumption. One El Paso garment finisher cited the move to block water rates as a factor in the firm's decision to relocate.[21]

3.4 Market Forces

Since blue jeans became popular in mass markets during the 1950s, the market for denim has followed a pattern of extreme peaks and troughs for most of its history (Rozelle, Isaacs, Elliot, McMurry, and Barker 1995). These cyclical gyrations abated somewhat in the 1990s as product innovations made denim a staple of the fashion world. The early part of the 1990s witnessed a boom in denim sales before experiencing a slowdown in late 1993 (Ozzard 1993; Clune 1994). Muted sales continued until 1995 and 1996 when the market again showed consecutive annual growth.[22] Increasing price competition among major labels characterized 1997 (Ozzard 1997). Through 1999, denim sales appeared flat (Malone 1999).

Among garment finishers in El Paso, feelings were mixed on the impact of downturns in the denim market. One finisher reported that the denim market had taken a 20 to 25 percent hit from increased consumer interest in non-denim pants, such as khaki twills.[23] Another finisher, however, downplayed the impact of the denim market on his business, estimating that his company's sales were up 40 percent in 2000 and 1,000 percent since 1990.[24]

4 Environmental Implications

Water use by the stonewashing industry in El Paso declined from 1990 to 2000. This section of the study reviews evidence from water consumption data of the industry's decline in water use and reports interview findings on the industry's track record in meeting water quality discharge requirements.

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20 ccf denotes 100 cubic feet, 1 ccf = 748.052 gallons (US) or 2830 liters.

21 Interview no. 3, interview by authors, telephone, 28 July 2000, Austin, Texas.

22 According to private sector market research, the denim bottoms market grew 12% in 1995, and 5.1% in 1996, see Anonymous, "Bottoms Up," *Women's Wear Daily* 173, no. 44 (1997): 14.

23 Interview no. 2, interview by authors, 27 July 2000, El Paso, Texas.

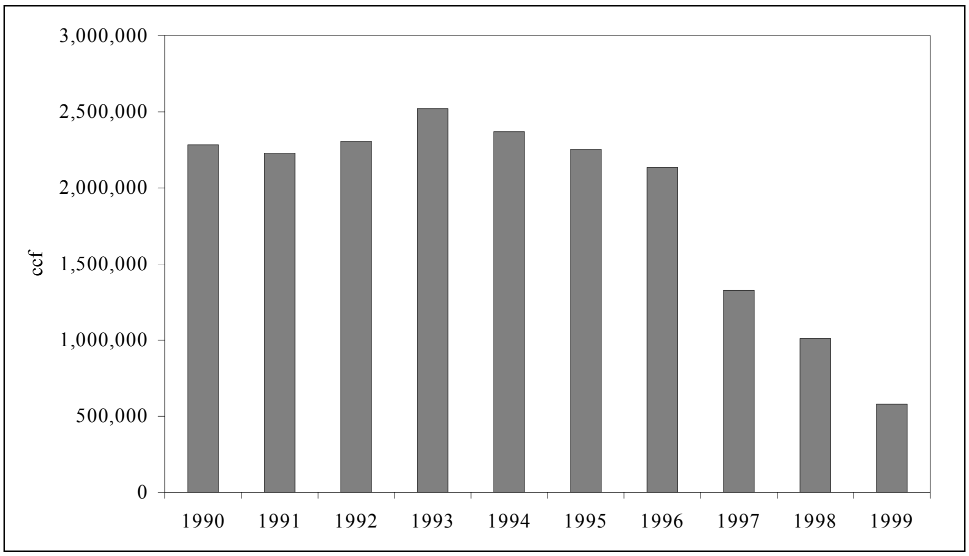
24 Interview no. 1.

4.1 Quantity

The water usage analysis was based on water consumption records for 27 garment-finishing accounts from 1990 to 2000.[25][26] Not all accounts maintained water service during the entire period. Some accounts opened after the beginning of the period, while others closed before its end. The 27 finishing accounts analyzed are representative of El Paso's stonewashing industry from 1990 to 2000.

Total annual water usage peaked in 1993 at over 2.5 million hundred-cubic feet (ccf), representing an average of approximately 5.2 million gallons per day (GPD) [19.7 million liters per day] that year. From 1993 through 1999, total annual water consumption declined 77 percent, including a 38 percent drop from 1996 to 1997 and a 42 percent drop from 1998 to 1999. Figure 2 shows the change in total annual water consumption during the period.

Figure 2. Total annual garment-finisher water consumption, 1990–1999



Source: EPWU.

Accordingly, monthly consumption figures show a marked decrease during the time period. Figure 3 shows total water consumption by month. The monthly consumption totals vary more widely than the annual totals. A 12-month moving average is used to show the trend over time.

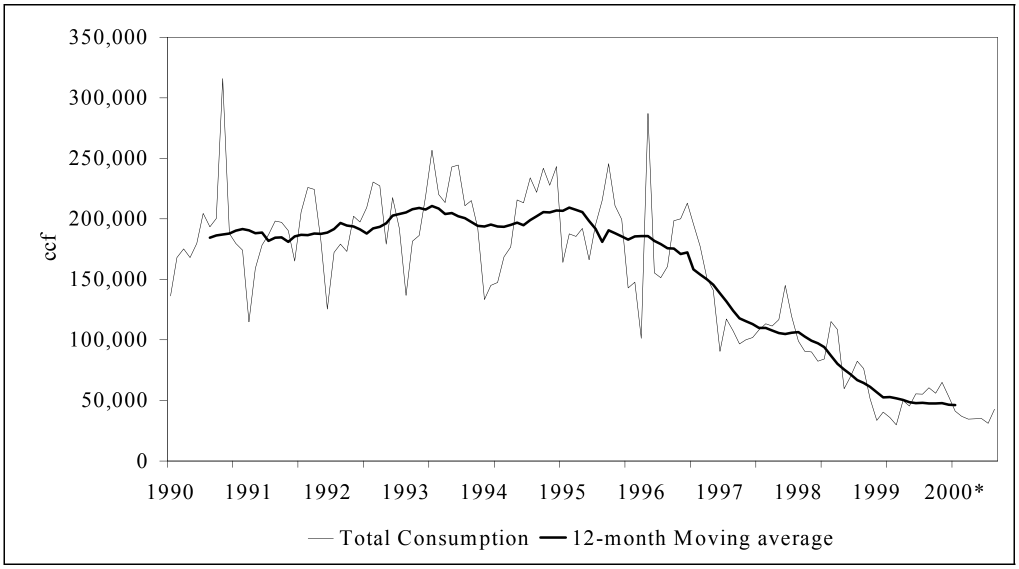
The decline in water consumption is not solely attributable to the decrease in the number of firms using water as they moved away. Water consumption per account also decreased during the study period. Figure 4 shows the annual decrease in average monthly consumption among active water accounts.[27] After its peak in 1993, average monthly use began to decrease annually through 2000, including a 27 percent drop from 1996 to 1997 and a 29 percent drop from 1998 to 1999. Between 1993 and 2000, average monthly use decreased 62 percent.

[25] Water consumption data and list of finishing accounts provided courtesy of EPWU.

[26] Some firms had multiple accounts due to various locations.

[27] Some firms maintained accounts, but were not consistently drawing water.

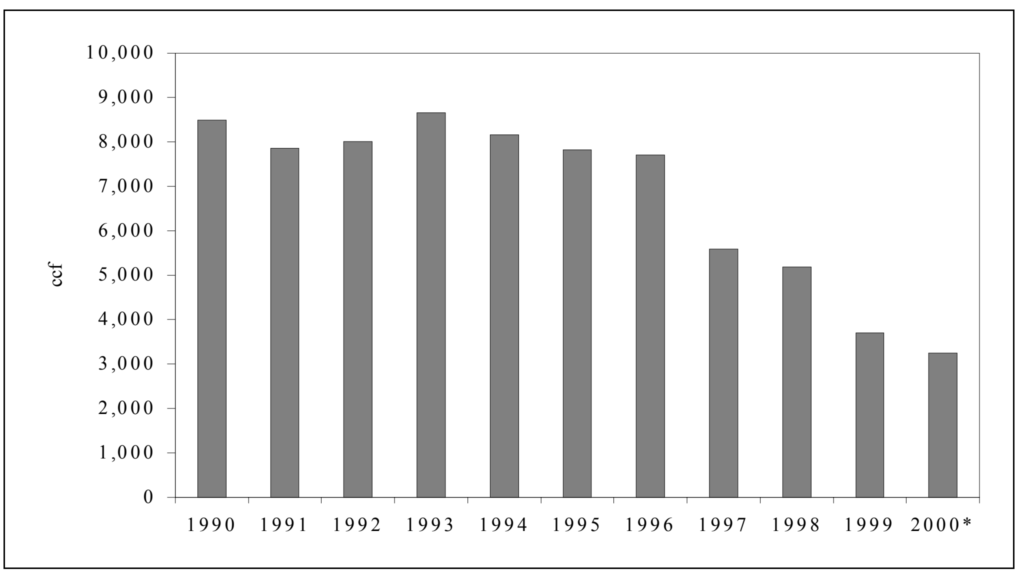
Figure 3. Total garment-finisher water consumption by month, 1990–2000



* Jan.-July. Source: EPWU.

In 1993, the stonewashing accounts analyzed were drawing approximately 5.2 million GPD (19.7 million liters per day), accounting for approximately five percent of average daily water demand for all of El Paso.[28] By 1999, this had declined to about 1.2 million GPD (4.5 million liters per day), accounting for approximately one percent of average daily water demand.[29] Both the outmigration of stonewashing firms and a reduction in water consumption by remaining firms were responsible for the decrease. Peaks in both total consumption and average consumption occurred in 1993. Significant drops in total and average consumption occurred in 1997 and 1999.

Figure 4. Average monthly garment-finisher water consumption by year, 1990–2000



* Jan.-July
Source: EPWU.

[28] See EPWU, *Selected Financial and Statistical Data*, available at <http://www.epwu.org>.

[29] Ibid.

4.2 Quality

Industrial wastewater users in El Paso are required to comply with PSB wastewater discharge standards, federal pretreatment regulations, and applicable state laws when releasing wastewater into El Paso's wastewater system (40 CFR 403). Industrial users, defined as "any person who contributes, causes or permits the contribution of industrial wastewater into El Paso's wastewater system, except from a vehicle," include stonewashing operations in El Paso (PSB 1999). Significant industrial users must obtain a discharge permit from the PSB before releasing wastewater into the system. Assuming a ten percent loss in the finishing process, 19 of the 27 finishing accounts would have qualified as Significant Industrial Users in 1993.[30]

To meet wastewater discharge requirements, finishers pass wastewater through onsite pretreatment systems before releasing it into El Paso's wastewater system. Construction, operation, and maintenance of pretreatment systems are the responsibility of the industrial user. According to Cindy Edgar, EPWU Pretreatment Engineer, the primary discharge violations among stonewashing operations were:[31]

- colored discharge (dye or coloring agent remaining in wastewater);
- discharge of stones or pumice material;
- unacceptable pH levels; and
- discharge of solids in quality or volume not representative of normal discharge.

Color discharge was evaluated according to the American Dye Manufacturer's Index (ADMI). Wastewater color concentrations in excess of 300 ADMI units were in violation of discharge requirements. Stones in wastewater discharge were prohibited as solids or viscous substances that may obstruct flow. Wastewater having a pH below 5.5 or above 10.5 was prohibited.

As the stonewashing industry developed new finishing processes in response to fashion trends, so did its need to develop industrial pretreatment. Initially, this translated into devising filter systems for removing pumice, lint, dyes, and chemicals from the wastewater. Without existing equipment, the industry relied on trial and error to develop pretreatment systems. Each new finishing process brought new challenges. Pumice stones, for example, sank to the bottom of wastewater settling tanks. Therefore, filters to trap and remove the pumice were placed at the bottom of tanks. When the industry began to experiment with perlite, however, they found that it floated. Firms then had to install filters at the top of wastewater settling tanks in addition to the bottom filters. John Balliew recounted opening up city manhole covers in El Paso to find a layer of perlite floating atop the wastewater.

When fashion trends introduced overdyed jeans, garment finishers again encountered new challenges. The indigo dye molecules used to achieve the traditional denim fabric color are relatively large. Color filters in denim finishing plants had been built accordingly. The dyes used to produce overdyed jeans in colors such as red, brown, and green, contained a much smaller molecule which passed through the color filters. Balliew said that EPWU received calls from El Paso residents concerned over quantities of red water being discharged into the waterways and that utility workers sometimes found colored water pouring into municipal wastewater treatment facilities.

The cost of industrial wastewater pretreatment by the stonewashing industry was ongoing in El Paso. It varied depending on the type of finishing processes and the company's ability to install state

30 Stipulations for classification as a Significant Industrial User are enumerated in PSB 1999, however, discharging an average of 25,000 GPD or more automatically qualifies one as a Significant Industrial User. According to Cindy Edgar, EPWU Pretreatment Engineer, wastewater discharge can be estimated to be approximately 10% less than water consumption for garment-finishers, Cindy Edgar, interview by authors, El Paso, Texas, 27 July 2000.

31 Cindy Edgar, interview.

of the art pretreatment systems. As new finishing techniques were developed and new trends emerged, the industry quickly had to develop pretreatment processes to handle new chemicals, dyes, and other inputs.

Pretreatment systems varied among finishers.[32] Larger finishers spent upwards of US$750,000 to install sophisticated pretreatment systems. Smaller finishers often could not afford more elaborate pretreatment systems, which meant that they were not able to perform processes such as overdying.

According to Cindy Edgar, the stonewashing industry was unprepared to meet wastewater discharge requirements in the initial stages of growth. El Paso's remoteness from other concentration points of the apparel industry in the United States contributed to stonewashing firms' difficulties in obtaining access to up-to-date research and development for pretreatment. As the industry grew, however, environmental compliance increased.

As the stonewashing industry matured, more sophisticated equipment emerged. Initially, washing machine operators had simply "eyeballed" water, pumice, and chemical inputs into the stonewashing process. Such variance in the stonewashing formula led to a less-than-uniform product. As stonewashing became a staple of the denim industry, however, more sophisticated equipment was developed and formulations were standardized. Newer automated equipment used less water, created a more uniform product, lowered production costs, and reduced chemical use.

5 Industry Insight

To gain insight into the industry perspective on the relocation of El Paso's garment stonewashing industry, interviews were conducted with executives from three garment finishers remaining in El Paso.[33] The facilities of the interviewees in El Paso ranged from full-service finishing operations to minimally staffed plants marked for closure. All of the businesses interviewed also operated facilities in Mexico. The authors sought to conduct more industry interviews both in El Paso and in Mexico, but were unable to attain access to other industry representatives willing to be interviewed.

All of the finishing operations interviewed had maintained facilities in El Paso at least since 1985. Two of the finishers had operated laundry facilities in El Paso prior to 1980. The duration of their facilities in Mexico varied. One finisher reported establishing sewing operations in Ciudad Juárez, Mexico, in 1980. Another had operated a finishing facility in Mexico since 1995, and a sewing operation prior to 1994. The other firm established finishing operations in Mexico in 1999.

Although all interviewed firms performed stonewashing work, business operations ran the gamut. One firm produced private label denim products entirely through in-house operations. The firm maintained its own design staff, as well as cutting, sewing, and finishing operations. Another firm performed finishing work through contracts with large retailers like Levi Strauss & Co, Tommy Hilfiger, and Guess?. Its facilities were able to perform a number of finishing processes in addition to stonewashing.

Overall, the industry executives downplayed the importance of water and wastewater issues and the cost of environmental compliance in relation to overall business costs as major considerations in their decision to relocate. When asked what factors may have led El Paso stonewashing firms to relocate, including their own, a common theme among the finishers' responses was reducing labor costs. Finishers compared the cost of doing business in El Paso to business costs in Mexico in their responses. They perceived operation costs, excluding labor, as not much costlier in El Paso. Rent and utilities costs were considered higher in Mexico than in El Paso. Opinions on the price of water

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32 This paragraph drawn from remarks by Cindy Edgar.

33 The following section is based on interviews conducted by the authors in El Paso, Texas during July 26-27, 2000 and by telephone from Austin, Texas on July 28, 2000.

for business in Mexico differed. Some felt water was more expensive in Mexico, while others felt it was cheaper. However, two finishers pointed to additional costs for construction of water treatment systems necessary for performing finishing work. Finishers felt that although operation costs excluding labor were somewhat lower in Mexico than in El Paso, the primary reason stonewashing firms relocated to Mexico was to benefit from reduced labor costs.

All three finishers felt that NAFTA's rule changes to accept finishing processes performed in Mexico played a role in stonewashing firms' decisions to relocate operations. However, they believed that without passage of NAFTA, El Paso's stonewashing industry would have relocated anyway. According to one finisher, NAFTA helped keep the industry close to the United States: "They would have gone anyway. Why give it away to the rest of the world?"[34] Another finisher felt that the industry's relocation would have been less severe without NAFTA. The other felt that NAFTA had helped speed the relocation process along. In his opinion, the industry would have moved anywhere with a stable government and cheap labor. In addition, he felt lower transportation costs were an advantage for Mexico because of its proximity to the United States.

When asked how NAFTA's rule changes had affected business, one finisher replied, "we've been very fortunate."[35] He cited his firm as one of three or four major garment finishers in the country, and the only major garment-finisher remaining in El Paso. "I've always believed there would be a market for totally made in the USA [products]," he remarked.[36] Another finisher reported that NAFTA initially had affected his firm's business negatively. They laid off 400 people from their El Paso operations and began to set up operations in Mexico. According to the finisher, the costs they incurred from letting people go and starting new operations were made doubly hard by increased price competition in the aftermath of NAFTA. In the long run, however, he felt they were doing very well with NAFTA and that it had worked for them in a positive way. Since passage of NAFTA, he had been able to increase his finishing business in El Paso by buying up other finishing operations that had gone out of business.

Finishers' reactions to El Paso's water situation differed. Seeing the potential for future water shortages, one finisher had moved operations outside of the city's limits and drilled wells pumping brackish water to secure a water supply for his company. After treatment, the company reused its wastewater for irrigated agriculture. Another El Paso finisher, however, had made no technical modifications to improve water usage efficiency. In regards to the role of El Paso's water supply in his business decisions, he responded, "we're getting what we need."[37]

One finishing operation that did not grant an interview, was in the process of relocating to an industrial park built by the PSB that partially relied on treated wastewater for its water supply. Relocation to the park enabled businesses to forgo additional water reuse requirements. The PSB provided water to the industrial park at half the price of that supplied to other industrial users.

The water and wastewater infrastructure in Mexico was generally judged inferior for relocated stonewashing facilities. In regard to the municipal infrastructure at the site of one of his firm's finishing operations, one executive remarked, "the infrastructure there is absolutely atrocious."[38] In his experience, the municipal infrastructure had not been capable of supporting large-size stonewashing operations. The company had to pay for water infrastructure improvements to ensure a consistent water supply to its facility. The municipal wastewater system consisted of one main underground collector from which untreated wastewater was pumped for irrigation. When asked about his firm's development of industrial wastewater pretreatment in its Mexican facilities, the

34 Interview no. 1.

35 Interview no. 2.

36 Ibid.

37 Interview no. 1.

38 Interview no. 3.

same executive indicated that in his view Mexico had not yet developed rigorous pretreatment enforcement procedures. His firm, he implied, was waiting to install wastewater pretreatment systems until the Mexican government required compliance. Another finisher developed a wastewater reuse system similar to that in their El Paso facility in which wastewater was treated and then used for irrigation on the company's land. The company engaged in agricultural production on its irrigated land to recoup expenses. Implementation of this system required purchasing a large amount of land.

6 Relocation to Mexico

Information gathered through industry interviews indicated that a number of stonewashing operations relocated to the tri-city region of Torreón, Gómez Palacios, and Ciudad Lerdo, located in northwestern Mexico, 850 kilometers south of El Paso. The number of jeans manufacturers in the three cities, collectively referred to as La Laguna, increased dramatically in the 1990s.[39] One study found the number of jeans manufacturers in La Laguna grew from two in 1993 to ten in 1998 (Gereffi and Martinez 1998). The number of pairs of jeans produced in La Laguna increased from 500,000 in 1993 to 4.5 million per week in 1998 (Gereffi and Martinez 1998).

Preliminary census data for 2000 indicate a population of 529,093 for Torreón, 272,806 for Gómez Palacios, and 112,272 for Lerdo (INEGI 2000).[40] Together, the population of the three cities is approximately half the combined population of El Paso and Ciudad Juárez. Jobs in the apparel and textile industry as a percentage of total employment grew from five to fourteen percent between 1993 and 1998 (Gereffi and Martinez 1998). In absolute terms, employment in the apparel and textile industry increased from 12,000 in 1993 to 70,000 in 1998, supplanting the automobile industry as the largest manufacturing sector in the region (Gereffi and Martinez 1998). Data were not available to compare former employment of those now working in the apparel industry.

The region's landscape of multi-stemmed cacti, yucca and shrubs is characteristic of the Mexican Chihuahuan Desert (WWF 1999: 341). Torreón and Gómez Palacios are separated by the Río Nazas, a dry river that flows only during periods of heavy rain or other overflow conditions. The Río Nazas originates 280 kilometers upstream from Torreón and Gómez Palacios. Two reservoirs—Lázaro Cárdenas, also known as “El Palmito,” and Francisco Zarco, also known as Las Tórtolas—regulate flow of the river above the sister cities. River water is used exclusively for agricultural irrigation.

The region's groundwater comes from the Comarca Lagunera. According to Ing. Martín G. Rodríguez Lara, regional manager of Mexico's National Water Commission (CNA), extraction exceeds recharge of the aquifer, and within the next 20 years, water needs are expected to double.[41] Water from the aquifer for the three cities is pumped at a rate of approximately 77 million GPD (291 million liters per day) from 106 wells. The majority of this water, approximately 84 percent, is used for agriculture and ranching. Of the remaining 16 percent, 10 percent is for municipal potable water, four percent for domestic watering, and two percent for industrial use.[42] This figure may not truly represent total water use as industry may have their own wells and, thus, are not accounted for in these figures.

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[39] Many of these facilities were “full-package” operations performing multiple production processes such as milling, cutting, assembly, finishing, and design. The number of clients of La Laguna's jean manufacturers also increased during this time.

[40] See also <http://www.inegi.gob.mx/>.

[41] Fax communication from Ing. Jaime Tinoco Rubi, International Coordinator, National Water Commission, 7 September 2000, containing information provided by Ing. Martín G. Rodríguez Lara, Regional Manager, National Water Commission.

[42] Ibid.

As firms relocated to the region, they brought water-reuse technology developed in their previous United States locations to Mexico.[43] This constituted a technology transfer as firms relocated to the region. Gereffi and Martinez assert that the transfer has been "spurred by increasing environmental preservation efforts by the Mexican government" (1998).

Torreón has 15 privately owned wastewater facilities located throughout the municipio. According to Rodríguez, these facilities work under an agreement with the public utility to treat municipal wastewater at a rate of 2.7 million GPD (more than 10 million liters per day) and reuse the water to irrigate green spaces. The city of Torreón has begun construction of a municipal wastewater treatment plant consisting of a lagoon system to handle municipal and industrial discharge. The plant's approximately 43 million GPD (163 million liters/day) treatment capacity is anticipated to serve municipal growth through the year 2020. Gómez Palacios and Lerdo also have initiated construction of municipal wastewater treatment plants.

Mexican environmental laws and regulations governing water and wastewater are similar to those in the United States. Three different standards (*Normas Oficiales Mexicanas)* exist on the national level governing different aspects of wastewater discharge: NOM-001-ECOL-1996, NOM-002-ECOL-1996, NOM-003-ECOL-1997. The Law for Ecological Equilibrium and Environmental Protection *(Ley del Equilibrio Ecológico y de Protección Ambiental)* applies on the state level. On the municipal level, the Rules and Regulations for Ecology and Environmental Protection *(Reglamento de Ecología y Protección al Ambiente)* apply.

The authors were not able to acquire specific information on Mexico's requirements for industrial wastewater pretreatment, including reporting and testing requirements. However, based on a number of interviews with experts directly involved in binational water and wastewater issues, enforcement and compliance with Mexico's wastewater laws varies considerably from city to city.[44]

Officials with CNA did indicate that there have been wastewater discharge violations by the stonewashing industry and that in each case penalties were applied in accordance with established regulations. Violations by the stonewashing industry in the tri-city region were similar to those in El Paso, including violations of total suspended solids, chlorides, color, solids, and toxic and corrosive substances.

7 Results and Conclusions

From a North American perspective, both Mexico and the United States will continue to face growing demand for freshwater to meet human and environmental needs. Wherever the stonewashing industry is located, it remains a water-intensive industry based on fashion demand.

In the debate that preceded the passage of NAFTA, some argued that in the long-run, aspects of NAFTA encourage industry relocation to areas with poor environmental compliance. Others argued that by opening North American markets, industries would move away from maquiladoras concentrated along the United States-Mexico border and spread throughout Mexico. As industries and accompanying environmental infrastructure spread, they argued that pressure and resources for environmental compliance in Mexico would increase. In its relocation to the Torreón, Gómez Palacios, and Ciudad Lerdo region, the stonewashing industry appears to have followed this paradigm, although the net environmental impact of its relocation is less clear.

Overall, some of the hypotheses were strongly supported by the research; however, others were less conclusive. Rule changes under NAFTA and changing trends in the increasingly globalized

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[43] This paragraph drawn from research conclusions by Gereffi and Martinez 1998.

[44] Based on two interviews from sources requesting anonymity but who are directly involved in the development of municipal water and wastewater infrastructure in the US-Mexico border region.

apparel industry played a role in the stonewashing industry's movement out of El Paso and into Mexico. Interviewees also suggested that water reuse requirements and the future availability of water in El Paso were not significant factors in businesses' decisions to relocate. The departure of the stonewashing industry alleviated pressure on border water resources, particularly the Hueco Bolson aquifer that provides water to El Paso and Ciudad Juárez. As the industry matured, water-use efficiency improved in El Paso and Mexico as a result of automated technology and the desire to create a more uniform product. Efficiency improvements did not appear to be a result of concern over future availability of water resources. Evidence of improved environmental impact in Mexico was inconclusive. However, the apparent lack of industrial pretreatment regulatory enforcement in Mexico is an area of concern. Progress in this area could significantly improve environmental protection.

7.1 Relocation Factors

Elements of NAFTA had an impact on the denim stonewashing industry in El Paso. Globalization and the apparel industry's shift toward developing nations were also important factors in the industry's relocation. Under competitive pressure in the increasingly globalized apparel industry, El Paso's garment-finishers were looking for locations affording a competitive advantage. The advent of NAFTA created trade conditions favoring relocation to Mexico over other Latin American or Asian countries. The removal of tariffs and quotas specific to the apparel industry appears to have given Mexico an advantage in attracting the industry over other countries. Mexico's proximity to the United States also ensured more timely and cheaper delivery of goods over other Latin American and Asian countries.

Lower labor costs in Mexico were the overriding factor in industry decisions to move operations out of the United States and into Mexico, based on information gathered during industry interviews. Reduction of labor costs was a significant means of lowering production costs in order to remain competitive. The industry's pursuit of reduced labor costs gave Mexico a competitive advantage to garner the lion's share of the relocated garment stonewashing industry.

Other factors, namely water reuse requirements and the potential for future water shortages in El Paso, seemed to have little or no impact in the industry's decision to relocate, or were of minor importance relative to labor costs.[45] Neither was the cost in El Paso of water and other utilities a predominant factor in the industry's decision to relocate. These represented a relatively small cost in the production equation. However, as companies set up finishing operations in Mexico, most had to develop their own water supply infrastructure, creating an initial expense. Industry interviews also revealed that other utilities, namely electricity, were more expensive and less reliable in the cities where the industry relocated to in Mexico.

The industry became more water efficient as it developed more sophisticated equipment and standardized processes. The impetus behind these changes, however, appeared to be based on producing a more uniform product and reducing the cost of production. Although the net effect was lower water use by the industry, the driving force for the changes was not concern over future water supply or the desire to conserve water resources in the Hueco Bolson. One industry executive interviewed indicated that the move toward more efficient water use also helped them come into compliance with El Paso's water reuse ordinance, but that this was an added benefit of production efficiency, not the driving force.

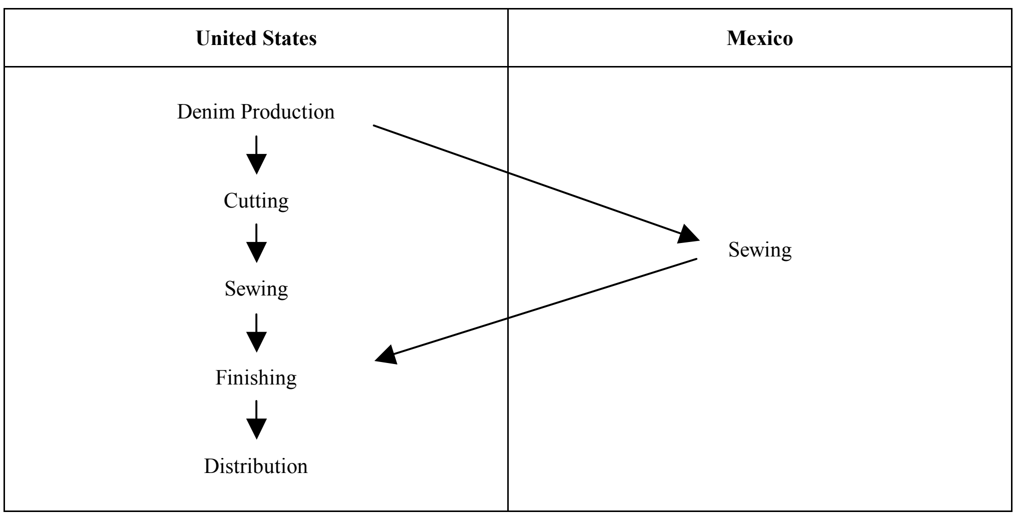
[45] Ironically, though, the largest downturn in the El Paso stonewashing industry in 1997 coincided with the EPWU's deadline for implementing the 1991 water conservation ordinance.

7.2 Changes in Production

Figure 5 shows the denim apparel industry production chain prior to implementation of NAFTA. Prior to NAFTA, the USTS 807 and USHTS 9802 programs gave preferential tariff treatment to garments assembled in Mexico from materials produced in the United States. In an attempt to remain competitive, the denim apparel industry opened new sewing facilities to assemble garments in Mexico, and subsequently reduced labor costs. The same preferential treatment was not extended to garment finishing. Many of these operations were located in El Paso.

After passage of NAFTA, denim finishing processes moved to Mexico (Figure 6). NAFTA's removal of tariff and quota restrictions on finishing work performed in Mexico, arguably were factors in contributing to the flight of the stonewashing industry. El Paso apparel industry firms found it economically advantageous to more fully integrate operations in Mexico or to develop partnerships with Mexican companies. With the national minimum wage in Mexico at approximately $5 per day, plus benefits, firms were able to lower production costs in order to remain competitive with other parts of the world. However, given the capital investment required to build new operations, some companies unable to compete went out of business entirely.

Figure 5. Pre-NAFTA denim apparel industry production chain

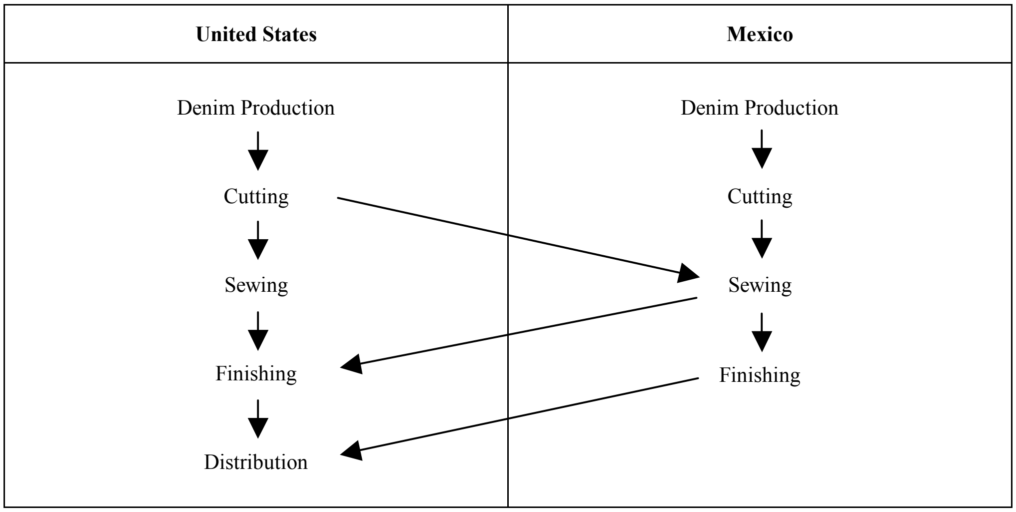


Of the firms interviewed, only one still performed all of its finishing work in El Paso. The others were in the process of either entirely relocating their finishing operations or engaging in joint ventures to operate finishing facilities in Mexico while maintaining operations in El Paso. Although marketing and distribution in the denim apparel industry remain in the United States, companies have been able to successfully integrate assembly and finishing processes in Mexico.

7.3 Benefits and Costs

An examination of the benefits and costs associated with the relocation of El Paso's stonewashing industry to Mexico reveals the influence of several factors in terms of net results.

Figure 6. Post-NAFTA denim apparel industry production chain



7.3.1 El Paso

In terms of border water resources, the expansion of the stonewashing industry in the early 1990s increased water demand and temporarily introduced additional pressures on EPWU wastewater treatment plants as the industry scrambled to develop adequate pretreatment. The industry's subsequent contraction in El Paso removed numerous large and very large water users, thereby decreasing pressure on the dwindling resources of the Hueco Bolson, a key underground aquifer that straddles the border. This clearly points toward an environmental benefit for the El Paso/Ciudad Juárez border region.

Box 2. Benefits and costs of relocation to the stonewashing industry

El Paso	
Benefits	**Costs**
• Reduced pressure on border water resources • Reduced industrial water use • Reduced load on municipal wastewater systems • Stonewashing industry void filled by less water-intensive industries	• Loss of jobs
Mexico	
Benefits	**Costs**
• Reduced pressure on border water resources • Pressure for environmental improvement • Job creation • Expanded infrastructure.	• Increased pressure on water resources • Increased pollution from inadequate industrial wastewater pretreatment

Water use in El Paso by the stonewashing industry was affected in two ways as the industry moved south. First, of the accounts analyzed, the number of firms drawing municipal water decreased from 25 at the industry's peak in 1993 to fewer than 15 in 2000. Second, as technology improved and firms had to comply with El Paso's water reuse requirements, the remaining firms consumed less water. Combined, this translates to an approximately 4 million GPD (15 million liters/day) decrease in average water consumption since the industry's peak. This is equivalent to the average municipal use of approximately 25,000 people.[46] Considering predictions of the Hueco Bolson being exhausted by 2025, this is not an insignificant amount.

El Paso benefited from a decrease in industrial demand on its dwindling freshwater resources. Municipal wastewater treatment in El Paso also benefited from reduced maintenance and upkeep costs associated with removing pumice buildup and floating perlite in wastewater systems.

El Paso's leaders had not sought out the stonewashing industry. It had emerged in El Paso by historical accident, the offshoot of a long established apparel industry that, in responding to market demand, discovered a new source of revenue. In its absence and in that of the apparel industry in general, El Paso's economic development planners focused on attracting less water-intensive industries to fill the void.

The costs to El Paso, however, were significant. The loss of jobs in the stonewashing industry was compounded by its occurrence during the overall flight of El Paso's apparel industry. Wages for workers in the apparel industry in El Paso, including garment finishing, ranged from US$7–$10 per hour with benefits. The industry had provided relatively well-paid jobs for workers, often women, many of whom were unskilled and spoke little or no English. The arrival of new industries in the wake of the apparel industry's departure did not necessarily ensure new employment for these workers. Employment in El Paso's new industries generally required a higher level of skills than those of the displaced workers.

7.3.2 Mexico

It is possible that the industry's relocation will bring increased pressure for environmental improvement in Mexico. Increased international trade and foreign investment in Mexico likely has increased public scrutiny of environmental regulation, both from abroad and at home. As the arrival of new industries further taxes Mexico's environmental resources, regulators could face increased pressure to enforce environmental regulations. NAFTA arguably has increased awareness and financial and technical resources to encourage creation of adequate water and wastewater systems in Mexico, particularly in the border region.

As the stonewashing industry built finishing facilities in the region, they brought with them industrial water conservation technology and made municipal infrastructure improvements in their new locations. The technology transfer resulting from water reuse practices led to improved water efficiency by the stonewashing industry. Many finishing operations provided municipal infrastructure improvements, such as extending water service to nearby neighborhoods, as they constructed manufacturing facilities. There is a direct public health link between the provision of potable drinking water and improved health.

Finally, the Torreón, Gómez Palacios, and Ciudad Lerdo region benefited from job creation due to the arrival of the stonewashing and other industries. However, data to analyze previous employment of those now working in the apparel industry were unavailable.

Parallels can be drawn between environmental conditions in El Paso/Ciudad Juárez and Torreón/Gómez Palacios/Lerdo. Both regions are in the arid Chihuahuan Desert. While the population of the tri-city region is approximately half of that in El Paso/Ciudad Juárez, both rely heavily on groundwater resources that are being extracted at a greater rate than they are recharged. In addition, both regions are situated on rivers whose natural flows have been altered by dams. Unless considerable efforts are made to strike a balance among competing municipal, industrial, agricultural, and ecological interests, both regions face the prospect of water shortages.

[46] Assuming EPWU system-wide consumption of 160 gpcd.

As the industry moves, the environmental issues move with it. In the case of water, stonewashing is a water intensive industry – no matter where it is located. For wastewater, the issue is more complex due to differences in the regulatory environment and available infrastructure. Wastewater quality became of lesser importance in El Paso once the industry developed adequate wastewater pretreatment systems. However, in La Laguna the quality of industrial wastewater discharge is cause for concern based on the region's less developed wastewater infrastructure and varying levels of regulatory enforcement reported during interviews.

Information from interviews indicates that enforcement of industrial wastewater discharge regulations for the stonewashing industry varies. Thus, some of the companies that have relocated to Mexico may not yet have incorporated effective industrial pretreatment processes. This likely will become more of an issue as more municipalities in Mexico develop municipal water and wastewater collection and treatment infrastructure. The most commonly used wastewater systems rely on bacteria to treat municipal wastewater. Without pretreatment, wastewater discharge by the garment-finishing industry with abnormal pH levels or containing chemicals runs the risk of destroying the bacteria necessary for wastewater treatment and could cause the facility to fail. Therefore, municipalities have a vested interest in the quality of industrial wastewater discharge and in their ability to enforce compliance.

The need for stronger industrial wastewater pretreatment enforcement in the stonewashing industry is an area of particular concern that should be addressed to protect water resources and affected flora and fauna. As Mexico makes a concerted effort to improve municipal environmental infrastructure, industry will need to install and improve wastewater pretreatment systems.

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Discussants:

Kal Raustiala (School of Law and Institute of the Environment, UCLA)

Mr. Raustiala said that untangling the effect of NAFTA on the environment is problematic. The three papers presented in this session represent different approaches, each interesting, but all ultimately testifying to the challenge of analyzing this question.

The Frederikkson-Millimet paper examines possible changes in strategic policy-making triggered by NAFTA. The variables used in this analysis are based on differences in environmental compliance costs between different jurisdictions. The authors argue that investors have not engaged in identifying least-cost environmental law regulations, but that does not mean environmental policy has been unaffected by NAFTA. Some environmental standards are set at the federal level—such as those for SO2 and many other pollutants—hence there would not be a search for lower cost jurisdictions for these pollutants. Nevertheless, the paper pointed to some interesting findings concerning NAFTA's effects on industry, although it provided little insight into policy changes induced by NAFTA.

As a general point, concerns around NAFTA's Chapter 11 appear warranted, although more analysis is needed to identify the actual effects of past and pending case law. These papers suggest that NAFTA's impact on environmental policies, with the exception of Chapter 11, has been modest and much less than was initially feared. Mr. Raustiala said that, given the difficulty in studying NAFTA-related policy issues directly, more attention should be paid to studying the policy implications of the CEC's Article 14 citizen's submission procedure, to provide an additional means of alerting us to any "race-to-the-bottom" trends.

David Barkin (Profesor de Economía, Universidad Autónoma Metropolitana, Unidad Xochimilco)

These papers deal with the lack of expertise in all three countries for tackling trade and environment issues. This is particularly troubling for Mexico. The Millimet paper assumes that capital flight is mainly an issue in border states. In fact, the issue is greater in the southeast and rust belt states, since border states can take advantage of "twin plant" relationships.

The Abel/Phillips paper raises critical questions that have been largely absent from trade-environment discussions and, more generally, from the work of the CEC. What has been the impact of industry relocation on local communities, and on communities' ability to maintain ecosystems? How have ecosystems been affected by production specialization and the resulting increase in importation of basic consumption goods?

Mr. Barkin stressed that trade-environment discussions need to examine alternatives to economic globalization. There is a growing threat that trade liberalization may impede the local linkages needed to foster proper ecosystem management and the development of more sustainable industries.

Session Three Questions and Open Discussion

One commentator, speaking on behalf of thousands of displaced textile workers in El Paso, argued that NAFTA has had a significant impact on the region's employment, local communities and the environment.

On the question of the degree to which environmental policies are responsive, Canadian provinces may be relatively more responsive to changes in US industry because of the Canada-US acid rain program. In addition, when talking about industry relocation and environmental regulations, it is important to note that utilities, which are the main source of SO_2, are capital intensive, with very long planning horizons and, hence, not easily subjected to relocation in the short term.

Questions related to NAFTA's Chapter 11 were also raised in this session. It was suggested that more analysis is required when approaching cases like Metalclad and Methanex. One person commented that generalizations about the effects of NAFTA's Chapter 11 should be viewed with caution. NAFTA prohibits expropriation without compensation, but there is a lack of jurisprudence in international law regarding what constitutes expropriation.

At the same time, more analysis is needed to examine the legal reasoning behind Chapter 11 decisions. Thus far, every decision taken involving Chapter 11 cases has leaned heavily toward expropriation. The consequence of these decisions is that environmental lawmakers are shying away from new environmental regulations, fearful of the potential for lawsuits that may run into millions of dollars.

Despite the legal uncertainties around Chapter 11, opportunities do exist to raise awareness of the relationship between advances in trade laws and corresponding environmental management steps. The CEC has an opportunity to facilitate the process of developing joint expectations and mutual awareness between the trade and environment communities. It was stressed that the participation of civil society in trade-environment issues is essential. At the same time, the capacity of Mexican civil society for such participation is weak and needs support. Civic organizations are funded largely externally and internal incentives do not encourage such participation. One tool to help overcome such constraints is the CEC's Citizen Submission mechanism. In theory, the process can draw upon the resources of civil society to monitor policy change in the NAFTA parties. In practice, the Article 14 and 15 process is long and complex and, given the political climate right now, is not likely to change. Nonetheless, it has the potential to be a very useful tool.

Session Four

NAFTA’s Transportation and Manufacturing Impact on the Environment

- NAFTA Transportation Corridors: Approaches to Assessing Environmental Impacts and Alternatives
- Mexico’s Manufacturing Exports and the Environment under NAFTA

Session Chair:

Gustavo Alanís Ortega (Centro Mexicano de Derecho Ambiental, A.C.)

The relationship between economics and the environment has been recognized for some time. Against this general backdrop, people are beginning to understand the links between trade and the environment.

NAFTA Transportation Corridors: Approaches to Assessing Environmental Impacts and Alternatives

Rachel M. Poynter and Sheila A. Holbrook-White

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Abstract

With the passage of the North American Free Trade Agreement (NAFTA), trade between the three signatory countries (i.e., Mexico, the US, and Canada) has dramatically increased, significantly shifting traditional patterns of production, distribution, and transport. Trade traffic across *all* modes of transport including highway, rail, and air has increased, often overwhelming the capacity of existing infrastructure, particularly along the border where 60–80% of goods are transported by truck. The value of "just-in-time" delivery and the cost of delay have risen sharply and in tandem, prompting analyses and assessments of the capacity of the current transportation infrastructure to absorb increased trade flows and to ensure future mobility.

The capacity of the transportation infrastructure to respond and absorb these growing trade flows has emerged as the "linchpin" of liberalized trade with the concept of the "NAFTA trade corridor" gaining traction. Broadly defined, the corridors comprise the transportation infrastructure and systems that facilitate the flow of traffic both within and across North American borders, particularly those traffic flows prompted by the trade liberalization of NAFTA. In the absence of a uniform definition or objective indicators that coherently distinguish a NAFTA trade corridor from another segment of interstate, discussions of specific routes and their designation as a NAFTA corridor are inherently dynamic, inextricably political, and typically, highway-centered. Various "corridors" have been proposed with competition among routes, both extant and proposed, increasingly fierce.

While most discussions of NAFTA trade corridors have been limited to the logistical challenges of accommodating increased traffic through highway upgrades and construction, rather than a broad-based investigation and analysis of the extent to which multimodal alternatives might provide relief. As a consequence, a broad-based comparative assessment of the environmental costs, impacts, and benefits of the range of transport alternatives, is rare. Related, comprehensive consideration, much less specific assessment, of these impacts on the communities through which the heaviest flows of traffic are expected or occurring, is rarer still.

This document is organized in three segments, as described below.

Part I: Case Studies of Two "High-Impact Locales": NAFTA Transportation's Impacts on the Ambient Environment

This report provides case studies of two of the most heavily impacted border communities: Laredo, Texas/Nuevo Laredo, Tamaulipas, on the US/Mexico border and Detroit, Michigan/Windsor, Ontario, on the US/Canada border. Providing, first, a "snapshot" of current transportation infrastructure and conditions in each area, the text presents an overview of the use of truck and rail for the movement of goods, particularly the operational aspects of each mode. Following the introduction, the impacts of transportation on the four major components of the ambient environment (i.e., air, water, land, and living things) are analyzed, albeit within a limited scope, using a series of indicators. Organized both by environmental media and by border region, this analysis uses both quantitative and qualitative national, state, and local data as available with limitations noted.

Part II: A Community-level "Report Card": Environmental and Data Assessment

Configured as a report card, an aggregate presentation of the community-level indicators covered in the case studies, as well as the identified gaps in data, are provided. The "report card" is designed as a template for community and nongovernmental organizations to use as they seek to understand some impacts associated with NAFTA transportation.

This document also summarily describes data gathering and the ease or difficulty with which data was located and extracted bears comment and consideration. Despite approximately three months of intense efforts to locate pertinent data on environmental indicators "nationally or

internationally recognized for their importance," unfettered access to the Internet, proximity to a major research university, as well as a technical advisory group of transportation professionals, data could not always be located or extracted (CEC 1999, 78). Therefore, the report card also contains an assessment of data gaps and barriers to data availability, accessibility, and collection, information summarily presented which may be of use to community groups as they begin the process of identifying data resources.

Part III: Recommendations for Action by the CEC

Recognizing the unique role of the CEC as an environmental oversight institution charged with "strengthen(ing) cooperation on the development and continuing improvement of environmental laws and regulation" and encouraging effective enforcement, compliance, and technical cooperation by each signatory nation, several recommendations are made (NAAEC 1993, Article 10(3)). These recommendations are specifically directed toward activities that fall within the purview of the Commission and the Council.

1 Introduction

1.1 The Environmental Impacts of NAFTA Transportation: A Preliminary Exploration and Assessment

In 1997, members of the City Council of Laredo, Texas, discussed the merits of an unusual proposal: placing portable toilets in the median of a downtown stretch of Interstate 35 (I-35). These accommodations were not intended for large crowds at a weekend rock concert or street festival. Instead, the City Council debated the long-term placement of these facilities in response to the unprecedented numbers of freight trucks delayed and idling, often for hours, along this stretch of heavily traveled urban highway. A mere three years after the passage of the North American Free Trade Agreement (NAFTA), Laredo had already emerged as the busiest point of entry along the US-Mexico border with freight truck crossings exceeding 3,900 per day. Although the proposal never passed, its serious consideration is a poignant reminder of the broad social and environmental impacts that the exponential growth of NAFTA-related transport, particularly truck traffic, has had on communities within the three nations (Sharp 1998, 75).

Increases in trinational trade have significantly shifted patterns of production, distribution, and transport

With the passage of NAFTA, trade between the three signatory nations has dramatically increased, exceeding previous levels significantly. From 1994 to 1998, total US trade with Mexico increased from US$101 billion to US$160 billion (CEC 1999b, 48-50). In the same timeframe, total Mexican trade with the US increased from US$3.07 billion to $4.6 billion (CEC 1999b, 48-50).

The United States and Canada have enjoyed long-standing, prosperous ties, beginning with the Auto Pact of 1965, which first established limited bilateral duty-free trade between the two countries. This trade relationship was further strengthened by the provisions of the United States-Canada Free Trade Act. With the passage of NAFTA, total Canadian trade with the US and Mexico has risen. Trade with the US increased from US$232 billion in 1994 to US$319 billion in 1998 (CEC 1999b, 48-50). Trade with Mexico increased during this time from US$3.8 billion to US$5.9 billion (CEC 1999b, 48-50).

With liberalization and the subsequent sharp increase in trade have come both increased traffic across all modes of transport including highway, rail, air, and shipping, as well as broad shifts in the location of production, patterns of transport, and distribution routes for these goods. While trade between the nations has increased in the aggregate, the most dramatic changes in the transportation infrastructure have been concentrated along the border regions, where 60–80 percent of goods are transported by trucks. For instance, the busiest port of entry on the Mexico/US border, Laredo, Texas, has seen a jump in the total number of northbound and southbound border crossings from 851,690 immediately following trade liberalization to 1.3 million trucks in 1999 (Ports-to-Plains Trade Corridor 1999). Similarly, the Detroit, Michigan/Windsor, Ontario crossings on the US/Canadian border, which handle a large majority of all US/Canadian trade traffic, have seen the number of truck crossings jump by 71 percent, from just over 2 million in 1994 to 3.2 million in 1998 (Benton 2000, 1). The dramatic growth in trade and the broad shifts it has engendered have dramatically increased pressure, often overwhelming the capacity of the extant transportation infrastructure with their impacts most starkly visible in the border regions.

Transportation infrastructure has emerged as the "linchpin" of liberalized trade. Absent consensus on a definition, the "NAFTA transportation corridor" concept has gained traction.

In the years since the passage of NAFTA, the capacity of the transportation infrastructure to respond to the pressures of increased commercial flows has emerged as the "linchpin" of liberalized trade. With minimal on-hand inventory, the value of just-in-time delivery and the cost of delay have risen sharply and in tandem, prompting analyses and assessments of the capacity of the current transportation infrastructure to absorb increased trade flows and to ensure future mobility for trade. With trade pressures projected to increase, the concept of the "NAFTA trade corridor" has gained traction. Broadly defined, the corridors comprise the transportation infrastructure and systems that facilitate the flow of traffic both domestically and across the North American borders, particularly those traffic flows prompted by the trade liberalization of NAFTA (Transport Canada 1999).

As straightforward as this definition appears, current discussions of NAFTA trade corridors are inherently dynamic, inextricably political, and typically, road-centered. In the absence of a uniform definition or objective indicators that coherently distinguish a "NAFTA trade corridor" from another segment of interstate, for example, various trade routes have been proposed for designation as "NAFTA corridors." Traffic flow analyses and projections have prompted proposals to retrofit entire transportation modes (e.g., rail), to construct major infrastructure facilities (e.g., new bridge construction linking binational border areas), and to upgrade and expand heavily traveled segments (e.g., increasing the number of lanes on Interstate 35 between Laredo, Texas and Dallas, Texas) to accommodate trade traffic (Texas Department of Transportation/I-35 Steering Committee 1999, ES 1-10). Other proposals have included construction of new transboundary highway systems with connecting overlays to existing roads (e.g., the I-69 route), thereby linking additional centers of trade and manufacturing throughout the three nations (CEC 1999c, 14). Competition among routes, both extant and projected, has become fierce.

Despite the lack of consensus on an appropriate working definition, this paper explicitly restricts the meaning of "NAFTA trade corridors" to those existing transportation systems that are actually carrying the majority of trade traffic volume. The "NAFTA trade corridors" concept is a useful construct through which to examine, specifically, heavily used North American trade routes, to analyze the pressures and impacts generated by this trade traffic, and to discuss strategies that might absorb or alleviate that which cannot be absorbed currently or is projected to exceed the capacity of the corridor. Most discussions, however, of strategies have been limited to the logistical challenges of accommodating increased trade traffic through upgrading existing highways and constructing new ones, rather than a broad-based investigation and analysis of the extent to which multimodal alternatives might provide relief As a consequence, a broad-based comparative assessment of the environmental costs, impacts, and benefits of the range of transport alternatives, is rare. Related, comprehensive consideration, much less specific assessment, of the impacts generated by these road-centered proposals on human and environmental health, particularly in those communities through which the heaviest flows of traffic are expected, are rarer still.

The CEC Analytic Framework informs this exploration and assessment of the impacts of NAFTA transport on the environment

The approach used in this paper is that outlined by CEC in its framework for assessing NAFTA-associated environmental impacts.[1] This paper examined physical infrastructure, one of the four critical linkages identified by the CEC through and by which NAFTA trade impacts the ambient environment (CEC 1999b, 65).

Macroeconomic and transborder shifts in the production and distribution of goods have led to a NAFTA-associated intermodal shift to trucks, particularly heavy-duty diesel models, as a mode for transporting and delivering goods. "Transporting goods and services may be done by sea, rail, road, or air, all of which affect the environment in different ways" (CEC 1999b, 69). This shift to truck transport has generated significant "environmental pressures (that) tend to increase the stress on the environment by providing a further load on its absorptive capacity" (CEC 1999b, 76). In the case of NAFTA transport, truck traffic has not been uniformly directed to those "geographic locations, where the existing infrastructure can absorb the new traffic and demands" (CEC 1999b, 67) Instead,

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1 *See:* Commission for Environmental Cooperation. June 1999. *Final Analytic Framework (Draft) for Assessing the Environmental Effects of the North American Free Trade Agreement (NAFTA).*

NAFTA truck traffic has been primarily concentrated along the border regions, transforming some of its communities into "high impact locales—places where environmental pressures (have) concentrated to overwhelm the available supports" (CEC 1999b, 77) The extent, however, to which communities have been overwhelmed has varied.

To assess the environmental impacts of this NAFTA-related shift, this paper drew from the CEC's categories of environmental indicators, selecting for analysis: air, water, biodiversity, and an aggregate indicator defined as "quality of life." Using data as available and accessible, the environmental impacts of the NAFTA-associated shift to truck transportation were examined.

2 Part I: Case Studies of Two "High-Impact Locales"

2.1 The Laredo/Nuevo Laredo Border Area

The first port of entry on the Mexico/US border was established by the city of Laredo in 1851. As a direct route from Mexico City and the large, northern city of Monterrey, the Laredo/Nuevo Laredo border serves as a critical through-put port of entry for the majority of trucks delivering goods from the interior of Mexico. The Port of Laredo has four international bridges that facilitate all truck crossings, as well as an international bridge for rail. In general, roads are the preferred mode of transportation, carrying 81 percent of US-Mexico exports and 68 percent of US-Mexico imports in 1996 (US Department of Commerce and Bureau of Transportation Statistics 1996).

