Land

6

Land

North America harbors about 11 percent of the world's agricultural croplands, which produce ample amounts of food, fiber, and other products both for the region's own needs and for export around the world. Almost 20 percent of the United States is covered by arable and permanent cropland and 26 percent by permanent grassland or pastures, totaling about 46 percent of all land used for agricultural production (OECD 1999). Although only 7 percent of Canada's land is devoted to agriculture, this represents virtually all the undeveloped land that is amenable to cultivation (EC 1996). Highly differentiated by region, the largest extensions of croplands are found in the states and provinces of the Great Plains regions, extending from central Canada to the southern United States. About 82 percent of Canada's agricultural land lies in the Prairie Provinces of the Central Plains (Wilson and Tyrchniewicz 1994).

Agricultural productivity has greatly increased with more intense land use and agricultural inputs—including irrigation, agro-chemicals, and multiple cropping—while the amount of cropland has remained fairly stable since World War II (Ervin, Runge, and others 1998). Agricultural activity contributes significantly to the North American economy, representing 2 percent of Canada's GDP and 3 percent of GDP in the United States (CEC 2000). Agricultural expansion, intensification, and industrialization have also contributed to land degradation, however, reducing the organic content of the soil and exacerbating its exposure to wind and water (CEC 2001a). Land degradation has been an issue of concern in North America.

Another issue of high priority for the region is the use of agricultural pesticides. While pesticides help expand food production, many have important environmental effects. Particularly harmful pesticides known as persistent organic pollutants (POPs) have received considerable attention because of their links to reproductive failure in animals and health effects in humans.

Land Degradation

Land degradation is difficult to define (see Box 33) but in general, it refers to unsustainable or poor land use that leads to the irreversible decline in its productivity (Eswaran, Lal, and Reich 2001).

Socioeconomic factors that sometimes can drive unsustainable agriculture and land degradation may include large federal subsidies, use of chemical fertilizers and pesticides, and uniform high-yield hybrid crops (Dregne 1986; Gold 1999).

Pressures to extract ever more produce from agricultural soils over the past 30 years often left them bare and exposed to wind and water erosion. For example, the shift to large, heavy equipment and sprinkler irrigation systems required field enlargement and the consequent elimination of many wind-breaking hedgerows and other natural features that help to reduce wind and water erosion (Miller 1982). Erosion reduces soil productivity by removing the finer soil particles so the soil becomes more compact and loses nutrients and the capacity to store water and organic matter (IISD 2001). Lessons learned after the Dust Bowl experiences of the 1930s, when about 3.6 million ha of farmland were destroyed and another 32 million ha severely damaged led to

Box 33: Definition of Land Degradation

There are many different definitions of land degradation. In general terms, it refers to the processes that negatively affect the land's or soil's natural functions of water, energy, and nutrient acceptance, storage, and recycling, leading to a decline in soil productivity. Humans are the major drivers of land degradation through socioeconomic and political pressures that lead to land clearing and deforestation, unsustainable agricultural activities, land conversion to urban uses, and contamination (Eswaran, Lal, and Reich 2001, IUSS 2001).

Physical, chemical, and biological processes are direct impacts that begin land degradation. Physical processes include the decline in soil structure, which leads to crusting, compaction, erosion, desertification, anaerobism, and contamination by pollutants. Soil structure affects all degradation processes. Chemical processes include acidification, leaching, salinization, reduced soil retention capacity, and fertility depletion. Biological processes include carbon reduction and decline in land biodiversity. Carbon loss leads to soil erosion and reduced fertility. Desertification refers to land degradation in arid, semiarid, and dry, sub-humid areas (Eswaran, Lal, and Reich 2001, IUSS 2001).

growing global demand for agricultural products, and increased trade liberalization (MacGregor and McRae 2000). Some of the human pressures leading to degradation over the last 30 years have been rapid technological change in production methods, fewer but larger farms, single and row cropping systems over many seasons, overgrazing in arid lands, extensive