In 1997, the Port of Laredo crossed 1.2 million loaded trucks, 246,000 loaded rail cars (the equivalent of another 1 million trucks) and 856 million kilograms gross landed weight (g.l.w.) of air cargo. In addition, the Port handled a million empty trucks and 14.3 million cars and buses. To put these numbers in perspective, in an average workday, Laredo's trade-handling community crossed 3,900 loaded trucks, 800 loaded rail cars, 1.24 million pounds (0.56 million kilograms) g.l.w. of air cargo, and 3,400 empty trucks, not to mention 39,000 cars. These numbers represent average volumes in Laredo during the six days a week that trucks cross and represent average volumes for cars throughout the seven days of the week (LDF 2000, 2).

In 1999, Laredo's bridges carried 1.3 million trucks (Gordetsky 2000, 21). According to data from Texas A&M International University, this number is greater than the nine other ports of entry in Texas *combined* (Gordetsky 2000, 21). As the Laredo Development Foundation recognizes, the exponential growth that has occurred in trade transportation is a critical issue "which impacts virtually every citizen living in Los Laredos and every importer and exporter using our port (LDF 2000, 1)." Laredo and Nuevo Laredo are being forced to accommodate NAFTA transportation rapidly, often with unforeseen environmental and community impacts. With the trade liberalization of NAFTA, these two relatively small sister cities have been rapidly thrust into the international trade arena with no assessment of their collective capacity to respond to intense trade and transport pressures.

2.1.1 A Laredo-Nuevo Laredo "Snapshot": Highway, Rail, and Air Transportation

Highways

There are four international bridges that facilitate all truck and auto crossings at the Laredo/Nuevo Laredo border. Since April 15, 1999, the two downtown bridges have been closed to truck traffic.[2] All truck traffic has been redirected to both the Columbia/Solidarity bridge, located 27.5 kilometers west of downtown Laredo and the new Fourth International Bridge (World Trade Bridge), located

[2] These two bridges include the Laredo Northwest International Bridge I, constructed in 1956, and the Juárez-Lincoln bridge, built in 1976 and marking the southern end of Interstate 35 [stretching down] from Duluth, Minnesota.

just over nine river miles (some 14.5 kilometers) north of the first international bridge. Thus far, this change has helped curtail the 8–10 kilometer- long traffic build-ups on Laredo's highways. Currently, the World Trade Bridge handles 4,200 trucks a day, while another 1,800 trucks per day cross the Columbia Bridge. While two-lane narrow roads on both sides of the border are the only arteries that currently connect to the Columbia bridge, a private toll road connecting it to Interstate Highway 35 (I-35) opened in October, 2000 (Gordetsky 2000, 21).

Rail

This year, Laredo is expected to move 400,000 loaded rail cars (LDF 2000, 2). To meet this projection, Union Pacific, TexMex Railroads and *Ferrocarriles Nacionales de México* (FNM), the three primary companies that operate on the Laredo/Nuevo Laredo border will have to work cooperatively to manage and move through an additional 154,000 more rail cars than they did just several years ago.

Just as the volume of truck traffic rapidly escalated as a consequence of NAFTA, so the Laredo International Rail Crossing has seen significant escalation in its traffic volume (see Table 1). As with trucking interests, rail customers have also experienced significant delay and congestion. Although the construction of a second railroad bridge has been considered, the underlying cause of this congestion appears to be an issue of external practices, rather than capacity. According to US Federal Railroad Administrator Jolene Molitaris, "the current bridge is not yet at capacity (Mertz 1999, 1)." Indeed, the vice president of finance for TexMex Railroads estimates that "the company could improve efficiency at the existing bridge by 300 percent if US Customs moved inspections into the Tex-Mex rail yard" (Mertz 1999, 1).

Table 1. Cross-border loaded rail car shipments, Laredo/ Nuevo Laredo—selected years

	1995	1997	1999	Cumulative Impact over Time (%)
Southbound shipments	109,385	152,230	167,871	+ 65
Northbound shipments	59,377	93,967	115,771	+ 51
Total loaded car shipments	**168,762**	**246,197**	**283,642**	

Source: Laredo Development Foundation 2000, "Table of Economic Activity" <http://www.laredo-ldf.com/ ecotable.html>, accessed 7 September 2000.

Air

In 1997, Laredo International Airport completed an US$11 million runway improvement program, installing both the necessary infrastructure for heavy freight cargo aircraft as well as a new Terminal Building. Through US$5 million of private sector investment, additional renovation and installation of new air cargo facilities were also added. The largest air cargo airport on the Texas-Mexico border, the Laredo International Airport processes approximately the same amount of Latin American air cargo as the cities of New York, Los Angeles, Houston or Dallas (LDF 2000, 2).

2.2 The Detroit, Michigan-Windsor, Ontario, Border Area

The US-Canada border is 8,893 kilometers long from the Atlantic to the Pacific Ocean. Of the 130 international crossings, approximately half are located along the eastern portion of the border from the Atlantic Ocean to Michigan and Ontario. In 1995, the eastern portion of the US-Canada border accounted for 73 percent of *all* US-Canada cross-border traffic (Taylor 1997, 5).

While the volume of cross-border trade in this region has historically been high because of the automotive industry, trucks as the preferred method of transport now comprise a much larger proportion of the traffic stream since the passage of NAFTA. With several of the busiest ports of entry for commercial traffic located in this border segment, since 1995, approximately half- 51 percent- of all NAFTA truck crossings have taken place in this region (Taylor 1997, 5). In contrast, the western US-Canada truck crossings represented only 14 percent of all North American truck border crossings and the US-Mexico truck border crossings only 36 percent (Taylor 1997, 5).

2.2.1 A Detroit-Windsor "Snapshot": Highway, Rail, and Air Transportation

Highway

Although renowned as the busiest North American port of entry, the Detroit-Windsor Tunnel conveys far less truck traffic than its border counterpart, the Ambassador Bridge. While this paper focuses specifically on the Detroit/Windsor crossings, there are other important border crossing facilities in the area, including the Blue Water Bridge in Port Huron and the Detroit/Windsor Truck Ferry. The Blue Water Bridge, located north of Detroit, ranks second only to the Ambassador for the volume of truck traffic, while the Ferry is primarily used for hazardous materials transport. As illustrated by the data in Table 2, like its southern counterpart, this transboundary crossing has experienced a dramatic increase in commercial truck flows since NAFTA's passage (Benton 2000, 1).

Table 2. Cross-border truck crossings by bridge: Detroit/ Windsor—selected years

Year	Ambassador Bridge	Detroit/Windsor Tunnel
1994	1,811,602	200,816
1995	2,218,596	267,187
1996	2,476,360	269,388
1997	2,697,176	257,557
1998	2,993,292	241,271
Cumulative Increase (%)	**+ 61**	**+ 20**

Rail

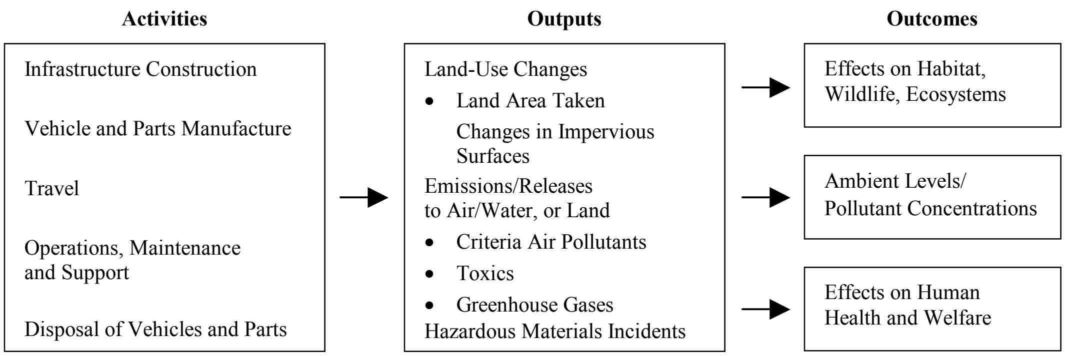
The Detroit-Windsor Rail Tunnel handles a significant portion of all rail traffic on the US-Canada border. While recent improvements now allow the tunnel to accommodate some larger international containers, double-stacked rail cars are still unable to pass through the enclosed portions of the structure. Instead, double-stacked cars must pass through an upgraded rail crossing further north in Port Huron. Despite these bypass limitations, however, the volume of rail traffic has increased: In 1997, the Detroit-Windsor Rail Tunnel handled 400,000 cars, a significant increase from its pre-NAFTA passage rate (MDOT 1998).

2.3 Assessing NAFTA Truck Transport on the Environment Using the CEC's Analytic Framework

As described in the CEC's Analytic Framework, the intersectoral or intermodal shifts in NAFTA-associated transportation "may produce a net move to more or less environmentally friendly modes. Transporting goods… may be done by sea, rail, road, or air, all of which affect the environment in different ways." (CEC 1999b, 69) With the popularity of the just-in-time inventory model and the convenience of door-to-door delivery, trucks have emerged as the leading mode of transport for NAFTA freight as measured by the value of trade. This net shift to truck transport has significant implications for the environment in absolute terms, both in the extent and permanence of its impacts, as well as relative to the impacts of other modes.

Analyses of the primary environmental impacts of transportation are traditionally divided between indicators which measure releases of substances into the air, water, and land, as well as those that demonstrate changes in land-use patterns, as shown in the flowchart in Table 3 below. Following this traditional pattern, this document will examine the nature, extent, and permanence of the impacts of truck traffic on the primary components of the environment within the border regions.

Table 3. Flow of transportation analysis



Source: US EPA 1999a, 8.

2.3.1 Air Quality

Air pollution from truck travel comes primarily from byproducts of the combustion process and the evaporation of unburned fuel. Nitrogen oxides (NO_x) and volatile organic compounds (VOCs) are each emitted directly from vehicle exhaust. Formed by the reactions of VOCs and NO_x in the presence of heat and light, ground-level ozone (O_3) is the primary constituent of smog. These three components react together to form ozone concentrations. Ozone concentrations can fluctuate greatly due to yearly changing weather patterns and are usually highest during summer months.

Also emitted directly from vehicle exhaust, particulate matter (PM-US term) or total suspended particles (TSP-Canadian term), generally, refers to a mixture of solid particles, such as smoke, dust, or soot, and liquid droplets found in the air. The numerical classification (i.e., $PM_{2.5}$, PM_{10}) that follows the abbreviation refers to particle size as measured in micrometers.

In high enough concentrations, each of these air pollutants has been known to cause harmful effects on both the ambient environment and human health (US EPA 1998a; INE 1999b). Of particular concern to the NAFTA trading partners are the levels of PM, VOCs and NO_x emitted, particularly as precursor contributors to ground-level ozone. High ozone levels can lead to a host of both environmental and public health problems. Similarly, particulate matter, especially of 2.5 micrometers or less (i.e., $PM_{2.5}$), has been shown to exacerbate existing respiratory conditions and may contribute to premature death.

Using varying standards, all three signatory countries monitor VOCs, NO_x, ground-level ozone, and PM.

Agencies, Criteria Pollutants, and Monitoring

United States: Using its own National Ambient Air Quality Standards (NAAQS), the United States Environmental Protection Agency (EPA) monitors air quality based on six principal criteria pollutants: carbon monoxide (CO), NO_x, VOCs, sulfur dioxides (SO_2), and lead (Pb). The US EPA classifies particulate matter (PM), the sixth of these pollutants, as either "fine" if the particle is smaller than 2.5 micrometers or "large" if the particle falls within the range of 2.5 to 10 micrometers (EPA 1998c). To be in "compliance," levels of these pollutants must remain within NAAQS parameters; measurements for any of these pollutants above NAAQS parameters are deemed an "exceedance."

Canada: The Ministry of the Environment uses all of the criteria pollutants used by EPA, as well as several more. Air pollution is monitored and analyzed by the Ministry, not only for each province, but for most cities and towns as well. Although somewhat more stringent than those used by the EPA, Canada's ambient air quality standards vary only slightly from the NAAQS.[3]

Often a source of confusion, Canada's description of particulate matter differs from the system used by the US EPA. The term "PM_{10}" refers to particles less than ten microns in size, while total suspended particles (TSPs) refer to those particles ranging from 0.1 to 100 microns in size (Ontario Ministry of the Environment 1997, 4).

Mexico: Using standards similar to its trading counterparts, Mexico has also set quality criteria, based on the Official Mexican Standards (*Normas Oficiales Mexicanas*—NOM) (*Gobierno de México*, INE 1999a). As set out in the NOMs, Mexico has distinguished levels of permissible exposure for its seven criteria air pollutants (e.g., ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, total suspended particulates, particulate matter of less than 10 microns, and lead) based on both immediate, intense exposures, as well as chronic exposures (*Gobierno de México,* INE 1999a).

Air Quality in Laredo/Nuevo Laredo: Ozone and Particulate Matter

The Texas Natural Resources Conservation Commission (TNRCC) operates two air quality monitoring stations near the Laredo/Nuevo Laredo border. The first station, located in downtown Laredo, has been in operation since 3 February 1998. The two pollution parameters currently being monitored at this site are carbon monoxide and ozone. The other monitoring station, located on one of Laredo's international bridges, has been monitoring air quality since September 1999.

Under EPA regulations, an "exceedance" of the eight hour ozone standard is indicated by a reading of 85 parts per billion (ppb) or more. As Table 4 shows, Laredo's ozone level has never reached "nonattainment." However, it has come within range of exceedance both in 1998 and 1999 with overall levels and trends remaining relatively static.

While a rigorous analysis of ozone in this region of the US/Mexico border has yet to occur, the relative decrease in ozone thus far recorded throughout 2000 has been largely attributed to the opening of the fourth international bridge and related, the reduction of congestion at the border. Despite the reductions captured in Laredo's most current ozone readings, the congestion relief provided by the opening of this additional bridge and thus, the ozone reductions are likely to be temporary as truck crossings are not likely to decrease significantly in the future and may, in fact, continue to rise in response to the recent addition of the bridge.[4]

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[3] For instance, the Canadian one-hour standard for ground-level ozone is set at 80 ppb, while the US one-hour standard is 125 ppb.

[4] The Fourth International Bridge in Laredo opened for travel in April 2000. Its opening has significantly reduced the level of traffic congestion at the border, in part because this bridge has been designated for use by international truck traffic only. Auto traffic has been re-directed to the two older bridges in the downtown area, while the third bridge north of downtown is also handling truck traffic.

Table 4. The four highest daily maximum 8-hour ozone concentrations in Laredo

Year	Highest	2nd Highest	3rd Highest	4th Highest
1998	72 ppb 10 May	72 ppb 7 May	67 ppb 11 May	67 ppb 30 April
1999	70 ppb 7 May	69 ppb 6 June	67 ppb 22 October	67 ppb 30 April
2000	65 ppb 25 April	64 ppb 8 June	62 ppb 7 April	62 ppb 8 February

Source: TNRCC 2000b.

As mentioned earlier, while the monitoring of Laredo's ozone levels has been a recent event, what little baseline data on air pollution trends exists prior to 1999 is not publicly accessible from the TNRCC.[5] However, extrapolations from that limited data which is accessible suggests that with increases in truck traffic and changes in freight operations, both NO_x and VOC emissions have increased, leading one to infer that, to some extent, ozone has most likely increased, as well (see Appendix). According to TNRCC's 1999 Commercial Truck Survey, "Interstate 35 is the primary highway that extends from Laredo, Texas, up to Chicago, Illinois, and from Nuevo Laredo, Tamaulipas, down through Mexico City to the Panama Canal Zone, making Laredo and Nuevo Laredo the largest inland port-of-entry into either country (Snow 1999, 1)." To take advantage of these voluminous trade flows, the report explains, many freight forwarding companies operate within both cities, resulting "in a number of vehicles moving through the port and (an) increased volume of trucks operating within city boundaries (Snow 1999, 2). " The direct and cumulative impacts of these freight operations and current NAFTA-related drayage activity are compounded, yet again, by the increasing prevalence of heavy-duty diesel vehicles in the region, the leading source of VOC and NO_x emissions throughout the border region.

Air Pollution in the Regional Context of Air Quality along the I-35 Trade Route

The flow of air pollution honors no political boundaries. So, while local air pollution levels in Laredo remain below the level of "exceedance," one must temper the enthusiasm such data seems to inspire by considering the broader context of air pollution and NAFTA-related transportation along the I-35 corridor.[6] The segment of I-35 from Laredo to Dallas remains the single most heavily used route by NAFTA trucks traveling north from the US/Mexico border (TX DOT 1998, 18). According to the Texas Department of Transportation (TX DOT), the state agency charged with interstate construction, maintenance, and tracking within the state's boundaries, "the segment of I-35 north of Laredo, between San Antonio and Dallas/Fort Worth is the segment of highway most heavily impacted by NAFTA in the state of Texas. On average, each mile of this segment carries over 4,000 NAFTA trucks per day (TXDOT 1998, 18)." Looking at changes in air quality along this trade corridor post-NAFTA rather than those exclusively recorded in Laredo, therefore, may provide a more accurate and comprehensive assessment of the impact NAFTA truck transportation has had on air quality.

5 Data has been collected by TNRCC, but is not publicly accessible on the Internet or in a library. Instead, it must be obtained through the TNRCC Data Department for a fee.

6 Just as the broader context of air pollution prompts examination of a longer segment of the I-35 corridor through Texas, so the broader context of trade transport demands that one acknowledge that the increase in truck traffic along the I-35 corridor cannot be attributed solely to NAFTA-related trade. As the CEC's framework explains, however, "the environmental impact of an activity will often be determined by a range of forces, many unconnected to NAFTA… (it) is necessary to identify and take into account… environmental, economic, social, geographic, and political factors that have an important effect." Clearly, the economic boon the US has experienced, as well as the economic recovery of Mexico have contributed to the increase in non-NAFTA-related consumer goods being transported through this same corridor. The economic growth and improvements experienced by both countries, clearly, have significant impacts on NAFTA truck transport, as well as the environment.

While Laredo has been able to maintain its ozone levels within the NAAQ parameters as a result of its moderately sized population and frequently favorable wind conditions, San Antonio, located approximately 96 kilometers north, has experienced a dramatic increase in the number of exceedances since 1994. Although the city had no exceedances of NAAQ standards in 1994 and 1995, three exceedances occurred in 1996 and, again, in 1998 (US EPA 1999a). Currently, San Antonio is facing designation by the EPA as an area "in nonattainment" for the new 8-hour ozone standard because of its repeated failures to remain within NAAQ parameters. Similarly, north of San Antonio on I-35, the Dallas/Fort Worth metroplex has experienced a dramatic increase in exceedances, increasing from no exceedances in 1994 to eight in 1995. While the area had made significant improvements with only five exceedances in 1999, the area has been designated "in nonattainment" with NAAQ standards (US EPA 1999a). While one cannot assertively state the extent to which NAFTA trucks have contributed to the upsurge in ozone exceedances recorded in these cities further north on the I-35 trade route, the dramatic increase in the number of exceedances post-NAFTA suggests, at a minimum, an area for further research and study.

With the heavy volume of heavy-duty trucks traveling through Laredo, PM levels are of particular concern. However, PM monitoring data is not yet available as the TNRCC and EPA began its collection as recently as 1999. Further, with no baseline data collected, there will be no accurate method by which to judge the increase of PM since the passage of NAFTA.

Like Laredo, Nuevo Laredo has not been designated a prioritized region for air quality monitoring, thus the number of monitoring sites is less plentiful than in zones, such as Mexico City, Monterrey, Guadalajara, Toluca, and Ciudad Juárez.[7] According to the National Institute for Ecology (*Instituto National de Ecología*—INE), there have been two manual air quality monitors in operation in Nuevo Laredo since 1997, measuring levels for PM_{10} and ozone (*Dirección General de Gestión e Información Ambiental, Sistema Nacional de Monitoreo Atmosférico,* 1997). While specific data on air quality could not be located, given the proximity of the sister cities and the nearly equal number of southbound trucks entering Mexico from the United States, emission levels may likely to be similar to those newly documented in Laredo, with similar health and environmental outcomes also facing that community.

Air Quality in Detroit, Michigan, and Windsor, Ontario

Because data on ozone levels in Detroit were not easily accessible throughout the research process, one can only provide a limited picture of air quality in the area. Gauged by the number of exceedances, the Detroit metropolitan area has significantly improved its air quality since its recorded peak of fifteen (15) incidences of "nonattainment" with NAAQS in 1987. With only two (2) recorded incidences of exceedance in 1997, southeastern Michigan (which includes the Detroit metro area) has met all NAAQ standards since the fall of 1999 (MDEQ 1999, 7; US EPA 2000c, 1). No PM data specific to the Detroit metropolitan area were found. [8]

In sharp contrast to the availability of air quality data in the Detroit area, there has been extensive monitoring, data collection, and research on the air pollution challenges that face the province of Ontario and to a lesser extent, specifically Windsor. Employing a one-hour standard of

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7 Because of their chronic violation of air quality standards, metropolitan areas such as the Dallas-Fort Worth metroplex and Houston, have received priority financial assistance in identifying and implementing strategies that lead to the reduction of air pollution. Similarly, according to the INE web site, Mexico City, Guadalajara, Monterrey, Ciudad Juarez, and Toluca, have been designated prioritized regions for air pollution and have, as a consequence, more numerous monitoring sites and test for a wider range of air quality indicators. See data collected from the *Dirección General de Gestión e Información Ambiental Sistema Nacional de Monitoreo Atmosférico* on the INE web site: <http://www.ine.gob.mx/dggia/indicadores/ingles/imeca.htm>.

8 Data collection processes by the Michigan Department of Environmental Quality differ from those used by the TNRCC, thus, information presented in this section is not directly comparable to that provided in the previous section of this paper.

80 ppb, a parameter more stringent than that employed by the US EPA, the Ministry of Environment characterizes ground-level ozone as Ontario's greatest air pollution challenge as it is this "pollutant that exceeds its provincial ambient air quality criteria most often." Emissions from vehicles are the primary source of the pollutant. Not surprisingly, vehicle emissions are also the primary source of the precursor pollutants associated with ozone: thirty percent of VOCs and 63 percent of NO_x are attributed to transportation sources (Ontario Ministry of the Environment 1999, 5-6, 9).[9]

While vehicular emissions generated from within Ontario contribute, transboundary flows from the United States also comprise a significant source of environmental pollution. With the hours of elevated ozone readings consistently higher along the southwestern border of the province where Windsor is located, the Ministry of the Environment estimates that "...more than 50 percent of provincial ozone levels during widespread ozone episodes are due to long-range transport of ozone and its precursors from neighboring US states (Ontario Ministry of the Environment 1999, 9-10)." While data was not available on the discrete sources of this transboundary ozone flow or the extent to which any one differentiated source specifically contributes, it is likely that emissions from NAFTA-related trucks comprise a source of these transboundary flows.

The similarities between the sources of Ontario's ground-level ozone and PM levels are striking. As with ozone, the primary sources are vehicle emissions with significant contributions provided by transboundary flows. In 1997, approximately 17% of all PM_{10} emissions in Ontario came from vehicles (Ontario Ministry of the Environment 1999, 15). As with ozone, the Ministry of the Environment attributes a large share of particulates measured in Ontario as originating in Detroit (Ontario Ministry of the Environment 1999, 16). Given the high levels of particulate matter emitted from heavy-duty diesel trucks, both those in Detroit and those that enter Ontario, NAFTA transportation, no doubt, contributes to these levels, although the extent of this contribution has not been calculated.

Located along the southwestern border of Ontario, Windsor consistently exceeds both the one-hour criterion for ozone, as well as the parameters for PM. In 1997 alone, Windsor exceeded ozone parameters 56 times with the highest one-hour ozone concentration (107ppb) in the province recorded at a monitoring site on the campus of the University of Windsor (Ontario Ministry of the Environment 1999, 9).

"Following a Path to Environmental Stress": Framework Links between NAFTA Truck Transport and Air Quality

Air pollution, as generated by NAFTA truck transportation, provides, perhaps, the most dramatic example of the interconnection between the CEC Framework elements, an interweaving that is, unfortunately, generating environmental stress with few environmental supports currently employed to offset these pressures. As identified by the Framework, physical infrastructure is a critical linkage through which one may "consider how the specific changes associated with NAFTA may be transferred into environmental pressures, supports, and changes that can ultimately determine their environmental impacts" (CEC 1999a, 12). In general, "transportation patterns will vary and have different environmental effects" with NAFTA trade either "directed toward sectors and geographic locations, where the existing infrastructure can absorb the new traffic and demands" or "generate production that follows a path leading to environmental stress" (CEC 1999b, 66, 67).

In response to the dramatic increase in trade between the three signatory countries and the accompanying shift in production and distribution, truck transportation has emerged as the dominant mode for delivering NAFTA-associated goods. These NAFTA-associated changes have translated into environmental pressures as measured by its impact on air quality. As trade "has increased and concentrated more rapidly than the infrastructure could be constructed to serve it," chokepoints have been created, particularly in "high-impact locales," such as the border region (CEC 1999b, 68, 77).

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9 Although still a significant contributor to ozone, Ontario's VOC emissions have decreased by 9.4 percent since 1989 due to the introduction of lower gasoline volatility. *See*: Ontario Ministry of the Environment, 1999, 10.

The increasing use of heavy-duty diesel trucks in this sector have led to a substantial increase in the emissions of VOCs and NO_x, precursors to ground-level ozone, increasing the environmental pressures already associated with the combustion. The shift toward truck transport- an intermodal movement whose dominance shows little sign of abating—has produced a net move to a less environmentally friendly mode, one with little potential for "creating movement toward sustainability (CEC 1999b, 77).

2.3.2 Water Quality

Absent an easily identified pollutant source, such as the telltale discharges associated with a nearby industrial plant or a sewage treatment facility, pinpointing the sources of most water pollution, particularly nonpoint water pollution, is difficult, if not impossible. As the US EPA confirms, "It is important to understand the difficulties in identifying causes and, in particular, sources of pollution in impaired waters. For many waters, states and other jurisdictions classify the causes and sources as 'unknown' (US EPA 1998a, ES-3)." With no point source water pollution discharges generally associated, discerning the exact nature and extent of NAFTA truck transportation's contributions to water pollution is a difficult and imprecise task.

The difficulty of assessing NAFTA truck transportation's contribution to nonpoint source water pollution stems from the diffuse nature of the pollution itself. As suggested by its name, nonpoint source pollution, typically, refers to an ever-changing fusion of pollutants and their various sources, including land run-off (e.g., pesticides, phosphates, sediments, etc.), atmospheric deposition (e.g., particularly, "acid rain,"), and drainage or seepage of toxic contaminants. The nonpoint source contributions associated with vehicle travel are typically those pollutants deposited on road surfaces and subsequently, moved or carried away during precipitation events (e.g., rainfalls, snowmelts, etc.) and re-deposited.

Vehicles, as well as the structures that support them, contribute significantly to nonpoint source runoff. Both the heavy metals that are released by car and truck exhaust, as well as the oils, greases, and toxic chemicals leaked from car and truck engines are deposited into the air and on road surfaces. Because impervious surfaces, such as roads and parking lots, generate more than nine times the runoff than, for example, a pervious surface such as an intact forested area, these paved surfaces very efficiently deliver these unabsorbed deposits into the fusion of pollutants moved during a precipitation event (US EPA 1998b). Land disturbances, such as the clearing, grading, and cut fills, associated with road construction and bridge structures also contribute significantly to the vehicle-related nonpoint source runoff (US EPA 1998b).

Mounting evidence shows that air pollution can contribute significantly to water pollution, thus, the increased emissions of pollutants, particularly particulate matter, associated with heavy-duty diesel trucks may prove to be an important contributing link between NAFTA truck transport and water pollution. As pollutants emitted into the atmosphere can be transported and deposited to aquatic ecosystems at great distances from their original sources, the environmental impacts associated with diesel trucks and increased particulate matter may no longer be restricted to the immediate location of emission (US EPA 2000a).

Agencies, Criteria Pollutants, and Monitoring

Water quality standards have been adopted by all of the signatory countries to protect public health and aquatic life.

United States: The US EPA monitors and regulates the nation's water bodies, often in coordination with state departments of environmental protection, such as the TNRCC. Water quality standards have three basic elements, each of which is interrelated. Each water body is assigned a "designated use," as defined by the US EPA's regulatory framework. Criteria, the second element, are those standards used to protect the quality of those water bodies with the degree of stringency dictated, in part, by the category of designated use assigned to the specific water body. To prevent waters from deteriorating, water quality standards contain the third element, anti-degradation policies.

Canada: The Canadian Ministry of the Environment measures and assesses water quality through its own set of standards, similar to those established in the United States.

Mexico: Most water management control is vested at the federal level in the National Water Commission (CNA). This agency has jurisdiction over hydraulic issues and most of the country's water planning, permitting, management and enforcement issues. It is responsible for ensuring compliance with national water laws and regulations (UT Austin 1999, 30).

Water Quality in Laredo and Nuevo Laredo

The Rio Grande/Rio Bravo is the life force of the majority of all sister cities along the US/Mexico border. Spanning approximately 3, 059 kilometers in length, the international reach of the river is about 2,053 kilometers. The watershed, or hydrologic region, encompasses approximately 924,300 square kilometers across the United States and Mexico (IBWC 1998, 1: 1). Many cities on both sides of the border obtain water from the Rio Grande/Rio Bravo to meet a wide variety of needs, including drinking water, agricultural and irrigation uses, and recreational purposes. Over the years, however, there has been much concern about the increasing presence of toxic substances, often originating from various sources near the border. Indeed, water quality has been a growing concern among the majority of the cities along the US/Mexico border, with Los Laredos proving no exception.

The cities of Laredo and Nuevo Laredo are located in the Middle Rio Grande/Rio Bravo sub-basin, which represents the portion of the river below International Amistad Reservoir downstream to International Falcon Dam (IBWC 1998, 1: 1). As noted by the IBWC Texas Clean Rivers Program, "sister cities located in this reach struggle to stay ahead of development and to provide the infrastructure to minimize the pollution going into the Rio Grande (IBWC-Texas Clean Rivers Program 2000, 8)." After testing water at stations along the entire length of the river, the binational toxic substances study indicated that much of the pollution in the section of the river near Laredo/Nuevo Laredo had come from untreated wastewater.[10] However, the relatively recent construction of a modern, secondary wastewater treatment plant in Nuevo Laredo has significantly contributed to better water quality and a mitigation of the specific pollution source identified by the IBWC. Less easily remedied, however, are the findings of a 1994 joint study of the Rio Grande by Mexican and US agencies which found that several sites, including areas just downstream from downtown Laredo/Nuevo Laredo, demonstrated a high potential for toxic chemical impacts (Borderlines 1996 6(3): 2).

A primary concern for Laredo is the management of its hazardous materials along the border, substances typically transported by truck. With the increase in NAFTA-related, cross-border trade, the number of warehouses, or storage facilities used by companies shipping products across the border, has exploded from approximately 600 in 1996 to well over 1,000 today.[11] Until recently, these warehouses, which, typically, serve as storage-transfer points for NAFTA goods, were not monitored. Sitting in close proximity to the Manadas Creek in Laredo, these warehouses have become a threat to the creek, which is currently being infiltrated by nonpoint source pollution. The IBWC binational study identified Manadas Creek as a potential conduit for contaminants to the Rio

[10] Station 11b.3, Station 11c, Station 12, and Station12.1 in Table 11, p. 20-21, of Phase II in the IBWC Binational Study, Volume 1, all indicate the presence of wastewater discharge into the Rio Grande/Rio Bravo.

[11] Based upon interview with Steve Niemeyer, TNRCC Border Affairs office on 7/15/00 and with Jose Garza, TNRCC Laredo Office on 7/24/00.

Grande/Rio Bravo, describing it as carrying "stormwater and urban runoff from a heavily industrialized area of Laredo (IBWC 1998, 1: 20)." In addition to Manadas Creek, several other creeks in Laredo are among the most polluted in the city and are listed as being influenced by stormwater/urban runoff, including Chacon Creek and Zacate Creek (IBWC 1998, 1: 20).

In response, the EPA via the TNRCC has recently funded activities by the City's Fire Department to implement a hazardous waste ordinance. This ordinance will regulate the warehouses that store 55 gallons or more of hazardous materials (TNRCC 2000a).

However constructive such regulatory implementation may prove, root challenges remain unaddressed. As described by Jose Garza, director of the TNRCC Laredo office, although products are currently shipped to the warehouses as goods in transit, some simply do not leave the warehouse for delivery once they arrive. If a company decides that it does not want a product or requires only a certain amount of it, no regulatory measures or prescriptions currently exist to require the safe transport and removal of these unwanted hazardous goods. With the increases in NAFTA-spurred trade and cross-border traffic, tracking and controlling the delivery and movement of these toxic substances is a monumental task. According to the Texas attorney general's office, "compliance with proper hazardous materials documentation requirements at Laredo, the border's busiest trade crossing, was estimated at a mere 2%" (Texas Office of the Attorney General 1997). Hazardous materials, transported and stored in warehouses along water bodies in Laredo, remain indefinitely undocumented and unsupervised with little opportunity afforded or mandate provided to ensure their safe, long-term storage.[12]

Water Quality in Detroit, Michigan, and Windsor, Ontario

As with the Rio Grande/Rio Bravo, the two countries that border the Great Lakes draw and use its waters to meet a wide variety of needs. Spanning a large section of the border between Canada and the United States, the Great Lakes contain 18 percent of the world's freshwater supply, and 95 percent of the surface freshwater within the United States. Over the years, however, its sensitive ecosystem has been disturbed by pollution, impaired by those contaminants directly discharged into its waters as well as by air-borne pollutants later deposited in its waters. Given the size of the Lakes and the proximity of several large cities, many with extensive industrial, manufacturing, and transportation sectors, the integrity of the Great Lakes' ecosystem is particularly vulnerable to the negative environmental impacts that the interrelated processes of air-borne pollution and aquatic pollutant deposition present.

On the US side, Michigan struggles with the quality of its surface waters. The leading sources of pollution in Michigan's surface water include unspecified nonpoint sources, combined sewers, agriculture, contaminated sediments, municipal and industrial discharges, and urban runoff. While Michigan has taken many positive steps to eliminate discharges into the Great Lakes, especially those from industrial sources, there is broad recognition that expanded efforts are needed to control nonpoint source pollution, a persistent problem for the state (US EPA 1998a, 320-321).

Within Detroit, the Clinton and Rouge Rivers, show ongoing contamination problems from nonpoint sources. Southeastern Michigan's Clinton River is located just north of Detroit and flows 128 kilometers from its headwaters to Lake St. Clair, flowing south through the Detroit area. According to the EPA, "although historical industrial and municipal discharges were the primary causes of environmental degradation in the Clinton River, and thus its designation as an Area of Concern, ongoing contamination problems are almost exclusively of nonpoint source origin" (US EPA 2000b)" No industrial discharges into the river or its tributaries can be currently discerned and most municipalities have adequate sewer control plans and industrial pretreatment plans. However, "stormwater runoff...(poses) the single greatest source of water quality degradation" to the integrity

12 Based upon interview with Jose Garza, TNRCC Laredo Office on 7/24/00.

of the Clinton with rapid urban expansion and the subsequent loss of habitat identified as the second significant contributor (US EPA 2000b).

Spanning 1,210 square kilometers, the Rouge River watershed encompasses the city of Detroit. The sources of degradation, which include “combined sewer overflows, urban storm water discharges, nonpoint source pollution, and municipal and industrial discharges” are typical of those identified for water bodies found in the urban areas within the Great Lakes Basin (US EPA 2000d).

Windsor is confronted by many of the same environmental pressures and challenges as those faced by Detroit, including commercial truck emissions found within stormwater runoff. However, Windsor and its surrounding communities are well within compliance for water quality standards on pollutants.

“Components Are Interrelated in Complex Ways”: Framework Links between NAFTA Truck Transport and Water Quality

Replicating the challenges of identifying the diffuse components and their sources in nonpoint water pollution, the exact interaction between NAFTA truck transport and water quality is not particularly well defined or understood. However, the potential impact and relationship which exists between air-borne pollution, particularly those toxics released via the combustion process, and their deposition in water bodies is, clearly, an issue that needs further monitoring, research, and response.

2.3.3 Habitat / Wildlife

Background Information: Agencies, Regulation, and Monitoring

United States: The Fish and Wildlife Service (FWS), an agency of the US Department of the Interior, is the federal entity responsible for the management of terrestrial and freshwater wildlife and their habitat.[13] Specifically charged with the administration of the Endangered Species Act (ESA), the FWS has responsibility for determining which species require the legal protections and active conservation measures of a “threatened” or “endangered” designation, for assessing the “reasonable and predictable” impacts of proposed activities (e.g., road construction) on species’ survival, habitat condition, and range, and for developing reasonable and prudent alternatives that mitigate the impact of a proposed activity on a species or habitat deemed at-risk.[14] To fulfill its mandates, FWS actively collaborates with parallel state agencies, such as the Texas Parks and Wildlife Department, to monitor and manage critical wildlife habitat areas.[15] Charged with responsibility for monitoring illegal trafficking of species protected through treaties, FWS, often, works, additionally, with federal, state, and local law enforcement agencies.[16]

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13 While the US FWS has primary responsibility for terrestrial and freshwater organisms, the National Marine Fisheries Service has jurisdiction mainly over marine species, such as salmon and whales. US Fish and Wildlife Service. <www.fws.gov/r9endspp/endspp.html> 29 August 2000.

14 “The purpose of the ESA is to conserve ‘the ecosystems upon which endangered and threatened species depend” and to conserve and recover listed” endangered or threatened species. As defined by the ESA, an “endangered” species is one in danger of extinction throughout all or a significant portion of its range, while a species designated as “threatened” refers to one likely to become endangered within the foreseeable future.” To implement their mission, the ESA designates that “federal agencies or those projects funded with federal dollars must consult with the US FWS to ensure that the actions they authorize, fund, or carry out will not jeopardize listed species.” <www.fws.gov/r9endspp/endspp.html> 29 August 2000.

15 The US FWS offers states federal financial assistance and other incentives to secure state participation and collaboration through its Partnership program.” US Fish and Wildlife Service. <www.fws.gov/r9endspp/endspp.html> 29 August 2000.

16 The ESA is the law that implements the US participation in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Canada: Operating under the auspices of Environment Canada, the overarching government agency responsible for environmental protection, the Canadian Wildlife Service (CWS) has primary jurisdiction over those wildlife and habitat matters for which the federal government is responsible. Although some wildlife issues are managed regionally, CWS' primary duties include the protection of the nation's migratory bird population, the conservation of nationally significant wildlife habitat, and the monitoring and enforcement of Canada's participation in international treaties, such as the Convention on the International Trade of Endangered Species (CITES). [17]

Mexico: The Secretariat of Environment, Natural Resources, and Fisheries, *(Secretaría de Medio Ambiente, Recursos Naturales e Pesca*—Semarnap), oversees wildlife and habitat issues. Under its auspices, several agencies responsible for wildlife and habitat protection operate. The Commission for the Knowledge and Use of Biodiversity, Conabio, created in 1992, sought to shift the focus of the numerous local governmental, nongovernmental, and academic conservation efforts to a broader federal conservation and protection agenda (*Gobierno de México*, Conabio 1999d). Similarly, on June 5, 2000, the National Commission of Protected Areas (Comisión Nacional de Áreas Protegidas) was created to coordinate and initiate a broad, federal approach to the conservation of critical wildlife habitat.

Operating independently from Semarnap, the Federal Attorney General for Environmental Protection, (*Procuraduría Federal para la Protección al Ambiente*—Profepa) has jurisdiction over enforcement.

Laredo/Nuevo Laredo

Once referred to as a "badlands" (*malpaís*) by area settlers, the Mexico-US border landscape is comprised of several distinct ecosystems, each of which features indigenous flora and fauna (Kourous 1998, 1). Centered along the border, Laredo/Nuevo Laredo are located in the Tamaulipan brushland, an ecosystem that has historically been home to more than 600 vertebrate species and more than 1,100 species of plants. Of these, approximately 70 are considered endangered or threatened by the US FWS.

The urban development spawned by NAFTA-associated transport investment and the environmental pressure it exerts has, in fact, directly and significantly encroached on the range of habitats for these species, "spelling disaster for biodiversity" (CEC 1999b, 91-93). While many of the area's native species have been entirely displaced, some remnant native species remain, able to sustain their nesting and/or migration requirements despite the fragmentation of their habitat. Two species, designated as "endangered" or "threatened," amply demonstrate the impact NAFTA transportation has had on the area's wildlife and their habitat—these species are the Interior Least Tern and the Ocelot.

An endangered bird, the interior least tern breeds during the spring in Texas along sandbars of the Rio Grande, Canadian, Pecos, and Red Rivers. Important characteristics of its breeding habitat include: the presence of bare or nearly bare ground particularly along sandbars for nesting, the availability of food (primarily small fish), and the existence of favorable water levels during the nesting, so nests remain above water. Terns construct their nests by scraping a depression in the surface of sandbars along riverbanks or reservoirs, including those alluvial islands found in Lake Casa Blanco near Laredo.

Despite an official "Finding Of No Significant Impact" (FONSI) by the US FWS in consultations on the construction of the third international bridge built near Laredo, the agency "expressed concern that the Ocelot and Interior Least Tern [were] two endangered species

[17] For example, the Ontario Region of Environment Canada implements the Great Lakes 2000 program and the Canada-Ontario Agreement Respecting the Great Lakes. Environment Canada. <http://www.on.ec.gc.ca/aboutus.html>. 9 August 2000.

potentially affected by the [Columbia-Solidarity Bridge] project (Parsons Brinkerhoff 1989, 44)." While recreational "draw-downs" and ill-time reservoir releases have also been acknowledged as threats to the survival of the Interior Least Tern, bridge-related construction and the run-off associated with the heavy traffic flows over the now-completed bridge have accelerated "the alteration of natural river or lake dynamics… causing unfavorable vegetational succession on many remaining islands (Parsons Brinkerhoff 1989, 44)." The cumulative impact of these environmental pressures—some of which are directly associated with NAFTA transportation—has been the reduction or "curtailing… use (of this habitat range) as nesting sites by terns (Parsons Brinkerhoff 1989, 44)."[18]

Similarly, the ocelot, the other species referenced by the US FWS in its FONSI, has also experienced significant reduction in its numbers and habitat. A small to medium-sized field mammal associated with the native thornbrush habitat that once dominated South Texas in dense thickets, the US FWS described in its 1987 Recovery Plan that "stabilization of habitats in Texas should remain the highest priority.. with habitat identified and protected" (US FWS, 1987) However, with the encroachment of urban development spawned directly by NAFTA-associated investment and development, the dwindling numbers of ocelot left finds their chances for survival severely compromised. With the construction of the third bridge, the city of Laredo has annexed the 27.5 kilometers that lay between the city center and the Columbia/Solidarity Bridge. With annexation has come development, growth that has irrevocably fractured the once nearly impenetrable thornbrush habitat that traditionally housed and secluded the ocelot.

The impacts of the third "NAFTA bridge" and the subsequent development on these two species, while direct, have hardly been isolated—other environmental pressures related to the confluence of urbanization and development in response to NAFTA, are prevalent in Laredo. Once-unoccupied land within the city's limits has been developed specifically to accommodate increased NAFTA trade and traffic flows. According to one description, "a few exits up I-35 from downtown [Laredo], warehouses and trailer lots built by customs brokers, freight forwarders and trucking companies flow over miles of acreage that once was scrubland. The fact that nothing man-made existed five years ago where these structures now stretch out of sight illustrates how the growth of NAFTA trade has affected the city (Gordetsky 2000, 20)." Although the substantive transformation of "miles of significant economic benefit to the city and many of its businesses has generated significant economic benefits, this commercial success has come at a significant and in some cases, fatal cost for the area's indigenous wildlife and their habitat.

Detroit/Windsor

While there are parts of land within and around Laredo/Nuevo Laredo that were unoccupied as recently as six years ago but which have become highly developed due to NAFTA, the landscape of the Detroit metro area has long been defined by industry and growth. Described as a "highly disturbed environment," little of the area's native habitat patterns remain (MDOT and SEMCOG 1997, 3:19). In completing an Environmental Assessment for a construction project on the US side of the Ambassador Bridge, the Southeast Michigan Council of Governments (SEMCOG) and the Michigan Department of Transportation (MDOT) found that the heavy urbanization of land and the associated disruption of the terrestrial and aquatic habitat have limited the ecological resources within the area (MDOT and SEMCOG 1997, 3:19). The only wildlife assumed to survive in this urban landscape, other than "typical species of urban and suburban environments" is the eastern fox snake (MDOT and SEMCOG 1997, 3:19).

With a population of approximately 200,000 compared to Detroit metro area's 4.3 million, Windsor's retention of its landscape and wildlife resources has been significant. The city has over

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[18] Recreational use is also a major threat to the tern's reproductive success, and release of reservoir water and annual spring floods often inundates nests (Parsons Brinkerhoff 1989, 44)."

2,000 acres of parkland, including a riverside recreational trail that begins at the Ambassador Bridge. However, while much of the area's original habitat no longer exists— a regional assessment of southwestern Ontario found that "less than 0.5% of (its) original prairies and savanna" remain—Windsor is home to the one of the region's few remaining "natural areas," the Ojibway Prairie Complex (Bakowsky and Riley 1994, 1). Composed of five closely situated natural areas, the complex hosts wetlands, forest, savanna and prairie, all of which provide habitat for a great number of rare plants, insects, reptiles, birds and mammals.

With more than 238 species of birds recorded at Ojibway, Windsor appears to be a particularly important area for migratory birds in addition to other species (City of Windsor). Although previous analyses of 12 migratory species common to the area suggested persistent population declines, recent data through 1997 suggests that half of these species have since recovered to former population levels (Environment Canada 1999, 4). The rich, intact resources act as a magnet to a wide variety of wildlife not only destined for Ojibway, but for the area as a whole. Eight (8) of the twenty species of bats indigenous to Canada have been observed and fifty (50) species of butterflies counted in the Complex, in the five (5) nearby cities, or in Essex County, where Windsor is located (City of Windsor 1999, 2).

Preliminary evidence is emerging that recent increases in air pollution and degradation of water quality, a portion of which is attributable to NAFTA transportation, is producing negative impacts on Windsor. Of the twelve (12) avian species documented as declining, six (6) species have not recovered and an additional eight (8) have been documented as declining in number (Environment Canada 1999, 7). Further, with the proposed construction of another bridge between Detroit and Windsor, the number of commercial trucks may well increase, further stressing the border region's ability to sustain wildlife.

"Small Increases in Pressures Can Have A Major Catalytic, Potentially Irreversible Effect… A Small Amount of Environment-Enhancing Intervention Can Generate Large Gains": Framework Links between NAFTA Truck Transport and Wildlife

As the CEC Framework distinguishes, "the impact of pressures, combined with supports, will vary according to the existing state of the natural environment in the geographic area they affect" (CEC 1999b, 77)" This assertion is, perhaps, best demonstrated by the impact of NAFTA truck transport on the wildlife and habitat of the two border areas being analyzed. In Laredo, the combined forces of annexation and the economic demand for warehouses, support facilities, and other structures to accommodate NAFTA trade have eliminated the stretches of brushland that once comprised an abundantly viable ecosystem for both cat and bird species. Without open land preservation initiatives or city planning designed to provide intact habitat, the rapid increase in the number of species now deemed "threatened" or "endangered" attest to the "major catalytic and potentially irreversible effect" of these urbanization and development pressures (CEC 1999b, 77).

In sharp contrast, the relatively vibrant ecosystem of the Ojibway Complex and the surrounding communities provides a poignant reminder of the importance of "a small amount of environment-enhancing intervention" (CEC 1999b, 77. Despite the documented decline of certain avian species, the Complex and indeed, Windsor, remains an important destination along the migratory route even as the community experiences major transportation-related pressures. With an unexpectedly rich wildlife population, including indigenous bats, butterflies, and others, Windsor enjoys the "benefits" of its "intervention": intact wildlife populations and habitats.

2.3.4 Quality of Life

A constellation of transportation-related factors can contribute or detract from a community's quality of life. However, "quality of life" is a subjective assessment that reflects the values and cultural context of those judging. Acknowledging openly that "quality of life" indicators do not enjoy the broad scientific consensus of, for example, VOCs or NO_x levels, this paper looks at several indicators that explicitly link NAFTA-related transportation and community impacts: traffic congestion, the prevalence of truck transport on urban streets, and noise pollution.

Each of the indicators chosen has significant environmental or human health impacts. Traffic congestion, to the extent that NAFTA trucks idle, increases emissions of heavy metals and PM, emissions linked to respiratory distress and illness. Examining travel by NAFTA trucks within urban boundaries (rather than on interstate highways) as an indicator of quality of life is not intended to diminish the importance of the economic benefits or tax revenues trucks and their drivers often bring to local businesses within the urban core. Instead, this indicator gauges "quality of life" by focusing on the proximity of the releases of heavy metal and particulate matter in the densely populated areas that typically surround urban roadways. Finally, noise pollution, not only obviously impacts the comfort level of individuals living within a community, but also can lead to incremental hearing loss.

Laredo/Nuevo Laredo

Traffic congestion

With the opening of the World Trade Bridge on April 15, 2000, the oppressive congestion that once characterized Laredo has been significantly eased. The opening of this bridge, along with the redirection of trucks to only two of the four international bridges, has significantly reduced the wait on both sides of the border. According to a recent article in *Transport Topics*, "trucks are still omnipresent [in Laredo] but they no longer dictate the flow of traffic in the heart of the city (Gordetsky 2000, 20)."

While the opening of the bridge has reduced the congestion in the city, the relief it provides is likely temporary as the number of trucks is expected to grow. According to Laredo Mayor Elizabeth Flores, "the management of international trade and trucking is a critical issue—keeping up with the flow is unquestionably a challenge." A fifth bridge, also focused on accommodating NAFTA truck transport, is currently being designed and planned. However, this new bridge will not be open for use for, at least, six years (Gordetsky 2000, 21).

NAFTA traffic on city streets

Despite the opening of the bridge earlier this year, commercial trucks carrying international trade continue to dominate the downtown streets of Laredo. As a recent article on Laredo states, "on almost any city street and in the parking lots of many businesses you'll find truck tractors (Gordetsky 2000, 21)."

While building transborder bridges offers some relief to congestion, the capacity and condition of the city's infrastructure to accommodate the rapidly growing number of companies involved in the transportation structure has not kept pace. Trucking companies that started out in Laredo with only a shack and telephone now have thousands of feet of warehouse space and run major operations. Thus, the character of Laredo has been affected.

Noise pollution

No readily available noise pollution data in the cities of Laredo and Nuevo Laredo exist.

Detroit/Windsor

Traffic congestion

With a fifty-percent increase in its commercial truck traffic volume since the passage of NAFTA, the Ambassador Bridge remains the busiest commercial border crossing in the United States (Cole

2000, 1). This sharp upsurge has manifest itself in a "snaking line of commercial trucks at the bridge in recent years," congestion with implications for air quality, nonpoint source pollution, and increased community impacts (Cole 2000, 2).

A recent study completed by Windsor Area Transportation Authority projected that the period before both the Ambassador Bridge and Detroit-Windsor Tunnel bridges reach the outer limits of their capacity is, at most, fifteen years. Similar findings were echoed, as well, in reports commissioned by the SEMCOG.[19] As a consequence, an exploratory study is underway to determine the feasibility of building a new transboundary bridge between these points. While such a bridge might provide some measure of temporary congestion relief, its long-term impact on air pollution impacts have yet to be fully considered.

NAFTA traffic on city streets

All of the border crossings in Detroit, both road and railway, have been privately owned since they were constructed in the early 1900s. As a result, MDOT was, until quite recently, prohibited from making direct interstate connections with these crossings (Benton 2000, 2). The absence of infrastructure connections has meant that all trade traffic between Canada and the United States has traversed city streets in order to eventually reconnect with the US interstate system. As a consequence, according to Kris Wisniewski of MDOT, the Ambassador Bridge currently "dumps into a neighborhood" on the Michigan side of the crossing.[20]

The primarily Latino residential community located just over the Ambassador Bridge in Detroit has borne the brunt of this outcome since the implementation of NAFTA.[21] As the director of the Southeast Michigan Council of Governments, Carmine Palomba describes, currently, it is very easy for trucks to get lost when heading toward the bridge. Searching for the access to the US interstate system, these heavy-duty diesel trucks will often wander through this residential neighborhood, traveling on city roads ill-equipped to accommodate the additional weight and stress of these trucks.[22]

The recent federal passage of the Transportation Equity Act for the 21st Century has changed this scenario dramatically. Michigan, now permitted to link its interstate system to privately owned crossings, has embarked on the Ambassador Bridge/Gateway Project that will offer a direct link from the interstate system to the international crossing. Leadership in the affected neighborhood is proving active participants in the planning of this project (MDOT & SEMCOG 1997, 3-19).

Noise pollution

The US Federal Highway Administration (FHWA), an agency of the US Department of Transportation (US DOT) has established a one-hour parameter of 67 decibels for noise associated with highway structures. Under FHWA guidelines, should this level be routinely approached or exceeded at the exterior of residences, churches, hospitals, parks and libraries, noise abatement measures must be considered. According to SEMCOG and MDOT, noise levels in the Detroit community living near the Ambassador Bridge currently exceed 67 decibels in nine of sixteen sites identified in the region (MDOT and SEMCOG 1997, 3: 29).

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19 Based upon interview with Carmine Palomba, Southeast Michigan Council of Governments, 8/1/00.

20 Based upon telephone conversation with Kris Wisniewski, MDOT, on 7/25/00.

21 Based upon interview with Carmine Palomba, Southeast Michigan Council of Governments, 8/1/00.

22 Ibid.

3 Part II: A Community-Level "Report Card": Environmental Parameters and Data Assessment

The text of this report card is contained in the Appendix.

4 Part III: Recommendations for Action by the CEC

"Environmental protection does not— regardless of one's opinion of the role of economic expansion, liberalization, and integration—occur automatically" (CEC 2000c, 3). Choices must be made either to calibrate and adjust carefully and deliberately the forces of trade loosed with liberalization with the biological limitations that characterize the ambient environment or to disregard the acknowledged limits of natural systems in favor of the economic benefits that unconstrained trade may provide, regardless of future consequences. Where and how one chooses to calibrate the economic forces of trade, no doubt, "depends in large measure on what one considers the importance of the contribution of underlying factors to environmental degradation to be" (CEC 2000c, 3-4). The final critical questions highlighted by the CEC capture the unspoken issues at the heart of the NAFTA transportation-environment discussion: NAFTA transport is indeed not merely transport. How one transports NAFTA-related goods is not exclusively an economic decision, but, represents a complex mesh of economic decisions inextricably bound in a framework with environmental limitations.

To what extent the explicit consideration of these environmental limitations prompt change or the consideration of other transport options is critical. As the CEC Framework points out, "NAFTA may direct trade toward sectors and toward geographic locations, where the existing infrastructure can absorb the new traffic and demands, thereby obviating the need for new investments, new routes, and associated impacts on the environment… However, NAFTA-associated trade may generate production that follows a path to environmental stress (CEC 1999b, 67)." There is a growing sense, particularly in the communities experiencing the heaviest flows of trade traffic, that NAFTA-associated trade with its growing use of truck transport is veering down the "path to environmental stress" and that "unprecedented rates of economic growth are (not) entirely separate and disconnected from unprecedented rates of environmental degradation" (CEC 2000c, 4).