Box 34: Conservation Strategies to Curb Soil Erosion

Erosion control practices include conservation tillage, which involves either zero tillage or keeping tillage to a minimum. In the former, crops are seeded into the previous crop's stubble. Both systems provide for minimal soil disturbance and by maintaining a cover of plants or crop residues on the soil, protect it from the erosive power of flowing water and the impact of heavy rain. Another method is to extend crop rotations to include forages by alternating them with cereals and oilseeds or legumes. Forages can be grown on poorer soils or steep slopes not suitable for other crops. When planted as a perennial crop or plowed back into the soil, forages return residue to the soil, increasing organic matter and nutrients. This improves the soil structure, allowing it to absorb more water and thus reduce runoff and erosion. Other strategies include planting shelterbelts, strip-cropping, contour cultivation, and restructuring the landscape with terraces, diversions, and grassed waterways (Acton and Gregorich 1995; Vandervel and Abday 2001).

the adoption of various soil conservation strategies that decreased water and soil erosion, such as contour plowing, no-till methods, reduced summer fallow, and increased crop residues (see Box 34) (Miller 1982).

In the late 1970s and early 1980s, both countries reported on the declining status of their nations' soil, and the messages in these reports led to the US Soil and Water Resources Conservation Act of 1977 and Canada's 1989 National Soil Conservation Program (Vaisey, Weins, and Wettlaufer 1996). They also adopted strategies that took fragile lands out of agricultural production to protect them from erosion (see Box 35, next page).

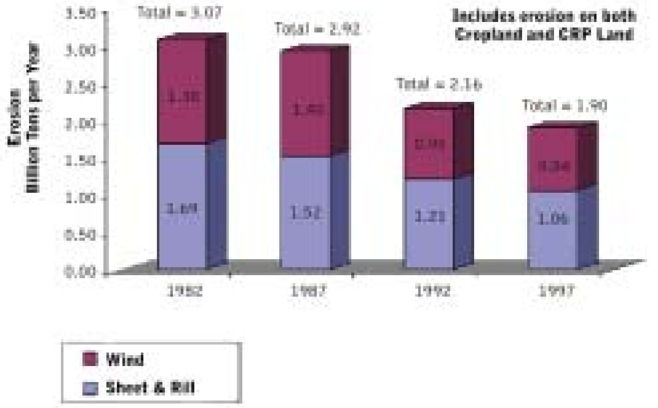
Conservation measures have led to significant declines in erosion over the past 30 years (see Figures 34 and 35). Between 1987 and 1997, soil erosion declined by about one-third in the United States. In addition to idling land, US agro-environmental programs included other cost-sharing schemes, such as those that paid farmers to construct field terraces, ponds to retain runoff laden with sediment, or windbreaks (Ervin, Runge, and others 1998). In the United States, 30 percent of croplands had highly erosion-prone conditions in 1982 compared to 24 percent in 1992 (H. John Heinz III Center 2001).

In Canada's agricultural regions, between 1981 and 1996 the average number of days soil was left bare declined by 20 percent while the share of cultivated land at high-to-severe risk of wind erosion declined from 15 percent to 6 percent thanks

Figure 34
Changes in erosion in the United States, 1982-1997.

Source: NRCS 1997

Changes in Erosion in the United States, 1982-1997



to improved management practices. In the Prairies reduced tillage technologies and summer fallow practices led to an overall decline of 30 percent in the risk of wind erosion between 1981 and 1985 (Padbury and Stushnoff 2000) (see Figure 35). In general, conservation practices spurred at least an 11 percent decline in the overall risk of water erosion over this period(Acton and Gregorich 1995).

Despite promising conservation measures, erosion continues to be a serious problem in many parts of North America, however. Excessive erosion occurs on more than 23.2 million ha of fragile, highly erodible cropland in the United States, while erosion exceeding the tolerable soil loss rate (a measure indicating the maximum rate of annual soil erosion that will permit crop productivity to be sustained economically and indefinitely) occurs on nearly 20.4 million ha of cropland that is not highly erodible (NRCS 2001b). In total, erosion, threatens productivity on about one-third of US cropland. Twenty percent of Canada's agricultural land was at high-to-severe risk of inherent (bare soil) water erosion in 1995 (USDA 1996, Shelton, Wall, and others 2000). Figure 36 shows the area of risk for wind and water erosion in North America in 1998.

Data for other indices of land degradation are somewhat scarce: consistent US data for the national level of organic matter, the degree of soil

Risk of Wind Erosion on Cultivated Land in the Prairie Provinces under Prevailing Management Practices, 1981-1996

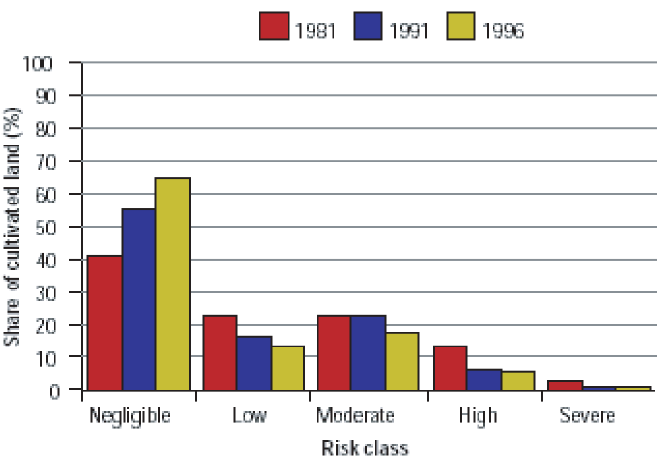


Figure 35
Risk of wind erosion on cultivated land in the prairie provinces under prevailing management practices, 1981-1996.

Source: Padbury and Stushnoff 2000

Water and Wind Erosion Vulnerability, 1998

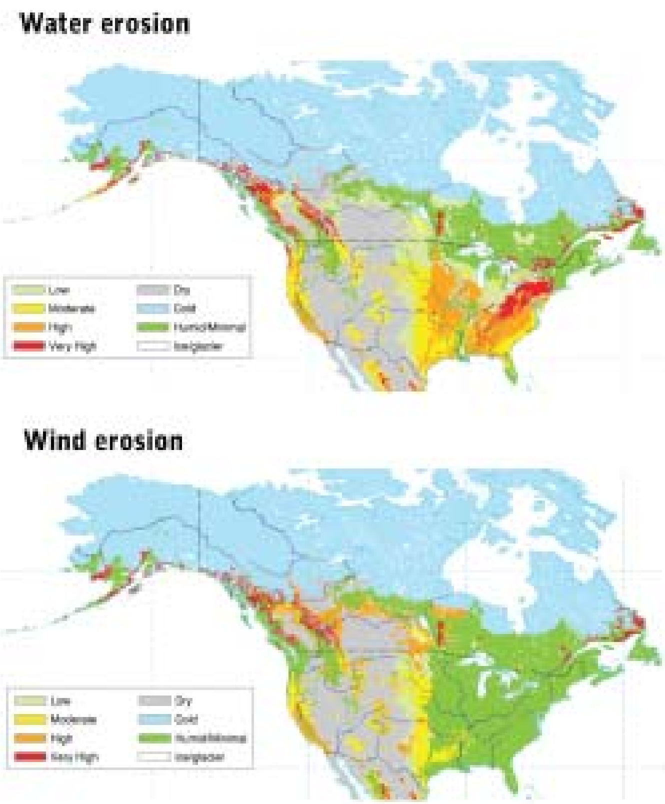


Figure 36
Water and wind erosion vulnerability, 1998.

Source: USDA 2001a and 2001b

Box 35: Conservation Programs

The US Conservation Reserve Program (CRP) of 1985, which came to dominate federal spending on conservation, was prompted by a farm crisis related to export market contraction, surpluses, falling commodity prices, and a growing environmental consciousness (Ervin, Runge, and others 1998; USDA 2001a). The aim was to reduce erosion and excess production by helping farmers to retire highly erodable or environmentally sensitive cropland for 10 years in return for rental and cost-sharing payments and technical assistance. Reversed economic conditions in the mid-1990s led many farmers to leave the program. It was re-authorized in 1996 under the Federal Agricultural Improvement and Reform Act (FAIR), which added more environmental and water quality goals (USDA 2000a), but participation remained voluntary (Ervin, Runge, and others 1998). In all, about 13 percent of US cropland was idled under federal programs between 1982 and 1997 compared to 11 percent of cropland between 1950 and 1970 (see Figure 33) (Zinn 1994; H. John Heinz III Center 2001). As of October 2000, more than 13.4 million ha were enrolled in the CRP, making it the most extensive US agricultural conservation program (USDA 2000a).