The pace of environmental protection related to NAFTA transportation has clearly lagged behind that of economic trade. To assure environmental protection in this context, therefore, will "require change and innovation" (CEC 2000c, 4). However, deliberate calibrating and balancing the forces of trade and the limits of the environment will require that options for transport be clearly defined and understood within a trinational environmental context, particularly as the number of "corridor coalitions" increases.

Recommendation 1: Inventory the existing intermodal resources, capacity parameters, and overall transportation infrastructure of the three signatory nations; investigate the transportation decision-making process used in each of the three countries, identifying those forces or pressures that support or oppose intermodal transportation resources and networks.

While the CEC Framework clearly supports such a recommendation, on-the-ground discussions of continued investment and construction in the "high-impact" border regions provide a clear sense of urgency. With consideration of a fifth international truck bridge underway in Laredo, as well as an additional vehicle bridge to supplement the Ambassador Bridge in the Detroit-Windsor area, the opportunity for change before irrevocable investment is made is short-lived.

Both of these discussions represent critical opportunities to seize as less environmentally destructive modes of transport *already* exist within each community—the capacity and utility of these alternative modes, such as rail, is currently limited only by contingencies that can be altered.[23] For example, relocating US Customs to the Tex-Mex rail yards in Laredo would allow the three operating rail companies to meet more readily, if not exceed, their 2000 target of an additional 154,000 loaded freight cars processed. Similarly, retrofitting the Detroit-Windsor Rail Tunnel to accommodate double-stacked freight cars, rather than diverting these rail cars north to Port Huron, would provide a direct rail route for these cars to Windsor, thereby altering the economic and logistic calculation that currently determines that transporting goods by truck to Windsor is more cost-effective and efficient than transporting these same goods via rail through diversion to Port Huron and then, to Windsor.

Why these highway expansion activities, rather than rail improvements, are being pursued first is not clear. Gaining an understanding, therefore, of the criteria by which decision-makers are judging the need for and projected efficiency of new NAFTA-related public investments in highway infrastructure, as well as the barriers (e.g., economic, regulatory, etc.) which limit the use of alternative modes is crucial, should innovation and change occur in coordination with economic growth and environmental limitations.

Should a comprehensive accounting of those intermodal alternatives which already exist in the NAFTA corridors, particularly those under the greatest trade pressures, already exist, it could not be identified or located. To the extent that such an accounting can provide estimates of capacity, used and unused, and barriers impeding full capacity, such an analysis would be invaluable when considering proposals for new transportation infrastructure. Analysis of those forces or pressures operating within the transportation decision-making process of the three signatory countries that encourage or stifle intermodal investment or consistently orient decision-making to one more environmentally destructive mode over less destructive modes would also be crucial in understanding external pressures that may be directing investment and decision-making.

Recommendation 2: Through recommendations developed by the CEC Council and a wide range of stakeholders, forge an agreement that specifies the protocol to be used in siting, planning, and designing intermodal transboundary "NAFTA Trade Corridors."

As evidenced in the deposition of far-flung airborne pollutants in the waters of the Great Lakes and the transboundary impacts of ground-level ozone in Ontario and Windsor, the substantive environmental impacts of transportation decision-making are often diffused to distant communities. If the three countries are to avoid continuing their forward movements on the "path to environmental stress," the capacity limits of the environment require that decisions on transportation infrastructure, particularly interstate highway investments, no longer be made in isolation.

The NAAEC provides that "the Council (of the CEC) may consider, and develop recommendations regarding… transboundary and border environmental issues, such as the long-range transport of air and marine pollutants; … environmental matters as they relate to economic development." [NAAEC 1993, Article 10(2)(g) and (l)] Further, "recognizing the significant bilateral nature of many transboundary environmental issues, the Council shall… consider and develop recommendations with respect to… assessing the environmental impacts of proposed projects subject to decisions by a competent government authority and likely to cause significant adverse transboundary effects… notification, provision of relevant information and consultation between Parties with respect to such projects; and mitigation of the potential adverse effects of such projects" [NAAEC 1993, Article 10(7)(a), (b), (c)].

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23 As cited earlier in the paper, in Laredo: "the underlying cause of rail congestion points toward an issue of use, rather than capacity. According to US Federal Railroad Administrator Jolene Molitaris, "the current bridge is not yet at capacity (Mertz 1999, 1)." Indeed, the Vice President of Finance for Tex-Mex Railroads estimates that "the company could improve efficiency at the existing bridge by 300 percent if US Customs moved inspections into the Tex-Mex railyard (Mertz 1999, 1)."

Through the auspices of the Council, the CEC should develop a series of NAFTA transportation-related recommendations that could form the foundations of an agreement to be forged between the three nations to guide the siting, planning, and development of transboundary NAFTA transportation corridors. As the CEC points out, the importance of NAFTA trade "can induce the federal governments in North America to engage in communication, capacity building, regional regulatory convergence, and cooperation" (CEC 1999a, 12). Not only will the early involvement and broad-based collaboration of government representatives, transportation and logistics service providers, community representatives, and nongovernmental organizations be essential if such recommendations are to gain the necessary political support and momentum for transformation into a binding protocol, but this coalition will afford "social organizations and civil society groups to present governments with demands for enhanced environmental performance" (CEC 1999a, 12).

Recommendation 3: Promote the availability of, public access to, and usefulness of environmental data.

One of the principal challenges in creating a document that effectively assesses the impact of a NAFTA corridor is the identification and location of complete environmental data sets for each country. As indicated in the text, the barriers to assessment of specific environmental indicators are substantive. As experienced in our research, barriers to data, generally, took one of three forms:

- **Difficulty in access:** Specific data on key indicators, particularly at the regional or community level, were often difficult to find. Searching a multitude of locations was often required with the usefulness of the data located often minimally beneficial relative to the time spent in search.
- **Public inaccessibility:** Information was often inaccessible to the public. Data was often completely unavailable in a publicly available format, such as via Internet or through traditional public information repositories, such as public libraries, state agency libraries, or publicly funded education and research institutions.

In other cases, where information was, in fact, available, it was only accessible at the request of another state agency or through a faculty member at a public university. Similarly, fees assessed were often exorbitant—thus, while data was, in theory, available, its public accessibility was limited to those exclusively with the means to pay

- **Uncollected data:** Information was often simply not collected either in the absence of a mandate requiring its compilation or in the absence of a monitoring source.

Task 1: Enhance the CEC's central environmental database.

Barriers to data are important to eliminate as a lack of information, whether as a consequence of difficulty in access or in noncollection, stifles the informed, vibrant public exchange to which the CEC is committed. While identifying sources for gathering "hidden" data, eliminating distribution barriers, and/or implementing collection are each direct resolutions to the data barriers identified, the cumulative impact these "data gaps" may have in impeding and stifling informed public participation in NAFTA transport decision-making must also be recognized. Enhancing the central data bank resources of the CEC to include a wider range of environmental indicators would be of substantial benefit to many community and nongovernmental organizations struggling to assess, understand, and respond to NAFTA-related pressures.

Task 2: Initiate process for the standardization of data by prioritizing the identification of key environmental indicators, standardizing their collection methods and parameters, and providing a standard framework for reporting.

Data collected on environmental indicators across the three signatory nations is rarely comparable. Ground level ozone data provides a powerful example of the limitations of data that is collected and assessed differently in each of the three countries. For example, data collected in the US must now be "adjusted" as the US EPA makes a transition from a one-hour to eight-hour standard. While Canada has traditionally used a one-hour standard, comparisons of one-hour data formerly collected by the EPA are not comparable as the parameters for these readings differ. Because Mexico distinguishes the values of its criteria as either immediate or chronic exposure, direct comparison across the countries is not always valid. For NGOs and community groups struggling to understand the impacts of transboundary transportation on the ambient environment of their community, this lack of comparability among similar indicators is often a hurdle too high to surmount.[24]

In addition, gaps in baseline data, should it exist, make it exceedingly difficult to gauge the impact of NAFTA-related transportation on many communities. For example, the US EPA has historic data for ozone levels only from those cities that have consistently exceeded NAAQ standards over time. However, even in the presence of acknowledged environmental stressors that might compel collection of data in the public interest, the EPA has not always quickly responded. For example, US EPA only has ozone data from Laredo beginning in 1999, a full five years after the passage of NAFTA—this despite early and clear indications that this small city had emerged as a major "choke point" for transboundary traffic.

NAAEC provides that "the Council may consider and develop recommendations regarding comparability of techniques and methodologies for data gathering and analysis, data management," as well as "establishing a process for developing recommendations on greater compatibility of environmental technical regulations, standards and conformity assessment" [NAAEC 1993, 10:2(a); 10:3(b)].

Given these provisions, the Council should initiate a collaborative process with the three signatory nations by which key environmental indicators are prioritized and a standard method of data collection and parameters established. This process is not an attempt to supplant current domestic environmental standards or methods. Instead, the identification, standardization, and reporting of data for key environmental indicators is a process designed to provide the necessary foundation for assessing and comparing, rather than guessing, NAFTA's environmental impacts.

There is precedent for undertaking such an effort at standardization, an effort that already involves the three trading partners. As described by INE, the agency, through its National Environment Program 1995–2000, has worked to "establish the development of a system of indicators of environmental performance evaluation as an instrument (by which) to evaluate environmental policy performance, promote public access to environmental information, and to contribute to environmental policy planning" [INE (b)]. Prompted by a 1988 request of the G7 countries to the Organization for Economic Cooperation and Development (OECD) for the identification of the most important environmental indicators, INE began developing a similar listing in 1993. While explicitly limited to those environmental indicators "considered to be under the jurisdiction of INE," the agency selected air pollution, hazardous waste, municipal waste disposal, wildlife and natural resources, climate change, and stratospheric ozone depletion as its categories of study. Attempting to avoid the troubling country-specific assessments that make international comparison difficult, the Environment Program has provided aggregate data on the environmental trends of Mexico.

INE's program provides an excellent model for a standardization effort, particularly in the criteria developed to select indicators. "To insure the reliability of the information used," INE used many of the data requirements that the OECD developed in its G-7 efforts, including choosing indicators that "provide a vision as to the status of environmental conditions, impacts, or societies'

[24] Even within nations, inconsistency in data collection makes it difficult to assess and compare accurately the extent to which environmental pressures are increasing or decreasing over geographic regions. For example, while the TNRCC collects various air quality data, some of which is publicly accessible, the MDEQ uses different data collection methods and parameters, making it very difficult to compare, even domestically.

solutions, (presentation in) a simple and easy to understand format capable of demonstrating tendencies over time, with (application) to a national and regional scale on a case-by-case basis, (and with) the ability to be updated on a regular basis" [INE (b)]. The template provided both by the OECD and INE's National Environment Program may assist the CEC in its own proceedings.

Additional Air Quality Recommendation for CEC Action:

- Following identification and standardization of key environmental indicators, data gathering on air quality indicators should be implemented for each city and region located along major NAFTA trade corridors. Data gathered should be made publicly accessible and available.

Additional Habitat/Wildlife Recommendations for CEC Action:

- Development of a best practices protocol for use in NAFTA transportation infrastructure projects. A promising start in the development of such a protocol can be found in the 1993 work of Tewes and Blanton in the construction of a NAFTA-associated bridge for the Port of Brownsville, Texas. Incorporating a variety of changes in construction blueprints, their proposal made specific design provision for wildlife, particularly the movements of the endangered ocelot. The components of this innovative design included:
  - Construction of a 500-foot span from the centerline of the Rio Grande over the north bank, rather than a bank-to-bank span of the bridge, allowing wildlife movements to occur under the bridge.
  - Creation of an interconnected system of "upland corridors" located parallel to and under the roadway
  - Development of a five-acre habitat tract on each side of the river corridor to serve as a staging area for migratory wildlife and to provide cover for species with substantive habitat range requirements.
  - Minimizing the impacts of the structures built around the bridge by locating them away from the river corridor, the upland corridor network, staging areas, and crossing.
  - Innovative use of pervious surface for parking areas to eliminate the discharge of vehicle-related nonpoint source contributions.

These design changes were "intended to produce post-construction conservation benefits (for wildlife) that exceed the pre-construction benefit levels" (Tewes and Blanton, p. 137). Given its organizational objectives and goals, the Commission has a unique ability to develop and distribute widely best practices tools and protocols that not only minimize the impact of NAFTA transportation on wildlife and habitat, but which *raise* the standard for conservation in a given region.

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Appendix

Part II: A Community-Level "Report Card": Environmental Parameters and Data Assessment

Aggregate Indicators	Specific Indicators	US/Mexico Border Region		US/Canada Border Region		Aggregate Monitoring, Data Collection, and Public Accessibility
		Nuevo Laredo	**Laredo**	**Detroit**	**Windsor**	
Air Quality	**Ozone levels**	No monitoring of ground-level ozone	Increased truck emissions since 1994	Significant improvement in air quality, as measured by days in nonattainment; several surrounding counties remain in nonattainment	Numerous criteria exceedence; the extent of transboundary flows on air pollution may be significant. Significant VOCs reduction reported	**US (Laredo, Texas):** Although data has been gathered on ozone, TNRCC data prior to 1998 is not publicly accessible. (**Detroit, Michigan):** Data not readily accessible to the public; what data is collected is limited in scope. Different methods of data collection and non-standardized pollutant parameters limit comparisons between states. **US EPA:** Monitoring of ozone levels is restricted to those cities in non-attainment with NAAQS. Despite significant risk factors, as in the case of Laredo, US EPA did not monitor ozone for several years, thereby missing the opportunity to collect baseline data. In transition between 1 and 8 hours ozone standards. **Mexico:** Limited monitoring of air quality overall. **Canada:** Data is widely available and accessible.
	NO_x levels	No monitoring of NO_x	No publicly accessible information available from TNRCC or EPA on this criteria pollutant	No specific data on this criteria pollutant publicly available	Criteria exceedance	
	VOC levels	No monitoring of VOCs	No publicly accessible information available from TNRCC or EPA on this criteria pollutant	No specific data on this criteria pollutant publicly available	Criteria exceedance; significant VOCs reduction reported for the province in 1997 as a consequence of conversion to reformulated fuels, beginning in 1989	
	PM_{10}	No monitoring of PM	Monitoring of PM began in 1999; no data currently available	No specific data on this criteria pollutant publicly available	Criteria exceedance for PM_{10}; the extent of transboundary flows may be significant	
Water Quality	**Contamination**	No indication of stormwater or urban runoff monitoring; recent construction of a secondary treatment plant may reduce discharges of untreated wastewater	Limited monitoring by the IBWC	Nonpoint source pollution remains the source of chronic impairments of water quality in the region	No indication of current exceedances	**US (Laredo, Texas):** Although data has been gathered on ozone, TNRCC data prior to 1998 is not publicly accessible. (**Detroit, Michigan):** Data not readily accessible to the public; what data is collected is limited in scope. Different methods of data collection and non-standardized pollutant parameters limit comparisons between states. **US EPA:** Monitoring of ozone levels is restricted to those cities in non-attainment with NAAQS. Despite significant risk factors, as in the case of Laredo, US EPA did not monitor ozone for several years, thereby missing the opportunity to collect baseline data. In transition between 1 and 8 hours ozone standards. **Mexico:** Limited monitoring of air quality overall. **Canada:** Data is widely available and accessible.
	Leakage of hazardous materials	Those indications of hazardous materials leakage are not calibrated sufficiently to assert the source of materials—may be a function of downstream flows from Laredo	IBWC reported leakage of hazardous materials into Las Manadas Creek, cited hazardous waste stored for truck transfer	No current indications, specifically attributed to transportation	No current indications	

Aggregate Indicators	Specific Indicators	US/Mexico Border Region		US/Canada Border Region		Aggregate Monitoring, Data Collection, and Public Accessibility
		Nuevo Laredo	**Laredo**	**Detroit**	**Windsor**	
Wildlife/Habitat	Endangered or threatened species	Limited monitoring; data not easily accessible	Extensive habitat loss associated with NAFTA transport with an increasing loss of species	Highly-developed area with few wildlife resources	Ojibway Complex, surrounding areas home to vibrant wildlife communities. Some reductions, some increases reported in avian species. Sightings of indigenous bats and butterflies	**US (Laredo):** Pressures of urbanization and NAFTA-related transportation directly impacting habitat. US (Detroit): Little change. **US FWS:** Limited scope of predictable impacts, particularly related to transportation projects, appear to underestimate impact on wildlife and habitat. **Mexico:** Limited monitoring, recent creation of the Commission for National Protected Areas may signal change. **Canada:** Data widely available and accessible.
	Changes in land-use patterns	Urbanization of previously undeveloped land	Urbanization of previously undeveloped lands accelerated by transportation-related impacts	Already highly developed environment	Data on land-use changes limited	
Quality of Life	Traffic congestion	No specific data available	With opening of fourth bridge, congestion is decreasing—relief may be temporary. Soon to consider the construction of a fifth international bridge	Continued congestion associated with Ambassador Bridge and the Detroit-Windsor Tunnel; consideration of an additional bridge	No current indications	No general consensus currently exists regarding indicators that capture "quality of life" and that are both measurable and culturally appropriate. Where regulations and parameters exist, localized and/or baseline data is often unavailable.
	NAFTA traffic on city streets	No specific data available; however, "quality of life" assessments may not be culturally appropriate	Prevalent; may be attributable to location of transportation-related businesses and transfer points within city limits	Extreme; no interstate access between Ambassador Bridge and the US Interstate system	No specific data available	
	Noise pollution	No specific data available	Limited data; exceedances were indicated in both EA studies for bridge construction; however, may not be generally applicable to city as a whole	Extreme, particularly in the Ambassador Bridge area	No specific data available	

Mexico's Manufacturing Exports and the Environment under NAFTA

Claudia Schatan

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1 Introduction

One of the most controversial topics in the discussions that preceded the North American Free Trade Agreement (NAFTA) was the potential role of Mexico as a "pollution haven," given its lower environmental standards compared to its northern counterparts. Five years after NAFTA started, considerable changes can be observed in the Mexican economy, most noticeably within its foreign sector, which has undergone the greatest transformation. Exports expanded by 23.4 % on average between 1994 and 1998, practically doubling total sales abroad in that period. Manufactured exports, including the maquila activities, grew 24% annually and primary products exports increased by 14.5% (Badecel 1999). The Mexican export expansion to the US was much more pronounced than the Canadian exports over the same period.

Although it is impossible to know exactly to what extent the Mexican export performance was stimulated by the devaluation suffered by the peso in December of 1994 (which was the start of a deep economic crisis in the country), and how much was the result of NAFTA creating favorable conditions for Mexican exports heading to the US, the latter undoubtedly had an important role as it gave way to lower tariffs (these fell from around 2.5% in 1990–1993 to 0.45% in 1998[1]), elimination of import quotas, and a substantial increase in foreign direct investment (FDI) in manufactured export activities, among other things.

Trade liberalization began in 1987, many years before NAFTA was signed in 1994; therefore, the treaty furthered an ongoing process. As a consequence of trade openness, there was a reorientation of the manufacturing sector toward the foreign market.

This paper intends to investigate whether the Mexican exporting industry has become more or less pollution oriented after the signing of NAFTA and whether its exports have found a special comparative advantage in the most polluting areas. The second section of the paper gives an overview of recent trends in the Mexican and Canadian export sector, including its specialization change according to the technological level of exports. In the third section, an estimate of the emissions originated in Mexican exports between the pre and post NAFTA period is presented as well as a calculation of the "scale" and the "composition" effects which, in principle, explain the variation of the estimated pollution during these periods. Fourthly, the competitive position of the Mexican and Canadian most polluting sectors in the US market is analyzed. Fifth, some links between foreign direct investment (FDI), manufacturing exports and environment will be developed. The paper ends with a short conclusions section.

2 Export Trends

Mexico has experienced a dramatic change both in its export dynamism as well as in its export structure since the seventies, but this tendency deepened during the nineties, particularly since NAFTA took off start and following the December 1994 devaluation. As seen in Table 1, in 1977 73% of total Mexican exports consisted of primary products and natural resources intensive goods, while in 1996 this proportion had fallen to 22%.[2] During the same time period opposite trends were occurring in the high and the intermediate technology exports. The high technology sector's participation increased from 10% to 30% and the intermediate technology participation did so from 5% to 27% between 1977 and 1996.

This tendency is much more pronounced than that experienced by Canada. Exports from the primary products and natural resources intensive goods sectors in total exports from Canada to the

[1] See Dussel 2000.

[2] In 1977 59% of total Mexican exports were primary goods and 15% were natural resources intensive products, while in 1996 these had fallen to 15% and 7% respectively (see Table 1).

US fell from 63% to 41% between 1977 and 1996. The intermediate technology exports rose from 25% to 32% and the high technology exports reached only 10% of total exports by 1996 (see Table 1).

As compared to the rest of Latin America, Mexico was perhaps the only country that experienced the aforementioned deep export structure changes. Brazil, the other most industrialized country in Latin America besides Mexico, had 80% of its total exports in the primary goods and natural resources intensive goods category in 1977 and in 1996 the participation of these goods was still 61% of total exports.[3,4]

In Mexico the high technology sectors that concentrated the export drive were mainly computers and other electronic equipment, along with the automobile industry, while it was the pharmaceutical sector and other segments of the chemical industry that did so in the intermediate technology industry. Apparel was outstanding as to export expansion in the lower technology level (Mortimore, Buitelaar and Bonifaz 2000). With the exception of the chemical industry and to a lesser extent iron and steel, most of the particularly dynamic manufactured exports during 1994–1998 were not intensive in natural resources, nor were they particularly polluting.

Another important characteristic of the Mexican export profile is the increasing participation of the maquila industry. In fact, the exports originated in the maquila activity reached, on average, 41.5% of total exports between 1993 and 1998[5] (Dussel Peters 2000). Interestingly, by 1996, 83% of the apparel exports, 75% of the plastic products exports, 73% of electric machinery and electronic exports (including computers, TV, etc. and their parts), 65% of the transport industry (including automobiles and autoparts) exports came from the maquila industry.[6]

Finally, it is interesting to examine the export/import coefficients (X/M) in the Mexican manufacturing industry since they can give some indication of the shift in export specialization.[7] Sectors which experience a significant increase in this coefficient may be reflecting a greater specialization in that kind of exports, while those which experience a decrease in this indicator may be experiencing an import penetration of that good. The sectors which underwent the greatest increase in X/M coefficient between 1992 and 1998 were footwear (324), beverages (313), furniture (332) and transport equipment (384) (including the automobile industry) (see Table 2), all of which are not particularly polluting. The most polluting industries, i.e., the chemical industry (351), non-ferrous metals (372), leather products (323), paper and cellulose (341) as well as oil refinery (353) all experienced a decrease in X/M coefficients. Only a few of the most polluting sectors, for example, other chemicals (352), and iron and steel (371) experience a slight increase in the X/M indicator. That is, though its exports were quite dynamic, Mexico's imports were more so, which suggests no relative shift of pollution-intensive industries to as a result of NAFTA, but rather, an absolute intensification of trade.

The chemical sector (including the petrochemical area) deserves special attention, given the fact that it is the most polluting industry of all. Notwithstanding this sector's exports were not as dynamic as the electronics and automobile branches, it still grew at very high rates in the 1990s (17.7% in the case of Mexico and 14.4% in the case of Canada, annually between 1990 and 1998, with even higher growth rates in Mexico in 1995–1998). There was a tendency for chemical exports

3 Calculations based on Canplus, CEPAL (*Comisión Económica para América Latina y el Caribe*).

4 For an analysis of the impact of economic reforms on the environment in Latin American countries, see Schaper (1999) and Schatan (2000).

5 This percentage refers to gross exports and not the value added of the maquila industry.

6 Information from *Instituto Nacional de Geografía e Informática* (INEGI), Mexico.

7 It was not possible to calculate these coefficients for Canada because Badecel does not count with Canadian imports and exports in ISIC, Rev. 2 classification, which is necessary to identify each category with pollution emissions of the Industrial Pollution Projection System (IPPS).

from Mexico and Canada, but especially from Mexico, to concentrate in the most dynamic chemical US markets.

Table 1. Primary products, natural resource-intensive products and technology level of Mexican and Canadian exports

	Product Participation According to Technology Vector of Mexican Exports (%)									
	1977	**1980**	**1985**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
A. Primary Products	59.3	60.3	51.3	28.9	27.1	23.3	19.8	17.5	15.8	15.4
B. Natural Resources Intensive Goods	13.8	13.7	11.8	9.5	8.4	7.8	7.5	7.6	7.3	7.4
C. Low Technology	8.9	6.3	7.7	12.9	13.5	14.3	14.9	15.7	16.4	16.8
D. Intermediate Technology	5.4	4.2	10.9	19.5	21.5	23.4	24.5	25.3	26.4	26.9
E. High Technology	9.9	11.6	15.7	25.3	25.9	27.4	29.5	30.2	30.3	29.9
F. Others	2.6	3.9	2.6	4.0	3.7	3.8	3.8	3.8	3.7	3.7
Total	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**
	Product Participation According to Technology Vector of Canadian Exports (%)									
	1977	**1980**	**1985**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
A. Primary Products	30.1	25.9	19.5	16.8	17.1	16.5	15.7	14.9	14.7	14.7
B. Natural Resources Intensive Goods	32.7	34.4	26.8	28.7	27.4	26.5	25.8	25.9	25.6	25.8
C. Low Technology	6.3	7.2	7.7	8.1	8.3	8.8	9.5	10.1	10.7	10.9
D. Intermediate Technology	24.8	22.5	33.2	31.3	31.2	32.2	33.5	33.6	32.9	32.3
E. High Technology	3.2	4.8	6.5	9.2	9.8	9.7	9.2	9.3	9.8	10.1
F. Others	3.0	5.2	6.4	6.0	6.2	6.3	6.4	6.2	6.2	6.1
Total	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**

Source: Calculations based on Canplus (CEPAL) and Péres and Alcorta (1998)

The chemical and petrochemical industry, nevertheless, does not seem to have the "pollution haven" seeking drive. In fact, it has always been of a global character and much of its international trade is intra-firm. In 1994, two thirds of this US industry's exports went to US based companies' foreign branches, while more than half of US chemical imports came from foreign affiliates to parent US based companies (Mowery and Nelson 1999). From the beginning, the US chemical industry based its competitiveness in its natural resources endowment, initially wood and mineral resources and later oil. Petrochemicals have been the greatest strength of this sector in the United States and in 1940 it accounted for 71% of the world refining capacity (Mowery and Nelson 1999).

The oil shocks of the 1970s reduced demand, increased costs and lowered the profitability of petrochemicals in the US. Many of them, which had become "commodities," started being produced in Mexico, whose abundance of oil made it particularly attractive as well as its state subsidized price for the petrochemical industry. The chemical industry in the United States (as well as in other industrialized countries) has since upgraded its production towards higher value added goods, occupying new niches of international competitiveness. US chemical and petrochemical enterprises are usually trying to narrow down their specialization, according to the comparative advantage they have been able to develop since the seventies with high technology, while leaving mass production of commodities to developing countries (Mowery and Nelson 1999).

A first approach to the topic of exports and pollution in Mexico suggests a tendency to specialize in technologically sophisticated products that are comparatively less polluting than the more traditional manufactured export products. Hence, there does not seem to be a shift of the most polluting industry toward Mexico. In the cases where commodities, such as the chemical industry (351), have expanded their exports at a high rate, so have their imports, which suggests a greater intensification of trade but not a shift of such production from other countries to Mexico.

Table 2. Mexican manufactured X/M coefficients*

ISIC Classification		Year						
		1992	1993	1994	1995	1996	1997	1998
311	Food products	0.20	0.22	0.23	0.48	0.51	0.49	0.50
313	Beverages	1.11	1.03	1.20	3.33	3.63	4.10	4.54
314	Tobacco	25.30	50.33	13.74	18.38	23.84	6.82	6.56
321	Textiles	0.56	0.49	0.46	0.77	0.74	0.72	0.61
322	Apparel	0.87	0.93	0.95	1.45	1.59	1.72	1.80
323	Leather prods.	0.69	0.78	0.72	0.91	0.79	0.70	0.57
324	Footwear	1.18	1.25	1.00	3.12	7.72	7.03	5.60
331	Wood prods.	0.53	0.62	0.53	1.03	1.28	1.23	0.98
332	Furniture	1.51	1.69	1.61	2.34	3.03	3.15	3.02
341	Paper and cellulose	0.29	0.26	0.15	0.23	0.23	0.23	0.23
342	Printed materials	0.31	0.31	0.26	0.46	0.48	0.54	0.54
351	Chemical industy	0.52	0.47	0.46	0.64	0.49	0.42	0.36
352	Other chemicals	0.44	0.40	0.42	0.67	0.61	0.65	0.64
353	Oil refineries	0.41	0.52	0.38	0.48	0.39	0.31	0.27
354	Oil and coal products	0.11	0.10	0.09	0.35	0.29	0.33	0.42
355	Rubber prods	0.12	0.17	0.19	0.29	0.23	0.24	0.24
356	Plastic prods	0.28	0.33	0.28	0.28	0.28	0.28	0.28
361	Ceramics	1.25	1.27	1.39	1.86	1.59	1.69	1.74
362	Glass	1.15	1.17	0.94	0.98	0.76	0.76	0.90
369	Other Non- metalic minerals	1.02	0.98	0.81	1.41	1.52	1.46	1.36
371	Iron and steel	0.35	0.48	0.48	1.28	0.92	0.89	0.67
372	Non ferrous Metals	1.07	1.10	0.93	1.61	1.21	0.91	0.69
381	Metal Prods	0.44	0.49	0.47	0.47	0.54	0.58	0.56
382	Non-electric machinery	0.33	0.39	0.45	0.69	0.70	0.74	0.75
383	Electric machinery	1.05	1.10	1.11	1.21	1.17	1.14	1.11
384	Transport equipment	0.79	0.94	0.96	1.81	2.24	1.86	1.82
385	Scientific and professional instruments	0.54	0.58	0.52	0.68	0.73	0.86	0.92
390	Other manufacturing	0.93	0.93	0.91	1.61	1.54	1.32	1.26
	Total	**0.61**	**0.68**	**0.68**	**0.98**	**0.98**	**0.94**	**0.92**

* Includes maquiladora imports and exports.

Source: *Banco de Datos del Comercio Exterior de América Latina y el Caribe* (Badecel).

3 Pollution and Manufactured Exports in Mexico

The purpose of this section is to estimate the polluting impact of export expansion at an aggregated and a disaggregated level in the post NAFTA period 1992/93–1997/98, i.e., just before the agreement was signed and the latest period for which data was available. A distinction will be made between the pollution expansion generated by a "scale effect" and that caused by a "composition effect."[8]

3.1 Methodology and Sources of Information

In this section the paper will analyze the pollution change for 28 manufacturing sectors over the period 1992/93–1997/98. The information on exports was obtained from Badecel databases, the International Standard Industrial Classification, second revision (hereafter: ISIC Rev. 2) with a three-digit aggregation. The information on the pollution by sector was taken from the Industrial

[8] If we could count with observed information on pollution variation between the two periods under study and our estimated pollution variation, the difference would mostly be a "technological effect", i.e., the change in pollution attributable to a change in technology. This effect could not be calculated because we lack information for that purpose.

Pollution Projection System (IPPS), World Bank (Hettige, Martin, Singh and Wheeler 1995), which is also available in the ISIC Rev. 2 classification. This information consists of the number of tons that each sector emits per US$1,000 of 1987 produced (in our case we limit the analysis to production for exports). This figure, multiplied by the amount of dollars exported (in thousands), provides an estimate of the tons of pollution produced for the years considered in the study.[9]

As the Badecel export information from Mexico has included the maquila since 1992, it was necessary to subtract this amount from each export category. The reason for this is that the international fragmentation of the production process does not account for the quantity of the total pollution process generated in Mexico. At the same time, the fact that the maquila industry is frequently located in sites with little infrastructure and few sanitary services changes considerably the profile of environmental problems of this industry if compared to the IPPS criteria.

The source for maquila exports for each sector was taken from INEGI, which uses the Standards International Trade Classification (SITC). Since it was impossible to convert the latter into the ISIC Rev. 2 classification, the percentage of maquila exports in each INEGI sector where these kind of exports exist was taken as an approximation and applied to the closest ISIC sectors for the Badecel information. Therefore, the latter exports minus maquila is an approximation.

The methodology used was the following (Schatan 2000):

$$\Delta P = (ti*xi_2 - ti*xi_1) = \text{scale effect} + \text{composition effect}$$
$$= \{[xi_1 * (X_2/X_1)] * ti - (xi_1 * ti)\} + \{[(xi_2 * ti) - (xi_1 * ti)] - [(xi_1 * (X_2/X_1)) * ti - (xi_1 * ti)]\}$$

$$\text{Scale effect} = \{[xi_1 * (X_2/X_1)] * ti - (xi_1 * ti)\}$$

$$\text{Composition effect} = \{[(xi_2 * ti) - (xi_1 * ti)] - [(xi_1 * (X_2/X_1)) * ti - (xi_1 * ti)]\}$$

Where:

ΔP: is the pollution change between period 1 and period 2.
ti: total pollution index for sector i.
xi_1: manufactured exports of sector i in period 1.
xi_2: manufactured exports of sector i in period 2.

$X_1 = \Sigma\, xi_1$
$X_2 = \Sigma\, xi_2$
$i = 1,2,\ldots\ldots, 28.$

The exports of period 1 of each of the 28 industrial sectors was multiplied by the growth of total exports index between period 1 (1992–1993 baseline) and period 2 (1997–1998). This result was, in turn, multiplied by the pollution index, which gives an estimate of the amount of pollution that would have been emitted if all sectors had expanded at the average rate of growth of aggregate exports. The difference between this hypothetical emission and that of period 1 is the "scale effect."

If we subtract from the scale effect the pollution of period 2, then we obtain the "composition effect." All difference between the "scale effect" and the estimated pollution in year 2 is attributed to a change in composition of exports ("composition effect").

9 It was not possible to make this estimate for Canadian exports since Badecel information for such country is not available in the ISIC classification, which is needed to be able to relate them to emissions in the IPPS.

3.2 Scale and Composition Effects: Results

Total manufacturing Mexican exports expanded by 171% in the period 1992/93–1997/98 (Table 3), and the pollution resulting from manufacturing export activity was estimated to have expanded by 86.9% during that same period, that is, an increase of 30.4 million tons of pollutants (see Table 4). This estimated figure was a result of the export dynamism ("scale effect") which would have, by itself, been responsible for an increase of 59.8 million tons of pollution if it had not been offset partially by the contraction of 29.4 million tons resulting from a change in the composition of exports ("composition effect") in favor of less polluting export sectors. In other words, if there had not been an expansion of manufacturing exports, pollution would have diminished in absolute terms, given the lesser weight of the most polluting sectors in total exports in the last period.

More specifically, most of the highly polluting export sectors contributed to the former results. At a disaggregated level, in fact, with the exception of Iron and Steel, the most important polluting sectors, namely, the chemical industry, oil refinery and non-ferrous metals, had a negative "composition effect." Also, other industries close to the highest polluting such as Paper and Cellulose and Plastic Products, experienced a negative "composition effect" (Table 4).

Table 3. Manufacturing exports excluding maquila (Millions of US dollars)

ISIC Classification Rev. 2		x1 1992–1993*	x2 1997–1998*
311	Food products	483,560	1,405,494
313	Beverages	201,596	601,813
314	Tobacco	172,509	63,380
321	Textiles	297,831	1,182,304
322	Apparel	156,073	1,011,853
323	Leather products	111,731	280,208
324	Footwear	108,580	193,436
331	Wood products	280,268	469,469
332	Furniture	120,740	480,148
341	Paper and cellulose	327,507	433,977
342	Printed materials	133,084	303,652
351	Chemical industry	2,063,420	3,112,337
352	Other chemicals	585,162	1,662,112
353	Oil Refinery	567,188	582,655
354	Oil and coal products	10,132	88,561
355	Rubber Products	42,012	296,565
356	Plastic products	163,352	337,312
361	Ceramic	118,950	267,919
362	Glass	503,428	832,910
369	Other non-metal mineral	169,854	443,669
371	Iron and steel	838,864	2,557,085
372	Non-ferrous metals	991,071	1,655,353
381	Metal products	530,630	1,708,705
382	Non-electric machinery	2,298,567	8,925,053
383	Electric machinery	2,547,612	7,901,354
384	Transport equipment	2,581,857	7,585,859
385	Scientific and professional instruments	889,660	2,595,957
390	Other manufactured products	335,521	807,914
	Total	**17,630,755**	**47,787,050**

* Simple average.

Table 4. Trends and breakdown of Mexican industrial pollution in the period 1992/93–1997/98

		Ti	xi1*ti	xi2*ti	Scale Effect *	Composition Effect *
ISIC Classification Rev. 2		Tons per million dollars of 1987	Tons 1992–1993	Tons 1997–1998	Tons	Tons
311	Food products	0.11	53,551	155,649	91,596	10,502
313	Beverages	0.07	14,883	44,430	25,457	4,090
314	Tobacco	0.14	23,520	8,641	40,230	-55,109
321	Textiles	0.41	123,016	488,337	210,410	154,911
322	Apparel	0.01	1,238	8,029	2,118	4,672
323	Leather products	2.33	260,765	653,968	446,022	-52,819
324	Footwear	0.22	23,956	42,678	40,976	-22,254
331	Wood products	0.18	49,838	83,482	85,245	-51,601
332	Furniture	0.69	83,077	330,371	142,097	105,197
341	Paper and cellulose	1.66	543,180	719,764	929,075	-752,491
342	Printed materials	0.21	28,308	64,589	48,419	-12,138
351	Chemical industry	9.95	20,532,098	30,969,365	35,118,858	-24,681,590
352	Other chemicals	1.37	799,611	2,271,239	1,367,684	103,944
353	Oil Refinery	1.46	830,423	853,068	1,420,386	-1,397,741
354	Oil and coal products	0.24	2,422	21,167	4,142	14,603
355	Rubber products	0.53	22,419	158,259	38,347	97,493
356	Plastic products	1.12	182,452	376,752	312,073	-117,773
361	Ceramic	0.55	64,952	146,297	111,097	-29,752
362	Glass	0.17	83,299	137,816	142,477	-87,960
369	Other non-metal mineral	0.46	78,173	204,192	133,710	-7,691
371	Iron and steel	3.17	2,656,835	8,098,758	4,544,348	897,575
372	Non-ferrous metals	5.00	4,956,405	8,278,523	8,477,618	-5,155,500
381	Metal products	0.81	430,825	1,387,318	736,899	219,594
382	Non-electric machinery	0.23	529,514	2,056,038	905,700	620,824
383	Electric machinery	0.54	1,384,941	4,295,358	2,368,854	541,564
384	Transport equipment	0.36	928,692	2,728,628	1,588,469	211,467
385	Scientific and professional instruments	0.22	199,385	581,790	341,036	41,369
390	Other manufactured products	0.27	89,179	214,736	152,534	-26,976
	Total		**34,976,956**	**65,379,243**	**59,825,877**	**-29,423,590**

* The addition of the scale and the composition effect is equal to the estimated variation of pollution between period 1 and period 2, i.e., xi2*ti – xi1*ti.

The technologically more sophisticated manufactured exports, whose weight in total exports increased the most—non-electric machinery, electric machinery and transport equipment—undoubtedly generated greater pollution as a result of the change in composition in their favor, but the pollution resulting from such "composition effect" was much lower than it would have been if the structure of exports had changed in favor of the sectors with the greatest emissions per unit of output. In fact, as mentioned before, the negative composition effect of the high pollution sectors outweighed by far the positive composition effect of the winning sectors.

4 Competitiveness of Polluting Sectors

In the previous two sections it was possible to appreciate that, with some exceptions, Mexico's export drive has concentrated in technologically sophisticated sectors in recent years, which are generally less polluting. Nevertheless, this does not give a complete picture of the position of polluting sectors in the international market, particularly the NAFTA market, which is of main interest here. In this section the competitiveness of 25 Mexican manufacturing most polluting export sectors in the US market is examined, and the same is done for Canada as a point of reference for the Mexican experience within NAFTA.

For the competitiveness analysis, the Module to Analyze the Growth of International Commerce (MAGIC) of CEPAL was used. This is a computational program that was designed as a tool to study the changes in the trade flows that have occurred between Latin American countries and the United States since 1990. The information is classified according to the Harmonized System (HS). Although the IPPS, which is in ISIC Rev. 2 classification, could not be applied to the HS, since the former information is not sufficiently disaggregated, a categorization was done at the two-digit HS level from higher to lower pollution levels based on the IPPS classification (Table A-1).

Table 5 shows the value of the most polluting exports from Mexico and Canada to the United States during the period 1990–1998 at the aggregate level.

Table 5. Most polluting exports as percentage of total exports from Mexico and Canada to the United States

	Year								
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Mexico									
Most polluting manuf. exports (% of total Mexican manuf. exports to US)	24.8	21.4	19.8	18.2	16.7	16.9	15.8	16.0	11.6
Most polluting manuf. exports minus oil exports (% of total Mexican manuf. exports to US)	7.2	6.3	6.3	6.0	6.3	7.4	6.5	6.2	6.0
Canada									
Most polluting manuf. exports (% of total Canadian manuf. exports to US)	31.3	32.0	31.3	30.4	29.3	30.7	30.8	30.4	27.5
Most polluting manuf. exports minus oil exports (% of total Canadian manuf. exports to US)	20.5	20.7	20.5	19.8	19.5	21.3	20.0	19.7	19.1

Source: MAGIC, CEPAL 1999.

From the data shown in Table 5 it is clear that Mexico is not specialized in highly polluting exports to the United States. The most polluting exports have been decreasing as a percentage of total manufacturing exports. In fact, while 24.8% of these belonged to that category in 1990, in 1998 this share had fallen to 11.6%. If oil exports are excluded, then this reduction in the participation of the highest polluting sectors is much less pronounced, from 7.2% in 1990 to 6.0% in 1998.

Mexico's exports are much less specialized in pollution sectors than Canada. In the latter case, 31.3% of total manufacturing exports were highly polluting in 1990 and this figure has fallen to 27.5% in 1998. If oil is excluded, then these percentages are 20.5 and 19.1 respectively.

At a more disaggregated level, in the Mexican case, besides mineral fuels and oils, the other most polluting sectors with the greatest weight in total value of manufacturing exports to the US in 1998 were in order of importance, iron and steel, plastics and articles, copper and articles and precious stones and metals (Table 6). Following the same criteria, in Canada, those non-oil polluting sectors with the greatest presence were paper and paperboard, plastic and articles, aluminum and articles and precious stones and metals, also in order of value of exports (not shown in table).

Table 6. US imports from Mexico, most polluting sectors (Thousands of US dollars)

Harmonized System Classification*		Year								
		1990	1991	1992	1993	1994	1995	1996	1997	1998
28	Inorganic Chemicals	236,398	182,385	195,494	181,014	243,923	240,299	246,735	279,583	223,413
29	Organic Chemicals	164,442	256,821	300,656	223,233	285,916	370,732	351,901	406,324	358,580
32	Tanning or Dyeing Extracts	38,669	28,742	30,102	30,988	29,521	31,252	41,461	54,464	63,846
71	Precious Stones and Metals	283,248	230,217	275,638	260,882	294,242	394,894	498,630	445,015	577,725
75	Nickel and Articles	249	596	773	452	286	383	692	636	1,004
76	Aluminum and Articles	107,791	104,992	122,563	121,806	172,891	280,047	259,471	300,452	319,818
78	Lead and Articles	25,249	15,575	32,788	17,930	18,552	36,301	46,526	45,188	35,289
79	Zinc And Articles	119,377	65,728	50,875	100,278	96,159	109,835	108,719	143,718	126,422
80	Tin and Articles	21,977	5,984	2,735	4,150	1,010	998	1,966	2,316	2,955
74	Copper and Articles	201,018	168,275	211,495	256,695	303,822	628,875	450,726	499,193	660,264
81	Base Metals	12,183	11,946	9,688	10,423	9,970	9,163	10,508	10,547	10,435
27	Mineral Fuels and Oils and Products	5,288,108	4,684,933	4,736,831	4,874,777	5,106,514	5,836,865	6,798,428	8,419,663	5,308,913
39	Plastics and Articles	241,695	300,919	342,944	377,513	500,349	660,129	715,645	820,491	940,102
72	Iron and Steel	278,900	227,713	231,742	334,478	578,310	849,110	990,254	1,136,646	1,055,984
56	Wadding, Felt and Nonwoven; Special Yarns	23,187	20,088	22,880	29,063	34,266	1,751	69,814	96,563	93,167
59	Impreg., Coated, Covered or Lam. Textile Fabrics	8,919	12,677	12,348	20,629	24,788	26,463	29,699	29,859	38,651
48	Paper and Paperboard and Articles	193,168	120,485	135,457	124,823	161,562	351,150	304,506	367,305	432,742
31	Fertilizers	14,692	14,942	13,018	14,212	40,952	86,358	86,352	31,800	25,048
30	Pharmaceuticals	3,053	6,258	8,154	10,806	9,072	12,657	19,358	22,072	24,581
33	Essential Oils and Resinoids	16,116	13,651	18,742	20,814	26,154	45,085	51,661	63,095	87,015
35	Albuminoidal Substances	2,682	1,961	2,667	3,322	6,279	12,149	11,375	7,418	9,836
36	Explosives; Pyrotechnic Products	803	547	2,386	5,666	5,270	7,393	9,915	11,676	13,642
38	Miscellaneous Chemical Products	49,477	50,321	50,745	54,251	60,478	59,879	90,775	64,435	159,975
15	Animal ar Vegetable Fats and Oils	18,416	33,204	27,396	31,706	40,765	53,013	56,778	9,955	46,054
40	Rubber and Art.	112,735	95,887	116,377	136,440	187,640	253,558	282,932	46,054	399,641
	Total	**7,462,552**	**6,654,847**	**6,954,494**	**7,246,351**	**8,238,691**	**10,398,339**	**11,534,827**	**13,734,468**	**11,015,102**

* See Table A-1 for classification of industrial sectors from greater to lower level of pollution.

Source: MAGIC, CEPAL 1999.

This picture, however, does not provide a precise idea on how competitive the Mexican and the Canadian highly polluting exports are in the US market. In this sense, Table 7 shows additional interesting information. Exports from Mexico and Canada are categorized according to whether they are experiencing (i) "retreats," i.e., those exports which lose participation in a particular US market, whose dynamism is lower than that of total US imports market; (ii) "missed opportunities," exports to the US which lose its market participation, while such market is dynamic as compared to the total US imports market; (iii) "declining stars" are those exports which gain a greater presence in a particular market in the US, but this market is relatively stagnant as compared to total US import market; and (iv) "rising stars," exports which gain a greater participation in a specific US goods market, which in turn is winning a greater weight in total US imports markets.

Mexico and Canada seem to have considerably different performances. While more than half of Canada's exports (53%) of the most polluting goods were either retreating or missing opportunities in the US markets in 1998, almost all of these types of Mexican exports were gaining greater presence in these US markets at the end of the nineties. In this way, 93% of Mexican most polluting exports were either "declining stars" or "rising stars." Of these, most belonged to the category of "declining stars," i.e., though these markets were declining in the United States, Mexico was maintaining a competitive stance in them (see Table 7).

In short, Canadian export specialization was much more pollution-prone than the Mexican exports in the nineties, while both countries' most polluting sectors have undergone shrinking export ratios to the US, hence they were not becoming more specialized in these kind of exports. For Mexico and Canada NAFTA seems to have promoted a greater specialization in non-pollution intensive exports. Nevertheless, there was a qualitative difference in their competitive position by which Mexico, in contrast with Canada, seemed to have been increasing its comparative advantage in several of those highly polluting markets, while Canada was leaving most of them. In other words, although in Mexico these sectors were less dynamic than the average rate of export growth, they still were considerably more dynamic than the US markets to which they were being exported, and hence, were gaining a greater share of them.

Table 7. Mexico and Canada export structure according to competitiveness

	Exports from most polluting sectors (% of total Mexico-US exports)								
	Year								
Competitiveness of products *	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Retreats	5.2	4.5	4.1	4.5	5.1	4.7	4.3	3.5	3.8
Missed opportunities	2.4	4.1	4.6	3.4	3.7	3.8	3.3	3.2	3.6
Declining stars	81.4	80.2	78.9	79.9	77.8	76.3	77.1	78.8	71.5
Rising stars	10.9	11.2	12.3	12.3	13.4	15.2	15.3	14.5	21.1
	Exports from most polluting sectors (% of total Canada-US exports)								
	Year								
Competitiveness of products *	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Retreats	26.8	25.1	26.3	25.3	26.9	26.8	25.0	25.0	25.1
Missed opportunities	28.6	29.6	28.5	28.1	26.4	29.0	26.7	25.4	28.0
Declining stars	38.1	38.9	38.2	38.7	37.6	34.4	38.5	38.9	34.9
Rising stars	6.5	6.4	7.1	7.8	9.1	9.9	9.8	10.7	12.0

* Refers to the competitive position of products after the introduction of NAFTA: 1994–1998.

Source: MAGIC.

5 Investment, Export Specialization and Pollution in Mexico

Contrary to what could be thought, the change in the Mexican manufacturing sector, excluding the maquila industry, was not very extensive in the period that followed the economic reform of the eighties. When NAFTA was signed there was a relatively stagnate manufacturing sector, which had an investment /production coefficient considerably lower than that which prevailed in the seventies and the beginning of the eighties (under 6% as compared to near 10% in the former period). In fact, the net stock of fixed capital in 1994 was the same as that in 1984, though modernized to a certain extent[10] (Moreno 1999). Although not enough information exists for the second half of the nineties, the capital stock probably increased somewhat, driven by the very significant FDI that has entered Mexico since. In fact, in the period 1995–1999, FDI flowing annually to Mexico (about 10.5 billion dollars) almost doubled that of the period 1990–1994 (around 5.4 billion dollars) (CEPAL 2000a). This expansion has nurtured mainly the export industry, which, in turn, has been the main catalyst of the manufacturing sector's transformation in the recent period. There were not many changes in the capital stock that could be directly linked to environment upgrading, since the specific investment on environment protection by enterprises seems to be quite limited still. In 1997 the environmental market was worth about 2 billion dollars in Mexico, i.e., about 0.6% of GDP, which is considered too limited an estimation, but the prospects are good, since such market has been growing at a 10 to 14% rate annually (CESPEDES 1999).

FDI was responsible for a large proportion of the Mexican export thrust, but both FDI and export growth concentrated mostly in a few sectors. Basically, of the 61% total FDI that went to

[10] An annual 5% depreciation of fixed capital is considered in that study (Moreno 1999).

manufacturing industry between 1994 and 1998, one third was absorbed by the automobile industry and electronic equipment including computers; one sixth went to chemical industry activities (especially pharmaceutical and other chemicals); another sixth was directed toward beverages and the tobacco industries (see Table 8) (Dussel Peters and Mortimore 2000; Mortimore, Buitelaar and Bonifaz 2000).

Table 8. Foreign direct investment (Millions of US dollars)

	Year						
						Accum. 1994–1998 [2/]	
	1994	1995	1996	1997	1998	Value	Part. (%)
Total	**10,413.7**	**8,061.7**	**7,384.0**	**11,082.6**	**6,619.6**	**43,561.5**	**100.0**
Manufacturing industry	**6,073.3**	**4,721.8**	**4,585.3**	**6,984.7**	**4,471.5**	**26,836.6**	**61.6**
Food products, beverages and tobacco	**1,764.6**	**604.2**	**496.9**	**2,896.2**	**633.9**	**6,395.8**	**14.7**
Meat industry	10.3	3.1	1.2	2.3	6.8	23.6	0.1
Milk products	3.6	70.9	12.1	27.3	-1.1	112.8	0.3
Canned food	11.3	-27.6	52.1	6.6	24.7	67.1	0.2
Processed cereals and other agricultural products	5.2	12.3	267.5	33.2	20.0	338.1	0.8
Bread products	0.7	154.9	7.8	7.8	1.3	172.5	0.4
Grinded nixtamal and tortillas elaboration	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Edible oils and fats	8.2	8.9	2.3	0.0	0.1	19.5	0.0
Sugar industry	0.9	78.5	25.0	0.0	0.0	104.4	0.2
Cocoa, chocolate and confectionary's products	5.0	43.1	14.2	1.5	1.9	65.7	0.2
Other food prod. for human consumption	861.9	-0.2	1.6	24.8	2.4	890.5	2.0
Prep. food for animals	3.4	2.1	21.8	1.3	0.2	28.9	0.1
Beverages	854.0	257.9	91.2	651.4	577.6	2,432.1	5.6
Tobacco	0.1	0.3	0.0	2,140.1	0.0	2,140.6	4.9
Textiles, apparel and leather industry	**250.4**	**179.2**	**181.3**	**159.7**	**264.0**	**1,034.7**	**2.4**
Textil ind. of hard fibers	2.3	0.2	0.4	0.0	6.4	9.2	0.0
Soft fiber yarn and fabric	97.5	62.2	46.6	12.6	17.3	236.2	0.5
Textiles materials	24.2	17.8	17.9	19.4	60.7	140.0	0.3
Knitted fabric	81.0	53.4	8.1	15.2	27.4	185.1	0.4
Apparel	35.5	41.4	72.4	106.7	133.7	389.7	0.9
Leather, furs and prod.	2.7	2.1	34.2	4.6	8.8	52.5	0.1
Footwear	7.2	2.1	1.7	1.2	9.8	22.0	0.1
Wood and wood products industry	**9.0**	**46.9**	**32.6**	**15.1**	**21.7**	**125.3**	**0.3**
Sawwood and carpentry	0.5	29.5	6.6	1.8	2.1	40.5	0.1
Packaging and other wood and cork products	0.2	4.7	0.8	4.5	10.0	20.2	0.0
Wood furniture	8.2	12.7	25.2	8.8	9.6	64.5	0.1
Paper and paper products, printing and editorial activities	**78.3**	**155.9**	**71.4**	**218.0**	**48.7**	**572.4**	**1.3**
Cellulose, paper and prods.	71.6	98.8	63.1	211.5	12.6	457.6	1.1
Printing and editorial ind.	6.7	57.1	8.3	6.5	36.0	114.7	0.3
Chemical substances and oil, coal, rubber and plastic derived products	**616.0**	**557.7**	**1,123.4**	**663.5**	**1,033.6**	**3,994.2**	**9.2**
Basic petrochemical ind.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Basic chemical substances	240.0	69.6	123.0	51.0	7.5	491.1	1.1
Artif. or synth. fibers	10.6	23.3	5.8	1.1	414.3	455.2	1.0
Farmaceuticals	157.0	118.6	150.0	165.4	179.0	770.1	1.8
Other chemical prod. and subst.	83.5	84.5	545.3	147.7	205.6	1,066.5	2.4
Oil refinery	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coal	25.3	19.7	38.2	28.6	7.1	118.8	0.3

Rubber industry	9.8	33.1	20.5	26.9	70.5	160.9	0.4
Plastic products	89.7	208.8	240.6	242.7	149.6	931.5	2.1

Table 8. (*continued*)

	Year						
						Accum. 1994–1998 2/	
	1994	**1995**	**1996**	**1997**	**1998**	**Value**	**Part. (%)**
Non-mineral products	**51.2**	**89.2**	**29.5**	**5.8**	**10.6**	**186.3**	**0.4**
Pottery and ceramics	1.7	2.0	0.1	0.1	0.4	4.3	0.0
Clay material for construction	53.9	61.3	19.4	4.3	-0.4	138.5	0.3
Glass and glass products	-5.2	-0.7	-0.7	0.4	9.3	3.0	0.0
Cement, lime, plaster and other non-metallic minerales products	0.8	26.7	10.8	1.0	1.3	40.5	0.1
Basic metal industries	**1,342.3**	**141.7**	**324.8**	**102.9**	**47.4**	**1,959.1**	**4.5**
Iron and steel	1,341.4	121.6	316.3	100.1	45.1	1,924.5	4.4
Basic non-ferrous metals	0.9	20.1	8.5	2.8	2.3	34.6	0.1
Metallic products, machinery and equipment	**1,862.3**	**2,832.3**	**2,174.6**	**2,664.9**	**2,035.9**	**11,570.0**	**26.6**
Metallic parts	19.2	19.3	25.1	19.0	17.3	99.9	0.2
Metallic structures, tanks and industrial boilers	2.8	26.4	14.8	2.9	84.6	131.6	0.3
Metallic furniture	17.7	3.1	0.7	7.3	11.0	39.8	0.1
Other metallic products	46.5	73.1	77.9	69.1	71.7	338.3	0.8
Mach. and equip. specific uses.	39.1	41.9	21.1	32.1	30.3	164.5	0.4
Mach. and equip. general use.	75.1	149.4	123.4	123.7	144.4	616.0	1.4
Office machines, including information processing	31.2	33.3	137.5	76.7	222.6	501.3	1.2
Electric machines, equip and accessories.	390.4	839.4	567.4	455.8	473.5	2,726.4	6.3
Electronic equip. including radio, TV, communication and medical use.	214.1	534.4	425.3	578.6	422.6	2,174.9	5.0
Instr. and acces. domestic use	60.6	71.3	113.5	96.9	96.3	438.7	1.0
Automobile industry	917.2	970.0	630.0	1,160.3	412.9	4,090.4	9.4
Transport equipment and parts	26.2	51.7	11.8	11.5	13.5	114.6	0.3
Precision instruments and equipment	22.3	19.0	26.1	31.1	35.1	133.5	0.3
Other manufacturing industry	**99.2**	**114.6**	**150.8**	**258.5**	**375.7**	**998.9**	**2.3**
Other manuf. industry	99.2	114.6	150.8	258.5	375.7	998.9	2.3

Source: *Secretaría de Comercio y Fomento Industrial, Dirección General de Inversión Extranjera.*

As to the environmental impact of this investment and export profile, the first observation is mixed. The most substantial part of FDI does not seem to promote particularly polluting activities, which is encouraging. Instead, it searches local advantages that may reduce costs other than lower environmental standards. This is consistent with other studies, which report that environmental costs are too small to determine the location of industry (approximately 2% of total value added in 85% of US industry) (Esty and Gentry 1997; Low and Yeats 1992). Among the elements that determine the location of these industries are the availability of natural resources, low salaries, access to local markets, among others. Even most of the chemical industry, which is the most polluting, does not seem to be attracted by lower environmental standards, as mentioned before. In fact, since much of it is integrated to transnational corporations or large national capital, which normally counts with important technological partners abroad, it usually uses technology which is close to the best available internationally (Mattar 1994; Péres 1998).