Acres (1 Acre=0.4 Hectare) of Cropland Converted to Conservation Reserve Program (CRP) Land, 1982-1997

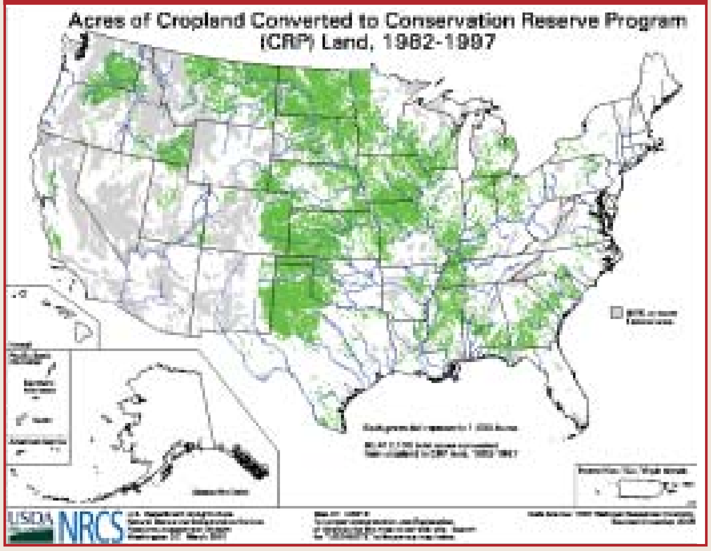


Figure 33 *Source: NRCS 2001a*

The CRP produces a wide range of environmental and economic effects (USDA 2000a). Allowing trees and vegetation to grow on what was once cropland not only prevents erosion but also can improve the amount and suitability of wildlife habitat and the abundance of species. Species that consume insects and plants pests can help to increase the commercial value of crops, while game species provide recreational economic benefits (Ervin, Runge, and others 1998).

In Canada, the Permanent Cover Program (PCP), first delivered in 1989 by the federal Prairie Farm Rehabilitation Administration (PFRA), aims to reduce soil deterioration on cropland at high risk for soil damage by maintaining a permanent cover of grass and trees. About 555,000 ha of marginal prairie agricultural land was removed from annual cultivation under the program. Despite the PCP’s shortcomings—it had limited funds, only applied for a short time period, restricted the amount of land each farmer can retire, and left some 4.9 million ha of land at risk of soil degradation under annual cultivation after it ended—between US $1.3 and 3.3 million dollars of soil productivity were saved by permanent cover on 320,000 ha of land (Wilson and Tyrchniewicz 1994; Vaisey, Weins, and Wettlaufer 1996; AAFC 1997a).

compaction, and the amount of land affected by salt are lacking (H. John Heinz III Center 2001). Levels of organic matter in Canadian soils in general have been maintained or increased in some croplands with the help of erosion-reducing practices (Acton and Gregorich 1995). There is some indication that conservation practices have led to a decline in the rate of organic carbon loss from 70 kg/ha in 1970 to 43 kg/ha in 1990 (Smith, Wall, and others 2000). On the other hand, the risk of soil compaction increased in eastern Canada and there has been an overall national decrease in the amount of land under cropping systems that improve soil structure (McBride, Joosse, and Wall 2000).

Desertification, which refers to land degradation in arid, semi-arid, and dry sub-humid areas, has generally been stabilized over the past 30 years as plant cover on rangelands improves and erosion and water logging are controlled (Dregne 1986; UNCCD 2001). In the mid-1980s, increasing salinity (salinization) was estimated to affect adversely about 25 percent of the irrigated land in the United States, and by 1992, at least 19.4 million ha of crop and pasturelands were affected by salinity. Conditions in heavily irrigated agricultural areas of the dry US southwest continue to worsen (De Villiers 2000).

In Canada's praire provinces, only 2 percent of agricultural land has more than 15 percent of its area affected by salinity (EC 1996). Dry land agricultural soil in some parts of the Prairie Provinces is subject to salinization, a significant problem (IISD 2001). In 1995, 7 percent of farmland in the Prairie Provinces was at high risk of salinization under 1991 management practices (Acton and Gregorich

1995).

Traditional policies to address land degradation in the United States have focused on land retirement (see Box 35). The US Department of Agriculture now recognizes that many emerging environmental problems on agricultural land can only be addressed by changing management practices, and it is looking at achieving cost-effective environmental benefits from conservation spending on working lands (USDA 2001a).

Furthermore, government agricultural policy in North America historically focused on economic and production goals, but more recently, sustainability has guided policy reforms (MacGregor and McRae 2000; USDA 2001a). The Canadian

Agri-Environmental Indicator Project, completed in 2000, contributed to a more informed debate about agricultural sustainability. A major step forward in judging the environmental sustainability of agriculture in the nation, it introduces two criteria: how well agriculture conserves natural resources that

support agricultural production, and how compatible agricultural systems are with natural systems and processes (McRae, Smith, and Gregorich 2000).

The Prairie Farm Rehabilitation Administration (PFRA), established in response to the drought and conditions of the 1930s, seeks to make large-scale dry land agriculture sustainable over the long term and has promoted sustainable development on the rural prairies for six decades (AAFC 2001a). The Canadian government set out its Sustainable Development Strategy for agriculture in 1997, with the objective of working cooperatively with all sectors to integrate environmental goals into decision-making and management (AAFC 1997b). To support the strategy, the National Soil and Water Conservation Program (NSWCP) was set up between 1997 and 1999, with the goal of advancing environmental sustainability initiatives across the country (AAFC 1999). A federal framework was put in place to guide the 1997 strategy and a new strategy was published in 2001 (AAFC 2001c).

The 1985 and 1990 US Farm Bills also led to more sustainable stewardship by farmers and landowners (McRae, Smith, and Gregorich 2000; NRCS 2000). In 1994, the US Task Force on Sustainable Agriculture set out recommendations to achieve environmentally and socially sound agricultural production, and two years later, the Federal Agriculture Improvement and Reform Act was signed expanding on earlier conservation themes (PCSD 1996; Gold 1999). Also, the US Food and Agricultural Policy calls for redefining 'output'—now limited to food, fiber, and timber production—to include environmental amenities, such as rural landscapes, wildlife habitat, wetlands, and improved water and air quality (USDA 2001a).

Canada and the United States have ratified the 1996 United Nations Convention to Combat Desertification, which commits participating nations to research, prevent, and reverse the transformation of fertile farm and pasture lands into arid deserts. Although as developed countries they do not have to prepare a National Action Plan under the Convention, they have committed themselves to properly addressing issues of drought and land degradation (CIDA 2000; ENN 2000).

Pesticides

Pesticides are part of the package of agricultural inputs that have contributed to the production of an abundant and affordable food supply (Gold 1999). Chemical pesticides include human-made herbicides, insecticides, algaecides, and fungicides. They are applied to crops to control unwanted insects, weeds, and diseases and to ensure crop quality and quantity (Statistics Canada 2000). About 10 percent of US land area is treated annually with pesticides (Muir 1998). This includes the use by forest companies to clear unwanted trees and vegetation and to fight forest insects and the use on lawns, playgrounds, parks, and golf courses, mostly for cosmetic reasons, although these uses represent a fraction of total application. Homeowners use between 5 and 10 percent of the total amount of pesticides sold in North America to keep lawns weed-free (Aspelin and Grube 1999; EC 2000).

North America leads the world in the consumption and use of pesticides, accounting for 36 percent of world pesticide use. The pesticide market has been growing at about 6 percent a year since 1990 (CEC 2000). The pesticide industry is worth about US $65.5 million yearly in sales in Canada and in 1995 in the United States, sales totalled US $10.4 billion (Benbrook 1997; Mulholland 2001). However, the benefits afforded by pesticides have come at a cost to the health of people, wildlife, and the environment.

By far the most common and widespread use of pesticides in North America is agricultural applications, which accounted for 76 to 77 percent of US pesticide use through 1990 to 1991, with corn and soybeans using 62 percent of all crop applications (Schmitt 1998). Over the past 30 years, the area treated with chemical pesticides has rapidly expanded. For example, in Canada it increased 3.5 times between 1970 and 1995 (Statistics Canada 2000). In 1996, Canada used an average of 644 kg of pesticides per ha of cropland while average use in the United States was more than twice as intensive at 1,566 kg per ha (UNDP, UNEP, World Bank, and WRI 2000).