The former situation, nevertheless, does not support the prospect of a country shifting its export activities toward technologically sophisticated, high value added sectors. A special characteristic of the export boom, as was mentioned in section 2, occurred in the maquila industry. In fact, the most dynamic segment of FDI went to the maquila industry. Between 1994 and 1998 the FDI flowing to that industry grew 24% annually and reached almost 25% of total FDI in Mexico in September of

1999 (Dussel Peters 2000). Hence, technologically, much of this industry has developed only a small segment of this high technology process in Mexico and usually, but not always, that which is intensive in labor. Although there are some references to a second generation of the maquila industry, which in theory incorporates more advanced processes of production than the first generation, even electronic and the automobile maquila industry continue carrying out mostly assembly operations, in a traditional way (Gerber 1999). Therefore, the industrial technological upgrade spurred by exports is definitely shallow and the change in the manufacturing export structure toward high technology products can be misleading if considered a sign of the level of technological development. Consequently, the transference of technology and the possibility of building an industry which may produce greater value added per unit of output and increase workers income is still an unaccomplished aim. Additionally, the segments of maquila production, located mostly along the northern border of Mexico, lack the necessary infrastructure to dispose of solid toxic wastes in an environmentally acceptable way, without causing a series of emissions to the air and water (EcoFrontera 2000).

6 Conclusions

NAFTA deepened the Mexican foreign trade tendencies spurred by trade liberalization policies in the second half of the 1980s. Of these, the most important were the high rate of growth of exports and imports as well as the reorientation of production activity towards the export markets, accompanied by the doubling of FDI received by Mexico, annually.

From an environmental point of view, the Mexican trade trends do not suggest a shift of export specialization toward more polluting sectors after 1994 (nor since the initial trade opening in such country around 1987). A first characteristic of trade worth mentioning is that while some polluting sectors expanded exports considerably in the post NAFTA period, so did imports, particularly in the chemical sector. This indicates an intensification of trade in some very polluting sectors, but not a shift of such production to Mexico.

Second, an estimate of pollution expansion related to manufacturing exports between a pre and a post NAFTA period (1992/93 and 1997/98, respectively) shows that it was the significant dynamism of exports which was responsible for the greater emissions and not a change in the structure of exports toward more polluting sectors. In fact, if exports had not increased during that period, pollution would have diminished because of the greater weight gained by less polluting sectors during that period. It was therefore the "scale effect" and not the "composition effect" which explains the pollution expansion in the period under study.

Third, the very deep change in the Mexican export structure has further implications for the environment if we consider that they tended to make a shift away from primary goods towards high technology export products, being the automobile and the electronics industries particularly predominant in the latter case. If compared to Canadian export structure, the Mexican one changed to a much greater degree in favor of the high technological sectors' exports after NAFTA, while within the Latin American context the Mexican experience was almost unique.

Fourth, the environmental favorable implications of relying less on natural resources and concentrating more in sectors with high technology have to be taken with reserve. Overall, investment was stagnant until 1994 and since then it has been the FDI that presumably has injected greater capital for innovation purposes. The most dynamic part of FDI has flowed to maquila industry and this activity only is in charge of a small segment of the production process, usually that which is intensive in labor force. In general, the high technology industries are not really integrated nationally, technological transfer from abroad is limited and value added, particularly in the maquila industry, is quite low. Hence, too, the impact of this activity on incomes and standards of living, which is essential to overcome some environmental problems, is also limited. The maquila industry in itself produces a wide range of environmental problems that are far from being solved.

Finally, although Mexico's most polluting industrial sectors exporting to the United States market are responsible for only a small fraction of total exports and grew at a lower rate than average Mexican exports, they have kept their competitiveness in many of those high pollution markets in the US and have not lost their comparative advantage. Notwithstanding this, Mexico is far from being a "pollution haven" as normally characterized.

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Appendix

Table A-1. Industrial sectors generating highest levels of pollution*

Order According to Pollution Level (from higher to lower)	Harmonized System Classification	
1	28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare earth metals, of isotopes
2	29	Organic chemicals
3	32	Tanning or dyeing extracts; tannins and derivatives; dyes, pigments and other coloring matter; paints and other mastics; inks
4	71	Natural or cultured pearls, precious or semiprecious stones; precious metals; precious metal clads; imitation jewelry; coins
4	75	Nickel and articles thereof
4	76	Aluminum and articles thereof
4	78	Lead and articles thereof
4	79	Zinc and articles thereof
4	80	Tin and articles thereof
5	74	Copper and articles thereof
5	81	Base metals nesoi; cermets; articles thereof
6	27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes
7	39	Plastics and articles thereof
8	72	Iron and steel
9	56	Wadding, felt and nonwovens; special yarns; twine; cordage; ropes and cables and articles thereof
9	59	Impregnated, coated, covered or laminated textile fabrics; textile articles suitable for industrial use
10	48	Paper and paperboard; articles of pulp, paper or paperboard
11	31	Fertilizers
12	30	Pharmaceutical products
13	33	Essential oils and resinoids; perfumery; cosmetic or toilet preparations
13	35	Albuminoidal substances; modified starches; glues; enzymes
13	36	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations
13	38	Miscellaneous chemical products
14	15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats
15	40	Rubber and articles thereof

* Author's categorization based on Industrial Pollution Projection System (IPPS).

Discussants:

Bob Currey (Center for Environmental Resource Management, University of Texas at El Paso)

Mr. Currey said that, while it is intuitively clear that NAFTA has had an effect on increased traffic volumes, demonstrating the environmental effects of that increased traffic is difficult. To help determine environmental change, there is a need to increase environmental monitoring, especially in the border areas. However, monitoring is expensive and local communities generally end up paying for such services, since the emphasis of states' work, understandably, is on large cities. El Paso del Norte is an example of a border community that has turned the corner in terms of air quality; it is also a community with an advanced environmental monitoring system. Experience shows that increased monitoring and assessment of truck traffic is needed to determine the environmental profile of trucks, as well as regulations needed to address increased environmental stress.

Mr. Currey said the effect of transportation on water quality is another issue that requires a lot more attention. Turning to the issue of the paper trail for hazardous waste, tracking waste shipments remains a difficult problem. Moreover, there are problems related to the "temporary" storage of hazardous waste shipments at the border. More inspectors and prosecutors are needed, as well as a Mexico-US waste emergency response system to address this growing problem.

The hazardous waste and border congestion issues raised in these papers point to the need for more work on improving NAFTA trade corridors, work that addresses environmental considerations. The issue of aging infrastructure has been a long-standing challenge in the border region—much of the infrastructure in Mexico is inadequate and out-of-date.

One of the general lessons to be drawn from these papers is that NAFTA has not sufficiently addressed environmental issues and border communities are paying the price.

Deron Lovaas (Sierra Club)

There have been some welcome trends in the US transport sector since the 1990s, including the passing of the National Transportation Act, which has made progress in ensuring a transparent and accessible process in transport planning. Each day, the US spends US$200 million in making and repairing roads. Roughly 50 percent of all criteria pollutants come from cars and trucks. It has long been recognized that non-point sources of air pollution are more difficult to reduce than point sources, and that these have largely been neglected.

Roads, by virtue of their nearly ubiquitous presence in large parts of North America, have a major impact on habitats through air, water, and noise pollution. Highway production is now the number one cause of urban sprawl. Road extension does not simply meet but also induces increased demand, and changes the structure of that demand.

There is a need to diversify means of transport, including expanded use of rail, buses, bikes etc., and to limit highway construction to mitigate environmental damage. There is also a need to involve citizens and NGOs in transportation planning. While it is clear that more attention is needed in scientific monitoring and assessment of the impact of transportation on the environment, the problems are already clearly defined. What is needed is the political will to make tough decisions that change the trajectory of current planning initiatives.

Session Four Questions and Open Discussion

Some methodological problems were identified in Schatan's paper. While it may be true that most polluting industries—notably oil and chemical—are not expanding in Mexico as a result of NAFTA, there is a need to look at other industries, including industries that are not export-intensive, to determine if they are polluting more or less. While evidence from Schatan's paper suggests that Mexico has not become a pollution haven, one commentator argued that such problems do exist in the border areas of Mexico, along with a decline in the quality of life in local communities and in their ability to provide for the needs of their citizens.

This paper used the ratio of the amount of pollution generated per employee (based on the method of the World Bank) in discussing pollution coefficients. A more useful analytical technique might be the ratio of pollution generated per unit of output. For example, under the former method, a firm's environmental profile may appear to have improved if the company lays off employees and thus reduces total output or, alternatively, if it hires more employees and thus reduces the pollution/employee ratio. These questions of relative changes in pollution coefficients underline the importance of examining not only compositional changes, but also scale effects.

On the issue of transportation, it was noted that the pro-highway lobby is highly organized at the national level, whereas alternative transportation lobbies are not. The CEC has a critical role to play in helping to organize those lobbies into an equally effective voice. In the near term, there is a need to ensure that trucks have access to cleaner-burning fuels; that intermodal urban and interurban development—such as the Cascadia corridor along the West Coast—are promoted; and, over the longer term, that a shift takes place emphasizing the most efficient way of moving total volumes of freight and passengers. The Holbrooke-White paper underlines the need to address not only border congestion issues, but also longer-term transport planning and "green" transport corridors. One strategy for increasing the policy profile of environmental issues linked to transportation is to use "report cards" issued by NGOs to increase participation and public interest in the issues. However, options are being reviewed at the US federal level to change regulations governing how much data and information are disclosed to local communities through the metropolitan planning organization. Any constraints on this information would be a step in the wrong direction.

Session Five

The Services and Public Sector and the Environment

- Services Trade Liberalization: Assessing the Environmental Effects
- Will Free Trade in Electricity between Ontario/Canada and the United States Improve Air Quality?
- Improving Wastewater Infrastructure along the Arizona-Mexico Border: An Analysis of Trends and Ideas

Session Chair:

Steve Charnovitz (Wilmer, Cutler and Pickering)

Services have generally been given less attention than goods in trade talks, and environmental services less still. The Andrew paper brings experience from the Organization for Economic Cooperation and Development (OECD) and a cutting-edge summary of environmental assessment of trade services liberalization. Plagiannakos' paper provides analysis of free trade in electricity between the United States and Canada, focusing on its impact on Ontario's air quality. The author projects future environmental effects and makes recommendations for policy harmonization. The Kornylak paper addresses compliance systems for wastewater treatment along the Arizona-Mexico border, including provision of environmental services, impact of trade liberalization, enforcement of pollution laws, and opportunities for citizen participation.

As a general point, liberalized trade in environmental services can lead to improved pollution abatement services. It can be more effective than governments, which have been the traditional providers of such services. Trade in other services can have a negative impact, although it is important to examine the relative environmental profile of alternative service options—for example, surface transport compared to air transport. Generally, the impact of other services, including banking or insurance, will tend to be neutral, although it depends on how such services are used.

Services Trade Liberalization: Assessing the Environmental Effects

Dale Andrew
in collaboration with
Silvia Zucchini and Edward Falloon

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Executive Summary

Although services are not precisely defined and the relevant economic data are rather poor, the WTO Secretariat estimates that international trade in services now constitutes some one-third of total international trade. Barriers to these international flows involve a host of national regulations, licensing requirements, approval procedures, ownership conditions, etc. With the signing of the Marrakech Agreement establishing the WTO in 1994, the General Agreement on Trade in Services (GATS) established a multilateral framework under which Members make horizontal and sector-specific commitments to free up these barriers. Using a somewhat different approach, the NAFTA also set up a system of commitments for liberalizing services trade amongst the three North American members. Whilst generally recognized as a modest beginning, GATS 2000 in Geneva is now addressing a whole host of general rules and sector-specific issues to further liberalize these quickly growing streams of international trade.

Only relatively recently has analytical work begun addressing the environmental impacts of services at the national level. Services and services delivery have many characteristics which distinguish them from extractive and manufacturing industries. Such differences mean that new approaches are useful in assessing their environmental impacts—both the positive as well as the negative effects. Impacts vary greatly according to services sector but many services activities lead to air, water and soil pollution and have implications for natural resource inputs as well as the production and disposal of wastes. Given the relationship between goods and services, it is also necessary to trace the goods used in the supply and consumption of services.

Despite the significance and growth of services trade, little attention has been paid to this sector in past environmental reviews of trade liberalization agreements. For example, despite the wide-ranging provisions in NAFTA on services trade and the comprehensive nature of the Final Analytic Framework for Assessing the Environmental Effects of NAFTA, the potential environmental effects of North American services trade were not addressed explicitly.

This paper reports on work in progress in the OECD Secretariat which has been mandated by the OECD Joint Working Party on Trade and Environment to develop its 1994 *Methodologies*—sometimes considered the "grandfather" of environmental review methodologies, but which, like others, was essentially designed to address trade in goods. The Secretariat's views on such a methodology to address environmental effects of services trade liberalization (focusing on the GATS) include the need to combine past approaches. Due to the relative complexity of the GATS compared to other trade liberalization frameworks and the limited resources for such environmental reviews, it will be essential to be practical and selective. Thus a first approach might: a) build scenarios on possible degrees of liberalization under GATS 2000; b) proceed sector-by-sector due to the varying environmental effects of individual services sectors; c) stress screening of sectors according to the significance of the positive and negative environmental effects; and d) include regulatory effects assessment including attention to provisions on domestic regulations.

1 Trade in Services

1.1 Definition and Significance of Services Trade

The services sector includes a broad and diverse range of industries such as communications, transport, retailing, finance and tourism. In general they produce non-material products, although their business often includes the supply and use of goods. UNEP notes (UNEP, 1998) that there is no single international standard for defining the service industries. Indeed, there is no precise definition of services in the WTO's General Agreement on Trade in Services (GATS). Instead, Uruguay Round negotiators devised an informal classification scheme based on the UN Central Product Classification scheme. This Services Sectoral Classification List (MTN.GNS/W/120) sets out 12 service sectors and 155 sub-sectors. While this list is an informal basis for defining services, and is not binding, most countries have scheduled their commitments using this classification scheme. The general purpose of the list is to facilitate, not mandate, standardized classification of services in members' schedules of commitments. The 12 sectors appear below in Box 1:

Box 1. Services sectors used in GATS

Business Services	Communications Services
Construction and Related Engineering Services	Distribution Services
Educational Services	Environmental Services
Financial Services	Tourism and Related Travel Services
Health Related and Social Services	Transport Services
Recreational, Cultural and Sporting Services	Other Services not included elsewhere

The supply of services tends to require the simultaneous presence of the producer and consumer. Nonetheless, the technological improvements in cross-border communication have increased the viability of other means of supply. The GATS defines trade in services in terms of the following four modes of supply:

- Mode 1 - cross-border supply (e.g., cross-border legal advice by electronic means),
- Mode 2 - consumption abroad (e.g., international tourism),
- Mode 3 - commercial presence (e.g., a branch office operating in a country outside of country of ownership),
- Mode 4 - the movement of natural persons (e.g., information technology professionals working abroad).

In 1980 services made up 53% of world GDP and by 1995 this had increased to 63%. In the United States and Hong Kong, China the service sector constitutes around 80% of GDP, and in most developed countries the figure typically lies between 60% and 70%, and even in lower income developing countries services can make up more than one third of the economy. In 1997 the value of world services trade has been estimated at some US$2.2 trillion, or over a third of total world trade (Karsenty 2000). The service sector has been the fastest growing area of world trade. Between 1990 and 1998 there has been 7% per annum growth in the value of world trade in commercial services.[1] Except in Asia and Africa in 1998 during the financial crises, there has been worldwide growth throughout this period. In 1998 the EU's rate of growth for services exports was twice that of exports of goods.

[1] WTO: *Annual Report 1999 – International Trade Statistics*, Table 1.4.

1.2 Barriers to Services Trade

Assessing the barriers to services trade is considered significantly more difficult than doing the same for trade in goods (Sauvé and Stern, 2000). Barriers to services trade predominantly take the form of non-tariff barriers (NTBs), the restrictive effects of which can be difficult to determine, especially given the paucity of data on services trade. Regulations, approval procedures, requirements of levels of commercial presence, and restrictions on capital and labor movement are all examples of barriers to services trade. Restrictions to trade in services have been described as a “policy that impedes producers and consumers interacting through any of (the modes of supply)” (Warren and Findlay 2000). Therefore discretionary entry and visa requirements for workers in the computer software industry could be a barrier to services trade as it can potentially impede interaction between the supplier (software worker) and the consumer (the company that wants to hire that worker). Equally a restriction on the form a foreign company can take may be an impediment to that company’s interaction between it and its consumers (mode 3). Finally the requirement of a telecommunications firm to use the monopoly connection provider may restrict the number of potential foreign consumers for that company, thus restricting its interaction with its consumers (mode 1). A number of other examples of measures restricting trade in services appear in Box 2.

Box 2. Examples of measures affecting trade in services

Cross-border supply (GATS mode 1)

- Requirement to obtain authorization, licenses or permit in order to market and supply services.
- Requirement to use monopoly or otherwise specified network access or connection provider (including for Internet or other electronic networks); access limited by specific government regulation.
- Cross-border transfer of capital, payments and/or use of credit cards for such transactions not permitted or subject to authorization.
- Establishment of full commercial presence required; may be granted only to specified “brand-name” entities; or required in the form of local partnership.

Consumption/purchase abroad (GATS mode 2)

- Permitted only through firms with commercial presence in-country or specified “brand-name” entities or a designated local partner.
- Requirement to use a monopoly or otherwise specified network access or connection provider, including for Internet or other electronic networks.
- Transfer of capital, payments and/or use of credit cards for such transactions not permitted or subject to authorization

Physical establishment of commercial presence (GATS mode 3)

Investment approval

- Approval based on policy guidelines and overall national interest considerations but without economic needs test or local participation requirements.
- Approval of foreign investment based on economic needs test or “net national benefit.”
- Automatic approval except for specific authorization or concession requirement for foreign investment in public entities or public works, newly privatized companies or government-contracted services (can be limited to nationals), or above a certain value threshold.
- Case-by-case authorization at political level with ceilings on permitted foreign investment varying by sector or within sectors; including without clear, consistently applied criteria for approval.
- Approval required for full or majority foreign ownership, or full or majority foreign ownership not permitted, joint venture with local partner mandatory.
- Establishment of new businesses prohibited or restricted; only minority shares in existing businesses permitted. Scope of foreign business limited to specified activities, narrower than those permitted local firms.

Legal form of foreign company

- Only one legal form permitted (e.g., joint-stock company, private limited liability corporation, joint venture); incorporation required with foreign equity participation ceiling and mandatory local partnership; only sole proprietorships or partnerships permitted.

- Direct establishment of branches of foreign companies not permitted; branching permitted subject to quotas on number and/or geographic location of branches.
- Only representative office permitted (i.e., promotional work and research for head office).
- *Licensing/authorization for provision*
- Licensing and authorization granted only to companies permitted to establish, with licenses limited numerically or subject to significant limitations (e.g., on foreign equity, local staff).

Nationality/residency requirements

- Requirement that CEO, or all or more than 50% of directors, be nationals of host country.
- Requirement that local agents of foreign companies be permanent residents.
- Requirement that providers established in one part of a country have a minimum number of resident providers or agents for provision in another part of a country.
- Prior residency required to obtain operating license; residency not permitted without license.

Temporary entry/stay of service providers (GATS mode 4)

- Only certain types of personnel permitted, with time-limits and/or conditions not specified, such that these may then be arbitrarily or discriminatorily applied.
- Requirement to undertake further training or pass local exam in the host country to be recognized as professional or specialist; criteria for local recognition of experience and/or qualifications for professionals and specialists vague, non-transparently or arbitrarily applied, or discriminatory.
- Permission for intra-corporate transferees and specialists subject to labor market testing/economic needs test; non-availability of local staff decided by host authorities without input from the foreign company concerned; requirement that a set proportion of foreign staff have local understudies for training/ transfer of skills.
- Permission for intra-corporate transferees subject to performance requirements (e.g., employment creation, transfer of technology, ongoing level of investment).
- Requirement that specified, significant proportion (e.g., >70%) of staff of foreign established company be nationals of host country, regardless of experience/qualifications; numerical limitations on foreign nationals in senior positions.
- Provision of services by self-employed persons not permitted.

Restrictions on provision, transfer and processing of information/data (all modes)

- Prohibition or restrictions on transfer of specified types of data (personal, financial institutional, commercial) without specifying the policy reasons for the prohibition or permitting transfer subject to adherence to reasonable standards.
- Requirement that provision and transfer of all or specified types of information take place on designated or monopoly networks.

Source: Based on OECD Secretariat's Indicative list of barriers to trade in environmental services (Annex 5, COM/TD/ENV(00)86/FINAL).

1.3 Liberalizing Services Trade

The WTO's General Agreement on Trade in Services

A major breakthrough in the multilateral trading system occurred at the end of the Uruguay Round with the establishment of a framework for services trade liberalization, known as the General Agreement on Trade in Services (GATS). The GATS is—not unlike its counterpart for goods, the GATT, when established at the end of the 1940s—a beginning, setting out general, systemic rules as well as schedules of commitments for freeing up trade in services. It is generally acknowledged that significant liberalization was not immediately implemented under the GATS agreement.[2] Many of the positive commitments did not extend liberalization beyond the actual state of affairs, often simply reflecting the situation at the time of scheduling. Nonetheless an integral part of the Agreement were undertakings to proceed regularly to liberalize, both through the development of rules in areas not covered, such as subsidies and government procurement, and to address new sectors or broaden commitments in existing sectoral undertakings. Since the end of the Uruguay Round, for example, negotiations have taken place in basic telecommunications, financial services and maritime transport (although negotiations in the latter sector failed twice). And GATS 2000,

2 http://www1.worldbank.org/wbiep/trade/services.html#GATS

currently underway in Geneva, is an ambitious new series of talks which will address a whole range of services trade topics.

Whatever the assessment of progress to date under this legal instrument for trade liberalization, it is nonetheless the GATS which clearly provides the multilateral framework for services trade. The current hum of services talks in Geneva under GATS 2000 shows the context to be analyzed when considering the environmental effects of new multilateral services trade liberalization.

The GATS is complex. Characterization below of the Agreement will purposely be schematic to show a series of axes along which liberalization is likely to be structured. Then a series of (further) difficulties is set out which confront analysts wishing to assess the economic effects of the current liberalization efforts, before proceeding to assess the environmental effects.

First of all, *horizontal* commitments may be entered, that is concerning restrictions applying across the board to all sectors, but which are mode-specific. Thus, a country which screens all FDI according to certain criteria before it is allowed enters such a condition in its Schedule of Commitments under mode 3, commercial presence. In liberalizing, this country may decide to limit the number of conditions or drop altogether its previous requirement of screening.

Secondly, liberalization concerns *sector-specific* commitments

- By sector
- For each of the four modes of delivery
- Concerning market access and national treatment limitations

By sector: As discussed above in section I, there are twelve main sectors in GATS and over 150 sub-sectors. While this appears detailed and comprehensive, numerous issues of definition and scope arise. Firms wanting to expand their services export opportunities and countries wishing to promote competition and efficiency in their imports of infrastructure services find certain sectors either a) narrowly defined, b) dispersed amongst a host of different sub-sectors or c) practically absent from the GATS classification system. Examples include, respectively, a) environmental services; b) tourism and travel-related services; and c) energy services. Current talks in Geneva have been focusing on classification problems. This work has included examination of classification issues, including proposals for expanded classifications of environmental services; new classifications for energy services; and using a cluster approach to group commercially related sectors classified separately.

For each of the four modes of delivery: Commitments are then made individually and separately for each of the four modes of supplying services. Thus, liberalized commitments on commercial presence (mode 3) may be more commercially significant than those to allow a greater number of persons to enter the territory (mode 4). A completely free of restriction commitment is scheduled as “none.” “Unbound” means that no commitments have been made. (In addition, a GATS Member may consider that a particular mode of delivery is not technically feasible and therefore schedules this mode as “unbound.”) In many cases, particularly concerning conditions for modes 3 and 4, horizontal restrictions may apply [e.g., foreign equity limits (mode 3) or nationality-based immigration regulations (mode 4)].

Concerning market access limitations: When making commitments in a given sector and for each of the four modes, commitments are made by granting market access (MA) and national treatment (NT). Market access commitments involve reducing the limitations in one of six areas: i) increasing the number of services suppliers; ii) increasing the total value of allowed transactions; iii) increasing the total number of service operations or the total quantity of service output; iv) allowing a larger number of employees in a particular sector; v) liberalizing restrictions on the legal form of the service supplier; and vi) increasing percentage limitations on the participation of foreign capital or total value of foreign investment.

And national treatment limitations: In principle, GATS members are to grant foreign services and service suppliers treatment no less favourable than that extended to the like services and service suppliers of its own domestic services industry. A member's GATS obligations however depend significantly on what it has specifically undertaken. Members are entitled to make the extension of NT in any particular sector subject to conditions and qualifications set out in its schedule. GATS members are also only obliged to extend NT to services and service suppliers in those sectors where they have made specific commitments.

To understand the GATS approach to liberalization, it is helpful to look at a schedule of commitments, as well as those for a particular sector. (It should be recalled again that Members are not required to make commitments under every sector.) The imaginary schedule below of specific commitments for "Arcadia" prepared by the WTO Secretariat shows the interaction of both horizontal commitments and sector-specific commitments.

Tourism is a services sector for which interest for further liberalization is high in Geneva, particularly on the part of developing countries, both for deeper and broader commitments. This sector, as set out in the informal sectoral classification list, includes 4 sub-sectors. The following tables give an overview of commitments for two of the tourism sub-sectors: hotels and restaurants, and "other" tourism services. As can be seen in Tables 1 and 2, the situation is radically different concerning the current status. Table 1 shows that the tourism sub-sector covering hotels and restaurants is quite liberal ("none") for modes 2 and 3 for many countries. On the other hand, the grey shading in Table 2 indicates that no commitments were entered by most countries regarding "other" tourism services.

Arcadia—Schedule of Specific Commitments

Modes of supply:
(1) Cross-border supply (2) Consumption supply (3) Commercial presence (4) Presence of natural persons

Sector or sub-sector	Limitations on market access	Limitations on national treatment	Additional commitments
	I. Horizontal Commitments		
All sectors included in this schedule	(3) Notification and examination in accordance with Arcadia's Law on Foreign Investment 1993 (4) Unbound, other than for (a) temporary presence, as intra-corporate transferees, of essential senior executives and specialists and (b) presence for up to 90 days or representatives of a service provider to negotiate sale of services	(3) Authorization is required for acquisition of land by foreigners	
	II. Sector-Specific Commitments		
4. Distribution services C. Retailing services (CPC 631,632)	(1) Unbound (except for mail order: none) (2) None (3) Economic needs test for supermarkets over 1,500 sq. meters (4) Unbound, except as indicated in horizontal section	(l) Unbound (except for mail order: none) (2) None (3) Certain tax incentives are available only to companies controlled by Arcadian nationals (4) Unbound	

Source: WTO Secretariat.

Table 1. Restrictions in hotels and restaurants based on the schedules of commitments

	Mode 1		Mode 2		Mode 3		Mode 4	
	MA	NT	MA	NT	MA	NT	MA	NT
Argentina	None	None	None	None	None	None	UB	UB
Australia	UB*	UB*	None	None	None	None	UB	UB
Austria	UB*	UB*	None	None	None	None	UB	UB
Brazil	UB	UB	UB	UB	None	X	UB	UB
Canada	None	None	None	None	L/N/R	N/R/X	UB/N/R	UB
Chile	UB*	UB*	X	X	None	None	UB	UB
Czech Rep.	UB*	UB*	None	None	None	None	UB	UB
EC	UB*	UB*	None	None	None/A/ETN	None	UB/N	UB
Egypt	UB*	UB*	None	None	L/ENT/Eq/X	X	None	None
Finland	None	None	None	None	None	None	UB	None
Hong Kong, China	UB	UB	None	UB	None	None	UB	UB
Hungary	None	None	None	None	None	None	UB	UB
Iceland	None	None	None	None	None	L/R	None	L/R
India	UB*	UB*	UB	UB	Eq	None	UB	UB
Indonesia	None	None	None	None	None/Eq	X	UB	UB
Japan	UB*	UB*	None	None	None	X	UB	UB
Korea	UB-	UB*	None	None	None	None	UB	UB
Malaysia	UB*	UB*	None	None	Eq/JV	None	UB	UB
Mexico	UB*/None	UB*/None	None	None	L/P	None	UB	UB
Morocco	None/UB	None/UB	None	None	None	None	UB	UB
New Zealand	None	None	None	None	None	None	UB	UB
Norway	None	None	None	None	None	None	UB	UB
Philippines	UB*	UB*	None	None	Eq/X	None	X	None
Poland	UB*	UB*	None	None	None	None	UB	None
Singapore.	UB*/None	None	None	None	None	None	UB	UB
Slovak Republic	UB*	UB*	None	None	None	None	UB	UB
South Africa	UB	None	None	None	None	None	UB	UB
Sweden	UB*	None	None	None	None	None	UB	UB
Switzerland	UB*	UB*	None	None	L/ENT	R/L/Exam	UB/CP	UB/CP/L/N
Thailand	UB	UB	None	None	None/X	None/Eq	UB	None
Turkey	UB*	None	None	None	None	None	P/X	None
USA	None	None	None	None	None	None	UB	UB

Note: A: Authorization; CP: Commercial Presence; Eq: Equity Limitations; Establish: Establishment required; ENT: Economic Needs Tests; Exam: Examination required; JV: Joint Venture; L: License; Local incorp.: Local incorporation required; N: Nationality Requirement; None: No restriction; P: Permit; R: Residency Requirement; UB: Unbound; UB*: Unbound due to the lack of feasibility; X: Other limitations

Source: "Assessing Barriers to Trade in Services: Tourism Services," OECD document TD/TC/WP(2000)10/FINAL.

Despite general guidelines on scheduling of commitments to liberalize individual sectors, a number of qualifications and provisos apply:

With respect to the precise *scope of the sector*:

- As already noted there is also no consistent system of references to service sectors used in scheduling services commitments (compared, say, to the role played by the Harmonised System in tariffs for goods) although many WTO members used the definitions contained in the Classification List. While some members referred to the UN Central Product Classification ("Provisional CPC," referenced in W/120), others did not.
- The "bottom up," or positive listing approach to GATS scheduling means that countries only schedule sectors in which they are making commitments, and thus in the schedules for many countries, certain sectors are omitted altogether. It is not possible to know what measures may exist in these sectors, or indeed for any new services not covered at the time of the negotiations.

Table 2. Restrictions in *"other services"* related to travel and tourism services based on the schedules of commitments

	Mode 1		Mode 2		Mode 3		Mode 4	
	MA	NT	MA	NT	MA	NT	MA	NT
Argentina	None	None	None	None	None	None	UB	UB
Australia								
Austria								
Brazil								
Canada								
Chile								
Czech Rep.								
EC								
Egypt	None/UB	None/UB	None	None	None/ENT	None/X	None/UB	None/UB
Finland								
Hong Kong, China								
Hungary								
Iceland								
India								
Indonesia	None	None	None	None	Eq	X	UB	UB
Japan								
Korea								
Malaysia								
Mexico								
Morocco	UB	UB	None	None	None	None	UB	UB
New Zealand								
Norway								
Philippines								
Poland								
Singapore.								
Slovak Republic								
South Africa								
Sweden								
Switzerland								
Thailand	UB	UB	None	None	X	Eq	UB	None
Turkey								
USA	None	None	None	None	None	None	UB	None

Note: A: Authorization; CP: Commercial Presence; Eq: Equity Limitations; Establish: Establishment required; ETN: Economic Needs Tests; Exam: Examination required; L: License; Local incorp.: Local incorporation required; N: Nationality Requirement; None: No restriction; P: Permit; R: Residency Requirement; UB: Unbound; UB*: Unbound due to the lack of feasibility; X: Other limitations

Grey shading indicates no commitments.

Source: "Assessing Barriers to Trade in Services: Tourism Services," OECD document TD/TC/WP(2000)10/FINAL.

With respect to the scheduling of market access and national treatment limitations:

- Measures that are inconsistent with both Market Access and National Treatment need only be scheduled under the Market Access column (GATS Article XX.2). It is thus not always possible to tell from looking at a schedule whether a particular measure is a discriminatory or non-discriminatory limitation on market access. This scheduling convention notwithstanding, some members have scheduled measures under both the Market Access and National Treatment columns.

With respect to the potential importance of *domestic regulations*:

- Schedules do not include all measures relating to the sector. The GATS only requires measures restricting market access and national treatment (see GATS Articles XVI and XVII respectively) to be scheduled. While some members have chosen to include other measures, including those that may fall under Article VI (*domestic regulations*), others have not.

- As many services barriers take the form of domestic regulations, it is not easy to assess their trade restrictive effects. Similarly, given the acknowledged right of governments to regulate and the various objectives which they may be pursuing, it is not always easy to reach agreement on the degree to which a particular measure affecting trade in services is an "unnecessary" barrier to trade.

With respect to the overall picture from the GATS schedules of restrictiveness:

- Members may make no commitments with regard to an aspect of a particular sector (e.g., national treatment with regard to architecture services) and will thus schedule the sector as "unbound." While this leaves the country in question with total flexibility to impose new measures, it does not necessarily indicate that the existing regime is restrictive. Thus schedules may not give an accurate snapshot of prevailing restrictiveness.
- Schedules refer to guaranteed minimum treatment, but do not prevent better, or more liberal treatment. Considerable unilateral liberalization has been undertaken since the Uruguay Round and 1994 GATS schedules may therefore not reflect the current situation in the market.

The NAFTA Approach to Liberalizing Services Trade

The North American Free Trade Agreement, completed in 1992, can be considered a "GATS- plus" agreement since it is the most comprehensive package of services trade liberalization achieved in an international negotiation (Stephenson 1999). The principles governing liberalization of services trade in NAFTA are MFN, national treatment and transparency. These principles are guaranteed to foreign service providers of NAFTA parties through freedom for cross-border trade and establishment of trade. Moreover, the agreement presents a more coherent treatment of investment in relation to services, the inclusion of more liberalized rules on government procurement, sector-specific rules on trade liberalization for financial services, telecommunications and transportation services.

Like the GATS, NAFTA is universal in its sectoral coverage. However, unlike the GATS, NAFTA takes a negative list or "top-down" approach to the liberalization of trade in services and investment. This is to say that exceptions and reservations for all sectors are to be specified in attached lists. All parties have to list all-non conforming measures within prescribed time limits. Failure to list non-conforming measures within these time spans entails their automatic liberalization. One of the consequences of NAFTA's negative list approach is that a set of annexes concerning reservations and exceptions to the general disciplines must be produced since non-conforming measures are not allowed. A major benefit is a higher level of transparency for both users and government negotiators. The negative list approach also represents a useful tool for domestic regulatory reform since it helps national bureaucrats to focus on the effective need for trade-restrictive regulations that their country has in place.

But NAFTA, as much as GATS, does not manage to guarantee the full liberalization of trade in services. In contrast to GATS, this "negative list" approach provides extensive and more transparent information on existing barriers to trade, the so-called non-conforming measures, increasing the stability of rules and provisions for services activities. In general, however it can be remarked that the distinction between these two "positive and negative list" approaches blurs if the length of the list of exemptions taken out by members of a NAFTA-type agreement coincides with the number of sectors not included in a GATS-type agreement. Furthermore, there is no commitment under NAFTA, as there is in GATS, to successive rounds aimed at achieving a progressively higher level of liberalization.

2 Environmental Effects of Services and Services Delivery

2.1 Characteristics of Services and Services Delivery

To understand the environmental effects of services, it is helpful to identify what differentiates the production and consumption of services from the production and consumption of goods. Goods are tangible, visible, and before or after supply can be stored. In general services are invisible or intangible, cannot be stored, require the close proximity of the supplier to the consumer, and have simultaneous production and consumption. Nonetheless there are exceptions to some of these definitions. Blueprints or information on computer disks can be stored, and the supply of medical advice on the net does not require either proximity or simultaneity. In addition the description of services as invisibles and intangibles, which aptly describes the service received, does not acknowledge the accompanying use of goods to supply such "invisible."

There are a number of characteristics of service producers that are important. The suppliers of services are often small producers such as restaurants, retail outlets, and accommodation providers. Exceptions to this include large companies in retail, finance and the food industry (yet with many small outlets). Because of the large number of small producers, there can be also a lack of capitalization and long-term planning in the service sector. In addition the service sector often lacks the environmental expertise that may be found in manufacturing companies engineering or science divisions. The means of production in services is often the employees themselves, and therefore a firm's environmental performance hinges on employees' awareness of the environmental effects of their actions. (The environmental awareness of the tourist guide is usually key to the impact of the tourists on the environment they visit.) Finally the boundary between services and goods is often indistinct because production and sales of goods can involve a number of services.

Box 3. Some characteristics of services and services delivery (tending to differentiate them from goods)

- "Intangibles" or "invisibles" and thus inability to store them
- Simultaneous physical presence of producer and consumer and therefore necessity for close proximity of supplier
- Diffuse sources and often small producers, (although with some notable exceptions such as retail chains, telecommunications companies)
- General lack of environmental expertise in firms, unlike in many manufacturing companies
- Use of goods in the delivery of services, but no actual production of the goods
- Lower capitalization in general (with exceptions).
- Personnel-based production

2.2 Identifying the Services/Environment Nexus

The past perception that the production and consumption of services do not have the potential for environmental harm is increasingly being called into question. In searching the literature three approaches to assessing potential effects were found. Note that these approaches also point to the often positive environmental effects of services in the national economy.

- large impact per facility and cumulative impacts from non-point sources
- direct and indirect effects
- upstream and downstream effects

Large impact per facility and cumulative impacts from non-point sources

James Salzman in his paper “Beyond the Smokestack: Environmental Protection in the Service Economy,” (Salzman 1999) examines the type of impacts that the service sector can have on the environment. One of the main distinctions that he advocates is between *direct* impacts per facility and *cumulative* impacts on the environment. He dubs services that have a sizeable and direct effect on the environment *smokestack* services. This includes such services as air transport, road transport and hospitals. These services are characterized by their easily identifiable and acknowledged effect on air pollution and waste levels. In the case of hospitals, their physical size means there is a noticeable and often regulated environmental impact.

Salzman makes a further distinction about services industries that points towards potential significant environmental impacts. Although an individual service supplier’s impact may be negligible, collectively these providers may have a substantial environmental impact. These services have a *cumulative direct* environmental impact. For example, a large number of automobile service stations in an area may have a major impact on the ground water supplies of that area. Although their individual effect from storage tank leaks and spills of oils, solvents and other hazardous substances is minor, their combined effect has brought them to the notice of regulators. In San Francisco, a high level of silver content in the bay was traced to the disposal of silver waste from dentists’ offices. Yet the individual disposal level of the silver bearing x-ray solution fixer was minimal. The seemingly minor effects of many industries in the service sector may have to be taken into account in a country’s environmental policy. The distinction between cumulative effects and direct impacts per facility draws to attention the far-reaching potential for significant environmental impacts from the service sector. Table 3 below illustrates these distinctions.

Direct and indirect effects

The services sector in the domestic economy has also been analyzed according to direct or indirect effects it has on the environment. Indirect effects result from the provision of professional services, such as consultancy, architecture and engineering. A recent investigation by UNEP produced the following useful overview of potential impacts.

An important premise is that the environmental effects of the service sector must be examined throughout the life cycle of the provision of a service. Therefore the long-term and short-term effects of the provision of a service must be included in our assessment. Thus in tourism the long-term effects such as soil erosion from the use of national parks should also be taken into account.

Secondly, it is suggested that both direct and indirect effects should be assessed. For services such as engineering, consulting and banking, although they only supply knowledge, finance or both, this supply facilitates further action by the consumer. Any effect on the environment of the action by the consumer of the service may be an indirect effect of the supply of the service. A building designed to have minimal environmental effects from its use over its entire lifetime, is a positive, long-term and indirect effect of the service provided by the architect.[3] The environmental impact of service sector inputs in the manufacture of goods can be assessed using the indirect effects methodology. To have an accurate picture of the environmental impact of the services sector, both direct and indirect environmental effects must be taken into account. There is of course a limit to the extent that indirect and long-term effects are relevant, but this can be worked out with common sense, and should not be an argument for disregarding these effects altogether.

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[3] The Norwegian Green in Practice program (GRIP) has brought out a manual on eco-effective building construction with the aim of improving knowledge of environmental building practices. See: *Industry and Environment,* UNEP, July-September, 1998, p. 11.

Table 3. “Smokestack” and Cumulative Services

Direct Environmental Impact Facility	Cumulative Environmental Impact: Low	Cumulative Environmental Impact: High
High		**Smokestack Services** Electric Utilities Courier Services Airlines Hospitals
Low	Business Services Insurance Financial Services Retail Sales Law Firms	**Cumulative Services** Auto Service Stations Fast Food Chains Dry Cleaners Dentist Offices Hotels

Source: Salzman (1999).

“Upstream” and “Downstream” Environmental Impacts

A third approach for assessing environmental effects arising in the provision of services in the national economy are “upstream” and “downstream” effects. In brief, these are the effects that service providers can have on their customers’ or suppliers’ environmental practices using their market position.

Since late 1999, Resources for the Future (RFF), has published three papers on the environmental implications of health care, foodservice and food retailing and tourism services. Part of a comprehensive study, these papers aim at better understanding how sensitive service sector activities impact on the environment, so that adequate management strategies can be implemented. For this purpose, RFF elaborates a methodology that identifies three different types of influences: direct impacts, upstream impacts and downstream impacts.

While direct impacts are the most straightforward, the other two categories appear to be more intriguing and valuable from the policy-maker point of view. According to the RFF definition, “upstream impacts are those resulting from the service provider’s influence over its suppliers’ products specifications or environmental performance” while “downstream impacts [are the outcome of] the service provider influences on its customers’ behavioral or consumption patterns” (Davies and Lowe 1999). The basic insight behind this framework of analysis is that certain services’ economic leverage can be exploited to improve suppliers’ and customers’ environmental behavior.[4]

In the paper on the *health care* service sector, Davies and Lowe analyze one of the largest US industries and its possible impacts on environmental quality. Many functions performed in this industry are similar to those found in other sectors, from transportation, to facility cleaning, passing through photo processing. Yet, others are unique to the health care sector such as infection waste generation and disposal; medical waste incineration; dental filling; x-ray diagnosis; mercury usage etc.

For example, mercury, which contributes to the built-up of hazardous wastes and of polluting emissions is contained in a variety of medical products (dental fillings, thermometers, blood-pressure units, saline solutions, thermostats, etc.) and is regularly discharged in wastewater. According to the RFF study, the strategic role played by the health care operators in this sectors can be utilized by the policy makers to exert a certain leverage on this industry’s supply chain so that

[4] For a similar concept, that of leverage services, see Salzman (1999).

non-mercury based alternatives are made available and more friendly environmental management initiatives are implemented.

In another study, Davies and co-author Konisky (2000), apply the conceptual framework previously elaborated, to discover that the *food service and food retail industries* can also exert a large influence on suppliers' and consumers' behavior due to their fundamental role in the food marketing system. Being the gatekeepers between producers and consumers, these two industries are in a strong position to "green" the supply chain, signaling government or customer environmental preferences to suppliers. Likewise, the intermediary position of foodservice and food retail companies provides similar opportunities to influence downstream environmental performance. Either offering environmentally friendly products to consumers or providing information about the environmental implications of their purchasing decisions, operators can help customers to improve their environmental record.

Food and food retail services are responsible for several negative environmental impacts such as energy consumption (the average foodservice building used 122.8 thousand Btu per square foot in 1995 compared with an average of 45.7 thousand for other commercial buildings), solid waste generation (21.9 million tons of food waste in 1997 and packaging materials), air emissions (CFCs), water polluting emissions and food-borne diseases. Food waste and packaging constitute alone the bulk of overall municipal solid waste.

In the most recent working paper presented by RFF, Terry Davis and Sarah Cahill apply the conceptual framework utilized in the previous analyses also to the *tourism industry*. In this sector, opportunity for a more environmentally responsible action is considerable. The supply chain in the tourism industry is composed of those industries that provide accommodation, transportation, and make arrangements for travelers. Thus, all of them can play an important role in reducing the degree of environmental impact of tourism. For instance, the lodging industry can require its suppliers to provide products that minimize environmental exploitation. Or, similarly, travel sector providers can supply consumers with information on possible environmental impacts of their actions and options to ameliorate natural resource use (i.e., hotels can give guests the option not to have their linen washed daily).

Tourism accounts for several direct environmental impacts such as resource use, pollution and waste outputs, habitat and ecosystem alteration and fragmentation, impacts on wildlife, cultural impacts and impacts on gateways communities. Tourism has also a cumulative impact. In fact, nutrients leaching from the septic system of a tourist's resort are very likely, in the long run, to accelerate eutrophication and ecosystem disruptions.

The methodology elaborated by RFF on "upstream" and "downstream" environmental impacts represents a further step towards a better understanding of the consequences of human actions on natural resources. It also provides, at the same time, a tool to assess how to take advantage of certain sectors' characteristics in order to improve national environmental regulatory action and policy-making.

2.3 Goods used and supplied with Services

Tracing the effects of the goods used in the supply and consumption of services in all of the above approaches is key for a full understanding of the environmental impact of the service sector. When looking at the direct or downstream effects of a service, its impact is often due to the environmental effect of the material consumption in relation to that direct or downstream effect. The service itself is in general intangible, and thus its direct environmental impact is measured by the effect it has on the consumption of materials (Table 4). The three approaches to assessing the environmental impact of domestic services facilitate the examination of the positive as well as negative environmental impacts of the material inputs and outputs of a service. A simple example is the reduction in overall waste through the use of rapidly biodegradable product wrapping in food retail. In this example the technology used to improve the wrapping was an input to the service, and the waste generated was an output of the service. The three approaches and this final point provide a framework for assessing the environmental effect of services in an economy. They also indicate that this large and increasing sector of the economy has a range of significant environmental impacts.

Table 4. Potential (negative and positive) environmental impacts of service industries

Service sector	Potential impacts
Retail sales and distribution	Emissions from transportation
Food, consumer goods	Impacts from ultimate disposal of goods purchased
	Potential to influence consumer behavior—negative impacts from increased consumerism, positive impacts from meeting and contributing to demand for sustainably-produced goods
Vehicle service and repair	Use and disposal of hazardous products
	Air emissions from vehicle fuelling and painting
	Contamination from leaking fuel tanks
Hotels, restaurants and food service	Food and packaging waste
	Impacts from energy and water use
Consulting	Indirect impacts through influence on client behavior
Facilities/building services	Use and disposal of hazardous products
	Positive impacts of recycling programs
Dry cleaning	Use and disposal of hazardous products
	Air emissions from cleaning chemicals
	Contamination from leaks of cleaning chemicals
Photo processing	Use and disposal of hazardous products
	Waste disposal impacts - film and disposable cameras
Consulting engineering	Technology choice with subsequent impacts from construction and operation
Tourism	Direct impacts on local environment from construction and operation of facilities
	Use and disposal of hazardous products for cleaning and maintenance
	Impacts from water, energy and resource use
	Indirect impacts through influence on client behavior
Transportation	Impacts from infrastructure requirements—roads, service centers
	Use of gasoline and hazardous substances for vehicle operation and maintenance
	Air emissions from vehicles
	Noise and visual pollution
Health care	Use and disposal of hazardous materials, medical and biological waste, radioactive materials from sources such as:
	Transportation, Food Services
	Laundries, Facility Cleaning, Photographic Processing
Environmental services	Soil, water and air pollution from waste disposal sites
(waste and water treatment, recycling)	Energy use for waste and water treatment
	Potential positive impacts from increased recycling and improved management of wastes
Financial services	Indirect impacts through influence on client behavior
Other—entertainment, advertising, accounting, computer services, communication, utilities	Use and disposal of hazardous products
	Impacts from energy and resource use
	Indirect impacts through influence on client behavior
	Waste disposal impacts

Source: UNEP (1998), Table 4, p. 7.

3 Assessing Environmental Effects of Services Trade Liberalization

3.1 Methodologies used in Past Reviews

OECD 1994 Methodologies

In its 1994 *Methodologies*,[5] the OECD Joint Session of Trade and Environment Experts developed a combination of two approaches for governments to use to evaluate the effects of trade liberalization (focusing on goods trade). The first approach considers the changes in output resulting from the phasing out of tariff barriers on goods and thus, their eventual impacts on the use, *inter alia,* of natural resources. The second approach has a more legal cut in the sense that it sheds light on the changes in national laws and regulations following trade liberalization.

Analyzing in more detail the OECD *Methodologies*, the first approach involves examining four different categories of economic impact of (goods) trade liberalization:

- Scale effects
- Structural effects
- Products effects
- Technology effects

Scale effects are triggered at the macro-economic level by the reduction of tariffs on tradable goods. As trade liberalization impacts on the level of economic activity, this in turn affects the use of environmental resources. On the positive side, higher levels of economic growth and higher disposable revenues will allow more resources to be devoted to address environmental concerns. However, augmented trade may also contribute to exacerbate environmental pressure since more growth means more consumption and more production, and thus more pollution. This vicious circle is perpetuated especially in the case of incorrect pricing of scarce environmental resources. In fact, when environmental costs are not internalized correctly, trade-induced economic growth tends to aggravate inefficient patterns of production and consumption.

Structural effects are associated with changes in the composition of economic activity. Therefore, they are more indirect and micro-economic effects, basically related to modification of processes of production stemming from the reduction in tariff barriers. Positive structural effects may result when liberalization improves the allocation of resources and the efficiency of production and consumption. The economic rationale behind this idea is the classic concept of "comparative advantage." In the context of the use of natural resources, this means that each country should be better off specializing in the production of those goods that are intensive in its natural endowment.

However, this simplified explanation overlooks some of the major peculiarities that characterize natural resources. If the environment is, indeed, to be considered as a factor of production like labor and capital, it is, however, not easy to price given the non-monetary values such as bio-diversity loss, soil loss and other irreversible effects that should enter the equation to provide full cost internalization. In general, environmental externalities exist since markets do not reflect totally the real value of environmental resources. Given the difficulty in attaching a monetary value to non-tangible environmental assets, Pareto-efficiency is rarely attained.

Product effects relate to the diffusion of environmentally sound, or hazardous, goods as a result of trade liberalization, since the reduction in trade barriers is likely to be associated with increased exchanges of specific products that can harm or enhance the environment. Positive product effects

[5] "Environmental Reviews of Trade Policies and Agreements," was the first half of the OECD document entitled, "Methodologies for Environmental and Trade Reviews." The entire document may be found at http://www.oecd.org/env/online-eco.htm.

may result from the diffusion of environmentally sound products, while negative product effects may result from augmented trade in environmentally sensitive/harmful products.

Technology effects will be triggered by the liberalization process as it impacts on production processes due to technology transfer. Positive technological effects can occur when trade liberalization facilitates the distribution of environmentally friendly technologies, which results in a reduction of pollution per unit of economic output. In contrast, negative technological effects will occur in case trade liberalization is conducive to the diffusion of harmful technologies.

The second general approach from the OECD Methodologies involves a legal rather than economic analysis. *Regulatory* effects result from the impact of trade liberalization on national environmental policies and standards. On the one hand, positive regulatory effects occur when trade measures do not impinge upon the ability of governments to implement effective environmental policies. In addition, openness can have an educative effect and lead to upwards harmonization of environmental regulations. On the other hand, negative regulatory effects occur in case harmonization provisions of trade agreement neutralize governments' ability to set environmental protection standards.