Since 1979, the total annual amount of pesticides (all types, by all sectors) used in the United States has fluctuated somewhat but overall has remained fairly steady while in Canada, pesticide use in agriculture leveled off since the mid-1980s (AAFC 1997). Scientists are increasingly advocating the use of biological and cultural pest management methods (USDA 2000a). Safer pesticide products, new management techniques for eliminating crop pests, and training and certification programs for pesticide users help to account for recent reductions in agricultural pesticide applications. Major developments include genetically

Box 36: POP Pesticides

Persistent Organic Pollutants (POPs) are a family of chemicals generally used as insecticides or industrial chemicals. They are very toxic and persist in the environment, taking decades or longer to break down. Some are also highly soluble in fat, bioaccumulating in food webs as they increase in concentration in the bodies of top predators (EC 1998). Of the 12 worst POPs called 'the dirty dozen', nine are pesticides. They include DDT, hexachlorobenzene (HCB), toxaphene, chlordane, and dieldrin (Statistics Canada 2000).

Because they last so long and can travel great distances in air and water currents, even those persistent, toxic organochlorine pesticides that have been banned in North America are still found in the food supply. Persistent residues of POPs pesticides used in the 1960s and 1970s remain in the soil, for example, and continue to be taken up in crops (Schafer, Kegley, and Patton 2000). They also travel long distances northward because of the 'grasshopper' effect as they migrate in repeated cycles of evaporation and condensation.

Entering the food chain, POPs pesticides can threaten human health. Exposure to dieldrin and DDE, a breakdown product of DDT, has been associated with breast and other types of cancer and nervous system disorders. Several POPs pesticides are present in the breast milk of Canadian women, with levels of the pesticide chlordane 10 times higher in the breast milk of Inuit women in the north than in women in southern Canada (Statistics Canada 2000).

Given their persistence and ability to travel, POPs need to be regulated and managed at a global level. After years of negotiation, during the fifth POPs negotiating session in December 2000, the international community finalized the text of a new legally binding treaty. Signed by both Canada and the United States in Stockholm in May 2001, the POPs Convention requires governments to eliminate or severely restrict the use and production of an initial list of 12 POPs of which eight are pesticides. Included in the treaty are commitments to the precautionary approach that move chemical regulation and management from a 'regulate and reduce' approach to one in which a lack of scientific certainty is no longer regarded as a reason to avoid taking preventive action (UNEP 2000).

engineered herbicide-tolerant varieties and plant pesticides, which reduce the need for chemical applications (USDA 2000a).

In the 1960s and '70s, the damaging effects on wildlife of persistent, toxic organochlorine pesticides included in the class of chemicals known as POPs (see Box 36) became known. As shown in the section on the Great Lakes, extremely high residues of some of these pesticides in a number of bird species were causing populations to crash. The freshwater section of this report highlights the trends in pesticide contamination in North America's groundwater.

As a result of their effects on wildlife, dieldrin and DDT pesticides were banned in the 1970s, and by the early 1990s, all exempted uses and the manufacture of DDT in North America had been phased out (CEC 1997; Schafer, Kegley, and Patton 2000). Pesticide rulings by the US EPA in the 1970s ended 25 percent of insecticide applications in use at that time and since then, 43 pesticides have been banned and 10 severely restricted (OECD 1996; Benbrook 1997). Because of these bans, concentrations of POP pesticides in biota have declined significantly since the 1990s (Schmitt 1998).

The use of insecticides declined markedly in the United States from the 1976 peak due largely to the implementation of Integrated Pest Management (IPM) programs (see below) and the use of new pyrethroid insecticides, which can be applied at about a tenth the rate of traditional insecticides (Muir 1998; Schmitt 2000). For a period of time, herbicide use grew as a way to control weeds, due in part to the increase in conservation tillage, which leaves crops and residue on the land to help control soil erosion (see Box 34): as a share of total pesticides applied, herbicides rose from 33 percent in 1966 to 70 percent in 1986. But there has been a more recent decline in herbicide use in US agriculture—about 25 percent from its 1982 peak—due to a reduction in farmed land, increased herbicide costs, and the greater potency of herbicides, which give greater control with lower levels of active ingredients (Ervin, Runge, and others 1998; Muir 1998). The use of fungicides and other compounds has risen steadily for the last 40 years (Ervin, Runge, and others 1998).