While in many respects the "grandfather" of environmental review methodologies, the OECD 1994 *Methodologies* is not the only framework of assessment for environmental effects of trade liberalization. In fact, a recent review by the CEC written for the 1999 OECD methodologies workshop on environmental assessments of trade liberalization agreements (OECD 1999) established a typology of five approaches used in past environmental reviews of goods trade liberalization. These are: 1) identifying and responding to public concerns; 2) responding to trade-environment hypotheses; 3) linking economic data with environmental outcomes; 4) examining the impact of economic sector-specific changes on environmental effects; and 5) assessing environmental media effects.

Public Concerns

Governments pursue the phasing out of trade barriers to promote growth through openness and, thus increased welfare. But governments recognize, as well, that economic growth alone does not always lead to equitable and sustainable outcomes. Thus, it is appropriate that governments commit themselves to mitigate negative effects of economic growth.

It is perhaps inevitable that the potential negative impacts of liberalization raise public concern. And, in the past, these concerns have represented one of the fundamental justifications for carrying out environmental reviews. For example, as for past trade rounds, public opinion and NGOs have more recently expressed fears that trade liberalization for services might neutralize domestic regulatory sovereignty and independence.

More specific to what GATS regulation defines as mode 3 (services rendered by a service provider of one member through commercial presence inside another member's territory), is the fear that Foreign Direct Investment (FDI) might have, in general, negative implications on the environment, and, in particular, will neutralize the national ability to implement environmental regulation. In fact, among the other forms of cross-border capital flows, FDI is the one that is often perceived as having the closest link to the environment. Since FDI often flows into facilities such as power stations, mines and plants, it raises concerns related to issues of pollution control, ecological protection, efficient resource exploitation and public health issues.

At the same time as addressing fears about effects of FDI on the environment, reviews offer the opportunity for governments to point out numerous cases of investment bringing clean technology and resource-saving management techniques (e.g., clean coal investments in China). FDI of course is, as domestic investment, subject to government regulations, including environmental standards.

Trade-Environment Hypotheses

The second strain of thought that has driven environmental reviews in the past is the one that identifies hypotheses about the relationships between trade and environment. Among the most famous presumptions that have been investigated using econometric analysis are the Environmental Kuznets Curve (EKC) and the migration of dirty industry (or pollution haven hypothesis). Even if both have a certain appeal, current research has not found much empirical evidence to support them. As far as the EKC is concerned, not only is there no unanimity on the approximate level of income at which pollution should stabilize and start declining, but also it has been shown that for some industrial global pollutants its inverted U-shaped relationship does not apply.

Similarly, for the migration of dirty industry, according to which reduced trade barriers will result in specialization by developing countries in pollution-intensive industries, evidence is scarce as well. If fact, if industrial relocation has to be triggered by less stringent environmental standards, several empirical studies (Ingo Walter 1973, Robison 1988, Tobey 1990, etc.) have shown that environmental control costs, thus costs of compliance, are so small as to hardly ever cause industries to relocate.

Linking Economic Data and Environmental Outcomes

The third approach on which past environmental reviews have been based is that characterized by the effort of bridging trade theory and economic models with environmental models and indicators. These efforts correspond closely to the OECD *Methodologies* described above which break down economic changes into components of scale effects and structural and technology effects. Even in the case of goods trade, where data are good, it has proved challenging to model environmental impacts following the liberalization process. Thus, given that the quality of the data on services trade is significantly worse than for goods trade, economic models are unlikely to predict meaningful environmental impacts.

Sector Approach

A fourth methodological approach employed in past governmental reviews is the one linking changes in specific economic sectors to changes in environmental indicators. From a theoretical point of view this type of exercise appears flawed since it lacks a more comprehensive perspective. However, in the case of services trade, a sector-specific analysis to investigate environmental impacts of liberalization seems to be particularly appropriate. Different services, in fact, impact very differently on the environment. While some services appear to have relatively small indirect impacts environmentally friendly (business services, law firms, consultants), some others, the so-called "smokestack services" (electric utilities, express delivery, hospitals) are characterized by the production of significant quantities of pollutants and hazardous waste. Moreover, once taking into account the limited resources available for environmental reviews, it seems more plausible to focus on those sectors that at the screening level appear likely to have important impacts on the environment. Through a screening process of individual services sectors, it should also be possible to identify sectors with potential positive effects, such as environmental services.

Environmental Media

The last methodological approach consists of analyzing the effects of trade on environmental media. Such reviews try to provide evidence of the effects of liberalization on environmental media such as water, land, air and bio-diversity. However, as with all previous approaches, this one has its weaknesses. Inevitably a sector-specific analysis focusing on the effects of trade-induced changes on each environmental medium has the major shortcoming of missing changes across sectors.

Final Analytic Framework for Assessing the Environmental Effects of NAFTA

From the very start of the NAFTA, environmental concerns have been at the forefront of the public policy debate. Opponents of the agreement have recurrently claimed that further trade liberalization, especially between Mexico and the United States, would result in significant environmental degradation. Among the major anxieties that have characterized the negotiations and the political climate thereafter were the possibility of a regulatory "race to the bottom," the migration of dirty industries to Mexico and the consequent creation of pollution havens.

In order to address these concerns, the Commission for Environmental Cooperation (CEC) (set up under the North American Agreement on Environmental Co-operation) assembled a NAFTA Effects Project Team to assist in designing a methodology to fulfil its mandate of considering on an ongoing basis the environmental effects of NAFTA. After four years, the North American experts produced the *Analytic Framework for Assessing the Environmental Effects of NAFTA*.[6] In addition, three detailed issue studies were produced in 1999 on maize in Mexico, cattle feedlots in the US and Canada and electricity in all three NAFTA members (CEC 1999b). Over 130 pages in length, the *Analytic Framework* provides a comprehensive methodology addressing economic, social and government policy linkages to environmental effects. Although the importance of both trade in services as well as trade in goods is referred to, there is little specific consideration of possible environmental effects arising from NAFTA-induced changes in services trade.

On the other hand, there is considerable attention devoted to transborder investment flows.[7] The *Analytic Framework* states that six factors are of importance in exploring NAFTA-associated changes in transborder investment with a view to tracing their environmental effects:

- Regional concentration of investment,
- Sectoral investment shifts, migration and subsidies,
- Technology transfer and diffusion,
- Intracorporate integration in production,
- Corporate concentration and
- Foreign portfolio investment.

The *Analytic Framework's* more complete discussion of these six central variables for Transborder investment flows appears in the Annex appended to this paper.

Due to the importance of NAFTA as an investment agreement as well as a trade agreement, it is understandable that the NAFTA Effects project focused on all investment flows—e.g., in extractive industries and manufacturing, as well as services, and not only FDI but portfolio investment flows. This fact—together with the different approach to liberalizing services trade adopted in NAFTA—probably makes the methodology of more limited use when addressing multilateral services trade liberalization. As some 60% of FDI that takes place in NAFTA is now in services and as services trade is liberalized further, it is for consideration whether the CEC may wish to study more directly the relationship of NAFTA-induced services trade and environmental quality.

6 CEC 1999a. Available on the CEC's web site: <http://www..cec.org>.

7 Overall, it was found that *"the available evidence from NAFTA's first few years in operation suggests that NAFTA-associated investment has not had a negative effect on environmental quality overall, and may well have led to environmentally-enhancing impacts in several ways. Such a portrait is sustained by a more detailed examination of investment trends in North America in recent years"* (CEC 1999a).

3.2 Lessons from Past Reviews for Services Trade Liberalization

After having briefly surveyed the different methodologies used in past environmental reviews to assess trade liberalization in goods, what are the lessons for services trade liberalization? Taking into consideration the previous approaches, it seems compelling to re-group them into three categories that might offer potential for assessing environmental effects of services trade:

- Linking economic changes and environmental indicators
- Addressing public concerns
- Sector by sector approach

Linking Economic Changes and Environmental Indicators

Being able to explore the links between economic output changes and variations in environmental indicators remains, among others, an appealing approach conceptually. The economic literature has more than once tried to decompose the environmental effects of changes in macro-economic conditions. For example, modeling the economy-wide effects of freeing up such measures has only recently been developed. Dean (1999), in a recent publication edited by the World Bank, provides an econometric analysis testing the impact of trade liberalization on the environment. She points out that since freer trade raises income, it directly contributes to increasing levels of pollution. But, at the same time, another mechanism is triggered provoking opposite effects. If the environmental Kuznets curve applies, once a country has reached a certain level of wealth, higher levels of incomes will also raise the demand for a cleaner environment.

Behind the simple causality of this mechanism, according to which freer services trade leads to more consumption and more production and thus, augmented pollution levels, reality is complicated by opposing effects. Therefore, especially in the case of services, where data is poor, the relative restrictiveness of various measures affecting services trade is not well understood and this approach seems unlikely to be effective. If the idea of linking changes in economic output with variations in environmental indicators cannot be totally dismissed, its applicability to services trade appears limited until these data and econometrics issues have been advanced.

Addressing Public Concerns

Given the distinctive nature of services including the role of domestic regulations, addressing public concerns becomes a serious candidate for approaching environmental reviews for services trade liberalization.

Public concern about services trade liberalization—to the extent certain environmental groups have focused on it—appears to center around possible effects on environmental regulation, national standards and environmental measures. Thus, a possible option of governments would be to assess the possible regulatory effects of services trade liberalization in order to address serious concerns regarding the effectiveness of existing environmental regulation and the freedom to introduce new environmental regulation in the future.

In the current debate on trade liberalization, in general, the fear of a possible "regulatory chill" dictated by rules negotiated at the international level is a recurring one. Most of all the threat seems to be that of experiencing negative regulatory effect whereby services trade liberalization impedes national environmental protection laws. With special reference to GATS mode of supply 3 (commercial presence of foreign supplier in the territory of another WTO member), some NGOs have pointed out how multinational corporations might be tempted to take advantage of more liberalized trade to shield themselves from environmental regulation of recipient countries. GATS recognizes that Governments have a right to regulate as they see fit. Other WTO Agreements (TBT and SPS) also endorse regulatory sovereignty and deal largely with the process and not the substance of regulation.

Generally speaking, FDI plays the role of a strong engine in world economic development and has been making significant contributions to the sustainable development of the host countries. However, FDI continues to be targeted by some environmental groups that point to negative impacts of liberalization of FDI. In a recent study, WWF claims that FDI liberalization in presence of externalities, such as the incorrect pricing of natural and exhaustible resources, can contribute to environmental degradation. WWF, also, underscores that in the sheer competition to attract FDI, countries that grant structural subsidies, through guarantees and aid flows, may distort international investment towards resource-intensive long-run projects. WWF fears also that competition for FDI may also depress the evolution of environmental standards. In fact, even if the most dreaded scenario of a “race to the bottom” does not apply, States, for fear of losing potential investors and experience competitiveness losses may be stuck in a “regulatory chill,” not implementing or enforcing optimum-level environmental standards.

Despite the fear that FDI may exacerbate negative pressures on environmental resources, environmental reviews focusing on such concerns offer the opportunity to stress the pivotal role in the improvement of recipient economies and their physical environment. Whenever investments help to establish links with the domestic economy, FDI can be a development propeller and positive direct gains for the environment. Among others improvements, FDI can transfer cleaner technologies, as well as technical know-how and managerial expertise. Also, instead of triggering a race-to-the-bottom in environmental standards, FDI, by improving communication, practices and awareness can lead to upward convergence of environmental regulation and practice. To accompany the development needs for FDI in developing countries, the World Bank, regional development banks and other donors extend significant technical assistance to develop their environment regulatory capacity. In addressing public concerns, both the positive as well as the negative aspects of FDI will need to be evaluated.

Sector by Sector

The third broad category of approaches used in past reviews holding promise for carrying out an environmental assessment of services trade liberalization is a sector by sector analysis. If the shortcoming of such a methodology is that it does not grasp the complexity of an economy-wide approach, its merits are various. First of all, environmental assessments are not cheap exercises. Therefore, given the limited resources granted by governments for this purpose, it becomes imperative to identify those sectors whose environmental impacts are likely and significant. Second, the panoply of different sectors has to be taken into account that make up services. Some of them such as legal consulting, financial services or insurance, for instance, appear to be relatively environmentally benign. While some others, such as parcel delivery and transportation services, tourism and energy-related services *a priori* produce discharges and emissions tantamount to those resulting from goods trade. The question becomes whether more trade in such services, following liberalization, would tend to increase such negative effects or, through structural and technology effects, lead to an improved environment.

At this stage, it seems appropriate to mention two specific-sector assessments in process. WWF, in a recent draft study (WWF 2001), presents a framework for assessment of environmental and social effects of trade liberalization in the tourism sector. This study is broader in scope than other environmental reviews as it undertakes a sustainability assessment, i.e., it also reviews social effects of tourism liberalization. The main objective of the WWF study is, indeed, to examine and clarify the linkages between trade, environment and development. In the context of on-going WTO services negotiations, WWF considers it fundamental to shed lights on the potential implications of liberalizing the tourism sector.

The liberalization-induced changes in the provision of tourism services are likely to produce extensive environmental and social impacts in the country of destination. First of all this is due to the fact that this sector is booming, accounting for the most rapidly growing service industry. Second, it is the largest creator of jobs. Finally, and even more important from an environmental point of view, the tourism industry prospers thanks to the exploitation of natural assets. Thus, the need for physical infrastructure, the indispensable role of (quality) foreign investments and the necessity of managing waste and discharges adequately, make this sector an important one to show how environmental and social impacts can support or impede sustainable development.

3.3 Techniques in Methodologies Currently under Development

Screening

Apart from the various assessment methodologies that have been exposed above, it is also common, especially in recent environmental reviews to utilize a further technique called screening. Screening is used, in the initial part of the environmental review, with a similar intent to reduce the extent of the assessment. It aims at identifying and separating out those parts of the liberalization agreement which are more likely than others to produce environmental effects, such as pollution and resource degradation.

Screening was already part of the 1994 OECD *Methodologies* for environmental review of goods trade liberalization agreements. According to the OECD indications, countries interested in reviewing trade policies with potentially significant environmental effects were to establish its own screening criteria. Given differences in countries' preferences, the criteria would reflect their national environmental concerns. The screening phase, however, would be for every country the beginning step of the environmental review in order to select specific trade measures meriting further consideration.

Screening is also contemplated in the Strategic Impact Assessment (SIA) developed by the University of Manchester on behalf of the European Commission as a preparation for the proposed Millennium Round of multilateral trade negotiations. The purpose of such an exercise is to determine which measures on the proposed new round agenda may be excluded from appraisal because they are unlikely to impact on the environment. Screening is intended to encourage cost effectiveness, allocating resources to those trade measures that are deemed significant. It is a procedure to be carried out on the basis of set criteria in order to decide which of the trade measures that have been multilaterally negotiated, can be excluded from the SIA. Those measures of the trade liberalization agreement whose analysis is ruled out are those unlikely to produce significant environmental impacts.

Several criteria might be taken into consideration, at this initial level of analysis, to decide which liberalization measures do not impinge on the environment. Among these are: whether the areas to be affected are already under economic, social or environmental stress, whether the measure is likely to contribute to cumulative impacts of the new Agreement as a whole or whether the existing regulatory and institutional capacities in the affected areas are sufficient to implement mitigatory measures (Kirkpark and Lee 1999). In the specific context of services liberalization, the EU SIA reached the conclusion, after the screening level, that significant impacts (economic, social and environmental) can be anticipated in most sectors.

A similar approach to the one just described is that undertaken by Canada in its *Draft Environmental Assessment Framework for Trade Negotiations*. The environmental framework seeks to provide trade negotiators with the key to understand environmental and trade linkages. Therefore one of fundamental *atouts* of the framework is that it is designed to be practical and flexible enough to be adapted on a case-by-case basis. Since Canadian policy-makers are aware of the challenges of conducting an environmental assessment, they point to the impossibility of considering all issues at once. In line with the EU SIA, they propose a rigorous scoping exercise. Similar to the screening procedure, scoping aims to discriminate the most significant and likely environmental impacts from other more neutral effects resulting from trade agreements. In fact, while many environmental issues should be examined, limited data, limited resources and practicality require that the assessment be focused on very specific pressure points (DFAIT Canada 2000).

Following a similar pattern, the US Guidelines for Environmental Review of Proposed Trade Agreements also propose a scoping procedure to identify potential environmental effects of trade agreements (United States Federal Registry 2000). The US is committed to undertaking objective and science-based assessments based on a scoping mechanism, which has two principal components: identification and prioritisation of relevant issues.

The first component of the scoping process is very similar to the screening exercise in the EU and OECD methodologies, since it involves the identification of a range of foreseeable environmental impacts to be further analyzed in the environmental review. Following the identification process, prioritization is used to select important issues warranting more in-depth analysis. Some of the initial identified impacts may be eliminated from consideration through the prioritization procedure.

Scenario-building

Any environmental review has to take into account the considerable uncertainty characterizing the package of measures resulting from a new round of trade negotiations. In fact, the level of liberalization reached in a future agreement will affect the sustainability impact of any trade measures. Consequently, the EU SIA considers alternative scenarios to be constructed to shed light on the sensitivity of the sustainability outcome to the adoption of different negotiation agendas (Kirkpark and Lee 1999). For practical reasons the scenarios have been limited to three: a "base" or benchmark scenario, an "intermediate" scenario and a "towards full liberalization" scenario.

The three scenarios envisaged for the GATS 2000 negotiations were:

- Base or benchmark scenario, where no new agreements were reached and the level of commitments remained unchanged.
- Intermediate scenario, where improved commitments regarding market access and national treatment were to be reached as much as a strengthening of GATS discipline on Article VI and new rules on safeguards, subsidies and government procurement.
- Towards full liberalization scenario, that assumed substantially more services trade liberalization with the adoption of new commitments in terms of market access and national treatment across the four modes of supply and twelve services sectors.

This scenario building analysis can represent a powerful instrument to render environmental reviews more flexible and adaptable to the evolving situation of particular requests and offers made in the context of trade negotiations.

4 Towards an Assessment of Possible Environmental Effects of GATS 2000

In 1994, with the signing of the Marrakech Agreement and the establishment of the World Trade Organization, the GATS represented a beginning. In its "bottom-up" approach to build a liberal services trade regime, it provides a framework for new commitments across a range of sectors. Using the GATS schedules of commitments, as explained above, however does not provide a full or accurate picture of the extent of a country's measures in place. Nor do attempts based on frequency indexes to assess the countries which have made commitments give a good portrayal of the relative restrictiveness of the various types of measures restraining trade. To further complicate the analyst's task, many countries have undertaken unilateral liberalization in the recognition that, through domestic regulatory reform, increased competition and improved access conditions are indeed in their own national economic interests, even when their industries are not necessarily an important supplier of a particular service. Therefore those commitments which have been "bound" in GATS schedules are often a minimum, when in fact access conditions are far more liberal for foreign services suppliers. All of these factors can be expected to frustrate the job of approaching the assessment of services trade liberalization for its environmental effects.

On the other hand, the "good news" is that WTO members have embarked on GATS 2000, a new round of negotiations to improve the current services trade regime, by extending commitments and developing the rules-based system. At the same time, a large number of OECD Members are committed to undertake an environmental review, across the board, of the potential impacts of freeing-up trade.

The OECD Joint Working Party on Trade and Environment is in the process of developing a methodology based on a checklist of questions to provide policy makers with a tool to assess environmental effects of services trade liberalization. This methodology will build on the OECD 1994 *Methodologies*—and its appended Checklist—developed for trade in goods. In assessing potential environmental effects, this methodology will take into account differences between trade in goods and trade in services and the complex aspects of multilateral liberalization of services trade barriers. In addition to examining the environmental effects associated with economic changes (scale, structural and technology effects), particular emphasis will be given to assessing the regulatory situation, in relation to current rights and obligations (and possible future developments) arising under GATS provisions on domestic regulations. It is also felt necessary to develop the additional approaches of building scenarios of likely trade liberalization as well as screening services from a sectoral point of view.

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Annex

Extract from *Final Analytic Framework for Assessing the Environmental Effects of NAFTA* on Transborder Investment Flows

Transborder Investment Flows

In important respects, NAFTA was an investment agreement as well as a trade agreement, and transborder flows of foreign direct investment (FDI) are closely associated with trade. In assessing changes among the three North American countries, it is important to focus first on direct investment, and second on portfolio investment.

Direct foreign investment, particularly that of highly integrated transnational corporations (TNCs), brings important capital, management, technology, distribution systems, reputation, markets, and other business assets. Attention should be given to both "greenfield" (new) investment, and acquisitions or expansions, and include both fully-owned investment, joint ventures and North American business alliances. Priority should be placed on changes in stocks, more than on flows of foreign investment, as the latter data incorporate the fullest range of investment alterations.

In assessing these changes, several variables are central:

1. ***Regional concentration of investment.*** This addresses how post-NAFTA FDI stocks (and secondarily, flows) among the three NAFTA countries, relative to pre-NAFTA periods and non-NAFTA partners, have changed overall, and in particular sectors, for each of the three countries. In all cases, transborder investment should be considered in the context of:

- domestic investment (including both net domestic investment and the percentage of an industry that is foreign-owned, by firms headquartered and owned in NAFTA and non-NAFTA countries);
- how investment from NAFTA countries and non-NAFTA countries is concentrating in, as opposed to outside, North America; and
- the geographic concentration of investment in particular countries and locations within each NAFTA country, including transborder production clusters or transportation corridors.

2. ***Sectoral investment shifts, migration and subsidies.*** This considers whether this investment is expanding most rapidly in relatively polluting or relatively clean sectors. Of particular interest is whether NAFTA-associated FDI constitutes an environmentally costly transfer of industries and plants (including costs for environmental regulatory compliance) from one country or locale in the NAFTA region to another, and how the standards, subsidies, and other relevant government policies compare in those locales. Transfers of investment can take the form of a physical move of an existing plant or an expansion or placement of new investment in one area at the expense of another.

3. ***Technology transfer and diffusio*****n.** This looks at the degree and speed of the spread of advanced technology from one firm to a related enterprise in the other NAFTA countries. Such a trend is promoted by regional production systems. It increases both technology transfer and diffusion to competing firms in the same industry, to related and non-related firms in the sector, and throughout the economy. Of particular relevance are technologies that improve overall efficiency, and those directed at enhancing environmental quality.

4. ***Intracorporate integration in production.*** This considers whether and how the NAFTA regime is increasing intracorporate trade and affiliated trade between and among the members. Such a process can be expected to encourage integrated production systems that make it more likely that plants operating in all three countries will adopt and follow a common set of standards and practices.

5. ***Corporate concentration.*** This examines how FDI may be encouraging changes in facility size and a trend toward concentration within industrial sectors by creating a smaller number of larger, more capable firms servicing the NAFTA marketplace.

6. ***Foreign portfolio investment*****.** This is concerned with how portfolio investment relates to, reinforces, substitutes for, or provides domestically owned firms with the finance for upgrades and expansion in technology and production.

Will Free Trade in Electricity between Ontario/Canada and the United States Improve Air Quality?

Takis Plagiannakos

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Executive Summary

Ontario and the eastern US have common airshed and heavily interconnected electricity systems. In addition, the electricity generation mix is very different in Canada and the US, resulting in significantly different air emission profiles. Studies have shown that US sources of emissions have a significantly larger impact on Canadian air quality than the impact of Canadian emission sources on the US. As a result, any change in coal-fired electricity generation in the US could affect the air quality in Canada.

Both countries have made significant reductions in emissions and regulatory trends indicate that further reductions will be required in the near future. With the opening of electricity markets in both countries, environmental regulatory policies will influence the flow of electricity across the borders.

The impact of the NAFTA agreement on electricity trade is difficult to quantify. The trade of electricity between Canada, Ontario in particular, and the US has been very volatile over the last decade. Two major factors have affected the size of electricity trade with the US at various times: limited excess supply of power for exports from Canada and limited access to the electricity markets in both countries since utilities continued to be regulated.

Based on the results of this study, the free trade in electricity between Ontario and US is not expected to affect the air quality in Ontario if both countries follow through with their plans to implement tighter NO_x emission standards (NO_x SIP Call). In the short-run, however, if open access takes place before the NO_x SIP Call comes into effect, the emissions could increase—adversely affecting the air quality in Canada and the US.

Based on the analysis above, the following policy considerations are proposed:

- The environmental regulations in both countries should take into consideration regional differences and potential impacts of air emissions.
- The regulatory systems in Canada and the US should continue to converge by harmonizing the air emissions standards for the electricity generators to compete on a level playing field as the electricity markets open to competition.
- The emissions trading programs should be harmonized in order for the generators in both countries to be able to take advantage of opportunities for reducing their emissions at lowest cost.
- The two countries should establish a process for harmonizing the development of new environmental regulations such as mercury emissions and long-term targets for SO_2 and NO_x emissions, as they address PM_{10} and $PM_{2.5}$ particulates in the coming years.
- The definitions of environmental provisions (i.e., renewable portfolio standards, emission portfolio standards and environmental reporting) proposed to enhance cleaner technologies need to be harmonized to ensure a level playing field in the electricity markets.

1 Introduction

Significant changes are taking place in the electricity industry around the world and particularly in North America. Following the deregulation in the telecommunications, transportation and natural gas industries over the last two decades, the electricity industry in North America is in the middle of massive restructuring. This is the result of many factors including globalization of trade, technological developments in electricity generation and pressure from large industrial customers to have the flexibility to choose their own supplier of electricity in order to reduce their electricity costs.

The deregulation of the electricity industry in Canada and the US and the competition in the wholesale and retail electricity markets that is gradually taking place will introduce new dynamics in the electricity trade between the two countries. The electricity trade between Ontario and the neighboring states in particular is expected to increase emphasizing regional competition and de-emphasizing the importance of the borders.

This report begins with a comparison of the electricity generation profile of Canada and the US followed by an assessment of the transboundary impacts of air emissions. Next, it focuses mainly on two of the four processes identified in the NAFTA evaluation framework proposed by the CEC. First, the current and future use of coal for electricity generation and the associated emissions under competitive market conditions that could affect the environment are assessed. Second, the impact of existing and emerging environmental regulations on coal generation and the competitive position of electric utilities are discussed. Finally the impact of these changes on the electricity trade between Ontario and its neighboring regions is assessed. The paper concludes with a summary of major findings and policy considerations to minimize the impact of electricity trade on the air quality of both countries.

2 Electricity Generation Profile of US and Canada

In order to examine the potential impact of electricity free trade on air quality, it is necessary to study the electricity generation mix of the two countries and the regions neighboring to the province of Ontario in particular.

As shown in Figure 1, 66% of electricity in the US is produced from fossil fuels, with coal and oil accounting for 57% of generation.

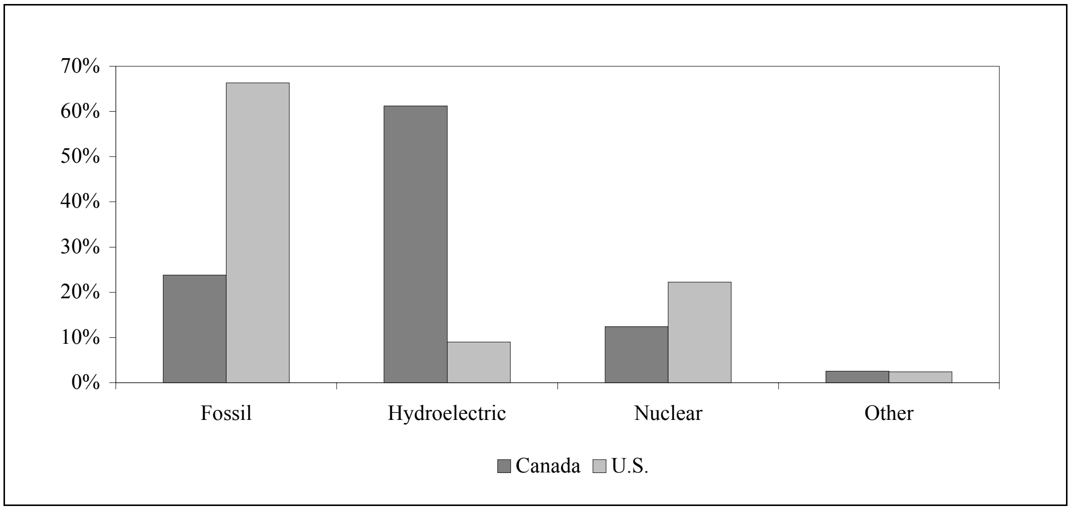
The electricity generation profile of Canada is quite the opposite. Only 24% of generation is produced by fossil fuels. The remaining is hydroelectric and nuclear generation, which do not emit any SO_2, NO_x or CO_2 emissions.

The contribution of coal to electricity generation in the US varies significantly by region. Figure 2 below shows the different regions as defined by the North American Electric Reliability Council (NERC). Ontario has high capacity interconnections with the East Central Area Reliability (ECAR) region and the Northeast Power Coordinating Council (NPCC) on the South and smaller capacity interconnection with Mid-continent Area Power Pool (MAPP) on the North.

The generation profiles of the two most important regions, NPCC and ECAR are discussed below and compared with Ontario. The electricity generation profile of the two regions is quite different.

The ECAR region is dominated by coal, which accounts for more than 80% of its electricity generation. Coal is cost-effective in this region, as the midwestern coal-producing states are located near or within the coalfields of the Illinois Basin and northern Appalachia, which lowers the cost of fuel transportation.

Figure 1. % of total generation by fuel type – 1999



NPCC has markedly different generation assets, with coal contributing less than 16% of its electricity with the remaining provided by nuclear, hydroelectric, oil and gas. This is because coal is relatively expensive in the NPCC region, due to higher transportation rates for both low and higher sulfur coals.

Ontario's electricity generation is also different when compared to the ECAR and NPCC regions. Ontario Power Generation (OPG), with total capacity of 31,000 MW, supplies more than 85% of all electricity used in Ontario. About 50% of OPG's electricity generation comes from nuclear power. Ontario's generation is dominated by nuclear, since the province made a strategic decision in the early 1970s to invest in nuclear power, given that it does not have endogenous coal or gas resources. Another 25% of electricity is produced from renewable hydroelectric sources, which produce virtually no air emissions. The remaining 25% of electricity is generated mainly by coal and natural gas.

Coal generation in the ECAR states accounts for close to 45% of the total coal generation in the US. Figure 3 shows the share of fuels used for electricity generation in the states within the ECAR region. It should be noted that the ECAR region, as defined by NERC, includes Indiana, Michigan, Ohio, West Virginia and parts of Kentucky, Pennsylvania, Virginia and Maryland states. To facilitate the analysis in this study, the last four states are included as a whole rather than partitioning them resulting in an "expanded" ECAR region.

It is interesting to note that in 1999 coal accounted for close to 100% of generation in both states of Indiana and West Virginia and for 95% of total generation in Kentucky. Pennsylvania and Virginia have the lowest share of coal generation, which accounts for about 60% of total generation.

Figure 4 compares coal-fired generation levels in the ECAR states with Ontario. With the exception of Maryland and Virginia, where coal generation is at similar levels to Ontario's, the coal generation in each of the remaining ECAR states is two to three times larger than Ontario's.

The analysis above suggests that any significant increase in electricity exports from the ECAR neighboring states will be based on coal and will impact on air quality in Canada and the US. The amount of electricity exports from the ECAR region to Ontario will depend on many factors including the environmental regulations in the two countries, the degree of deregulation of electricity generation and transmission and the differences in electricity prices between the two regions. These factors are addressed in more detail later on in the report.

Figure 2. NERC regions

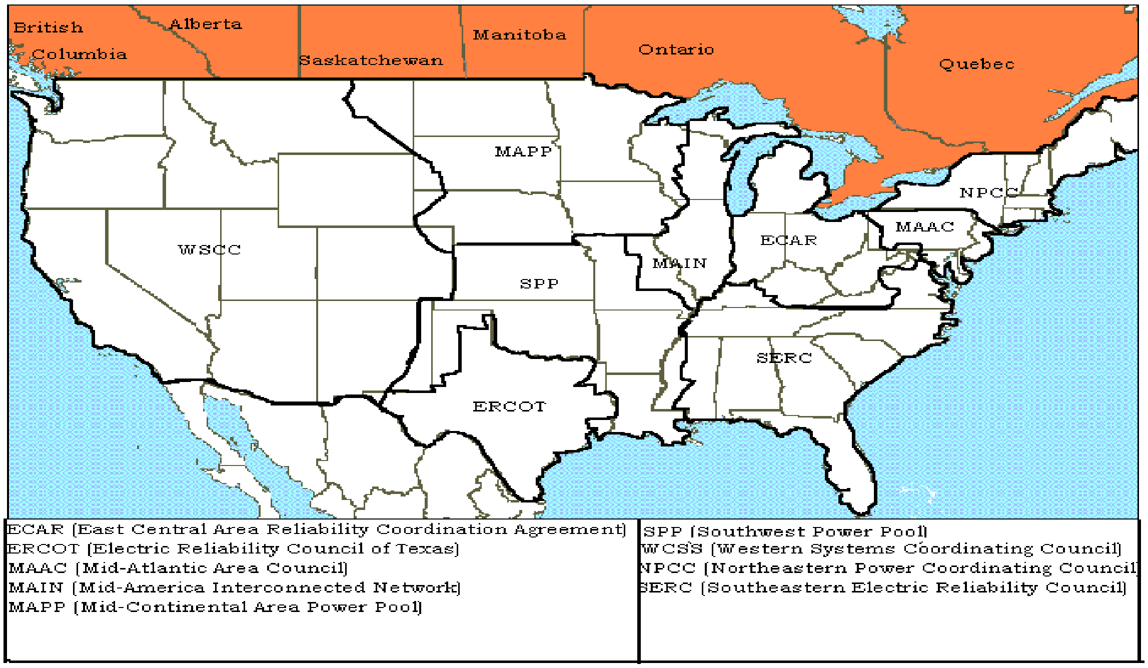
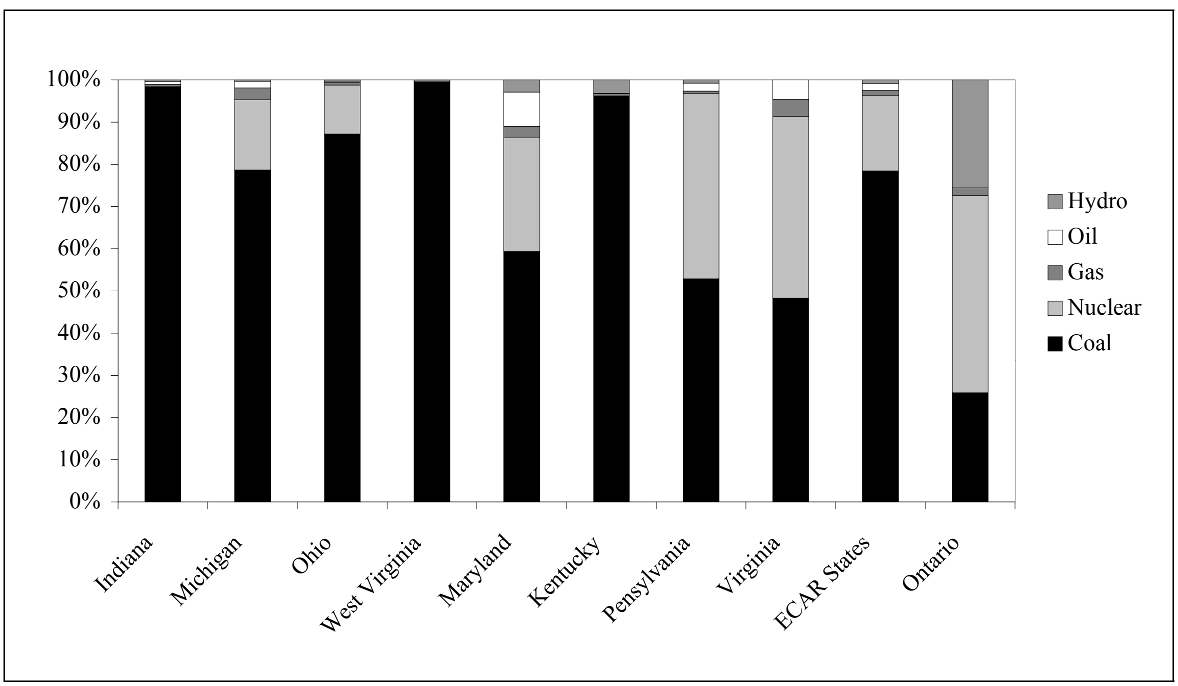


Figure 3. ECAR states – % of electricity generation by fuel type – 1999

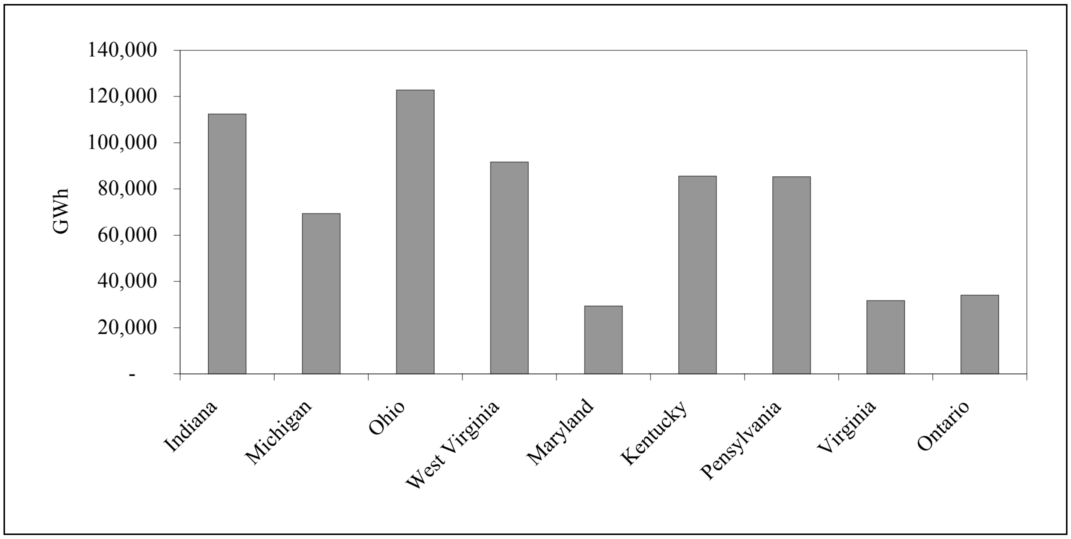


Source: 'Electric Power Monthly March 2000' EIA. 1999 Progress Report (OPG).

3 Electricity Trade between Canada and the United States

Traditionally electricity trade between Canada and the US is very much a north-south activity, based mainly on regional economics. This is because the natural resources in Canada, primarily those that are hydroelectric and nuclear, tend to have lower cost than the cost of generation in the US. As a result, the stronger transmission lines and US interties have been developed with Quebec, Ontario, Manitoba, BC and Saskatchewan. Alberta market does not have a direct north-south intertie into the US.

Figure 4. Comparison of coal generation in ECAR states with Ontario – 1999



Source: Electric Power Monthly 2000, EIA. 1999 Progress Report, OPG.

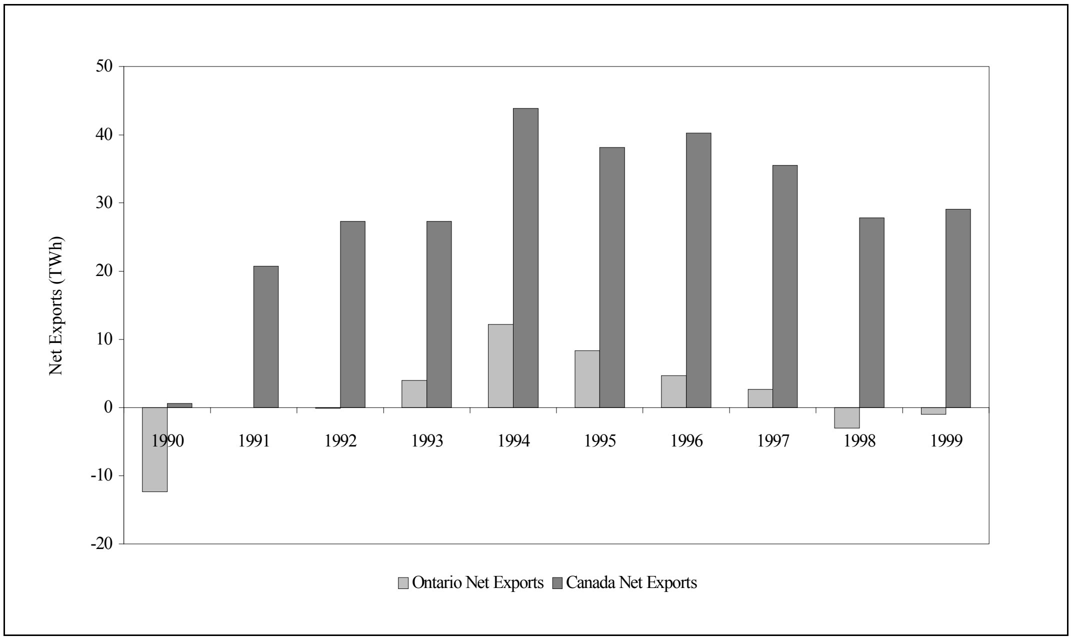
The capacities of Ontario's interconnections with the ECAR and NPCC in the south are 2100–2400 MW and 1700–1750 MW respectively, while with MAPP in the north, the capacity is much smaller—ranging from 100 to150 MW.

Figure 5 shows the net electricity exports (exports minus imports) of electricity to the US. Historically, the province of Ontario, and Canada in general, has been a significant electricity exporter into the US market. The electricity exports from Canada to the US have been quite volatile over the last 20 years, reflecting mainly the availability of generation in Canada. Electricity exports peaked in 1987 and 1994 at approximately 50 TWh (or 44 TWh net). Canadian exports using coal accounted for less than 20% of total exports. This has contributed over the years to the US significantly reducing its fossil fuel-burning emissions. The imports from the US, on the other hand, tend to be dominated by coal generation.

Ontario exports over the last 20 years peaked in 1994 at 12.6 TWh. Since then, electricity exports have constantly declined, reaching 2.02 TWh in 1999. Electricity imports from the US have increased recently to 6.05 TWh and 3.04 TWh in 1998 and 1999, respectively, making Ontario a net importer of electricity. This is because Ontario has shut down two of its nuclear stations since 1997. As the nuclear recovery program proceeds over the next few years, Ontario is expected to reestablish itself as a net exporter of electricity into the US.

Although there was an increase in electricity net exports in 1990s, it is difficult to attribute any significant changes in electricity trade to NAFTA. Two major factors have determined electricity exports over this period: limited excess supply of power in Canada for exports and limited access to the electricity markets in both countries since utilities were regulated.

Figure 5. Canada and Ontario net electricity exports to US



Source: RDI, 1999 & PHB Hagler Bailly, 2000

4 Transboundary Air Pollution Associated with Coal-fired Generation

Sulfur dioxide (SO_2) and nitrogen oxide compounds (NO_x) are emitted from the burning of fossil fuels. These compounds, once released into the atmosphere, combine with other chemicals to form acid rain and ozone. The acid rain affects lakes and forests, while ozone, known as smog, is a significant health hazard. CO_2 has global impacts, as it is associated more with climate change.

Air emissions do not only affect the immediate surrounding area in which they are produced. Rather, they are transboundary in nature and are carried by prevailing winds, affecting an entire airshed. The map in Figure 6 shows the prevailing wind patterns across eastern North America and the relative magnitudes of regional NO_x sources.

Winds travel from the Gulf of Mexico in a circular, northeastern direction. Thus, airborne emissions are carried from the central and northcentral states into Ontario, Quebec and Nova Scotia in Canada and the northeast states in the US. The distance of transportation is dependent on the altitude of the emissions. Low-level emissions (primarily from vehicle emissions) travel a shorter distance than high-level emissions (primarily from fossil fuel-generated electricity). Industrial, commercial and transportation emitters both inside and outside of the province contribute to the smog problem in southern Ontario. The Ontario government has estimated that 50% of the average annual ozone formation in Ontario can be attributed to US sources.

Research co-sponsored by Environment Canada, OPG and Hydro-Quebec, indicates that, during high smog conditions, 55% of southern Ontario's ozone is a result of vehicle and industry emissions in the US (Figure 7). Another 27% is the result of US electricity production and 16% is from Ontario vehicle and industry emissions. Only 2% of southern Ontario's ozone is the result of electricity production in Ontario.

Figure 6. Eastern North American prevailing wind pattern and sources of NO_x

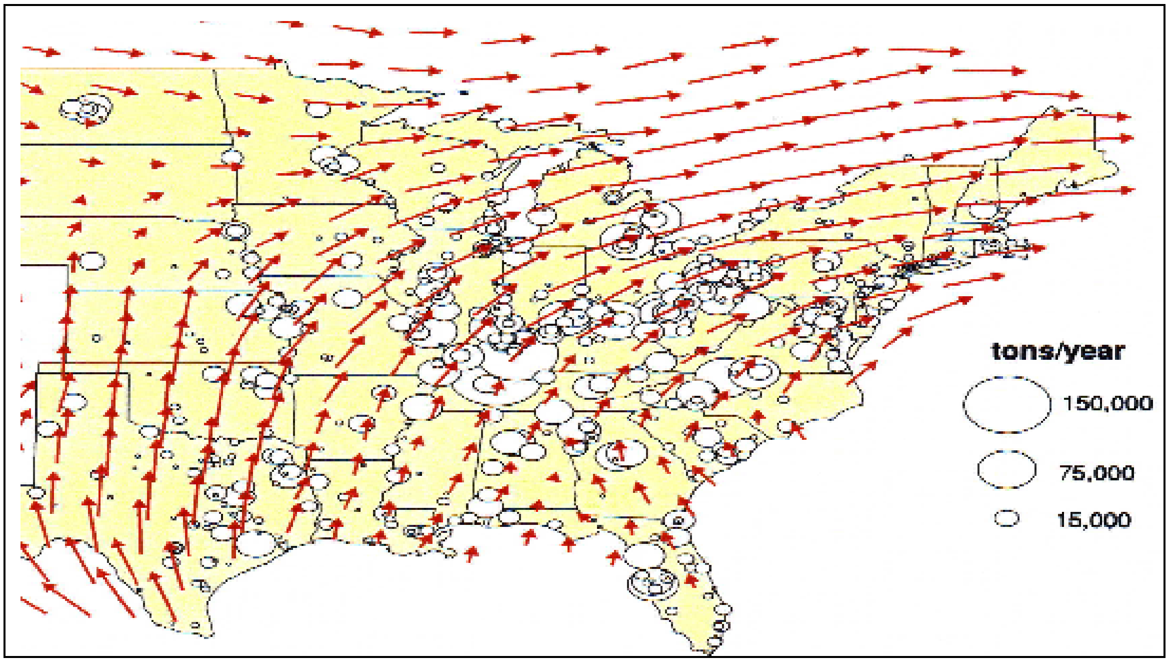
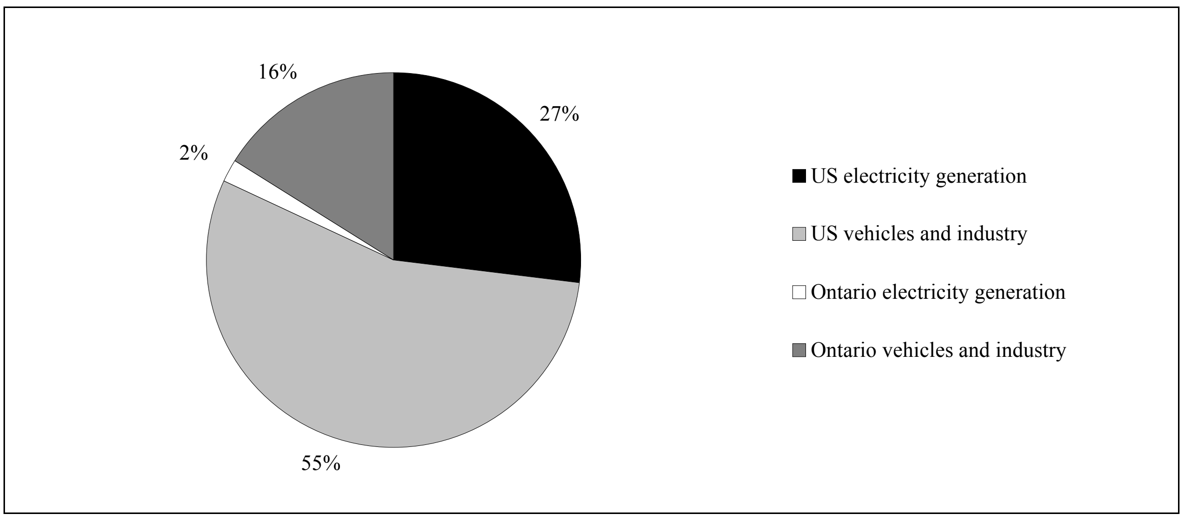


Figure 7. Ozone sources of smog-producing pollutants affecting southern Ontario



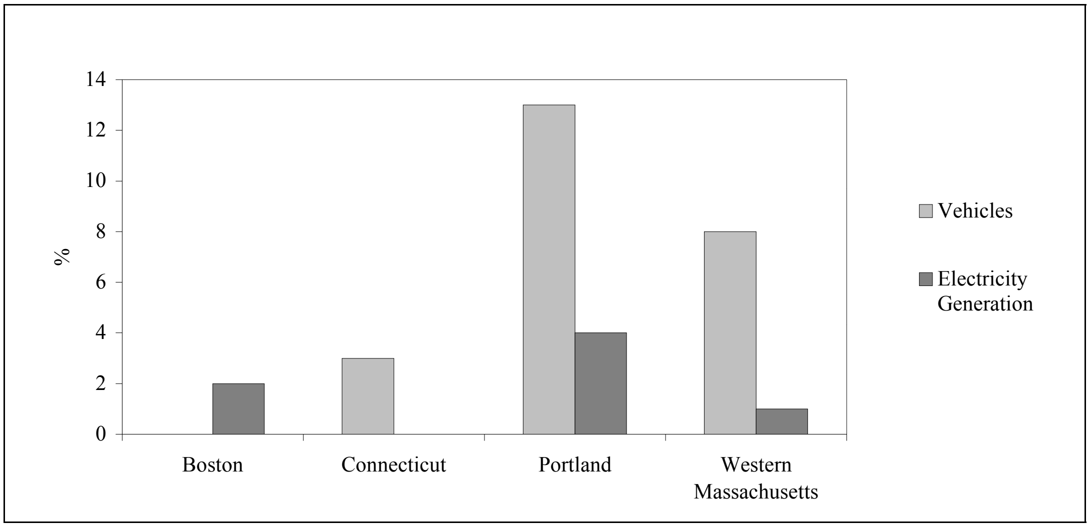
Source: Stratus Consulting Inc., 1999

In addition to receiving airborne emissions from the US, southern Ontario is also a contributor, although to a lesser extent, of airborne emissions to downwind states. Figure 8 shows southern Ontario's contribution to ozone formation at four US locations.

Overall, southern Ontario emissions from vehicles contribute from 0% to13% to ozone formation in the Boston and Portland (Maine) nonattainment areas, respectively. The maximum contribution of Ontario's fossil fuel-burning in the US is in Portland, where 4% of the ozone during high smog conditions can be attributed to Ontario generation.

Based on the above analysis, if Ontario were to shut down all of its fossil fuel-fired electricity generating plants, it would only have a 2% impact on the overall ozone in the southern Ontario region. The major impact in the US would be a 4% reduction of ozone formation in Portland. Conversely, if all fossil-fired electricity generating plants in the central US were shut down, the potential impact would be an ozone reduction in southern Ontario of 27%.

Figure 8. Percent ozone formation from southern Ontario



It is clear that as the electricity industry is deregulated over the next few years and electricity would flow freely between regions, NAFTA could have a direct impact on air quality through its effects on fossil generation in both countries.

Canada and the US, recognizing early on that they could not solve their air quality problems simply through domestic action alone, have tried to address the air quality issues through bilateral agreements. The first was signed in 1991 and addressed the acid rain issue. The second is expected to be signed before the end of this year and will address the NO_x emissions that contribute to ozone formation.

5 Environmental Regulations in the United States and Ontario/Canada

This section will examine the major environmental regulations in the United States and Canada that affect electricity generation. In a competitive electricity market, where electricity trade is expected to increase, differing levels of emission limits may affect competitiveness. If one country or province/state establishes significantly different environmental performance levels in certain areas could undermine the competitive position of the electric utilities. This issue is explored in more detail in the following sections.

5.1 US Environmental Regulations

US environmental regulations are too complex to be analyzed thoroughly in this paper. They span the gamut from the federal to regional levels and state to local levels. This overview will be limited to the 1990 Clean Air Act Amendments (CAAA) applicable to air emissions from fossil fired stations.

There are three main initiatives under the CAAA that affect the air emissions of electricity producers in the United States: the Acid Rain Program, the Ozone Transport Commission

Regulations, and the Environmental Protection Agency's NO_x State Implementation Plan Call (NO_x SIP Call). Although some states have developed their own environmental regulations, they will not be discussed in this report because their emission standards usually fall within the standards of the CAAA.

5.1.1 The Acid Rain Program

The Acid Rain Program was established by the Clean Air Act to address SO_2 and NO_x emissions and is being implemented in two phases; Phase I began in January 1995 and targeted the largest electric industry sources (261 generating units) to reduce SO_2 emissions. Phase II began in January 2000 and affects all fossil-fueled power plants larger than 75 MW. Under Phase II, SO_2 power plant emissions will be capped at 8.9 million tons (8.07 million metric tons) per year. This is equivalent to an emission rate of 1.2 lb/mmBTU (0.54kg/mmBTU).

As part of the Acid Rain Program, the EPA (Environmental Protection Agency) has implemented a program of SO_2 emission allowance trading as a means for generators to meet their obligations under the Clean Air Act. The US program is known as a cap-and-trade program, whereby the EPA sets an emissions cap and allowances are distributed to the various utilities, up to the level of the cap. An allowance is an authorization to emit one ton of SO_2 during a given year or any year thereafter (i.e., allowances in this program can be banked indefinitely). At the end of each year, the utility must hold a number of allowances equal to its emissions of SO_2 for the year. Utilities that reduce their emissions of SO_2 may choose either to bank their allowances for future years or to sell them either on the open market or through EPA auctions.

The utilities have been very active in SO_2 emissions trading in Phase I of the CAAA and have banked close to 10 million tons (9.07 million metric tons) of SO_2 emission allowances that will be used to comply with the Phase II SO_2 requirements. In this way, as it will be shown later on, they plan to delay the installation of scrubbers that would reduce the SO_2 emissions to the Phase II emission levels.

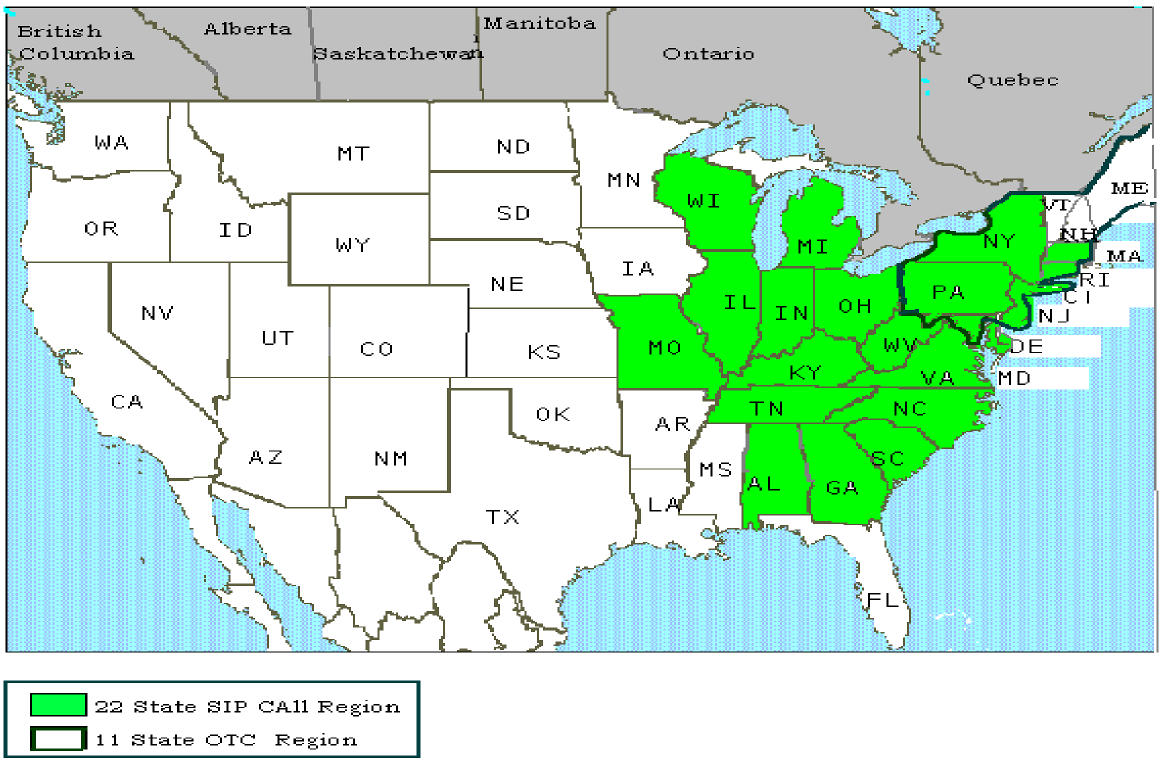
The Acid Rain Program also contains technology-based standards for NO_x emissions, designed to reduce these emissions by 2 million tons (1.8 million metric tons) below 1980 levels. Phase I annual emission limits for NO_x was 0.50 lb/mmBTU (0.226 kg/mmBTU) for dry bottom wall-fired boilers, or 0.45 lb/mmBTU (0.2 kg/mmBTU) for tangentially fired boilers. Phase II limit for NO_x is 0.46 lb/mmBTU (1.02 kg/mmBTU) for dry bottom wall-fired boilers and 0.40 lb/mmBTU (0.18 kg/mmBTU) for tangentially fired boilers.

It should be noted that the CAAA does not impose a total NO_x cap and does not allow for NO_x emissions trading. As a result, the certainty and pattern of NO_x mass reductions vary from year to year, depending on utilization of sources. While it offers advantages, a rate-based control program does not achieve the consistent level of NO_x reduction achieved under a firm budget. The cap-and-trade approach provides more certainty regarding the limit on aggregate emissions over the life of the program regardless of unit level emission rates.

5.1.2 The Ozone Transport Commission (OTC)

The OTC has developed regulations affecting NO_x emissions by electricity generators. Figure 9 shows the 11 northeastern most states that comprise the OTC region. This region is classified by the EPA as a non-attainment region, meaning that the region does not meet federal air quality objectives. The OTC's objective is to implement regulations in order to help the region meet federal air quality standards. The OTC NO_x budget requires two phases of reductions: compliance with first phase began during the 1999 ozone season (May 1 through September 30) and calls for 55% reduction from 1990 levels. Compliance with the second phase will begin during the 2003 ozone season and will require a 70% reduction in NO_x from 1990 levels to 143,000 tons (129,700 metric tons). The 11 OTC states can meet their NO_x budgets by installing NO_x control technologies or using emissions trading.

Figure 9. OTC and SIP Call regions



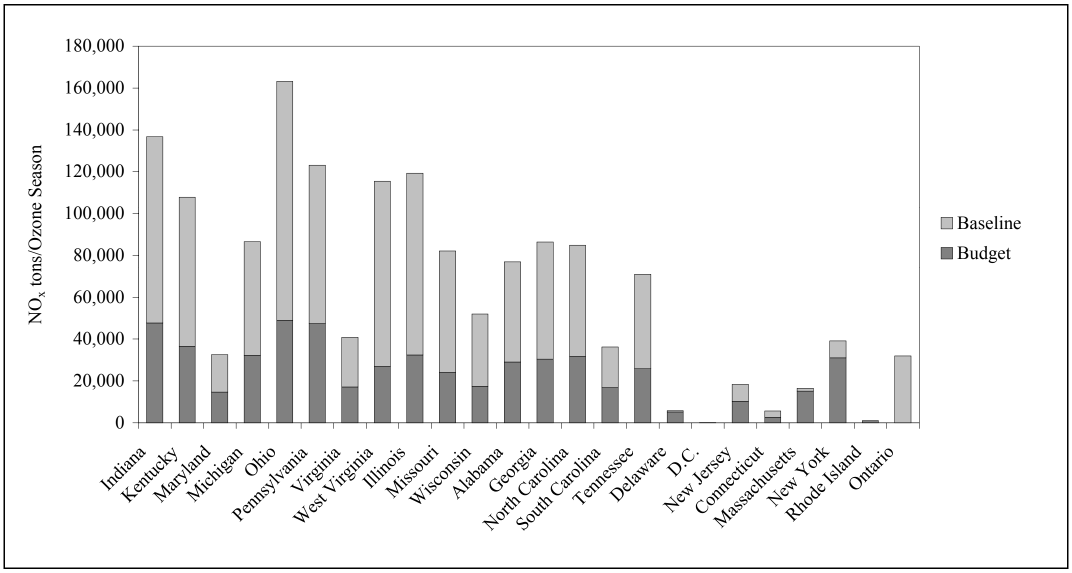
5.1.3 NO_x State Implementation Plants (SIP) Call

As discussed earlier, air pollution is transboundary in nature and is carried by prevailing winds. The US Environmental Protection Agency (EPA) determined that a significant portion of the air pollution in the OTC region was the result of emissions from the Midwest states. Extensive air pollution modeling has shown that the eastern states would be unable to meet national air quality objectives without significant reductions of NO_x emissions in the Midwest. The EPA therefore decided to implement a NO_x SIP Call, establishing a limit for NO_x deemed low enough to allow all the states to be in attainment of national air quality objectives and demanding that the 22 affected states and the District of Columbia develop implementation plans for these limits. The NO_x SIP Call budgets are based on an emission rate of 0.15 lb/mmBTU NO_x (0.33 kg/mmBTU) designed to result in a NO_x reduction of 70% from 1990 emission levels over the ozone period (May to September). Based on the SIP Call regulations the states are allowed to develop NO_x emissions trading programs to meet their budgets.

The NO_x SIP Call uses a modeling system to project a state's emissions to the year 2007 if no action were taken to reduce emissions. The resulting emission level becomes the baseline from which reductions are measured. A second model is run to determine what level of emissions would be required to allow all SIP Call states to attain the EPA's ambient air quality standards and therefore bring all non-attainment areas into attainment with the standards. This number becomes the state's NO_x budget. The NO_x budget is the equivalent of an emissions cap for the state. Therefore, generating units are allowed to emit up to the NOx budget level for the entire state. It will be up to the states to assign NO_x budgets to the individual generators, so that the overall state budget can be met.

Figure 10 below shows the baseline estimates and the NO_x budgets allocated to the states included in the SIP Call.

Figure 10. NO_x SIP Call baseline and 2003 ozone season budgets (May – September)



Ontario is included with NO_x loading of 32,000 tons for the ozone season. This is based on 45% (to account for the ozone season) of the new NO_x annual cap of 61,000 tons (55,300 metric tons) proposed in the new regulations plus 5,000 tons (4,535 metric tons) of NO_x from non-utility generation emissions.

It is interesting to note that the proposed NO_x limit in Ontario is comparable to the SIP Call budgets in neighboring states. Specifically, the Ontario NO_x proposed limit is comparable to the NO_x SIP Call budgets for New York, Michigan and Illinois and much lower than the NO_x budgets for Indiana, Ohio and Pennsylvania. If Ontario were to apply the SIP Call rate of 0.15 lb/mmBTU (0.07 kg/mmBTU), its emissions budget would be among the lowest in the region.

The NO_x SIP Call is currently being challenged in the courts. Industry presented the first challenge, claiming that the EPA did not have the jurisdiction to implement such rules. Their initial challenge was successful, but the EPA succeeded in getting that decision reversed on appeal. In September, in a new decision regarding the time of implementation, the courts delayed the implementation of SIP Call until 2004. It is expected that the challenge to the SIP Call will go before the Supreme Court, but that it will succeed in the end and be implemented before 2005.

5.2 Ontario/Canada Environmental Regulations

In contrast to US where the EPA develops regulations that apply across the country or to specific regions, in Canada the provinces usually take the lead in developing environmental regulations within the environmental framework and standards set by the federal government under the Canadian Environmental Protection Act.

The Ontario Environmental Protection Act (OEPA) is the province's most comprehensive environmental law and is the primary legal authority for controlling air emissions in the province, including those arising from coal-fired electric stations. The OEPA is administered by the Ministry of the Environment.

The major air emission regulations are part of the province's Countdown Acid Rain Program. Under this program, the province of Ontario has used a system of emission caps to regulate air emissions from the major industries including the electricity sector. Trading and banking emissions are not allowed. This is in contrast to US regulations, which tend to focus more on emission rates or use aggregate emission caps with emissions trading.

New emission caps were proposed in January 2000 for NO_x (61,000 tons or 55,327 metric tons) and SO_2 (174,000 tons or 157,818 metric tons). The emission cap for NO_x is equivalent to the CAAA Phase II emission rates while the SO_2 cap corresponds to a lower emission rate than that mandated by the Phase II of the CAAA.

In addition to these domestic caps, the government has also proposed equivalent emission performance standards of 4.39 lb/MWh for NO_x and 10.14 lb/MWh for SO_2 (1.99 and 4.59 kg/MWh, respectively) to be applied to all electricity generated or sold in Ontario by coal or oil fired plants greater than 25 MW. As a result, all foreign producers will be required to meet provincial standards for air emissions before being allowed to sell electricity in Ontario. It should be noted that at this stage it is not clear how effective the proposed performance standards will be in limiting electricity imports that exceed the proposed emission standards for NO_x and SO_2.

The Ontario government has also made a commitment to matching any EPA-issued emission limits if they are stricter than the current Ontario limits. In essence, the provincial government has pledged to meet or exceed the SIP Call limits once they are implemented in the US. This will require Ontario generators to make further reductions in NOx emissions.

A formal emissions trading program does not exist in Ontario, although it is proposed in the new regulations. Instead, Ontario has developed a Pilot Emission Reduction Trading (PERT) program. This is a voluntary, multi-stakeholder program involving industry, government, and environmental organizations. Unlike the US program, there is no initial distribution of emission allowances. Rather, participants in the program earn credits for emission reductions below a historical level that has met the provincial or federal regulatory limits. These credits can then be used towards meeting provincial emission limits or voluntary reduction targets. Excess credits can be traded on the open market. Emission reductions are verified by an independent auditor to ensure their authenticity. To date, the program has developed markets for NOx, SO2, and CO2 equivalent. The Ontario's PERT program is expected to be incorporated into the "Cap, Credit and Trade System" proposed in the new environmental regulations that are under development.

Because emissions trading in Ontario is relatively new and is operating only as a pilot program, companies have not had the opportunity to earn and bank credits for their emission reduction activities over the years. This is in contrast to the US, which has had emissions trading for many years. While Ontario's generators were reducing emissions in order to comply with the legislation, their US utilities were earning emission allowances for the same activities. Now, as the EPA implements tougher SO2 emission standards, as part of Phase II of the CAAA, the American utilities have close to 10 million tons (more than 9 million metric tons) of banked emission allowances to begin to draw from. Ontario generators on the other hand have no such a bank, although they have made proportionally equal or greater reductions in their emissions. This could affect the level playing field of electricity generators as the electricity markets open to competition.

In addition to the above emission regulations, in anticipation of competitive electricity markets in Ontario, the government of Ontario will require the mandatory tracking and reporting of all harmful emissions starting in 2001. Under this mandate, all generating facilities of more than one megawatt will be required to report their emissions as well as the type of fuel used and the amount of electricity they generated over a 12-month time period.

5.3 Other Environmental Regulations

Standards for mercury, and PM_{10} and $PM_{2.5}$ particulates are under development in Canada as part of the Canada-wide Standard process and in US under the authority of the EPA. In addition, Canada is investigating various strategies to comply with the Kyoto Agreement to reduce CO_2 emissions while US has not ratified the agreement yet.

Although the processes are moving in parallel in the two countries, there is a need to harmonize the time-frame for monitoring, developing the emission limits and implementing the programs in order to maintain a level playing field among the electricity generators in an open electricity market.

To avoid potential effects of electricity restructuring on air emissions, many states have included environmental provisions in state restructuring laws. State and federal energy regulators are using three mechanisms to support clean technologies and help reduce air emissions in the transition to a competitive industry.

- **System Benefit Charges:** a per kWh surcharge on electricity is used and the proceeds are used to support renewable or energy-efficiency projects.
- **Renewable Portfolio Standards:** A requirement that retail electricity suppliers provide a certain percentage of their kWhs from emerging cleaner resources.
- **Emission Portfolio Standards:** It requires all electricity suppliers in the state to meet portfolio average emissions standards for NO_x, SO_2 and CO_2.

There is a need to harmonize the definitions of these standards in order to avoid undermining unfairly the competitive position of electricity generators in the two countries.

It is evident from the analysis above that the environmental regulations of the two countries have converged significantly over the last few years. There is a need, however, for further harmonization of environmental regulations and emissions trading mechanisms used for compliance in order to maintain a level playing field in the electricity markets.

6 Air Emission Profiles of Ontario and the ECAR Region

The SO_2 and NO_x emissions produced by the states in the ECAR region and in Ontario are discussed in detail below.

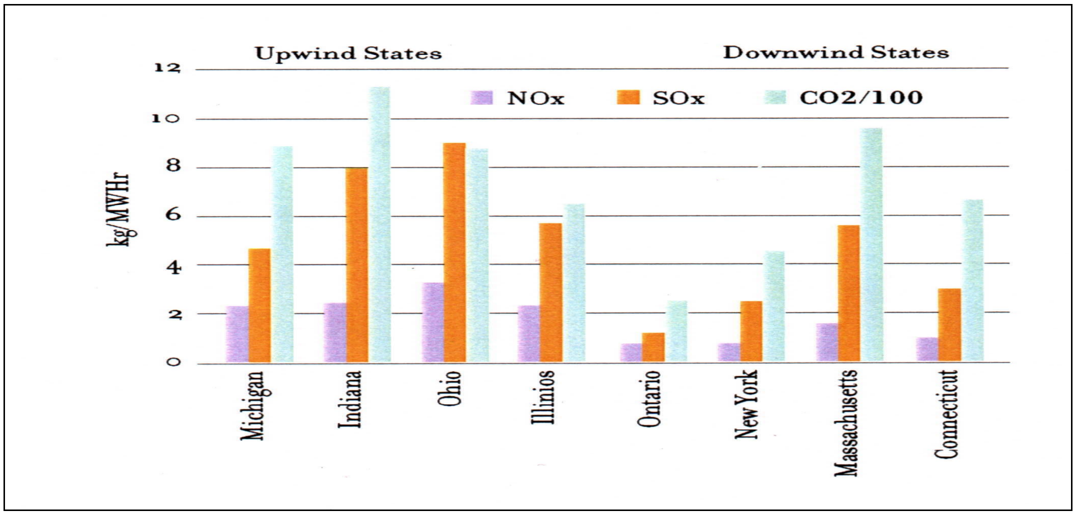
Figure 11 compares Ontario’s emissions with the emissions in the upwind and downwind states. Ontario’s emissions per unit of electricity are lower than any other electrical producer in Ontario’s regional airshed and among the lowest of all electricity producers in North America.

Ontario’s emission rates are lower because of its diverse generation mix, which includes nuclear, hydroelectric and fossil energy. In contrast, electricity producers in neighboring US states that share Ontario’s airshed rely primarily on fossil fuels to meet the electricity demand. The SO_2 and NO_x emission trends in ECAR and Ontario are discussed below.

6.1 Comparison of NO_x Emission Trends in ECAR Region and Ontario

Figure 12 compares the 1999 NO_x emission levels (left vertical scale) and NO_x emission rates (right vertical scale) of the ECAR states with that of Ontario.

Figure 11. Airshed emission rates for NO_x, SO_2 and CO_2



Source: Clean Air Corporation 1999.

Ohio, followed by Indiana, West Virginia and Kentucky, produced the largest amounts of emissions and they also had the highest emission rates among the ECAR states. Ontario had the lowest NO_x emissions, together with Maryland and Virginia. Pennsylvania had the lowest NO_x emission rate, while Ontario is in the middle of the pack, together with Maryland and Michigan. It was expected that NO_x emission rates would be reduced further in 2000, as the utilities are required to meet the CAAA Phase II standards that range from 0.40 to 0.46 lb/mmBTU (0.18 to 0.21 kg/mmBTU), depending on the type of boiler used.

Figure 12. NO_x emission levels and rates for ECAR states and Ontario – 1999

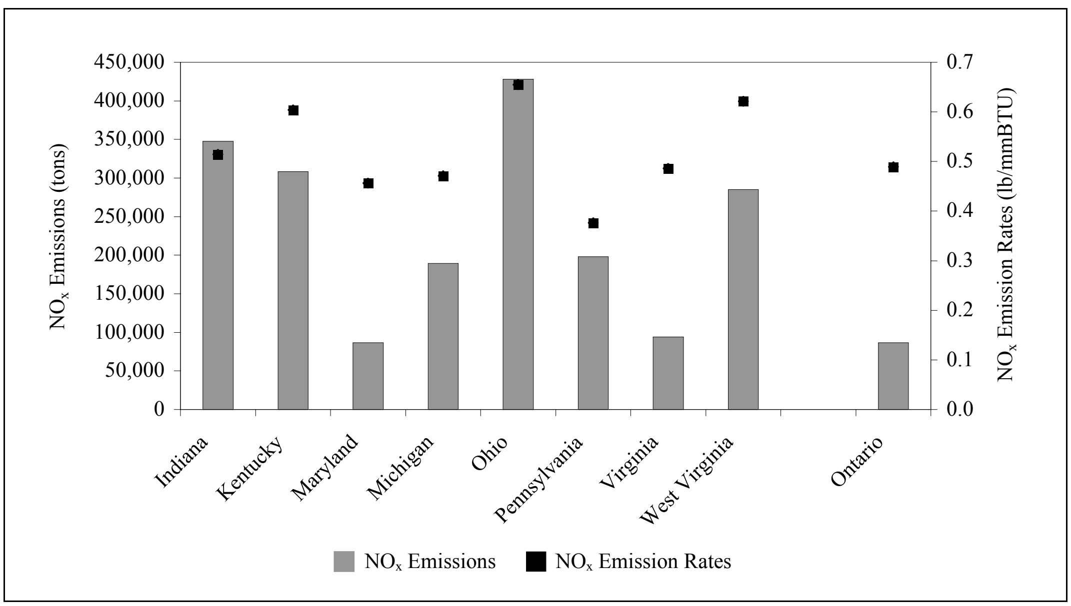


Figure 13 shows historical NO_x emissions for ECAR on the left vertical scale and Ontario on the right vertical scale. It should be noted that the scale on the left is about 30 times larger than the scale on the right. The ECAR emissions have declined by 16%, from 2.3 million tons in 1985 to 1.9

million tons in 1999 (2.1 to 1.7 million metric tons, respectively). The decline in 1997 onwards is the result of the CAAA Phase I limits that came into effect in 1995. The downward trend continues over the last three years as utilities install Low NO_x Burners and other NO_x controls in preparation for the Phase II of the CAAA that came into effect on January 1, 2000.

Ontario's NO_x emissions declined by 17% between 1985 and 1999. By the middle of 1990's the NO_x emissions had been reduced by 45% but they have gradually increased recently—in part because of the greater demand imposed by the temporary lay-up of eight nuclear units as part of OPG's Nuclear Improvement Plan.

Figure 14 shows the NO_x emission rates for ECAR and Ontario for selected years over the period 1985–1999.

Although NO_x emission rates have declined for both regions over time, Ontario's emission rates are consistently lower than ECAR's throughout the 1985 to 1999 period. Environmental improvements such as low-NO_x burners, continuous emission monitors, smart computer control systems, and the conversion of oil-burning units to also burn natural gas, have helped to reduce Ontario's NO_x emission rate by 33% since 1985. It is expect that further investments over the next two years will reduce NO_x emissions by an additional 10% to 15% by 2002.

The NO_x emission rates in the ECAR region have been reduced by 36% since 1985 and are expected to be reduced further in 2000 as the CAAA Phase II limits of 0.40 to 0.46 lb/mmBTU (0.18 to 0.21 kg/mmBTU) come into effect.

It should be noted here that in the US the CAAA Phase II NO_x standards are based on emission rates and as a result they do not limit the generation level. In Ontario the NO_x limit is based on an emissions cap of 61,000 tons (55,327 metric tons), which cannot be exceeded without the purchase of emissions credits, as was discussed in Section 5 above. This could impose additional costs to the electricity generators in Ontario.

Figure 13. NO_x emissions for ECAR and Ontario

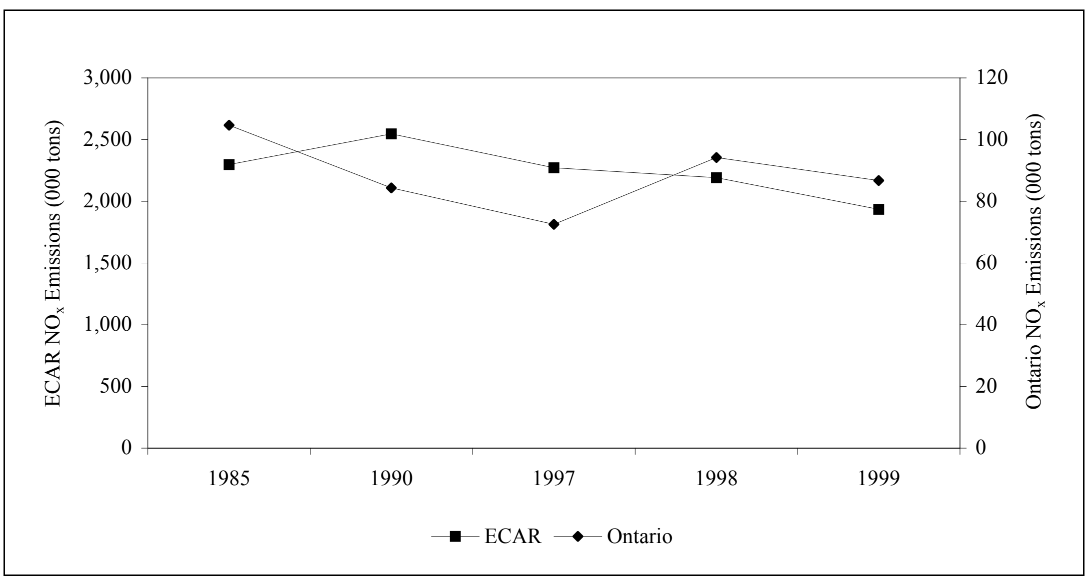


Figure 14. NO_x emission rates for ECAR and Ontario

The analysis above has shown that as the electricity markets open to competition in the coming years, the electricity generators in ECAR and Ontario will face similar NO_x emission rate limits. The emissions cap system used in Ontario however could burden the electricity generators in Ontario with the purchase of emissions credits and put them in a disadvantage position relative to the US generators.

6.2 Comparison of SO_2 Emission Trends in ECAR Region and Ontario

Figure 15 compares the total SO_2 emissions and emission rates for the ECAR states with those of Ontario. Ohio has by far the largest amount of SO_2 emissions followed by Pennsylvania and Indiana while Ontario has the lowest SO_2 emissions. The SO_2 emission rates follow the same pattern, with Ontario again being the lowest. The emission rates are not expected to be reduced immediately starting in 2000 as the Phase II of the CAAA comes into effect, because utilities have banked SO_2 allowances that they plan to use over the next two to three years.

Figure 16 shows the ECAR and Ontario SO_2 emissions on the left and right vertical scales, respectively. The ECAR region produced in 1999 5.5 million tons (4.99 million metric tons) of SO_2, which is roughly 20 times the Ontario emissions and accounts for 44% of total US emissions from fossil fuel generation. The SO_2 emission rates have declined by 32% since 1985 in the ECAR region, versus 58% in Ontario.

Ontario has achieved these reductions by converting oil-burning units to burn natural gas, increasing the use of low-sulfur coal, and installing scrubbers in one coal fired station. As the nuclear units return to service over the next few years SO_2 emissions in Ontario are expected to decline again. Similarly, the ECAR generators have installed scrubbers and switched to low sulfur coal to reduce SO_2 emissions.

Figure 17 shows the SO_2 emission rates for ECAR and Ontario. Ontario's SO_2 emission rates are consistently lower than ECAR's over the 1985 to 1999 period with the gap widening to 42% by 1999.

Figure 15. SO_2 emission levels and rates for ECAR states–1999

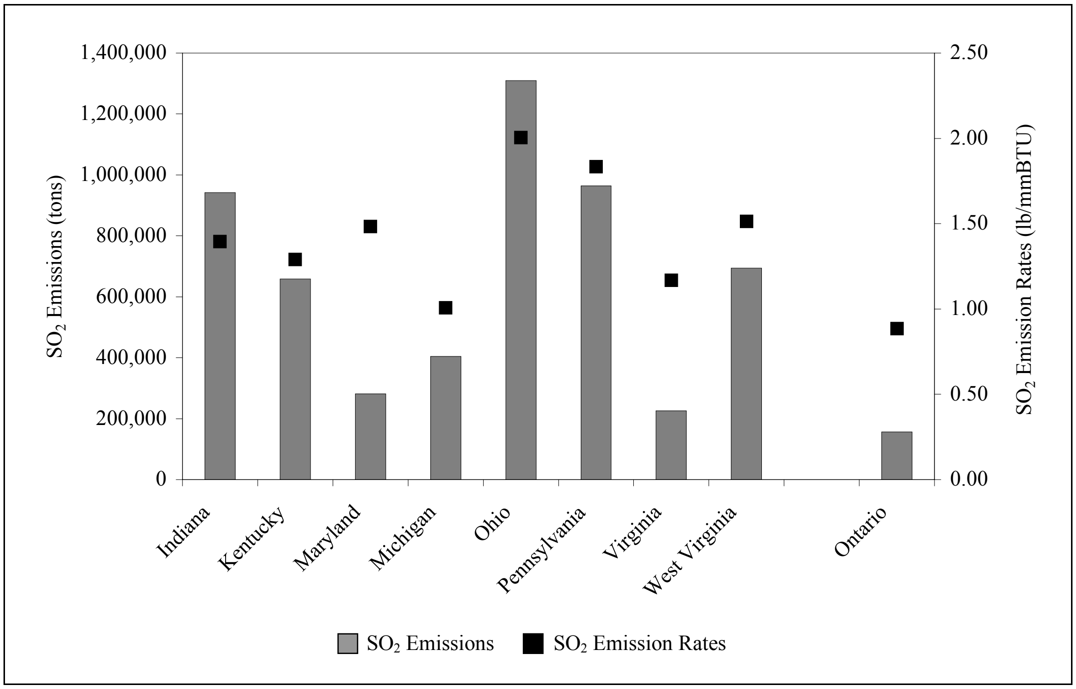
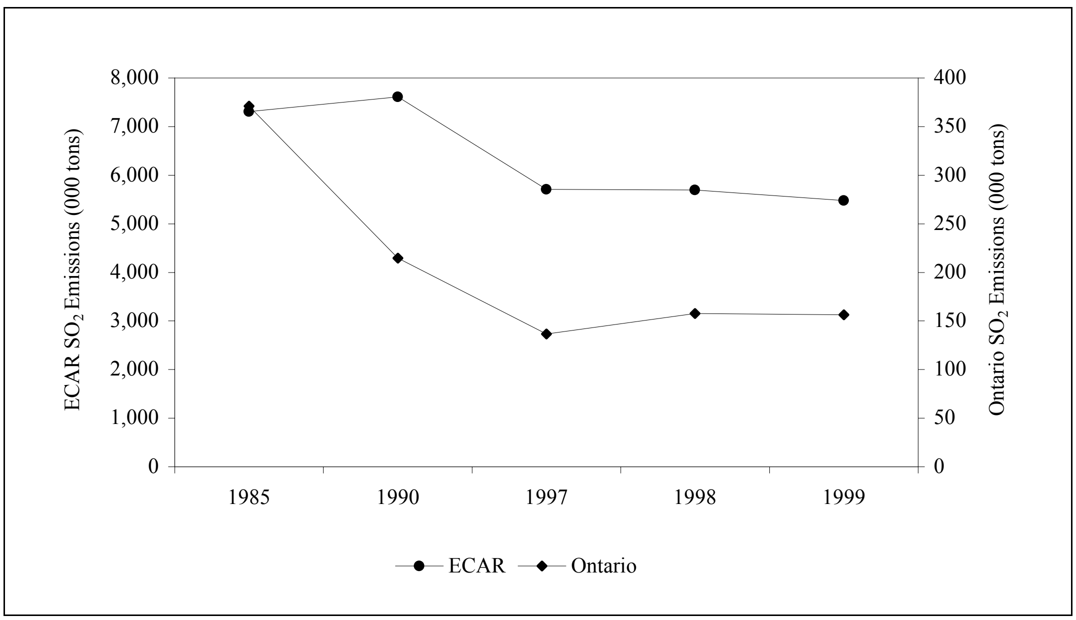


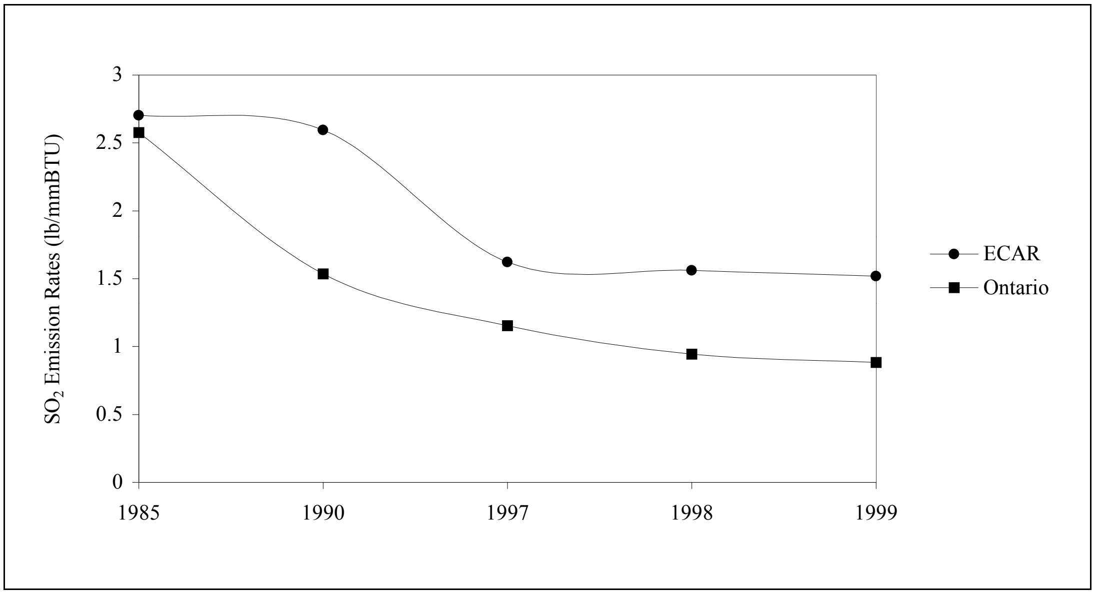
Figure 16. SO_2 emissions in ECAR and Ontario



This difference reflects the leadership role that Ontario took in the early 1990s to tackle the acid rain problem. It is interesting to note that Ontario already exceeds the CAAA Phase II rate of 1.2 lb/mmBTU (0.54 kg/mmBTU) for SO_2. In ECAR region, the major reduction in SO_2 took place in 1995, when Phase I of the CAAA came into effect.

As the electricity markets open, the US utilities will have a competitive advantage in the control of SO_2 over the Ontario generators, since they will be able to use their banked SO_2 emission allowances and delay investing in costly SO_2 control technologies to comply with the Phase II of the CAAA.

Figure 17. SO_2 emission rates for ECAR and Ontario



7 Impact of Environmental Regulations on Coal Generation, Air Emissions and Trade of Electricity

This section will present results from two studies that Ontario Power Generation has conducted with assistance from external expert consultants. The studies were undertaken to address specific strategic issues pertaining to electricity deregulation in Canada and the United States and its impact on electricity generation in Ontario. As a result, only the portion of the findings relevant to this report has been extracted from these studies.

7.1 Modeling of the North America Electricity System under Open Competition

The first study was undertaken by Hill and Associates, a US consulting firm specializing in modeling and forecasting coal demand and electricity generation. The study modeled the behavior of utilities in the United States and Canada under competitive market conditions and different environmental scenarios over the 2002–2007 time period. The model considered environmental and transmission constraints, specific characteristics of generation plants, fuel costs and emission control costs under various environmental scenarios. From these variables, the model generated projections about fossil generation, emissions, compliance strategies, price, and imports and exports.

The model forced utilities to remain within national or regional pollution limits. In order to comply the model allows the utilities to switch to lower sulfur coals, trade emission allowances, install emission control equipment, and manipulate the load factor for each plant.

The model is composed of two pieces, the Utility Fuel Economics Model (UFEM) and the National Power Model (NPM). The actual running of the integrated model is an iterative process for each year run, requiring first a set of fuel and clean-up choices (from the UFEM), followed by a decision on how heavily to dispatch each plant at those particular fuel costs and emission rates (from the NPM). Once the plants are dispatched by the NPM in the most economic manner (while staying within the total national or regional pollutant limits), the amount of generation required of each coal plant is then fed back to the UFEM model where new fuel and clean-up choices are made, given this updated load on each plant. As these new fuel choices are made, yielding new fuel costs and emission rates for each plant, these are fed back over to the NPM model, which re-dispatches all plants. This loop continues until convergence is reached with no significant change occurring in each model's results during a new loop. Thus, the model is not just finding which fuel provides the lowest cost per million BTU's of heat input—it is answering the question of whether the plant actually dispatches with that fuel's costs (including necessary clean up costs) and emission rates of SO_2 and NO_x.

PHB Hagler Bailly, a consulting firm specializing in energy studies and modeling the electricity system of North America, undertook the second study. The GE MAPS model was used to model the Eastern Interconnection electricity system of the US, including Ontario. The model contains detailed information on generating stations and transmission lines in the areas it models. Information on generation facilities includes the location of the stations, capacity of the stations, their fuel efficiency, start up costs, fixed and variable operating costs, and technical data such as forced outage rates. For transmission systems, data include the capacity of the available transmission lines, the nodes at which they intersect, the connection points of generators, and the demand points for load. New plants enter the system only when the average price over a year is sufficient to pay their full costs, including capital costs. In an hourly competitive market, generators are expected to supply electricity at any price that covers their incremental generation cost. Since that cost will not also cover capital costs, generators must expect higher prices at some times of the year if they are to believe that they can make an overall profit. This representation of the physical system forms the basic model.

The GE MAPS model solves for the optimal dispatch, given the resources available, in each period of the day. The model solves every other hour for a year. At each solution time, the model dispatches the resources that will most cost effectively satisfy the load.

The GE MAPS model also included assumptions about electricity demand forecasts, fuel prices and open electricity markets over the next 10 years that were generally consistent with the assumptions used in the Hill model under the NAAQS Case. The Hagler Bailly study however, focused on the 2005 to 2012 period rather than the 2002 to 2007 period addressed by the Hill study.

7.2 Environmental Scenarios

The impact of future environmental regulations on fossil generation and trade of electricity were assessed using two environmental scenarios:

Base Case: This case imposed the restrictions of Phase II of the Clean Air Act Amendments (CAAA). In the year 2000, SO_2 was limited to 1.2 lb/mmBTU (0.54 kg/mmBTU) and NO_x was limited to 0.40–0.46 lb/mmBTU (0.18–0.21 kg/mmBTU), depending on the type of boiler. For the eleven states in the Ozone Transport Commission (OTC) Region further emission reductions were imposed. For Ontario, a cap of 193,000 tons on SO_2 and 64,000 tons on NO_x (175,051 and 58,048 metric tons, respectively) was imposed. (Since the study was completed, the government of Ontario has proposed the SO_2 and NO_x caps for Ontario to be reduced to 174,000 tons [157,818 metric tons] and 61,000 tons [55,327 metric tons] for SO_2 and NO_x respectively effective in 2001.)

NAAQS Case: This case imposed the more stringent 22 State Implementation Plan (SIP Call) restrictions proposed by the EPA in order for states to meet the National Ambient Air Quality Standards (NAAQS). For the year 2003, NO_x was reduced to 0.15 lb/mmBTU (0.045 kg/mmBTU). The SO_2 limits were assumed to be the same as in the Base Case over the 2002 to 2007 study period. For Ontario, the NO_x limit was set to a flat cap equivalent to 0.15 lb/mmBTU (0.068 kg/mmBTU) while the SO_2 limit remained the same as in the Base Case.

7.3 Impact of Environmental Regulations on Coal Generation and Air Emissions

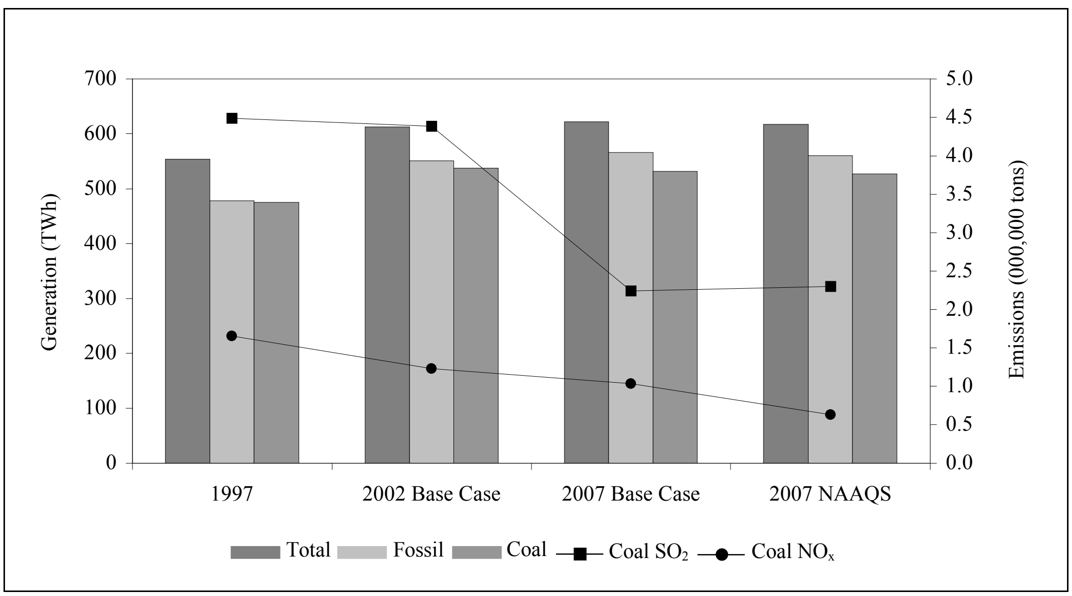
First the results from the Hill study will be reported, followed by the results from the Hagler Bailly study.

The increased capital and operating costs to coal-fired generation under the NAAQS Case relative to the Base Case were estimated to be $1 billion per year by 2007. These costs are above and beyond the clean up costs associated with the new NO_x and SO_2 limits imposed by the Phase II of the CAAA starting in 2000. With current total annual US generation costs (including capital) in excess of US$70 billion, the incremental cost for cleaning up under the NAAQS Case is not expected to have significant impact on the overall cost of power in the US. However, because the financial impact will be concentrated in the coal-dominated Midwestern and southeastern portions of the US, generators in these regions will have to invest a high amount of capital in emission control equipment in order to maintain their business.

As it was discussed in the previous sections, the region of highest interest for this study is ECAR as it is one of the major Ontario's direct trading partners in the US and its generation is dominated by coal. It should be noted that ECAR region here is as defined by NERC. It includes Indiana, Michigan, Ohio, West Virginia and only parts of Pennsylvania, Kentucky, Virginia and Maryland states.

Figure 18 shows, for the Base Case and the NAAQS Case, the ECAR region's total expected generation and coal-fired generation (bar chart reading off the left vertical scale) as well as the tons of SO_2 and NO_x emitted from ECAR coal plants (solid lines reading off the right vertical scale).

Figure 18. ECAR – generation and emissions projections (Hill Study)



Although the Phase II of the CAAA came in to effect in 2000, the SO_2 emissions are not expected to be reduced significantly, as the utilities have accumulated significant amount of SO_2 allowance after over-complying with Phase I emission limits. As a result, utilities are expected to postpone major investments in reducing SO_2 by two to three years.

Another factor keeping 2002's SO_2 emissions level up is the fact that utilities in general are postponing the big-ticket capital decisions (like installing scrubbers) in the face of deregulation uncertainty and environmental uncertainty. After the SO_2 bank has been exhausted and several new scrubbers are built between 2002 and 2007, the ECAR's coal-fired SO_2 emissions finally drop in response to the acid rain limitations of Phase II.

Looking at the NO_x trend in ECAR under the Base Case, without a bank of allowances to draw down (as was the case for SO_2), NO_x clean up begins immediately with the implementation of the CAAA Phase II standards. As a result, the 2002's NO_x tons emitted from coal plants is significantly lower than 1997's emissions despite coal generation having grown about 8%. Then as coal-fired generation remains basically stable from 2002–2007 and NO_x clean up continues, the total annual tonnage of NO_x emitted from coal-fired plants drops further to approximately 1 million tons (907,000 metric tons). Under the NAAQS Case, the NO_x emissions are reduced by more than 65% from the 1997 level to 600,000 tons (544,200 metric tons) in 2007.

It is interesting to note that the amount of coal-fired generation is basically the same for the Base Case and the NAAQS Case in the ECAR Region in 2007. The NO_x emissions, however, have been reduced by more than 40 % relative to the base case. This indicates that the clean-up costs have been incurred but are not high enough to reduce coal-fired generation over this period.

Note that although it has been expensive to achieve this clean up, the coal generation in the ECAR region has not decreased. As a result, coal is expected to continue dominating the electricity generation in the Midwest even after the most stringent environmental regulations have been implemented.

The findings of the Hill study were supported by the Hagler Bailly study. The modeling results over the period 2005 to 2012 have shown that, even under the NO_x SIP Call environmental regulations and competitive electricity markets, coal will continue to be the fuel of choice in the Midwest and the ECAR region, in particular.

Figure 19 shows that coal generation will increase by 15% from 1999 to 2005. As the NO_x SIP Call comes into effect, the generation from coal will stay relatively constant at 2005 level over the study period.

Both studies have found that under competitive market conditions in the electricity sector the coal generation will not decrease over the next ten years. The SO_2 and NO_x emissions however, will be reduced drastically as the CAAA Phase II limits come into effect and the NO_x SIP Call limits are implemented. It should be noted that if the electricity markets were opened to competition before the implementation of the NO_x SIP Call limits, the air emissions from the Midwest states could increase and would have a negative impact on air quality in Canada and Northeast US.

7.4 Impact of Electricity Deregulation on Electricity Trade

Figure 20 shows that the electricity "transfers out" from ECAR to other regions could decline as much as 54 %, from 28 TWh in 1998 to less than 13 TWh by 2010. One of the major reasons for this decrease is the NO_x SIP Call limits that come into effect before 2005. In addition, the electricity demand will grow within the ECAR region and as a result will decrease the availability of generation for "transfers out."

Figure 19. ECAR – electricity generation by fuel type (Hagler Bailly Study)

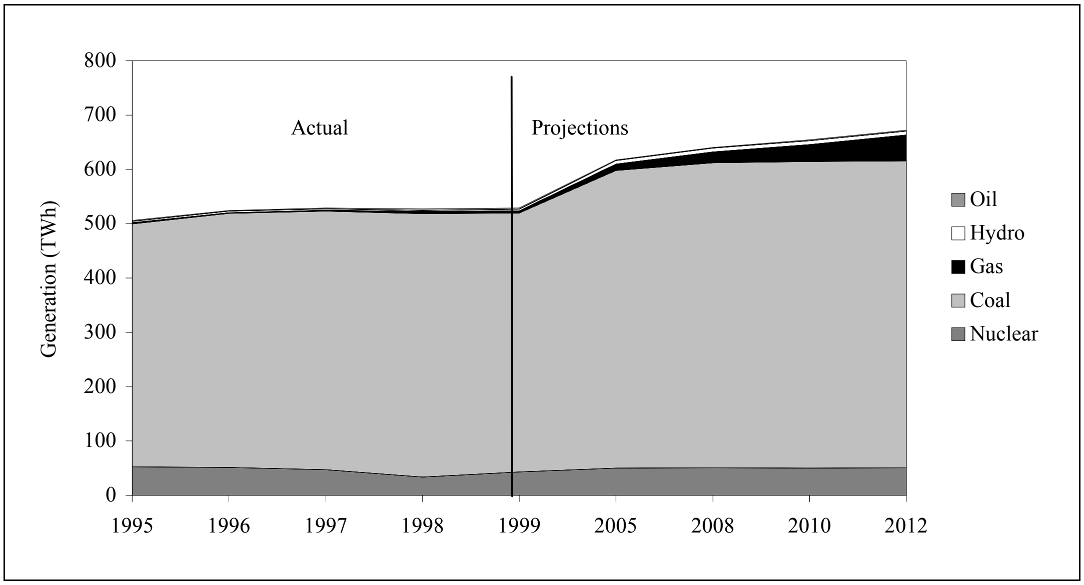
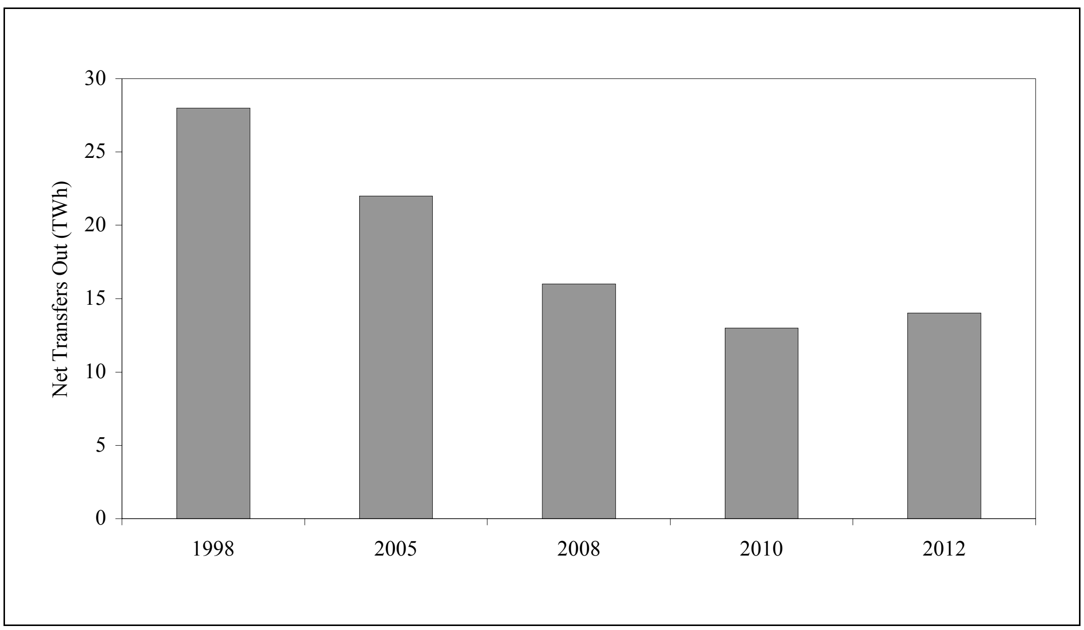


Figure 20. ECAR – electricty net transfers out projections (Hagler Bailly Study)

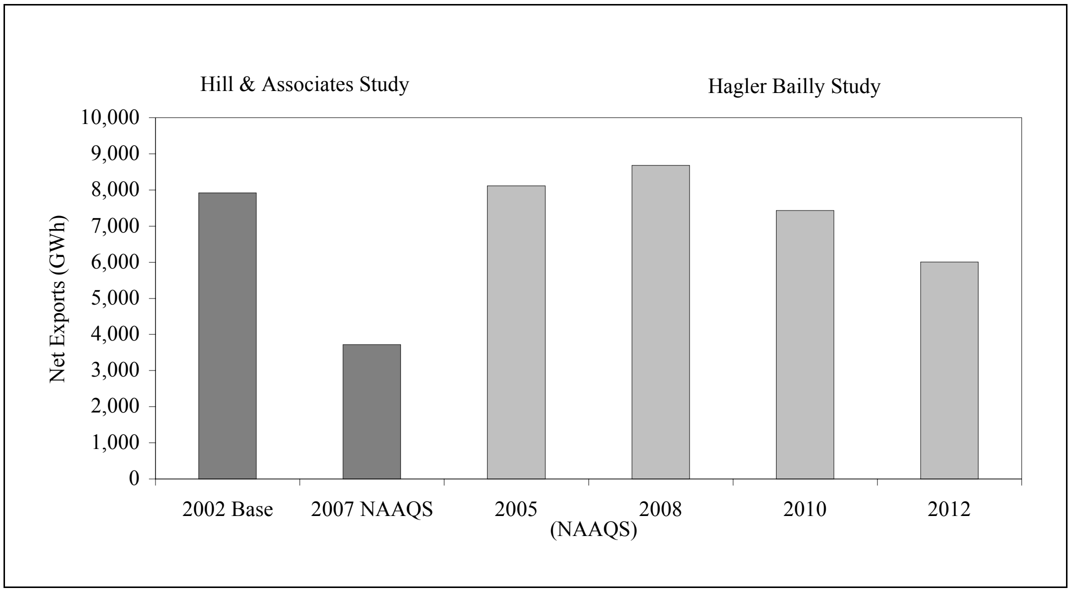


Source: 'Coal and Power Import and Export', DOE 1998. PHB Hagler Bailly, 2000

The expected reduction of ECAR "transfers out" is an indication that the electricity restructuring will not increase in the long run the flow of coal-generated electricity from Midwest to Northeast part of US to Canada.

Another indicator of the impact on environmental quality is the amount of electricity trade expected between Ontario and US under open access of electricity markets. Figure 21 shows the results from the two studies.

Figure 21. Ontario net export projections by Hill & Associates and Hagler Bailly



Both studies have estimated that Ontario will continue to be net exporter of electricity even when the SIP Call standards (NAAQS Case) are applied throughout the region.

The Hill study estimated that electricity exports could increase to 8 TWh by 2002 under the Base Case. As the SIP Call comes into effect, the net electricity exports are reduced below 4 TWh per year in 2007. The Hagler Bailly study estimated higher net annual exports ranging from 8.7 TWh in 2008 to 6 TWh in 2012.

These export levels are in line with the historical trends. In all cases, the majority of electricity is exported to the ECAR (Michigan) and NPCC (New York) regions. The amount of imports from the US is expected to be small over the study period relative to the exports, which is indicative of the competitive advantage that Ontario has over the electricity producers in the neighboring regions.

Based on the above analysis, we could infer that the impact of free trade in electricity between Ontario and US is not expected to adversely affect the air quality in Ontario if both countries follow through with their plans to implement the NOx SIP Call emission standards. In the short- run, however, if open access were to take place before the SIP Call came into effect, the emissions could increase, adversely affecting the air quality in Canada and Northeastern states.

8 Summary of Findings

The major findings of this study are summarized below:

- The US produces about 66% of its electricity from fossil fuels, compared to only 24% for Canada. The share of coal in electricity generation in the ECAR region is over 80%, in comparison to 25% in Ontario.
- It has been estimated that more than 50% of the annual smog in Ontario originates from US sources. Most recent research has shown that more than 80% of the ozone in Ontario during high smog conditions is caused by US sources—of which, 27% is attributed to US electric utilities in the Midwest. Ontario emissions also contribute to smog in some US locations but to a much smaller degree—ranging from 0% in western Massachusetts to 4% in Portland, Maine.

- The deregulation of electricity markets has proceeded simultaneously in the two countries, with full competition at the wholesale level, and retail access expected in Ontario and much of the US in the coming years.
- Environmental regulations for reducing NO_x and SO_2 had diverged in 1980s and early 1990s, with Ontario and Canada taking a lead role in reducing acid gas emissions. With the implementation of Phase II of the CAAA in the US that started on January 1, 2000, there is evidence that the environmental regulations for NO_x have converged—resulting in the Midwest utilities having average annual NO_x emission rates very close to those of Ontario.
- Although both counties have made progress in SO_2 reductions, Canada—and Ontario, in particular—has made reductions early on, so that it has met the Phase II CAAA limits since 1997. In the US, the utilities will rely heavily on selling allowances that they have accumulated by over-complying with the Phase I of the CAAA. As a result, they will avoid making significant capital (equipment) investments over the next two to three years to reduce SO_2 emissions.
- The emission allowances trading programs for NO_x and SO_2, in particular, have a long history in the US, with electric utilities minimizing their costs of complying with environmental regulations. Although Ontario has an emissions credit program, it is at the pilot stage and has not been included as part of the environmental regulations yet.
- The use of coal for electricity generation is expected to increase over the next four to five years. With the most recent decision by the US courts to delay the NO_x SIP Call implementation until 2004, there is a risk that air emissions in the US Midwest will increase in the short-term before they start declining again.
- Although it will be expensive to meet the NO_x SIP Call standards, coal-fired generation in the Midwest, and the ECAR region, in particular, is not expected to be reduced even after the implementation of the NO_x SIP Call regulations. The NO_x emissions, however, are expected to be reduced by more than 65% from the 1997 level by 2007.
- Electricity transfers from the ECAR region to the rest of the US are expected to decline over time after the implementation of the NO_x SIP Call.
- To mitigate the potential effects of electricity restructuring on air emissions, many states have included environmental provisions in state restructuring laws, including system benefit charges, renewable portfolio standards and emissions portfolio standards.
- Ontario is expected to maintain its competitive position in the region, with electricity exports estimated to increase—returning to historical levels as the nuclear recovery program is fully implemented.
- The deregulation of electricity industry in the two countries and the free trade of electricity between Ontario and its neighboring jurisdictions is not expected to adversely affect the air quality in the long run. This assumes that the NO_x SIP Call emission limits will be in effect as the electricity markets open to competition.

9 Policy Considerations

Any policy considerations should take into account the following factors:

- Ontario and the eastern US have common airshed and heavily interconnected electricity systems.
- The electricity generation mix is very different in Canada and the US. This difference has resulted in significantly different air emission profiles in the two countries.
- US sources of emissions have a significantly larger impact on Canadian air quality than the impact of Canadian emission sources on the US.
- Both countries have made significant reductions in emissions and regulatory trends indicate that further reductions will be required in the near future.
- With the opening of electricity markets in both countries, environmental regulatory policies will influence the flow of electricity across the borders.
- Based on this analysis, it could be inferred that the impact of free trade in electricity between Ontario and the US is not expected to affect the air quality in Ontario and the US, if both countries follow-through with their plans to implement the NOx SIP Call emission standards. In the short- run, however, if open access takes place before the SIP Call comes into effect, emissions could increase—adversely affecting the air quality in Canada and the northeastern US.

Taking the above factors into account, the following policy considerations are proposed to ensure a level playing field in the electricity markets and minimize future environmental impacts of electricity trade as the electricity markets open to competition:

- The environmental regulations in the two countries should take into consideration regional differences and potential impacts of air emissions.
- The regulatory systems in Canada and the US should continue to converge by harmonizing the air pollutant emissions standards for the electricity generators to compete on a level playing field as electricity markets open to competition.
- The emissions trading programs should be harmonized in order for the generators in both countries to be able to take advantage of opportunities for reducing their emissions at lowest cost.
- The two countries should establish a process for harmonizing the development of new regulations, such as mercury emissions and long-term targets for SO_2 and NO_x emissions, as they address the issue of PM10 and PM2.5 particulates in the coming years. The new regulations should maintain the level playing field among the electricity generators as electricity markets open to competition in the two countries.
- The definitions of environmental provisions (i.e., renewable portfolio standards, emission portfolio standards and environmental reporting) proposed to enhance cleaner technologies need to be harmonized to ensure a level playing field in electricity markets.

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Improving Wastewater Infrastructure along the Arizona-Mexico Border: An Analysis of Trends and Ideas

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Abstract

This project examined the effect of NAFTA on the number and type of Clean Water Act violations at three wastewater treatment facilities along the Arizona-Mexico border. This study also focused on the relative availability of information regarding environmental compliance in the United States and Mexico. Discharge monitoring reports were collected for up to ten years from three wastewater treatment plants, City of Yuma, Figueroa, the Nogales International Wastewater Treatment plant, and the Bisbee Mule-Gulch plant. The number and types of Clean Water Act violations were then tallied from the discharge monitoring reports. The study revealed the importance of open government in monitoring environmental compliance and concluded that both the Untied States and Mexico could improve public access to government information. Furthermore, the data collected revealed that NAFTA does not appear to have directly impacted the number or type of wastewater treatment plant violations at the three plants. Finally, that both the Nogales and Bisbee plants are in need of upgrades, although it is unclear when or how such repairs will occur. A further study incorporating more complete data from the United States, and data from Mexico, are necessary to fully evaluate NAFTA's effects on wastewater treatment along the Arizona-Mexico border.

1 Introduction

Although the Arizona-Mexico border area[1] is only about 350 miles long, its environmental problems are no less severe than those of California or Texas, which often dominate press attention. Since the adoption of the North American Free Trade Agreement (NAFTA) in 1994, the Arizona-Mexico border has seen an insurgence of industrialization and growth, despite the inadequacy of basic services such as wastewater treatment. At public meetings, many people living on the Mexican side of the border voice concerns regarding the lack of potable water.[2] On the Arizona side of the border, however, one of the worst environmental problems is lack of wastewater treatment.[3] While there are many wastewater treatment facilities along the border area, most are in disrepair or unable to handle the amount of wastewater generated today because the facilities were built before increased industrial development along the border. Some facilities have applied for, or have already received funding from various border agencies to upgrade or rebuild the facility. Others, however, continue to inadequately treat water, pollute the environment, and violate federal law. In some places, such as Naco, Arizona, the lack of any wastewater treatment facility poses potentially serious environmental and health concern.

Despite the ongoing wastewater treatment problem, no treaty or other law specifically addresses how binational wastewater treatment problems should be solved. NAFTA and the North American Agreement on Environmental Cooperation (NAAEC) discuss the general prohibition against violating one's own environmental laws,[4] but neither agreement addresses how wastewater treatment problems should be addressed on a binational level.[5] More importantly, no law or treaty clearly assigns enforcement obligations to any specific agency or nation. As a result, many violations of environmental law along the border are ignored and laws remain unenforced.

While the lack of wastewater treatment poses detrimental health and environmental effects, several factors can be identified that may assist in finding solutions to this, and other, environmental problems along the border. At least three primary causes contributing to environmental degradation along the border can be identified: (1) lack of an overall plan to address border environmental needs;[6] (2) lack of enforcement of environmental laws in the border area in particular;[7] and (3) lack

[1] According to the La Paz Agreement, the "border area" includes the land 100 kilometers north and south of the border itself. 80 Stat. 271, Article 4, August 14, 1983. The La Paz Agreement is a treaty between the United States and Mexico which provides, in part, that the two countries work cooperatively to solve environmental problems along the border.

[2] See Rosario T. Limon, *Drinking Water Source of Death in Mexico*, Reuters, August 12, 2000.

[3] For the purposes of this paper, the term "wastewater" includes water being discharged from households, industrial facilities, and stormwater run-off, which can often contain a combination of natural sediment and other organic substances, industrial, and household wastewater.

[4] A citizen submission may be brought pursuant to Articles 14 and 15 of the NAAEC, against another country party to NAFTA, for failure to uphold its own environmental laws.

[5] The International Boundary and Water Commission ("IBWC") is the primary binational (the IBWC's Mexican counterpart is the Comisión Internacional de Límites y Aguas ("CILA")) agency involved in operating wastewater treatment plants that treat water from both the United States and Mexico. IBWC operates at least two plants, one in San Diego, California, and one in Nogales, Arizona. Both are currently being upgraded with funds awarded by US EPA, the IBWC, and the Border Environmental Cooperation Commission ("BECC").

[6] See G.A.O. *Report to Congressional Requesters, US-Mexico Border: Despite Some Progress, Environmental Infrastructure Challenges Remain*, March 2000 (hereafter "GAO Report 2000").

[7] Despite violations at the Nogales International Wastewater Treatment Plant ("Nogales plant), US EPA has taken no enforcement action under the Clean Water Act, 33 U.S.C. § 1319, to remedy the violations. While US EPA is responsible for recent funding to improve the Nogales plant, EPA maintains that it has complete discretion regarding whether or not to enforce the Clean Water Act. See US EPA's Motion to Dismiss, *Sierra Club et al. v. Browner et al.*, CV-00-184-TUC-RCC (D. Ariz. 2000). In June of 2000, EPA initiated enforcement action against the City of Bisbee Mule Gulch Wastewater Treatment Plant ("Bisbee plant"), although EPA has not publicly released any information on this enforcement action.

of funding to improve and maintain necessary wastewater treatment plants.[8] All three of these deficiencies are evident when analyzing wastewater treatment violations along the Arizona-Mexico border. This paper will review data regarding wastewater treatment violations[9] along the Arizona-Mexico border, and present suggestions for improving wastewater infrastructure. It will also address the importance of open government in the context of environmental regulation.[10] In Arizona, data were collected for three cities: Nogales, Bisbee, and Yuma.[11] In an attempt to collect similar data from Mexico, a survey relating to wastewater treatment was sent to government and other agencies in San Luis de Colorado, Nogales, and Naco, Sonora, the sister cities of the chosen cities in the United States. Unfortunately, no information was received from Mexico. Compliance data, however, were collected from three wastewater treatment plants on the United States side of the border. In the following discussion, I will first briefly discuss the hypothesis and applicable environmental law from the United States and Mexico. Then, I will discuss the methods for data collection, analysis, and conclusions. Finally, I will include ideas on open government and dissemination of information.

Hypothesis

Prior to receiving and analyzing any data, I hypothesized that the number of wastewater treatment plant violations would increase following the initiation of NAFTA in 1994. I suspected violations to increase after NAFTA because of the increase in development and industrialization in all three sampled cities after NAFTA became effective. I further expected that the violations would continue to increase until the wastewater treatment plant at issue was upgraded to accommodate the increased wastewater generated by the sudden growth spurred by NAFTA. The data collected indicate that NAFTA has had no direct effect on the number of wastewater treatment plant violations—violations occurred before and after NAFTA at approximately the same rates.[12] Before addressing the specific data, however, it is important to understand a few differences between environmental laws in the United States and in Mexico, and how these differences affected my ability to obtain compliance information.

2 Introduction to Applicable Law

2.1 Applicable US Law

The US legal system is a common-law system which relies upon the establishment of state and federal laws that are then interpreted by state and federal courts. Comprehensive environmental law

8 Most of the border towns do not have enough sources of funding within their own communities to pay for necessary wastewater infrastructure. Such cities and towns are forced, instead, to seek funding from agencies such as US EPA, the North American Development Bank ("NADBank"), and other Mexican equivalents.

9 "Wastewater treatment plant violations" refers to any violation of the Clean Water Act which occurred at a wastewater treatment plant. Part II of this paper describes the Clean Water Act, and what constitutes a violation of the Act.

10 The analysis of violations at the wastewater treatment plants was done using the water indicators listed in the CEC's *Final Analytic Framework for Assessing the Environmental Effects of the NAFTA*, June 1999 ("Framework"). The Framework describes, in section V,B, water indicators, which are useful when discussing whether or not water quality as increased or decreased since NAFTA. This paper specifically analyzed one main water indicator, surface water pollutants. Because the concentration of pollutants in surface water has direct consequences on drinking water quality, fish and wildlife, and human health concerns, this indicator was considered to be extremely important, and was predominately used for this paper.

11 Initially, I had hoped to review violations data for six different cities, three in the United States, and three in Mexico. Even if I had received some information from Mexico, it would have been difficult to compare that information to what I received from the United States. Mainly, this is because Mexico uses a different system than the United States for monitoring compliance with environmental laws. Each country, therefore, is better compared against its own laws, and its own theories on environmental preservation.

12 There were two exceptions to this general rule. For the Nogales data, violations were extremely high in both 1994 and 1998. The Bisbee data also showed an extremely large number of violations in 1998.

has existed in the United States since the early 1970s. Most environmental laws are similarly structured, containing a description of what is required, a delegation of duties to various agencies that will be implementing and enforcing the statute, and an enforcement provision which describes penalties and other remedies which may be sought under the statute. While there are several federal statutes that discuss water, the Clean Water Act (CWA)[13] is the main federal law dealing with water treatment, and the standards that waters must meet if they will be discharged into a stream. The fundamental goal of the CWA is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[14] The CWA further requires that a minimum level of water quality be achieved in all navigable waters in the United States—such water quality must provide for the protection and propagation of fish, shellfish, and wildlife, and allow for recreational uses on the water.[15]

One of the primary means for achieving the objectives of the CWA is through the issuance of permits which govern the discharge of pollutants into rivers, lakes, and other waters.[16] A National Pollution Discharge Elimination System (NPDES) permit is required for all discharges from point sources into navigable waters.[17] Any wastewater treatment facility that discharges into waters of the United States is required to obtain an NPDES permit.[18] The NPDES permit establishes certain standards and limitations with which the permittee must comply. In addition, the NPDES permit requires that the permittee submit, on a monthly basis, a discharge monitoring report (DMR) which describes the permittee's compliance with its permit and specifically reports any violations of the permit. DMRs are submitted to the agency that administers the NPDES permit program for the state at issue. The Environmental Protection Agency (EPA) was delegated responsibility by Congress to enforce and implement the CWA, including the NPDES permit program. EPA may, however, delegate administration of the NPDES permit program to a state which meets several criteria.[19] In the State of Arizona, EPA, not the state, is responsible for the NPDES permit program, and DMRs are therefore submitted to EPA Region IX in San Francisco, California. In addition, many wastewater treatment plants in Arizona also submit DMRs to the Arizona Department of Environmental Quality (ADEQ), the state environmental protection agency.

All United States environmental laws, including the CWA, have in common one very important provision, the citizen suit provision. A citizen suit is a lawsuit brought by any person who has an interest[20] against either a polluter or the regulator in charge of ensuring the CWA is not violated. A citizen suit against a polluter may seek injunctive relief asking the court to issue an order requiring the polluter to cease the polluting activities. A suit against the regulatory agency (either the federal

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13 The Clean Water Act, 33 U.S.C. § 1251 et. seq. For the purposes of this paper, when I discuss wastewater treatment plant violations, I am referring to violations of the Clean Water Act or LGEEPA for discussions on the United States or Mexico, respectively, unless otherwise noted.

14 33 U.S.C. § 1251 (a). Notably, Congress also announced a national goal that "the discharge of pollutants into the navigable waters be eliminated by 1985," an ideal that will probably never be achieved. Today's version of the goal is pollution control by permitting all discharges from any point source into a navigable water. Point source is specifically defined in the CWA, 33 U.S.C. § 1362 (14).

15 33 U.S.C. § 1251 (a)(1).

16 *See Gwaltney of Smithfield, Ltd. v. Chesapeake Bay Foundation*, 484 U.S. 49, 52-53 (1987).

17 33 U.S.C. § 1342.

18 There is one wastewater treatment plant in the United States that does not have an NPDES permit. That is the Douglas Wastewater Treatment Plant, the outfall of which is across the United States border, in Mexico. Although the CWA does not require that the Douglas plant have an NPDES permit, there is no prohibition against ensuring that the water discharged from the Douglas plant is meeting water quality standards set by both the United States and Mexico. Yet there is no evidence indicating that discharges from the Douglas plant are monitored.

19 33 U.S.C. § 1342 (b).

20 The term "citizen" is defined in the CWA as any person who has "an interest which is or may be adversely affected." 33 U.S.C. § 1365 (g).

EPA or a state agency) is brought for failure of that agency to uphold a mandatory duty[21] under the CWA. The main remedy available for this type of citizen suit is an order from the court requiring that the agency uphold its mandatory duties. Any plaintiff that has substantially prevailed through a citizen suit is entitled to attorney's fees and costs, but no other compensatory or punitive damages. While some attorneys argue that citizen suits grant too much power to the people, it is clear that such suits are "useful additional tool[s]" to enforce environmental laws in the United States.[22] Without the ability of individuals to act as an attorney general through the citizen suit provision, the quality of the United States environment would be much worse off than it is today.

Although the citizen suit provision is important, its value to the people is directly proportional to the amount of compliance-related information available to those who might be affected and in a position to have standing[23] to bring a citizen suit. The Freedom of Information Act[24] (FOIA) allows for public access to government information and documents through written requests. Although some exceptions exist,[25] most information must be produced to an inquiring person. FOIA also contains a fee waiver provision so that members of the public who may not be able to afford copying and mailing costs can still have access to the information they desire. The citizen suit provision and FOIA are the two main ways in which United States law explicitly provides for the people to take an active role in protecting the environment and their own health.

With regards to researching CWA violations, DMRs are the simplest and most direct method for a member of the public to learn of violations and proposed remedies to the problem.[26] DMRs are an important source for information regarding industrial and governmental compliance with NPDES permits. DMRs are made even more important by their availability to the public, as they are probably the most readily available documents describing violations of federal law. In Arizona, the most direct method to obtain DMRs is to go to ADEQ's main office in Phoenix, Arizona, and request to see DMRs from a particular plant. Another method to obtain DMRs is by submitting a FOIA request[27] to EPA or ADEQ. The availability of DMRs, and other information, through FOIA, helps keep the government open and accountable to the people who elected and established that government.

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21 Exactly what duties are "mandatory" under the CWA is currently an issue of great controversy being litigated in several courts around the country, including the District of Arizona. *See Sierra Club et al. v. Browner et al.,* CIV-00-184-TUC-RCC, EPA's Motion to Dismiss (D. Ariz. 2000). In the next few years, this issue is likely to emerge as one of the most important environmental concerns—how and to what extent will environmental laws be enforced. The issue tackles, from a policy perspective, the problems that result when regulators "choose" not to enforce an environmental law, especially in a sensitive area such as the Arizona-Mexico border region.

22 *Gwaltney of Smithfield v. Chesapeake Bay Foundation*, 484 U.S. 49, 61 (1987) (quoting Senator Bayh).

23 Standing is a fundamental requirement a plaintiff must satisfy in order to bring a citizen suit. Standing is defined by Article III of the US Constitution which requires there be a case or controversy for the court to hear. The Supreme Court of the United States, in *Lujan v. Defenders of Wildlife*, 504 U.S. 555 (1992), further enumerated a multi-tiered test for determining whether a plaintiff satisfies the standing requirements of Article III. In order for a plaintiff to have standing to bring a citizen suit, the plaintiff must demonstrate (1) injury in fact; (2) that the defendant caused the plaintiffs injury; (3) that the court will be able to grant relief to redress the plaintiff's injury; and (4) that the plaintiff falls within the zone of interests protected by the statute under which the action is being brought. The Supreme Court most recently discussed standing in *Friends of the Earth v. Laidlaw Environmental Services* (TOC), Inc., 120 S. Ct. 693 (2000).

24 5 U.S.C. § 552.

25 There are nine primary exceptions to FOIA that are listed in section 552(b) of the statute. They include things like privileged information or trade secrets. Most information requested by the public, especially under the CWA, would not fall into a FOIA exception. Even if the government claims a privilege, or another exception, the person requesting the information may challenge the withholding of the information in court.

26 DMRs that report violations are often accompanied by a letter from the wastewater treatment plant operator discussing the reason for the violation and sometimes stating that the problem has already been resolved, or will be soon.

27 The following web site is very helpful in the FOIA submission process: <www.citizen.org/public_citizen/litigation/foic/foilguid>. See also, <www.epa.gov/foia>.

2.2 Applicable Mexican Law

The roots of Mexican environmental law come from Mexico's Constitution, as opposed to federal law as is the case in the United States. Mexico has a civil code system, as opposed to a common law system, which, in essence, means that courts do not play a central role in law reform and interpretation. Mexican environmental law is similar to United States law in both substance and organization. Mexico's *Ley General del Equilibrio Ecológico y la Protección al Ambiente*[28] (LGEEPA) describes basic principles of environmental law, and also addresses wastewater treatment. There are several different government agencies that carry out the obligations described in LEEGPA.[29] The Secretary of Social Development (Sedesol) is the main agency responsible for implementing and enforcing LGEEPA. Sedesol also includes two other agencies each with more specific duties under LGEEPA. The National Ecology Institute (INE) is responsible for general policy and law development, including the establishment of environmental standards and conducting studies to determine the impact of pollution on the environment. The enforcement powers are placed in an attorney general type office, the *Procuraduría Federal para la Protección Ambiental* (Profepa).

In Article 117, LGEEPA can be roughly translated to say that urban wastewater should receive treatment prior to being discharged into a receiving water.[30] Although LGEEPA does not impose a permit program like the NPDES permits, regulations and "norms"[31] established by Mexican environmental agencies control water quality standards that wastewater should satisfy.[32] Mexico does have a registration system, which is essentially a less regulated version of a permitting system. The registration is overseen by the National Water Commission (CNA). This program requires that all discharges be registered with the CNA, and reminds the entities causing the discharge of the technical standards the discharges must meet.[33] Article 24 further enumerates several water quality standards. The CNA is responsible for enforcing these provisions of LGEEPA. LGEEPA does not appear to provide any mechanism for ensuring all discharges are registered. Furthermore, it is not clear whether the remedy for failure to register is to require registration, or whether there are some potential penalties or fines associated with failure to register. The latter would provide an incentive for dischargers to register and therefore make the process more effective.

While LGEEPA is very similar in substance and procedure to United States environmental laws, LGEEPA does not have any provision authorizing a citizen to bring a legal action against a regulator or violator of LGEEPA.[34] LGEEPA describes the idea of "popular action," which is a method for citizen participation, but without any direct delegation of authority to that citizen. Article 66 of LGEEPA states that any person may denounce, through a popular action, the existence of any source of pollution, particularly those pollutants regulated by LGEEPA. The popular action is not a legal complaint, however. Rather, it is a method of raising environmental concerns with CNA. Once a

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28 *Diario Oficial de la Federación*, January 28, 1988, at 24-57.

29 For more specific information on government agencies in Mexico, as well as Mexican environmental law, see <www.semanarp.gob.mx/gestion/legislacion.htm>.

30 For the Spanish version, see LEEGPA, Chapter III, Article II7, Section IV.

31 Mexican environmental agencies, like EPA, are authorized to establish technical standards to apply to industrial and other sources of air and water pollution. The technical standards are called norms.

32 For a brief yet thorough description of Mexican environmental law overall, see Anne Rowley, "Mexico's Legal System of Environmental Protection," 24 E.L.R. 10431 (1994).

33 LGEEPA, Chapter II, Article 7-10 (discussing the registration of discharges). Household, domestic wastewater appears to be excluded from this otherwise mandatory registration. This is interesting because improper treatment of household waste (i.e., sewage) is a major cause of environmental and health concerns along the border.

34 There is an idea in Mexican law referred to as Amparo, or "shelter" which allows a citizen to ask the government to uphold Constitutional authority. These suits are limited, and have not been readily used for environmental problems. For more information, see Greg M. Block, "One Step Away from Environmental Citizen Suits in Mexico," 23 E.L.R. 10347 (1993).

popular action is brought with CNA, that agency has the responsibility of investigating the matter and making a finding regarding whether or not to pursue the problem as a government agency.[35] While this process includes the public in enforcement decisions, it does not allow a citizen to actually step into the shoes of regulators and sue a violator of LGEEPA. In addition, Mexico's lack of FOIA-type regulations may make it more difficult for interested persons to obtain compliance-related information, which in the United States often forms a basis for a citizen suit. However, an injured person would probably have at least enough information to initiate a popular action, although that person's power is limited. Public access to government information may also deter citizen suits because people will be able to understand that the government is developing and implementing solutions to problems. It is likely that when the public is unaware of either compliance or solution information, the public is more prone to criticize the government for inaction. Despite popular sentiment, there are many similarities between Mexican and United States environmental law. The main differences are that Mexico's legal system provides fewer avenues for the public to participate in government action.

2.3 Applicable Provisions from NAFTA and the NAAEC

Both NAFTA and the NAAEC contain sections that discuss the environment, but only in general terms. NAFTA itself briefly mentions environmental objectives. NAFTA's preamble states that NAFTA should be undertaken "in a manner consistent with environmental protection and conservation."[36] The Preamble further states that the development and enforcement of environmental laws should be strengthened.[37] The failure of NAFTA to establish specific environmental standards was one of the reasons for the creation of the NAAEC.[38] The NAAEC contains some provisions specifically designed to protect the environment along the border. For example, the NAAEC created the CEC, a multi-national agency that, among other duties, is charged with reviewing citizen submissions. Part Two of the NAAEC requires that all countries that are party to NAFTA "periodically prepare and make publicly available reports on the state of the environment."[39] Despite this requirement, no procedures are described that would allow for widespread dissemination of the report.[40] Article 5, Section 1 of the NAAEC requires that each party to NAFTA, "shall effectively enforce its environmental laws and regulations through appropriate governmental action;"[41] failure to do so may form a basis for a citizen submission. The NAAEC also establishes procedures for reviewing and settling inter-party disputes regarding patterns of noncompliance with environmental laws.

The critical section of the NAAEC is the requirement that all parties to the agreement effectively enforce their environmental laws. According to the NAAEC, effective enforcement includes publicly releasing non-compliance information and establishing a record keeping and

[35] See LGEEPA, Chapter VIII, Articles 66-69.

[36] NAFTA, Preamble.

[37] *Id*. The CEC has published, as part of its duties under the NAAEC, many documents to assist countries in establishing procedures to ensure compliance with environmental laws. See www.cec.org/publications for more information. Furthermore, the CEC created, within itself, the Enforcement Cooperation Program to assist parties in preparing national reports, and improving enforcement and compliance with environmental laws.

[38] The North American Free Trade Agreement Between the Government of the United States of America, the Government of Canada, and the Government of the United Mexican States, signed Dec. 17, 1992; Effective Date Jan. 01, 1994 (hereafter "NAFTA"). For the full text of NAFTA, see <www.nafta-sec-alena.org/english.index>.

[39] NAAEC, Part Two, Article 2, Section 1 (a). See also, Four-year Review of NAAEC: Report of Independent Review Committee, June 1998, available at <www.cec.org>.

[40] Some government web sites do contain information and reports on the border environment. See e.g., <www.epa.gov> and <www.cec.org>.

[41] *Id.* at Article 5 Section 1.

reporting system.[42] In other words, the NAAEC recognizes that effective enforcement includes promotion of open government and public participation in government decisions. It seems clear that publicly available compliance information contributes to a person's ability to be involved in government decisions regarding the environment.

The citizen submission procedure is one of the strongest provisions for the environment established by the NAAEC. Articles 14 and 15 of the NAAEC discuss the requirements for a citizen submission that is made to the Commission for Environmental Cooperation (CEC). The CEC has also published several guides for citizens to use in preparing a submission. In addition, many prior submissions are available on the Internet at the CEC homepage.[43] According to the CEC's web site, there have been a total of 28 citizen submissions since 1995.[44] Of these 28 submissions, the CEC has investigated and required factual records on only four; nine are still ongoing and 15 were terminated without the creation of a factual record.[45] The existence of the citizen submission is a move forward, but environmental improvement is more likely to occur through more investigations into citizen complaints. Because each country that is party to NAFTA has different standards of public participation, it is important for the CEC to take into account that not every citizen submission will contain all the available information on the particular topic of the submission. A better citizen submission process would allow the CEC to assist citizens in collecting compliance-related information from their governments; or the CEC could advise the governments on how they might make environmental information more accessible to the public.

3 Methodology

3.1 United States

In order to obtain compliance information from the selected wastewater treatment plants in the United States, I wrote a letter to the Arizona Department of Environmental Quality ("ADEQ") requesting discharge monitoring reports (DMRs).[46] Upon receiving the data, I documented each violation on a spreadsheet. After the initial analysis, I requested further information from ADEQ, which I reviewed at the offices of ADEQ. For the Nogales and Bisbee plants, DMR data were collected for nine years.[47] For the city of Yuma, only five years worth of data were received, 1994, 1995, 1997–1999.[48]

3.1.1 General Discussion of United States Data

Generally, the United States data revealed that there were repeated violations at the Nogales and Bisbee plants, but only three violations total at the Yuma plant.[49] Thus, the Yuma plant's data demonstrate a critical possibility: compliance with federal law is achievable. Conceivably, both the

42 *Id*.

43 See <www.cec.org> for information on the CEC, its programs, and publications, specifically those dealing with citizen submissions.

44 See <www.cec.org/citizen/index.cfm?varlan=english>.

45 *Id*.

46 Although EPA is officially responsible for receiving DMRs from wastewater treatment plants in Arizona, ADEQ maintains a complete file and is often able to send out documents much more efficiently than EPA.

47 Some of the DMRs from the Bisbee plant were not clearly legible. As a result, any violations listed on those DMRs were not recorded. In all cases, information on violations was conservatively recorded, if there was any indication that a violation may not have occurred, that information was not included in the data set.

48 The data was collected from the primary wastewater treatment plant in Yuma, referred to as Figueroa, which apparently only began operation in 1994. No DMRs were available from ADEQ for the years preceding 1994.

49 Because the Yuma plant had only three violations over the sampled five-year period, no graph was made for Yuma.

Nogales and Bisbee plants could also come into compliance. Graphs representing the data from the Nogales plant and the Bisbee plant are presented in Attachments 1–10; Attachments 1–5 reflect the Nogales data and Attachments 6–10 reflect the Bisbee data. Attachment 11 is a graph of rainfall for the Tucson area, covering the same years as the plant data collected.[50] The data from the Nogales and Bisbee plants suggest several preliminary conclusions. First, it seems that the beginning of NAFTA itself has had little effect on eliminating, reducing, or increasing the number of wastewater treatment violations at the Nogales and Bisbee plant. Second, rainfall would appear to play a role in wastewater treatment violations at the Bisbee plant in particular, and possibly at the Nogales plant. If so, it is likely that the failure to control stormwater run-off is affecting these wastewater treatment plants. It is possible that implementation of better stormwater run-off controls therefore could significantly reduce violations at the plants. Third, a further, expanded, study which includes data from more wastewater treatment plants in the United States, as well as reliable data from Mexico, is clearly warranted and would be likely to yield more definitive conclusions.

3.1.2 Nogales Data

The Nogales data[51] are set forth in Attachments 2–5. The graph in Attachment 2 is a graph of the total number of violations per year at the Nogales plant. Notably, 1994 and 1998 were both years of increased violations. The number of violations in 1998 was more than double the average number of violations over the entire nine-year period. After the 1998 peak, violations decreased substantially in 1999, and the year 2000 appears as though it will also have a relatively low number of violations. Although the number of violations has fluctuated from year to year, over the entire nine-year period, the plant always violated the CWA at least several times per year. While the chart of overall violations indicates a decrease in the number of violations since 1998, it is likely that the plant will continue to violate the CWA until it undergoes substantial upgrading.[52] The remaining three Nogales graphs, Attachments 3–5, break down the data by type of violation, and the numbers of each type of violation for the years before, and after, NAFTA became effective.

Attachments 3–5 summarize the data per type of violation. Attachment 3 presents the data for all nine years, 1991–2000. This graph demonstrates that the top three most violated standards were biochemical oxygen demand (BOD) removal, total residual chlorine, and fecal coliform. It is likely that these are the substances that tend to be most violated at wastewater treatment plants around the nation, due to the fact that they are organic and naturally occur in almost every environment where wastewater is being processed.[53] Furthermore, because chlorine is often used to combat high fecal coliform counts in wastewater, it is not unlikely that the number of fecal coliform and chlorine violations are directly related. Biochemical oxygen demand is the dissolved oxygen required by organisms for the aerobic decomposition of organic matter present in water. BOD is often used as a measure in determining the efficiency of a sewage treatment plant, or to determine the potential of an effluent to degrade a stream. In order to maintain the proper ecological balance in the receiving

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50 I was only able to find Tucson rainfall data. It is possible that more rainfall may occur directly along the border because the border area is generally at a higher elevation than Tucson.

51 Notably, while DMRs provide a lot of useful and interesting compliance information, they do not report every single violation that occurred at the plant that month. For reasons still unclear to me, some violations need not be reported on DMRs. Therefore, the violations data presented in this paper are a "minimum" number, and it is likely that more violations have occurred. See Attachment 1 for the entire Nogales data set, in spreadsheet form.

52 The Nogales plant was recently approved by the Border Environmental Cooperation Commission to receive funds to upgrade and repair the plant. The repairs are expected to be completed by 2003. Ideally, at the time the repairs are completed, the plant will be in full compliance with all applicable laws. See also, *Water, Sewer Rates to Rise*, Nogales International, April 20, 2000 (this article briefly summarizes the proposed upgrades for the Nogales plant). More information on the upgrades planned at the Nogales plant is available from the City of Nogales, 777 N. Grand Ave., Nogales, AZ 85621.

53 Because a large portion of "wastewater" flowing into wastewater treatment plants is sewage water, it is not unreasonable to suspect that fecal coliform will be one of the more often violated parameters.

water, natural decay of organic matter must continue at the natural rate for that particular water. A wastewater treatment plant discharging effluent must therefore ensure that its effluent will not accelerate or decelerate the rate of decay in a receiving water.[54] Although BOD is naturally occurring, it is regulated in an NPDES permit to ensure that the biological integrity of the receiving waters remains the same despite the effluent discharged.[55]

Attachments 4 and 5 break down the data shown in Attachment 3 into two different spans of years: 1991–1994 and 1995–2000 respectively. For the years 1991–1994, the three most-violated parameters were BOD removal, mercury, and fecal coliform. For the years 1995–2000, the three most-violated parameters were BOD removal, BOD, and fecal coliform. Notably, over the entire nine-year period, there were many violations of inorganic materials such as chromium, lead, copper, cyanide, mercury, all substances known to be harmful to human health at certain levels.[56] The graphs for the Nogales plant do not indicate that NAFTA has had a direct effect on the number or type of violations at the plant. Thus, the questions that arise are: (1) why are the violations are occurring, and (2) what is the cause of the violations?

NAFTA's Effect on the Nogales Plant

Although, as noted above, except for 1998, violations at the Nogales plant occurred at approximately the same rate before and after NAFTA came into effect, this does not necessarily suggest that effects stemming from NAFTA had no effect on the plant at all. Rather, the data indicate that several factors affect the number of violations at a plant; it is likely that such effects are among the factors. Clearly, as a result of NAFTA, the Nogales area has seen an increase in industry. This increase may account for the inorganic substance violations, especially the heavy metals such as lead, chromium, and mercury. Yet in spite of this increase in development, there does seem to be a recent decline in the number of violations. This apparent decline of violations at the Nogales plant may suggest that NAFTA-related funding to improve wastewater infrastructure has had some positive effects. Moreover, the influence of NAFTA's funding may be more evident in future years. The Nogales plant was recently approved for a major grant to completely upgrade and repair the facility, a project that should take approximately three years, according to the IBWC, EPA, and the city of Nogales.[57] Presumably, the planned upgrades will eliminate violations altogether.

Failure to Control Stormwater at the Nogales Plant

The control of non-point source water pollution is one of the most challenging environmental problems of this century. "Non-point source pollution" is pollution that comes from many different sources; the pollutants themselves are carried in stormwater run-off from rainfall or snowmelt.[58] Non-point source pollution is often regulated at a local level through city ordinances that require businesses, homes, and industries to comply with stormwater drainage and other rules to control run-off and erosion from a particular site or area. According to the United States Section of the International Boundary and Water Commission (US IBWC) the run-off of metals and other pollutants into the Nogales plant is a principal source of violations at the plant.[59] According to EPA, the plant's failure to adequately treat the run-off water containing pollutants such as mercury,

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54 For more information on BOD, see Nigel J. Bunce, Introduction to Environmental Chemistry, at 340-341, Wuerz Publishing, 1993.

55 One reason for the regulation of BOD is that one goal of the CWA is to "maintain the chemical, physical, and biological integrity of our nation's waters." 33 U.S.C. § 1251. Regulation of BOD promotes this goal.

56 Agency for Toxic Substances and Disease Registry, HazDat Database, available at <www.astdr.cdc.gov/hazdat.html>.

57 See Water, Sewer Rates to Rise, Nogales International, April 20, 2000.

58 For more information on EPA's non-point source pollution program, see <www.epa.gov/owow/nps>.

59 Letter to Carol Browner, EPA Administrator from John Bernal, Commissioner of US IBWC, dated June 12, 1998 (hereinafter "June 12 letter").

copper, lead, and cadmium, among others, is a source of pollution in the Santa Cruz River.[60] In the letter of June 12, 1998, from US IBWC to EPA, US IBWC expressed concern over the proposed "influent limitations and requirements on the US IBWC over which the US IBWC, acting on behalf of the United States government under the international agreements with Mexico governing the international plant [Nogales plant], does not have the legal authority to ensure enforceable control mechanisms in Mexico."[61] EPA's response to this argument was two-fold. First, EPA stated that "the presence of the internal limitations in the permit would motivate the US IBWC to engage diplomatic processes early and often to prevent effluent violations, rather than defer action until after—as a reaction to—an end-of-pipe violation."[62] Second, EPA responded that,

> While EPA recognizes that the United States lacks authority to impose requirements on the Mexican industrial dischargers, we [EPA] do not agree that US IBWC cannot leverage its diplomatic resources in order to improve the quality of the transboundary flows. The Nogales treatment plant is not designed to provide full treatment of industrial wastewater. The only practical means of complying with the effluent limits for many toxic pollutants is to control them at their source, i.e., to limit their entry into the treatment plant…The internal limitations in the proposed permit are intended to prevent the entry of deleterious industrial wastewater into the Nogales plant in order to promote efficient and effective domestic wastewater treatment and compliance with effluent limits.[63]

The above passage demonstrates some of the problems associated with the control of stormwater run-off, particularly when it comes from another country. The EPA's position, however, is commendable, because it focuses on solutions. Through its letter, the EPA appears to be insisting that the US IBWC treat pollutants coming into its plant, regardless of their source, to ensure the protection of the environment in the United States. While EPA seems to both support and promote US IBWC's efforts to negotiate with Mexico on this matter, EPA appears to recognize that such negotiations cannot take precedence over water quality in the United States.

Notably, since 1996, the Nogales plant has been operating under an expired permit. Although in 1998 EPA attempted to issue a new permit, the US IBWC protested the provisions regarding treatment of certain pollutants (as is indicated in the June 12 letter) and EPA has not yet issued a new permit.[64] Although EPA asserted in its August 13 letter that "The US IBWC accepts the wastewater for treatment, and thus, it must also accept responsibility for the discharge of that treated wastewater (or lack of treatment thereof). The influent limitations in the proposed permit provide the US IBWC with an objective, results-oriented measure to prevent effluent violations…,"[65] it has never fully acted on this position. As of the date of this paper, EPA has not required that US IBWC comply with higher, safer, and healthier effluent limitations for many toxic substances that continue to be discharged into the Santa Cruz River.

3.1.3 Bisbee Mule Gulch Data

The data from the City of Bisbee Mule Gulch Wastewater Treatment plant ("Bisbee plant") are presented in Attachments 6–10.[66] Attachment 7 is a graph of the total number of violations per year

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60 Letter to John Bernal from Felicia Marcus, Regional Administrator, dated August 13, 1998 (hereafter "August 13 letter").

61 June 12 letter at 1.

62 August 13 letter at 1-2.

63 August 14 letter at 1-2.

64 I was advised on September 7, 2000, that EPA had a new permit drafted, and ready for public comment. However, not even the permittees have yet received a copy of the permit yet, and as of September 11, 2000, there is no public access to the draft permit.

65 August 13 letter at 2.

66 Attachment 6 is the entire data set for the Bisbee plant, in spreadsheet format.

at the Bisbee plant. Like the Nogales plant, the Bisbee plant had the highest number of CWA violations in 1998. Unlike the Nogales plant—a sanitary sewer—the Bisbee plant acts like a combined sewer, which, during rain events, will discharge untreated wastewater.[67] A combined sewer is one in which a single collection pipe is used to convey both stormwater run-off and sanitary wastes. During heavy rains, the overflow is usually discharged, untreated, into the receiving waters for that plant. Such an event is referred to as a combined sewer overflow (CSO).[68] According to EPA, wet weather discharges, one of which is a CSO, have been cited by the states as a leading cause of water quality impairment in the United States.[69] EPA's policy is that all operators of combined sewer systems must take the necessary steps to prevent overflows, and upgrade their systems.[70] According to a file maintained by ADEQ, the plant intends on upgrading some parts, although there was no indication that the combined sewer effect would be eliminated in the near future.[71] Because the Bisbee plant continues to operate as a combined sewer, whenever it rains the capacity of the plant to treat wastewater is substantially decreased and violations are more likely to result. In addition, the influx of stormwater run-off into the plant brings with it many deleterious substances such as hexavalent chromium, selenium, cyanide, and phenolic compounds, all of which are hazardous substances.[72]

Attachments 8–10 demonstrate the types of violations that have and continue to occur at the Bisbee plant. In the years immediately following the passage of NAFTA, the Bisbee plant had violations that it never had in the years before NAFTA. For example, violations of silver, copper, thallium, selenium, and hexavalent chromium occurred in the years of 1995–2000, but not in the years of 1992–1994. The Bisbee plant also had an increase in reporting violations in the years following NAFTA. Reporting violations can take many forms, but the most common in the Bisbee DMRs seemed to be that the DMR was not correctly filled out. In such a case, a person reviewing the DMR has no way of knowing whether the plant in question failed to conduct certain tests, failed to document the test results, or whether some other reason exists for the reporting failure. One example of a reporting failure documented in the Bisbee DMRs occurred when the DMR did not report anything in the column entitled "No. Ex." which denotes the "Number of Exceedances." Despite numerous other violations at the plant, very few violations were actually noted in the "No. Ex." column. Given the high number of violations, and the plant's status as a combined sewer, the Bisbee plant cries out for attention from regulators.

The Bisbee plant is an important wastewater treatment plant for the eastern half of the Arizona-Mexico border area for two main reasons. First, it is the main wastewater treatment plant for that area located very close to the border, east of the Nogales plant. Second, the Bisbee plant is located just a few miles away from an area directly along the border, in Naco, Sonora, Mexico, where untreated wastewater passes from Mexico, into the United States.[73] Local residents are concerned

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[67] A notation on the February 1993 DMR, by Mark Mansfield, Wastewater Supt., states, "Heavy rain and infiltration, as this is a combined sewer not a inclosed sanitary as is believed by EPA and ADEQ." This notation indicates that neither ADEQ nor EPA is aware that the Bisbee plant is a CSO. On September 8, 2000, I spoke with ADEQ employees, who informed me that when the Bisbee plant was originally constructed, it was intended to be a sanitary sewer. Severe deterioration over many years, however, has caused the plant to act like a combined sewer. As a result, the plant's ability to treat wastewater is significantly impaired.

[68] For further information on CSOs, see <www.epa.gov/OWM/cso>.

[69] EPA's *National Water Quality Inventory, Report to Congress, 1996*; available at <www.epa.gov/OWM/wet>.

[70] See 40 C.F.R. Part 122, Combined Sewer Overflow Control Policy.

[71] A 1996 consent decree involving the plant and EPA required upgrades to the Bisbee plant within five years, including repairs that would reduce the combined sewer effect, according to ADEQ employees. But, ADEQ employees informed me that due to the cost of all the necessary upgrades and repairs, the plant is not likely to be completed for another twenty years, at least. Clearly, this is not acceptable. ADEQ was unaware if the plant had applied for border infrastructure funds available through EPA, the BECC or the NADBank.

[72] See <www.astdr.cdc.gov/hazdat.html>.

[73] See <www.epa.gov/region09/water/becc/nacoea.html>.

that the wastewater from Naco could contaminate Bisbee's drinking water supply, which is located near Bisbee Junction, fairly close to the Naco flow. Furthermore, there has been some discussion about bringing the untreated wastewater to the Bisbee plant, via an underground pipeline where it would be treated. At this point, there is little information directly available to the public regarding the violations at the Bisbee plant, plans to upgrade it from its deteriorated state, or the Naco sewage flow. As recently as June 2000, however, EPA did issue the Bisbee plant a notice of violation and a compliance schedule, which indicates that, at the very least, EPA is aware of the violations and is prepared to take some action.

3.1.4 City of Yuma Data

Five years worth of DMRs for the City of Yuma, Figueroa Street Wastewater Treatment Plant ("Yuma plant") reveal that during that period, the Yuma plant recorded only three violations. This is an unusually low number of violations, compared with other plants along the Arizona-Mexico border, and it is a strong indication that the methods of operation at the Yuma plant may serve as an example for the other wastewater treatment plants along the Arizona-Mexico border. The three violations noted in the DMRs were one settleable solids violation in August of 1999 and two fecal coliform violations in July of 1999.

There is one possible explanation for why the Yuma plant is, essentially, in complete compliance with its NPDES permit. The Yuma plant is located on the Colorado River, one of the most controversial rivers in the western United States.[74] Because this waterway is a very high profile water source for both the United States and Mexico, it is likely that the Yuma plant was built in a manner to ensure that it would not further contribute pollutants to an already overburdened river. Thus, the success of the Yuma plant in complying with the CWA corroborates the theory that the problems experienced by the lower profile border areas are as much a result of politics, as any other factor.

3.2 Mexican Methods

In addition to data collection from the United States, attempts were made to collect compliance information from Mexico. A review of Mexican law, however, revealed that Mexico contained no FOIA-type statute granting any person access to government documents and information. Furthermore, none of the Mexican environmental laws require the submission of a discharge monitoring report, or something similar, which catalogues compliance with permits and other laws. Consequently, the only way to obtain compliance information was voluntarily. A survey consisting of 10–13 questions was prepared and sent, along with a cover letter, to fifteen different agencies in Mexico. Using the Internet, and other available directories of border agencies, addresses were obtained for a cross-section of the Mexican environmental community, including government agencies and non-profit groups in all three cities. Approximately one month was given for responding to the survey, and the survey was sent with a coupon for return postage. Despite this, only one response to the survey was received, from Procuraduría Federal de Protección al Ambiente (Profepa), which is the agency in Mexico responsible for prosecuting violations of environmental law. In its response, Profepa did not answer any of the questions on the survey, but rather, wrote a short letter. Profepa's letter cited a recent public notice regarding wastewater treatment, and stated that it lacked authority in the matters discussed in the survey.[75] No other responses of any type (e.g., phone or electronic mail) were received. As a result, no compliance information was obtained from Mexico.

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[74] For a detailed history of the Colorado River, see Marc Reisner, *The Cadillac Desert*, Penguin, 1993. This is also a multi-volume PBS documentary available at many public libraries in the United States.

[75] This is a rough translation from, "*Procuraduría carece de atribuciones en la materia objecto de la investigación*."

The lack of any information from Mexico demonstrates the weaknesses of NAFTA and the NAAEC with regards to public participation. Although the NAAEC addresses public participation in government rulemaking and other decisions, the practical reality is that obtaining environmental compliance information is very difficult. Publicly available information has many components. First, it must be accessible through means available to the average citizen (i.e., on the Internet or by writing a letter to a clearinghouse or the agency itself). Second, information must be available despite language barriers. Third, there must be a clear procedure for obtaining and requesting information. The most obvious solution to the apparent difficulty in obtaining information on wastewater treatment, particularly in Mexico, is to establish an “ambassador” to assist the public in requesting and obtaining such information. There could be an office, or an individual, within the CEC, for example, whose job it would be to field letters, calls, or electronic mail from citizens of Canada, Mexico, and the United States who are all seeking information of various types. This ambassador could then forward letters or requests to the appropriate government agency or other person within each country, who maintains information to be publicly available.

Alternatively, each country could have its own FOIA-type officer. However, open government and public access to information is achieved, such access is necessary for adequate and effective environmental compliance. Unless the public has the opportunity to review government activity in the area of environmental compliance, it is often the case that violations go both unnoticed and unprosecuted. This is not necessarily because government agencies are intentionally failing to uphold the law but rather due to the fact that there are so many violations. Many times government agencies do not have the resources to address even severe problems, or, for various reasons, choose to focus their resources elsewhere. Public access to information allows citizens to monitor both the polluter and the government, and where the government fails to act, the citizen can often step taken necessary action.[76] A system of checks and balances of this type ensures environmental protection, and promotes cooperation between citizens, the government, and the countries party to NAFTA.

The most direct and effective method of ensuring that all citizens in Canada, Mexico, and the United States have access to government documents is by an additional treaty requiring open government. Due to the differences in the legal regimes of the three parties under NAFTA, the open government treaty need not dictate what every country should do to provide public access to government information. Rather, each government should, on its own, establish and implement open records laws. Once such laws are implemented, citizen submissions should be accepted for any failure of a country to abide by its applicable open records law. In sum, without the availability of compliance information, enforcement and public participation cannot be effective.

4 Strategies to Solve Border Wastewater Treatment Problems

There are no easy solutions to the problems created by ongoing violations of federal law at both the Nogales and Bisbee plants. Furthermore, it is likely that were this study expanded to include more wastewater treatment plants, even more violations would be found. Certainly, it would be convenient to blame NAFTA for the violations, but the data do not, at this point, suggest that violations have increased following NAFTA. Rather, the data from the Nogales, Bisbee, and Yuma plants indicate that many different factors contribute to a plant’s level of compliance. Even so, there are various strategies that could lead to increase compliance all along the border. One strategy would be the consistent, timely, and appropriate initiation of enforcement actions against violators. EPA maintains the position, contrary to the plain text of the CWA, that it has complete discretion in deciding whether or not to bring an enforcement action.[77] The result of this position is that EPA has

[76] Of course, a citizen is generally poorly equipped, in comparison with a government agency, to stop a violator. In the US, the EPA, for example, has the power to issue an abatement order to the violator, and to pursue criminal penalties. A citizen can do neither.

[77] *See Sierra Club et al. v. Browner et al.*, CIV-00-184-TUC-RCC, all pleadings.

focused its attention on other state and other problems, instead of on the Arizona-Mexico border, where violations have been ongoing for years.

4.1 Location of Enforcement Personnel

In addition to enforcement, and in fact a key component to the success of an enforcement plan for the Arizona-Mexico border area, would be the establishment of an EPA office in Arizona. Even though EPA administers the NPDES program under the CWA in Arizona, EPA maintains no offices nor even one employee focused on water issues who is permanently stationed in Arizona. Currently, all of the oversight along the Arizona border comes from the Region IX office in San Francisco, California. While that is a large office staffed with many attorneys, the fact remains that when no one is present to enforce the law, the law is more likely to be violated. Strong enforcement is the backbone of all law and this is no less true in the environmental arena. A cleaner border can be achieved through strong enforcement and planning. Upgrading and repairing facilities, coupled with ongoing enforcement and public participation, would ensure that the Arizona-Mexico border's fragile Sonoran desert environment will be sustained for years to come.

4.2 Create a Plan of Attack

Another potential strategy, which could be implemented in conjunction with the two already proposed above, would be the creation of a step-by-step plan of action to stop pollution along the Arizona-Mexico border.[78] The United States General Accounting Office presented a report in March 2000 which concluded that "binational efforts to address communities' needs are hampered by a lack of a strategic plan that addresses impediments to environmental infrastructure improvements."[79] Furthermore, the GAO noted that government agencies have not "identified environmental infrastructure needs on the border or prioritized those needs."[80] Prioritization will ensure that localities with the greatest need, such as Bisbee and Nogales, will be able to make the necessary changes to protect human health and the environment through better wastewater treatment processes. Without prioritization, government assistance is more likely to succumb to special interests or the cities that are the most politically connected, rather than those locations that desperately require basic services such as potable water and wastewater treatment to survive. It may be that the development of a strategic plan cannot be accomplished on a binational level. Rather, each nation must to decide for itself what its priorities will be. If each nation works independently on a strategic plan, it is more likely that such a plan will exist sooner rather than later. Once the plans are created, binational efforts to make the plans cooperative are likely to ensure the success of both nations' plans. At this point, Mexico and the United States should make an inventory of the problems that need to be resolved, prioritize the problems, and establish meaningful strategies for achieving solutions.

5 Conclusion

The results of this study strongly suggest that further research and data collection on wastewater treatment plant violations are likely to reveal the problems, and solutions, that will improve wastewater treatment in the Arizona-Mexico border area. A longer-term and more inclusive study may provide more information on the causes of pollution in the Arizona border area. Furthermore, additional data could lead to an agreement between the United States and Mexico to improve

78 GAO Study 2000 at 5.

79 *Id.*

80 *Id*. at 17.

wastewater treatment infrastructure and control stormwater run-off, which is a substantial problem in the border area. A long-term study could also include a site visit and construction update elements. The information could be posted on the Internet and people living in the border area would be able to access this information anytime. The information would provide up-to-date descriptions of repairs at the plant, and compliance with applicable law.

Another area ripe for inquiry is the amount of money that has been allocated to border communities in the years since NAFTA came into effect. While there are several sources of these data on the Internet, none appear to be complete. The North American Development Bank ("NADBank") and the Border Environmental Cooperation Commission ("BECC") both have web sites that summarize some statistics,[81] although the information is not up-to-date and complete. The GAO Study 2000 also summarizes various funding information. The resources, therefore, exist for such a study, and the results of such a study would be very informative as a gauge of NAFTA's true impact on environmental infrastructure in the border area.

The exercise of studying the effects of pollution on the environment is often an essential first step towards developing and implementing solutions. There is, however, ample evidence that pollution along the Arizona-Mexico border is a serious problem. Thus, while we may continue to gather data, it should not delay action. Attention should be turned to developing and implementing solutions. Such actions should be specifically focused to remedy particular problems. Only through this type of systematic application of solutions will the border environment be truly sustained.

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81 The BECC web site is <www.cocef.org>. The NADBank web site is <www.nadbank.org>.

Appendix

Attachment 1. Wastewater discharge violations at the Nogales (Arizona) International Wastewater Treatment Plant

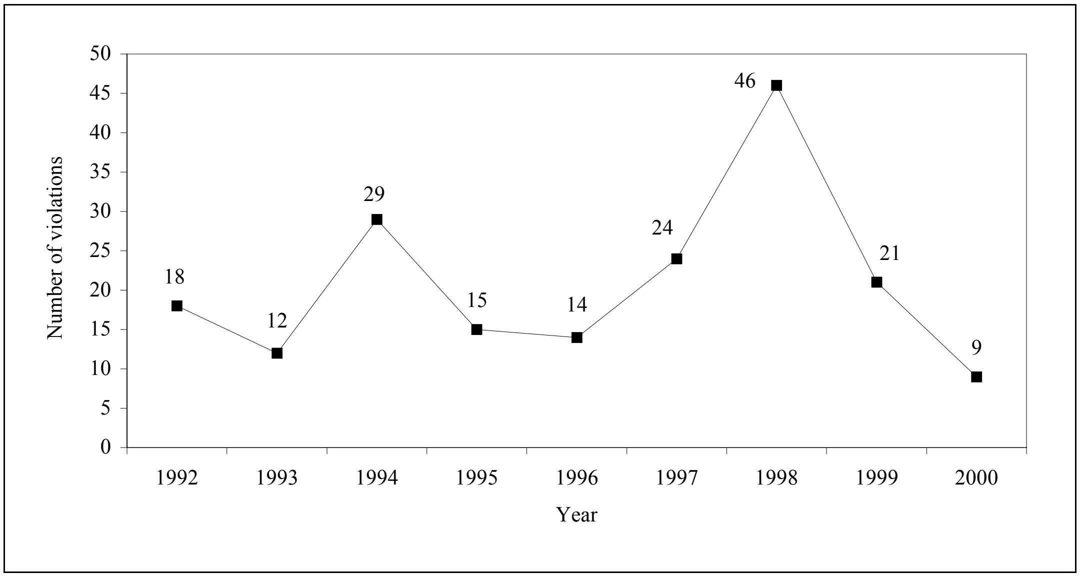
Date of Violation	Parameter	Permit Limit	Amount Reported	What Was Violated
Jan-92	Mercury (ug/L)	0.2	2	Daily Maximum
Jan-92	Fecal Coliform (colonies)	800	1600	Daily Maximum
Feb-92	Mercury (ug/L)	0.2	0.6	Daily Maximum
Mar-92	Total Residual Chlorine (mg/L)	0.011	0.05	Daily Maximum
Mar-92	BOD Removal (Percent)	85%	81%	Monthly Average
Apr-92	Fecal Coliform (colonies)	800	900	Daily Maximum
Apr-92	BOD Removal (Percent)	85%	66%	Monthly Average
May-92	BOD Removal (Percent)	85%	69%	Monthly Average
Jul-92	Mercury (ug/L)	0.2	0.5	Daily Maximum
Jul-92	Fecal Coliform (colonies)	800	900	Daily Maximum
Jul-92	BOD Removal (Percent)	85%	64%	Monthly Average
Aug-92	BOD Removal (Percent)	85%	74%	Monthly Average
Sep-92	Copper (ug/L)	204	321	Daily Maximum
Sep-92	Fecal Coliform (colonies)	800	1600	Daily Maximum
Sep-92	Fecal Coliform (colonies)	800	1600	Daily Maximum
Sep-92	Fecal Coliform (colonies)	800	1600	Daily Maximum
Sep-92	Fecal Coliform (colonies)	800	1600	Daily Maximum
Nov-92	TSS Removal (Percent)	85%	83%	Monthly Average
Apr-93	Fecal Coliform (colonies)	800	1600	Daily Maximum
Apr-93	Fecal Coliform (colonies)	800	1600	Daily Maximum
May-93	Mercury (ug/L)	0.2	1.6	Daily Maximum
May-93	Mercury (ug/L)	0.2	1.6	Daily Maximum
May-93	Mercury (ug/L)	0.2	1.6	Daily Maximum
Jul-93	Mercury (ug/L)	0.2	0.6	Daily Maximum
Aug-93	Mercury (ug/L)	0.2	0.5	Daily Maximum
Sep-93	Mercury (ug/L)	0.2	0.9	Daily Maximum
Sep-93	Mercury (ug/L)	0.2	0.9	Daily Maximum
Oct-93	BOD Removal (Percent)	85%	82%	Monthly Average
Nov-93	Mercury (ug/L)	0.2	0.5	Daily Maximum
Dec-93	BOD Removal (Percent)	85%	81%	Monthly Average
Jan-94	BOD Removal (Percent)	85%	75%	Monthly Average
Feb-94	Fecal Coliform (colonies)	800	900	Monthly Average
Feb-94	BOD Removal (Percent)	85%	73%	Monthly Average
Mar-94	BOD Removal (Percent)	85%	78%	Monthly Average
May-94	BOD Removal (Percent)	85%	84%	Monthly Average
May-94	Total Residual Chlorine (ug/L)	0.011	0.07	Daily Maximum
Jun-94	BOD 5-Day Effluent (kg/d)	1953	3451	Monthly Average
Jun-94	BOD 5-Day Effluent (kg/d)	5051	6678	Daily Maximum
Jun-94	BOD-5 Effluent (ug/L)	30	80	Monthly Average
Jun-94	BOD-5 Effluent (ug/L)	45	73	Daily Maximum
Jun-94	Settleable Solids (ug/L)	3	2	Daily Maximum
Jun-94	Reporting			Failed to do 9 required tests
Jun-94	Total Residual Chlorine (mg/L)	0.011	1.22	Daily Maximum
Jun-94	Fecal Coliform (colonies)	800	1600	Daily Maximum
Jun-94	BOD Removal (Percent)	85%	48%	Monthly Average
Jun-94	TSS Removal (Percent)	85%	83%	Monthly Average
Jul-94	Total Residual Chlorine (mg/L)	0.011	0.21	Daily Maximum
Jul-94	Mercury (ug/L)	0.2	0.8	Daily Maximum
Jul-94	Settleable Solids (mg/L)	2	5	Daily Maximum
Aug-94	Settleable Solids (mg/L)	2	4	Daily Maximum

Date of Violation	Parameter	Permit Limit	Amount Reported	What Was Violated
Sep-94	Total Residual Chlorine (mg/L)	0.011	0.21	Daily Maximum
Sep-94	Mercury (ug/L)	0.2	0.5	Daily Maximum
Oct-94	BOD 5-Day Effluent (kg/d)	5859	7449	Daily Maximum
Oct-94	BOD 5-Day Effluent (mg/L)	30	43	Monthly Average
Oct-94	BOD 5-Day Effluent (mg/L)	45	159	Weekly Average
Oct-94	Pentachlorophenol (ug/L)	13	<20	Daily Maximum
Oct-94	Total Residual Chlorine (mg/L)	0.011	0.12	Daily Maximum
Oct-94	BOD Removal (Percent)	85%	62%	Monthly Average
Dec-94	Total Residual Chlorine (mg/L)	0.011	0.31	Daily Maximum
Dec-94	Fecal Coliform (colonies)	800	>1600	Daily Maximum
Jan-95	Total Residual Chlorine (mg/L)	0.011	0.011	Daily Maximum
Mar-95	BOD Removal (Percent)	85%	84%	Monthly Average
Apr-95	Pentachlorophenol (ug/L)	13 ug/L	<60 ug/L	Daily Maximum
Apr-95	Total Residual Chlorine	.011 mg/L	.39 mg/L	Daily Maximum
Apr-95	Fecal Coliform	800 col.	> 1600 col.	Daily Maximum
May-95	Fecal Coliform	800 col.	> 1600 col.	Daily Maximum
Jun-95	Total Residual Chlorine	.011 mg/L	.3 mg/L	Daily Maximum
Jul-95	Total Residual Chlorine	.011 mg/L	.24 mg/L	Daily Maximum
Jul-95	Fecal Coliform	800 col.	900 col	Daily Maximum
Jul-95	BOD-5 Removal Rate	85%	83%	Monthly Average
Sep-95	Fecal Coliform	800 col.	1600 col.	Daily Maximum
Oct-95	Total Residual Chlorine	.011 mg/L	2.06 mg/L	Daily Maximum
Oct-95	Fecal Coliform	800 col.	1600 col.	Daily Maximum
Nov-95	Total Residual Chlorine	.011 mg/L	.17 mg/L	Daily Maximum
Nov-95	BOD-5 Removal Rate	85%	83%	Monthly Average
Jan-96	Fecal Coliform	800 col.	1600 col	Daily Maximum
Jun-96	Total Residual Chlorine	.011 mg/L	1.37 mg/L	Daily Maximum
Jul-96	Effluent BOD-5 Discharge	30 mg/L	34 mg/L	Daily Maximum
Jul-96	Fecal Coliform	800 col.	>1600 col.	Daily Maximum
Sep-96	Total Residual Chlorine	.011 mg/L	.51 mg/L	Daily Maximum
Sep-96	Fecal Coliform	800 col.	>1600 col.	Daily Maximum
Oct-96	Total Residual Chlorine	.011 mg/L	.04 mg/L	Daily Maximum
Oct-96	Cyanide	2 reports required	1 report filed	Reporting requirement
Oct-96	BOD-5 Removal Rate	85%	68%	Monthly Average
Nov-96	Total Residual Chlorine	.011 mg/L	.04 mg/L	Daily Maximum
Nov-96	BOD-5 Removal Rate	85%	68%	Monthly Average
Nov-96	Effluent BOD-5 Discharge	30 mg/L	35 mg/L	Monthly Average
Dec-96	Total Residual Chlorine	.011 mg/L	.04 mg/L	Daily Maximum
Dec-96	Fecal Coliform	800 col	unclear--reported by U.S. EPA, but not on DMRs	Daily Maximum
Dec-96	BOD-5 Removal Rate	85%	70%	Monthly Average
Dec-96	Effluent BOD-5 Discharge	30 mg/L	35 mg/L	Monthly Average
Jan-97	BOD-5 Removal Rate	85%	70%	Monthly Average
Jan-97	TSS Removal Rate	85%	83%	Monthly Average
Feb-97	BOD-5 Removal Rate	85%	80%	Monthly Average
Mar-97	Total Residual Chlorine	.011 mg/L	.04 mg/L	Daily Maximum
Mar-97	BOD-5 Removal Rate	85%	82%	Monthly Average
Apr-97	Total Residual Chlorine	.011 mg/L	.04 mg/L	Daily Maximum
Apr-97	BOD-5 Removal Rate	85%	84%	Monthly Average
May-97	BOD-5 Removal Rate	85%	77%	Monthly Average
May-97	Effluent BOD-5 Discharge	30 mg/L	35 mg/L	Monthly Average
May-97	Effluent BOD-5 Discharge	45 mg/L	52 mg/L	Weekly Average
Jun-97	Effluent BOD-5 Discharge	30 mg/L	33 mg/L	Monthly Average
Jun-97	BOD-5 Removal Rate	85%	82%	Monthly Average
Jul-97	Effluent BOD-5 Discharge	30 mg/L	34 mg/L	Monthly Average
Jul-97	BOD-5 Removal Rate	85%	84%	Monthly Average
Aug-97	Effluent BOD-5 Discharge	30 mg/L	35 mg/L	Monthly Average

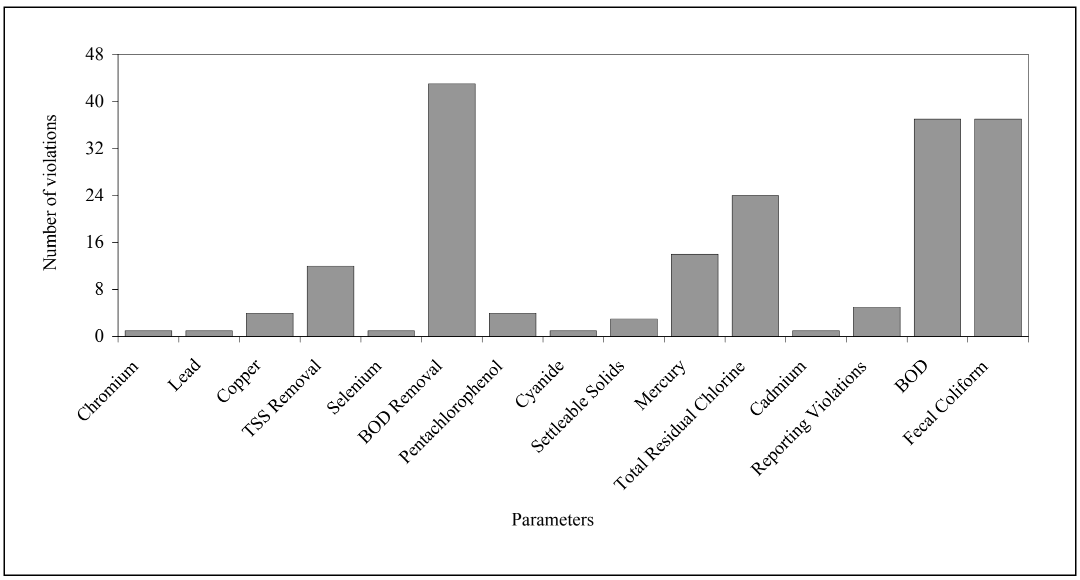
Date of Violation	Parameter	Permit Limit	Amount Reported	What Was Violated
Aug-97	Effluent BOD-5 Discharge	45 mg/L	56 mg/L	Weekly Average
Aug-97	BOD-5 Removal Rate	85%	82%	Monthly Average
Aug-97	Copper	50 ug/L	78 ug/L	Daily Maximum
Sep-97	Fecal Coliform	800 col	unclear--reported by U.S. EPA, but not on DMRs	Daily Maximum
Oct-97	BOD-5 Removal Rate	85%	81%	Monthly Average
Nov-97	Fecal Coliform (not on DMR; reported by EPA)	800 col	unclear	Daily Maximum
Nov-97	TSS Removal Rate	85%	84%	Monthly Average
Dec-97	BOD-5 Removal Rate	85%	81%	Monthly Average
Dec-97	TSS Removal Rate	85%	84%	Monthly Average
Jan-98	BOD-5 Removal Rate	85%	81%	Monthly Average
Jan-98	TSS Removal Rate	85%	79%	Monthly Average
Feb-98	BOD-5 Removal Rate	85%	81.40%	Monthly Average
Mar-98	Effluent BOD-5 Discharge	30 mg/L	36 mg/L	Monthly Average
Mar-98	BOD-5 Removal Rate	85%	82.00%	Monthly Average
Mar-98	TSS Removal Rate	85%	78.00%	Monthly Average
Apr-98	Effluent BOD-5 Discharge	45 mg/L	62 mg/L	Weekly Average
Apr-98	Effluent BOD-5 Discharge	30 mg/L	33 mg/L	Monthly Average
Apr-98	BOD-5 Removal Rate	85%	79%	Monthly Average
May-98	Effluent BOD-5 Discharge	30 mg/L	33 mg/L	Monthly Average
May-98	Effluent BOD-5 Discharge	1953 kg/day	1985 kg/day	Monthly Average
May-98	Effluent BOD-5 Discharge	45 mg/L	48 mg/L	Weekly Average
May-98	BOD-5 Removal Rate	85%	77.80%	Monthly Average
Jun-98	Fecal Coliform	800 col	>800 col	Daily Maximum
Jun-98	Effluent BOD-5 Discharge	1953 kg/day	2593 kg/day	Monthly Average
Jun-98	Effluent BOD-5 Discharge	5859 kg/day	5869 kg/day	Daily Maximum
Jun-98	Effluent BOD-5 Discharge	30 mg/L	53 mg/L	Monthly Average
Jun-98	Effluent BOD-5 Discharge	45 mg/L	81 mg/L	Weekly Average
Jun-98	Selenium	2 lab reports	1 lab report	Reporting requirement
Jun-98	BOD-5 Removal Rate	85%	71.90%	Monthly Average
Jun-98	Fecal Coliform	800	>800	Daily Maximum
Jul-98	Effluent BOD-5 Discharge	1953 kg/day	2066 kg/day	Monthly Average
Jul-98	Effluent BOD-5 Discharge	30 mg/L	49 mg/L	Monthly Average
Jul-98	Effluent BOD-5 Discharge	45 mg/L	89 mg/L	Weekly Average
Jul-98	Fecal Coliform	800 col	900 col	Daily Maximum
Jul-98	BOD-5 Removal Rate	85%	73. 60%	Monthly Average
Aug-98	BOD-5 Removal Rate	85%	74%	Monthly Average
Aug-98	Influent BOD-5 Sampling	4 samples required	3 samples taken	Reporting requirement
Aug-98	Effluent BOD-5 Sampling	4 samples required	3 samples taken	Reporting requirement
Aug-98	Influent TSS Sampling	4 samples required	3 samples taken	Reporting requirement
Aug-98	Effluent TSS Sampling	4 samples required	3 samples taken	Reporting requirement
Aug-98	Effluent Settleable Solids	4 samples required	3 samples taken	Reporting requirement
Aug-98	Total Residual Chlorine	0.011 mg/L	0.06 mg/L	Daily Maximum
Sep-98	Effluent BOD-5 Discharge	45 mg/L	48 mg/L	Weekly Average
Sep-98	Fecal Coliform	800 col	8000 col	Daily Maximum
Sep-98	Total Residual Chlorine	0.011 mg/L	0.05 mg/L	Daily Maximum
Sep-98	BOD-5 Removal Rate	85%	76.80%	Monthly Average
Oct-98	Cadmium	10 ug/L	16 ug/L	Daily Maximum
Oct-98	Lead	50 ug/L	153 ug/L	Daily Maximum
Oct-98	Copper	50 ug/L	603 ug/L	Daily Maximum
Oct-98	Fecal Coliform	800 col	>800 col	Daily Maximum
Nov-98	TSS Removal Rate	85%	81.07%	Monthly Average
Dec-98	Mercury	0.2 ug/L	1.1 ug/L	Daily Maximum
Dec-98	BOD-5 Removal Rate	85%	82.33%	Monthly Average
Dec-98	TSS Removal Rate	85%	82.91	Monthly Average
Jan-99	Effluent BOD-5 Discharge	1953 kg/day	2327 kg/day	Monthly Average

Date of Violation	Parameter	Permit Limit	Amount Reported	What Was Violated
Jan-99	Effluent BOD-5 Discharge	30 mg/L	46 mg/L	Monthly Average
Jan-99	Effluent BOD-5 Discharge	45 mg/L	67 mg/L	Weekly Average
Jan-99	Fecal Coliform	800 col	>1600 col	Daily Maximum
Jan-99	BOD-5 Removal Rate	85%	70.23%	Monthly Average
Jan-99	TSS Removal Rate	85%	75.32%	Monthly Average
Feb-99	Chromium	50 mg/L	60 mg/L	Daily Maximum
Feb-99	Total Residual Chlorine	0.011 mg/L	<.05 mg/L	Daily Maximum
Feb-99	BOD-5 Removal Rate	85%	84%	Monthly Average
Feb-99	TSS Removal Rate	85%	79%	Monthly Average
Mar-99	Effluent BOD-5 Discharge	45 mg/L	52 mg/L	Weekly Average
Mar-99	TSS Removal Rate	85%	79%	Monthly Average
Mar-99	BOD-5 Removal Rate	85%	84%	Monthly Average
Mar-99	Fecal Coliform	800 col	832 col	Daily Maximum
Apr-99	Effluent BOD-5 Discharge	45 mg/L	48 mg/L	Weekly Average
Apr-99	Copper	50 mg/L	167 mg/L	Daily Maximum
Apr-99	Fecal Coliform	800 col	5000-8000 col	Daily Maximum
Jun-99	Effluent BOD-5 Discharge	45 mg/L	48 mg/L	Weekly Average
Jun-99	Fecal Coliform	800 col	2000 col	Daily Maximum
Jun-99	Fecal Coliform	200 col	284 col (unclear)	Monthly Average
Aug-99	Fecal Coliform	800 col	1600 col	Daily Maximum
Sep-99	Total Residual Chlorine	.011 mg/L	.05 mg/L	Daily Maximum
Sep-99	Fecal Coliform	800 col	1600 col	Daily Maximum
Oct-99	Effluent BOD-5 Discharge	30 mg/L	34 mg/L	Monthly Average
Nov-99	Effluent BOD-5 Discharge	1953 kg/day	1989 kg/day	Monthly Average
Dec-99	Effluent BOD-5 Discharge	30 mg/L	44 mg/L	Monthly Average
Dec-99	Effluent BOD-5 Discharge	45 mg/L	76 mg/L	Weekly Average
Jan-00	Effluent BOD-5 Discharge	30 mg/L	34 mg/L	Monthly Average
Feb-00	Effluent BOD-5 Discharge	30 mg/L	40 mg/L	Monthly Average
Feb-00	Effluent BOD-5 Discharge	45 mg/L	51 mg/L	Weekly Average
Mar-00	Effluent BOD-5 Discharge	30 mg/L	31 mg/L	Monthly Average
Mar-00	Effluent BOD-5 Discharge	45 mg/L	63 mg/L	Weekly Average
Apr-00	Effluent BOD-5 Discharge	1953 kg/day	3689 kg/day	Monthly Average
Apr-00	Effluent BOD-5 Discharge	30 mg/L	76 mg/L	Monthly Average
Apr-00	Effluent BOD-5 Discharge	45 mg/L	92 mg/L	Weekly Average
Apr-00	Pentachlorophenol	13 ug/L	<20 ug/L	Daily Maximum
Apr-00	BOD-5 Removal Rate	85%	74.60%	Monthly Average
May-00	Effluent BOD-5 Discharge	45 mg/L	50 mg/L	Weekly Average
May-00	Pentachlorophenol	13 ug/L	<50 ug/L	Daily Maximum
May-00	Fecal Coliform	800 col.	1600 col.	Daily Maximum

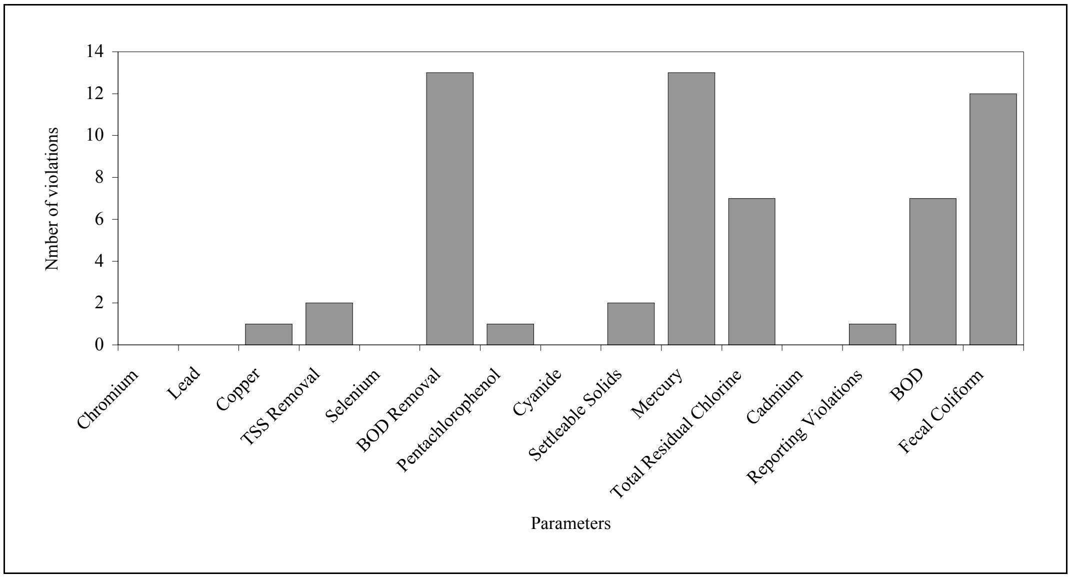
Attachment 2. Nogales International Wastewater Treatment Plant total violations per year



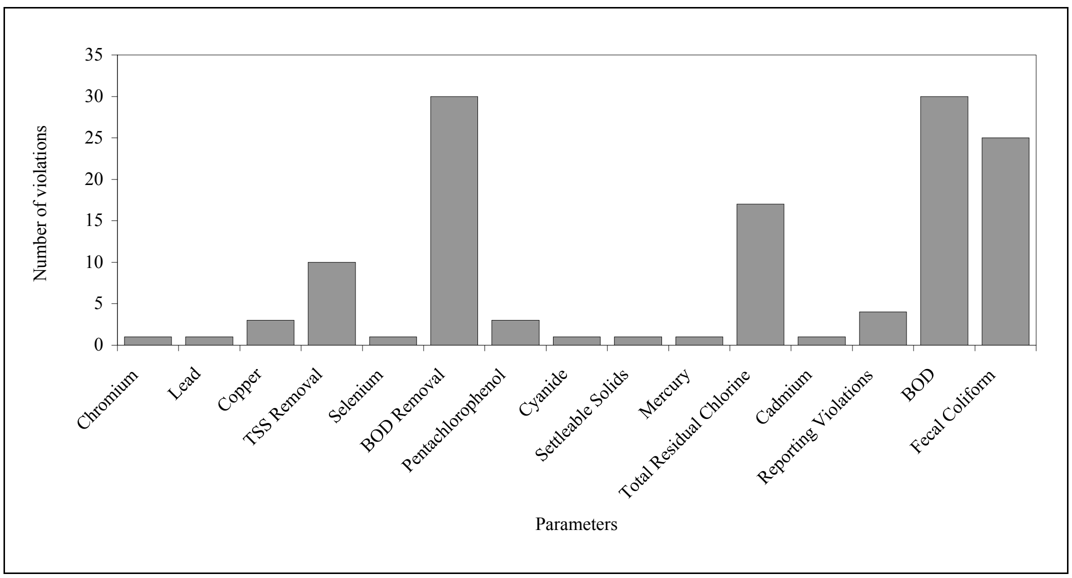
Attachment 3. Nogales – Violations per parameter (1992–2000)



Attachment 4. Nogales – Violations by parameter (1992–1994)



Attachment 5. Nogales – Violations per parameter (1995–2000)



Attachement 6. Wastewater Discharge Violations at the City of Bisbee Mule Gulch Wastewater Treatment Plant

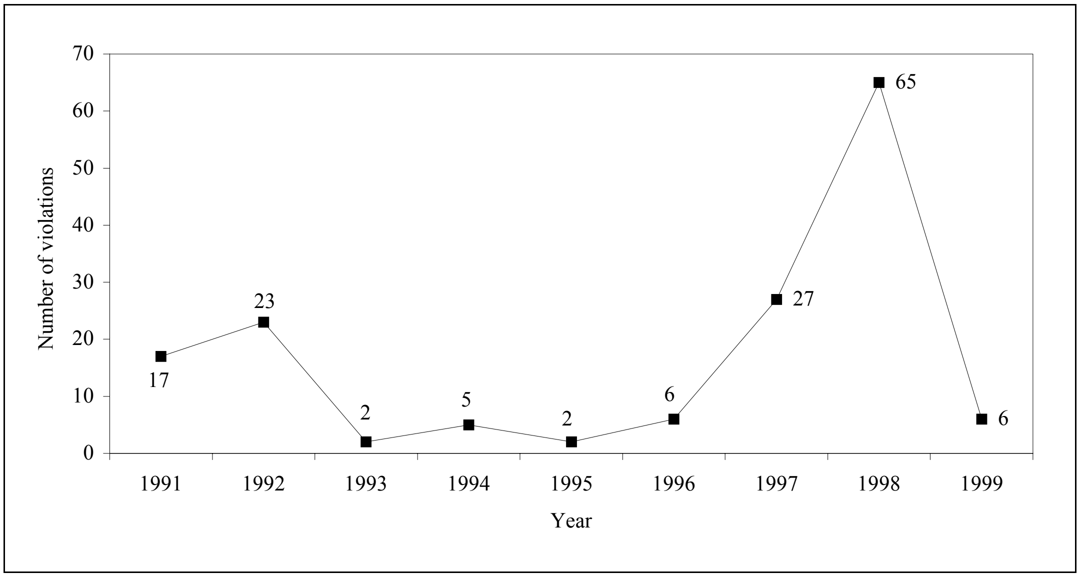
Date of Violation	Parameter Violated	Permit Limitation	Amount Reported	What Was Violated
Mar-91	Suspended Solids (kg/d)	34	41.9	Monthly Average
Mar-91	TSS Removal (Percent)	85%	81.80%	Monthly Average
Mar-91	Cadmium (kg/d)	0.011	0.0183	Daily Maximum
Mar-91	Chromium (kg/d)	0.057	0.078	Daily Maximum
Mar-91	Lead (kg/d)	0.114	0.209	Daily Maximum
Mar-91	Lead (kg/d)	0.057	0.209	Monthly Average
Mar-91	Ammonia (kg/d)	0.023	0.52	Daily Maximum
Apr-91	TSS Removal (Percent)	85%	83.50%	Monthly Average
Sep-91	Lead (kg/d)	0.057	0.058	Monthly Average
Sep-91	Lead (mg/L)	0.05	<.08	Daily Maximum
Sep-91	Ammonia (kg/d)	0.023	2.7	Daily Maximum
Sep-91	Ammonia (mg/L)	0.02	3.7	Daily Maximum
Sep-91	Phenolics (kg/d)	0.006	0.016	Daily Maximum
Sep-91	Phenolics (mg/L)	0.005	0.023	Daily Maximum
Sep-91	Sulfides (kg/d)	0.114	0.29	Daily Maximum
Sep-91	Sulfides (mg/L)	0.1	<.40	Daily Maximum
Nov-91	TSS Removal (Percent)	85%	80%	Monthly Average
Jan-92	Suspended Solids (kg/L)	34	143.7	Monthly Average
Jan-92	Suspended Solids (kg/L)	102	143.7	Daily Maximum
Jan-92	Suspended Solids (mg/L)	30	94	Monthly Average
Jan-92	Suspended Solids (mg/L)	45	94	Weekly Average
Mar-92	TSS Removal (Percent)	85%	84.30%	Monthly Average
Mar-92	Cadmium (kg/d)	0.011	0.021	Daily Maximum
Mar-92	Cadmium (mg/L)	0.01	0.03	Daily Maximum
Mar-92	Ammonia (kg/d)	0.023	9.53	Daily Maximum
Mar-92	Ammonia (mg/L)	0.02	13.4	Daily Maximum
Mar-92	Cyanide (kg/d)	0.023	0.04	Daily Maximum
Mar-92	Cyanide (mg/L)	0.02	0.057	Daily Maximum
Mar-92	Phenolics (kg/d)	0.006	0.004	Daily Maximum
Mar-92	Phenolics (mg/L)	0.005	0.006	Daily Maximum
Mar-92	Sulfides (kg/d)	0.114	0.28	Daily Maximum
Mar-92	Sulfides (mg/L)	0.1	0.4	Daily Maximum
May-92	TSS Removal (Percent)	85%	81%	Monthly Average
Jun-92	Phenolics (kg/d)	0.006	0.0077	Daily Maximum
Jun-92	Phenolics (mg/L)	0.005	0.008	Daily Maximum
Jun-92	Sulfides (kg/d)	0.114	0.193	Daily Maximum
Jun-92	Sulfides (mg/L)	0.1	0.2	Daily Maximum
Jun-92	Mercury (mg/L)	0.0001	0.0002	Daily Maximum
Sep-92	BOD 5-Day Effluent (kg/L)	34	36.8	Monthly Average
Sep-92	TSS Removal (Percent)	85%	84.30%	Monthly Average
Jan-93	TSS Removal (Percent)	85%	83.70%	Monthly Average
Sep-93	TSS Removal (Percent)	85%	69.40%	Monthly Average
Apr-94	Reporting	Max/Min pH		Monthly Average
Dec-94	TSS Removal (Percent)	85%	64.50%	Monthly Average
Dec-94	Settleable Solids (kg/d)	34	76.3	Monthly Average
Dec-94	Settleable Solids (mg/L)	30	60	Monthly Average
Dec-94	Settleable Solids (mg/L)	45	60	Weekly Average
Jun-95	TSS Removal (Percent)	85%	83%	Monthly Average
Sep-95	Reporting	Settleable Solids		Monthly Average
Apr-96	Reporting	Suspended Solids		Monthly Average

Date of Violation	Parameter Violated	Permit Limitation	Amount Reported	What Was Violated
Apr-96	Settleable Solids (mg/L)	1	18	Monthly Average
Apr-96	Settleable Solids (mg/L)	2	18	Daily Maximum
Mar-96	Cadmium (mg/L)	0.01	0.05	Daily Maximum
Mar-96	Cadmium (kg/d)	0.011	0.02	Daily Maximum
Jul-96	TSS Removal (Percent)	85%	66%	Monthly Average
Jan-March 1997	Ammonia (mg/L)	0.02	0.023	Daily Maximum
Jan-March 1997	Selenium (mg/L)	0.02	<0.05	Daily Maximum
May-97	Solids Suspended (mg/L)	30	34	Monthly Average
Jul-97	Copper (mg/L)	0.05	0.064	Daily Maximum
Jul-97	Reporting	Copper		
Jul-97	Ammonia (kg/d)	0.023	4.4	Daily Maximum
Jul-97	Ammonia (kg/d)	0.02	5.5	Daily Maximum
Jul-97	Phenolics (kg/d)	0.006	0.058	Daily Maximum
Jul-97	Phenolics (mg/L)	0.005	0.072	Daily Maximum
Oct-97	Selenium (g/d)	1.74	<25	Monthly Average
Oct-97	Selenium (ug/L)	2	14.2	Monthly Average
Oct-97	Thallium (g/d)	10.45	<25	Daily Maximum
Oct-97	Total Residual Chlorine (g/d)	4.35	500	Monthly Average
Oct-97	Total Residual Chlorine (g/d)	9.58	500	Daily Maximum
Oct-97	Total Residual Chlorine (ug/L)	5	280	Monthly Average
Oct-97	Total Residual Chlorine (ug/L)	11	280	Daily Maximum
Oct-97	Lead (g/d)	3.53	<20	Monthly Average
Oct-97	Lead (ug/L)	4.06	11.4	Monthly Average
Oct-97	Copper (g/d)	12.12	18	Monthly Average
Oct-Dec 1997	Mercury (g/d)	0.17	<.2	Monthly Average
Oct-Dec 1997	Chromium Hexavalent (g/d)	9.6	<10	Monthly Average
Oct-Dec 1997	Cyanide (g/d)	8.45	<20	Monthly Average
Oct-Dec 1997	Cyanide (ug/L)	9.7	<11.4	Monthly Average
Nov-97	Solids Suspended (mg/L)	40	30	Monthly Average
Nov-97	TSS Removal (Percent)	85.00%	81%	Monthly Average
Dec-97	Total Residual Chlorine (g/d)	4.35	144	Monthly Average
Dec-97	Total Residual Chlorine (g/d)	9.58	144	Daily Average
Dec-97	Total Residual Chlorine (ug/L)	5	200	Monthly Average
Dec-97	Total Residual Chlorine (ug/L)	11	200	Daily Maximum
Jan-98	Total Residual Chlorine (g/d)	4.35	143.9	Monthly Average
Jan-98	Total Residual Chlorine (g/d)	9.58	143.9	Daily Maximum
Jan-98	Total Residual Chlorine (ug/L)	5	200	Monthly Average
Jan-98	Total Residual Chlorine (ug/L)	11	200	Daily Maximum
Jan-Mar 1998	Selenium (mg/d)	1.74	36	Monthly Average
Jan-Mar 1998	Selenium (mg/L)	2	50	Monthly Average
Jan-Mar 1998	Silver (kg/d)	4.9	7.2	Daily Maximum
Jan-Mar 1998	Cadmium (kg/d)	1.15	14.4	Monthly Average
Jan-Mar 1998	Cadmium (mg/L)	1.32	20	Monthly Average
Jan-Mar 1998	Lead (g/d)	3.53	71.9	Monthly Average
Jan-Mar 1998	Lead (ug/L)	4.08	100	Monthly Average
Jan-Mar 1998	Copper (g/d)	12.12	28.8	Monthly Average
Jan-Mar 1998	Copper (g/d)	18.47	28.8	Daily Maximum
Jan-Mar 1998	Copper (ug/L)	13.92	40	Monthly Average
Jan-Mar 1998	Copper (ug/L)	21.21	40	Daily Maximum
Jan-Mar 1998	Chromium Hexavalent (g/d)	9.6	14.4	Monthly Average
Jan-Mar 1998	Chromium Hexavalent (g/d)	13.9	14.4	Daily Maximum
Jan-Mar 1998	Chromium Hexavalent (ug/L)	11	20	Monthly Average
Jan-Mar 1998	Chromium Hexavalent (ug/L)	16	20	Daily Maximum

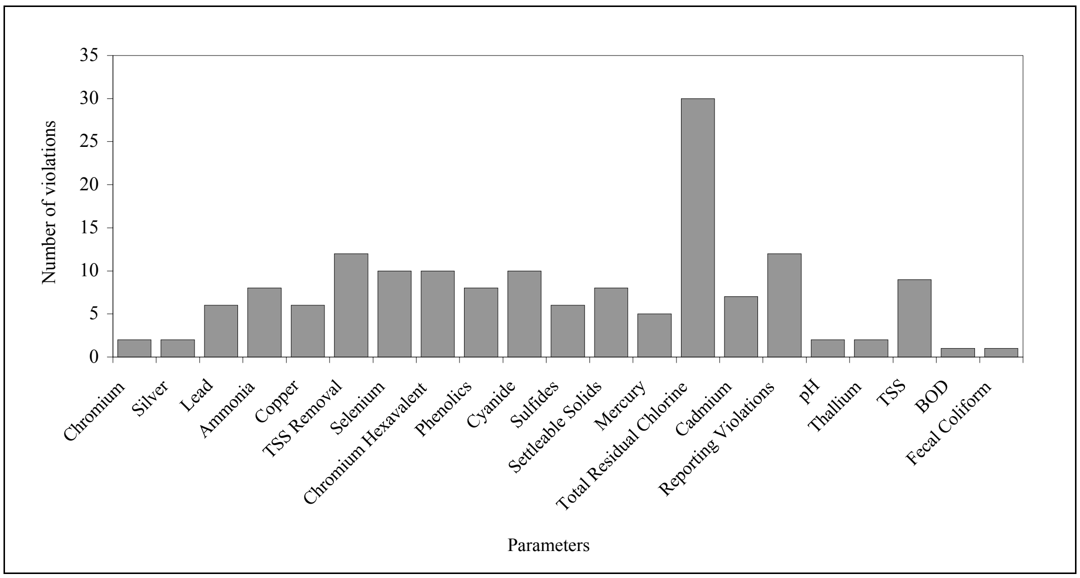
Date of Violation	Parameter Violated	Permit Limitation	Amount Reported	What Was Violated
Jan-Mar 1998	Cyanide (g/d)	8.45	14.4	Monthly Average
Jan-Mar 1998	Cyanide (ug/L)	9.7	20	Monthly Average
Feb-98	Reporting	Suspended Solids		
Feb-98	Total Residual Chlorine (g/d)	4.35	208	Monthly Average
Feb-98	Total Residual Chlorine (g/d)	9.58	208	Daily Maximum
Feb-98	Total Residual Chlorine (ug/L)	5	200	Monthly Average
Feb-98	Total Residual Chlorine (ug/L)	11	200	Daily Maximum
Mar-98	Reporting	Total Residual Chlorine		Daily Maximum
Mar-98	Total Residual Chlorine (ug/L)	5	200	Monthly Average
Mar-98	Total Residual Chlorine (ug/L)	11	200	Daily Maximum
Apr-98	Total Residual Chlorine (g/d)	4.35	113.6	Monthly Average
Apr-98	Total Residual Chlorine (g/d)	9.58	113.6	Daily Maximum
Apr-98	Total Residual Chlorine (ug/L)	5	200	Monthly Average
Apr-98	Total Residual Chlorine (ug/L)	11	200	Daily Maximum
May-98	pH	6.5	0.86	Monthly Average
May-98	Total Residual Chlorine (ug/L)	5	200	Monthly Average
May-98	Total Residual Chlorine (ug/L)	11	200	Daily Maximum Concentration
Jun-98	Total Residual Chlorine (ug/L)	5	200	Monthly Average
Jun-98	Total Residual Chlorine (ug/L)	11	200	Daily Maximum
Jul-98	pH	6.5	0.58	Minimum PH level Monthly Average
Jul-98	Total Residual Chlorine (g/d)	4.35	150	Monthly Average
Jul-98	Total Residual Chlorine (g/d)	9.58	150	Daily Maximum
Jul-98	Total Residual Chlorine (ug/L)	5	200	Monthly Average
Jul-98	Total Residual Chlorine (ug/L)	11	200	Daily Maximum
July-Sept 1998	Selenium (g/d)	1.74	47.5	Monthly Average
July-Sept 1998	Selenium (g/d)	43.5	47.5	Daily Maximum
July-Sept 1998	Selenium (ug/L)	2	<50	Monthly Average
July-Sept 1998	Thallium (g/d)	10.45	<38	Daily Maximum
July-Sept 1998	Thallium (ug/L)	12	<40	Daily Maximum
Aug-98	Reporting	Total Residual Chlorine		Monthly Average
Aug-98	Reporting	Total Residual Chlorine		Daily Maximum
Sep-98	Settleable Solids (ug/L)	1	12	Monthly Average
Sep-98	Settleable Solids (ug/L)	2	12	Daily Maximum
Sep-98	Reporting	Total Residual Chlorine		Daily Maximum
Oct-98	Reporting	Total Residual Chlorine		Daily Maximum
Oct-98	Reporting	Suspended Solids		Monthly Average
Oct-98	Reporting	Suspended Solids		Daily Maximum
Oct-98	Chromium (ug/L)	1	<10	Daily Maximum
Oct-Dec 1998	Silver (ug/L)	5.63	<10	Daily Maximum
Oct-Dec 1998	Cyanide (g/d)	8.45	<9.4	Monthly Average
Oct-Dec 1998	Cyanide (ug/L)	9.7	<20	Monthly Average
Oct-Dec 1998	Selenium (g/d)	1.74	<23.5	Monthly Average
Oct-Dec 1998	Selenium (ug/L)	2	<50	Monthly Average
Dec-98	Fecal Coliform (colonies)	1000	<1600	Monthly Average
July-Sept 1999	Mercury (ug/L)	0.2	1.9	Monthly Average
July-Sept 1999	Chromium Hexavalent (g/d)	9.6	<11.4	Monthly Average
July-Sept 1999	Chromium Hexavalent (ug/L)	11	<20	Monthly Average
July-Sept 1999	Chromium Hexavalent (ug/L)	16	<20	Daily maximum
July-Sept 1999	Cyanide (g/d)	8.45	<11.4	Monthly Average
July-Sept 1999	Cyanide (ug/L)	9.7	<20	Monthly Average
Jan-Mar 2000	Mercury (g/d)	0.17	0.38	Monthly Average

Date of Violation	Parameter Violated	Permit Limitation	Amount Reported	What Was Violated
Jan-Mar 2000	Mercury (ug/L)	0.2	0.38	Monthly Average
Jan-Mar 2000	Chromium Hexavalent (ug/L)	11	25	Monthly Average
Jan-Mar 2000	Chromium Hexavalent (ug/L)	16	25	Daily Average

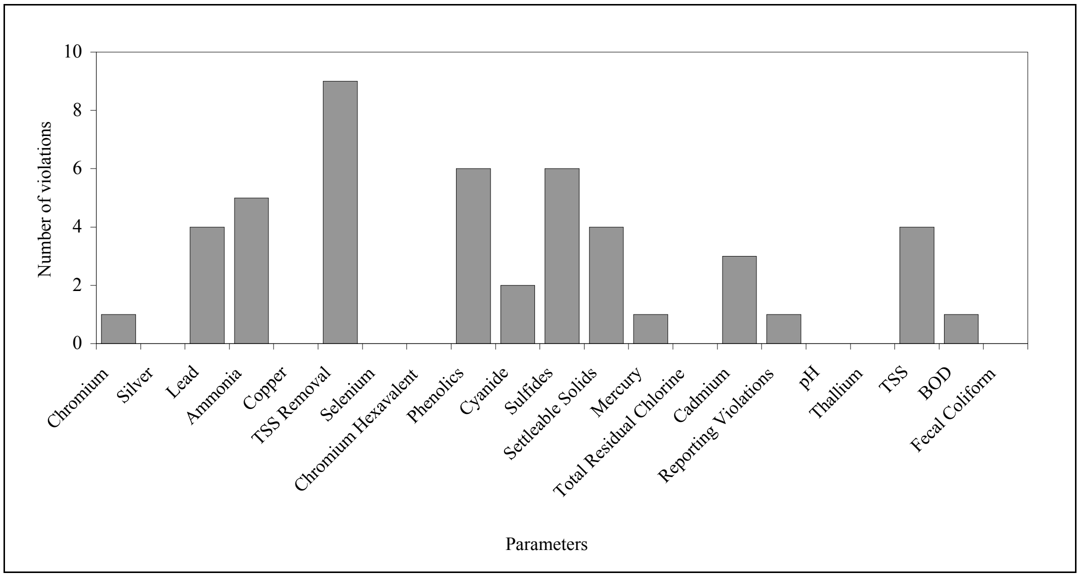
Attachment 7. Bisbee Mule Gulch – Violations per year



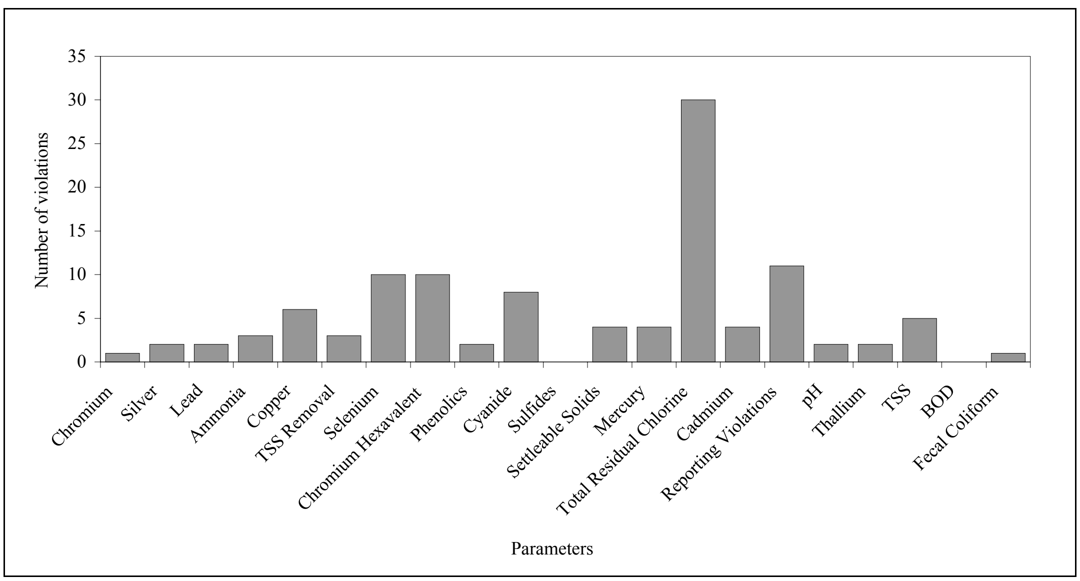
Attachment 8. Bisbee Mule Gulch – Violations by parameter (1992–2000)



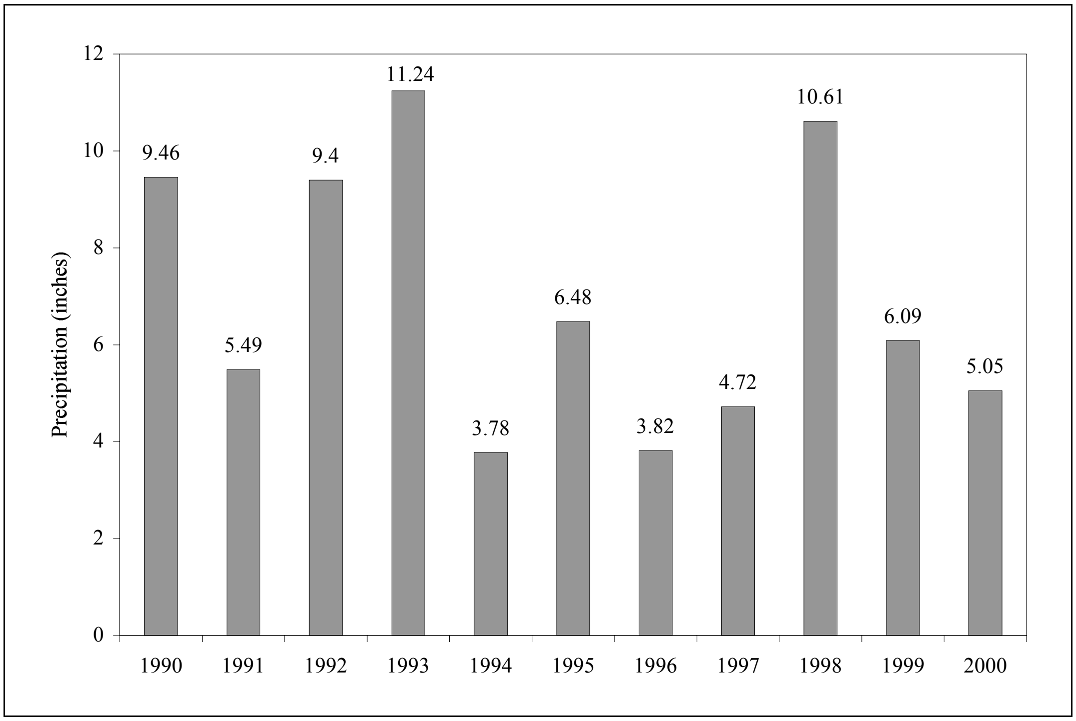
Attachment 9. Bisbee Mule Gulch – Violations by parameter (1991–1994)



Attachment 10. Bisbee Mule Gulch – Violations by parameter (1995–2000)



Attachment 11. Tucson yearly rainfall since 1990 Jan 1 through Aug 17 (Normal = 6.62 inches)



Discussants:

Jake Caldwell (National Wildlife Federation)

Services now comprise two-thirds of the Canadian and US economies, roughly one-third of all world trade, and are the most rapidly growing area of world trade globally. Services are broadly defined and hence difficult to talk about comprehensively. The Kornylak paper underlines the difficulty in obtaining information on compliance-related issues. However, the paper offers some very interesting recommendations, including the creation of an ombudsperson for information on compliance, and measures to increase access to information and public records. The paper does not address the effect that liberalization has had on wastewater treatment and provides little mention of the mandate of the CEC, the various border cooperation initiatives, or the work of the North American Development Bank in this area.

Andrew's paper provides a comprehensive overview of a complex topic. Among the important points he raises is the importance of a "top-down" or "negative" approach, in which exceptions to free trade need to be identified. This approach contrasts with the listing of industries that are to be opened and puts pressure on negotiators to be able to itemize, at the outset of negotiations, everything that needs to be protected. The paper also emphasizes the importance of "upstream" and "downstream" market players in the services sector. Also, the dominance of large retailers in the services sector should not be underestimated.

Andrew's paper could have examined domestic regulatory mechanisms in more detail and the effect that those measures will likely have on the services sector. Given the difficulty in identifying barriers to service trade, the benefits of liberalization are also hard to identify and we should think seriously about possible costs.

Philip Raphals (Centre Helios)

The paper by Plagiannakos concludes that deregulation is unlikely to affect air quality unless regulations evolve differentially between Canada and the US—if the US delays its reductions because it has stockpiled credits for SO_2 reductions in recent years. The paper focuses entirely on air quality issues in its analysis and ignores other environmental factors related to the electricity sector, including uranium mining, nuclear waste, habitat destruction etc. This omission reflects general discussions of electricity and environment. It is important not to draw policy conclusions based on partial analysis.

Ontario is the source of only a small part—roughly 11 percent—of Canada's electricity exports. Eighty percent come from British Columbia, Quebec, and Manitoba, and are largely hydroelectric. The environmental effects of hydro power come almost entirely from initial construction. Quebec is planning new facilities for export. Regulations for new US hydro projects are stringent, whereas in Quebec, there are none. The consequence of this difference in regulations is that US consumers enjoy cheap electricity, while Quebec pays a high environmental price. These differences in environmental regulations should be the focus of analysis of the environmental effects of electricity free trade in North America.

Session Five Questions and Open Discussion

Several participants called attention to the importance of subsidies for electricity export. Little work has been done on the price and environmental effects of electricity subsidies. Reference was made to the Ontario Clean Air Alliance report, which provides analysis of emission cap programs, and the flaws inherent in caps and trading systems. It was noted that under such systems, pollutant emissions are allowed to rise substantially. It was countered that caps are effective. The question is whether the tools to implement them are the right ones. From a trade perspective, a country can reduce its emissions by importing energy. A harmonized or cooperative regulatory regime would mean this loophole would be closed.

In looking at liberalization of the services sector, there is some evidence that a "win-win" relationship is developing. The OECD has analyzed 64 private investments in wastewater treatment around the world and found that gains have taken place in the economic, environmental and developmental arenas. However, lack of demand for environmental services remains an issue.

It was noted that FTAA negotiators are addressing both investment and services, and will have to decide on whether to adopt a negative top-down approach as in NAFTA, or a positive bottom-up approach as in the GATT. In discussing the comparative strengths of these two approaches, the advantage of a negative, top-down approach is transparency—negotiators and the public have a good idea of what limitations will be imposed, and there is no danger of maintaining unnecessary restrictions due to oversight. The positive approach is more gradual and cautious. From an environmental perspective, transparency seems like a good idea, although it is an important question that needs further analysis.

The FTAA negotiations have encountered basic transparency problems from the outset. While the US negotiating position advocates a top-down approach, other parties do not. With a top-down approach, the stakes tend to become very high during the initial stages of negotiation.

The role of the Border Environment Cooperation Commission was noted, since it continues to work towards a strategic plan in this area.

Closing Session

Next Steps—Policy Responses to Environment-Trade Links

Session Chair:

Durwood Zaelke (Center for International Environmental Law)

A closing information session took place to highlight key lessons learned from the papers and discussions, and to point towards some next steps involving policy options.

Mr. Zaelke said the key question at the end of the analysis is: given what we now know, what do we do about it? The FTAA is a case in point: there is a need to undertake a full environmental assessment that includes meaningful public participation. Unless this takes place in a meaningful way, with the public having input into assessment work, then trade and environment will continue on a collision course. Public concern about the free trade agenda generally is growing, as seen from the public demonstrations in Seattle and Washington.

The symposium raised a number of important issues related to process, institutions, substantive measures, and measures that are needed to move towards sustainability. While the CEC remains a shining star in addressing some trade-environment links, it needs a more comprehensive mandate to turn analysis into policy discussions and options.

Examining the Implications to Trade Policy from Environmental Reviews

Jeffrey Schott (International Institute for Economics)

Mr. Schott recalled that, when international trade negotiations were being held a decade ago, environment was never considered. Ten years ago, one could have predicted North American market integration, with or without NAFTA. It is important to remember that many of the environmental problems these papers have examined would have occurred with or without NAFTA.

However, it is now clear that more attention needs to be paid to how trade negotiations can help the public deal more effectively with environmental problems. Mr. Schott said the papers that dealt with particular issues and case studies were more useful than the aggregate analyses. The aggregate analyses were based on broad assumptions, and their supporting data were less convincing than that in the more focused analyses.

The suggestion of a regulatory chill arising from Chapter 11 issues is worrying. There is a need to have a much more transparent process, with regular publication of reports and supporting documents. The evidence suggests that interpretations around expropriation are cause for concern and there is a need for clarification.

It was recommended that the CEC—given its small budget—should narrow the scope of its activities, produce smaller, more accessible documents, focus on in-depth investigations (despite reluctance of governments to submit to them), and become a repository for environmental data. One of the lessons of this conference is the need to develop a consistent database across North America. There should be an annual conference to address data harmonization issues among the three countries.

The track record of the North American Development Bank suggests that financing procedures are too cumbersome, financing too limited, and its geographic scope too narrow. There is a need to broaden the scope of the NADBank and BECC activities. This work should also address underlying issues, in particular, the need for tax reform. In Mexico, the tax system is so centralized that it limits the ability of local jurisdictions to fund infrastructure investments.

Finally, Mr. Schott asked if there were precedents from the NAFTA experience that could guide the FTAA. There is concern in Latin America over the threat of latent protectionist trade sanctions imposed in the name of environmental and labor regulations/violations. But there is also a commitment to work toward hemispheric cooperation on sustainable development in parallel with the FTAA. One lesson is that hemispheric talks may lend themselves to greater cooperation than does the NAFTA approach, which is based on the possibility of sanctions and punitive measures.

Examining the Implications for Environmental Policy from Environmental Reviews

Konrad von Moltke (International Institute for Sustainable Development)

Mr. von Moltke said care is needed in shifting from academic studies to policy recommendations. In general, macroeconomic analysis has not been useful in the trade/environment arena. Trade liberalization is a cumulative process and sorting out NAFTA effects from the broader process of globalization is problematic. At the same time, this work is useful, especially insofar as NAFTA serves as problem solving/testing ground for globalization in general. Even in sectors where trade balances have not changed, trade liberalization may induce significant changes in operations that are difficult to detect and analyze. To help examine these issues, the CEC should find more innovative ways of engaging academia in the study of these critical issues.

Proponents of free trade have argued that each country will be able to choose its own level of environmental protection as trade rules come into effect. However, the Chapter 11 cases have shown that, in practice, a higher level of institutional sophistication and regulatory integrity is needed to withstand the effects of trade rules.

There is a need to look for ways in which international environmental regulation works. One of the clear lessons of the trade-environment debate is the key role of strong institutions.

Regina Barba (Joint Public Advisory Committee)

There is a need to find common ground between civil society—including environmentalists, social groups and others with growing concerns about free trade and economic globalization—and business groups and others that support NAFTA. Unless this common ground is found, free trade accords like NAFTA or the FTAA will lose public support.

In looking at these public debates, we should begin to ask ourselves: where do we want to be in 60 years? To help answer these longer-term questions, the trade-environment debate needs to become more public. The CEC is a good institutional forum to help push transparency issues. The CEC has already contributed to a more public debate in a number of ways, including:

- the Articles 14 and 15 citizen submission process,
- the mandate of the Joint Public Advisory Committee,
- the work of the three National Consultation Committees, and
- the role of the North American Fund for Environmental Cooperation in helping to support community organizations.

Governments have made progress in disseminating information. However, it is not enough to rely solely on the Internet for information. Moreover, the Internet is not universally accessible, especially in Mexico and Canada. We need to evaluate the impact of the CEC on NAFTA and, more importantly, on a range of environmental management issues affected by NAFTA, including land use, forestry, agriculture and communications among the three countries. To that end, this symposium marks a useful beginning.