Farm workers risk direct exposure to pesticides, but accurate national and comparative data about their exposure is sparse. In the United States today, more than 85 percent of fruits and vegetables are hand harvested by disenfranchised workers who often lack access to the proper information about controlling their exposure to agricultural pesticides (Acury, Quandt, and McCauley 2000). This is often because of the migratory nature of their activities, which also affects the ability to monitor and treat pesticide-related illness (OECD 1996).

Recent evidence suggests that some pesticides may be linked to immune system suppression, reproductive damage, and hormonal system disruption (Colburn, Myers, and Dumanoski 1996). Children are more vulnerable than adults to the effects of pesticides, which impair their neurological development, growth, and immune and endocrine systems (as shown in the human health section).

With increased public concern about the health effects of pesticides and recognition of the special vulnerability of children and indigenous peoples living in (see Box 54 in the human health and the environment section) the north, pesticide regulation in North America became more stringent during the 1990s. Re-registration of existing pesticides, initiatives to help replace old and dangerous pesticides with newer, safer ones, reviews of high-risk pesticides, accelerated registration for reduced-risk compounds, and improved consumer information were introduced.

The 1996 US Food Quality Protection Act eliminated a previous prohibition against wording that pertained to all residues that might cause cancer, streamlined the approval process for new, safer pesticides, targeted children for protection, and required more pesticide information on food products (Ervin, Runge, and others 1998). In response to the risks faced by migratory farm workers, worker protection standards and worker outreach efforts were extended (OECD 1996).

Canada's regulatory system was reformed with the 1995 Pest Management Regulatory Agency, which assesses the human health and environmental safety of pest control products prior to their use (PMRA 2001). Inactive ingredients in pesticides were recently brought to the attention of Canadians when it was found that the list of these ingredients was outdated and that many were dangerous to human health. Legislation was subsequently introduced requiring manufacturers either to remove them or to list them on product labels (Mittelstaedt 2001a).

Canada and the United States now work together in a number of ways to reduce the risks associated with pesticides and other POPs (see Box 37). In addition, heeding public demand to protect children from lawn pesticides, many North American municipalities are now restrict-

Box 37: Bilateral Cooperation

In 1996, Canada's Pest Management Regulatory Agency (PMRA) and the US EPA developed a joint process to divide between them the review applications made simultaneously on both sides of the border for reduced-risk pesticides and biopesticides. Through these initiatives, an increasing number of these chemicals were brought forward for evaluation and registration. In 1998, procedures were revised to broaden the process to include chemicals that do not meet reduced-risk requirements but qualify as organophosphate alternatives or NAFTA (North American Free Trade Agreement) priority chemicals (e.g., methyl bromide alternatives) (PMRA 1999; PMRA 2000).

The two countries also work together (with Mexico) under the Commission for Environmental Cooperation of North America's Sound Management of Chemicals initiative to reduce the risks of toxic substances to human health and the environment. Begun in 1995, the project focuses on persistent and bioaccumulative toxic substances. It provides a forum for identifying priority chemical pollution issues of concern to all three NAFTA countries; developing North American Regional Action Plans (NARAPs) to address the issues; overseeing the implementation of approved NARAPs; and facilitating and encouraging capacity building to support the project's goals. Action plans for three POPs (PCBs, DDT, Chlordane) are being implemented. A fourth plan for mercury is also underway. An action plan on dioxins, furans, and hexachlorobenzene as well as one for environmental monitoring and assessment are currently being developed (CEC 2001b). Consideration is also being given to developing a NARAP for lindane. Lead is currently undergoing a scientific review to see whether it is of mutual concern to the three countries.

ing pesticide use on public land and some have instituted total bans (see the example in Box 38).

Although some new pesticides that are used in higher volumes today are safer than their predecessors (OECD 1996), pesticides still pose a number of problems. 'Soft' pesticides produced since 1975 are shorter-lived than POPs and do not accumulate, but they are fast-acting and highly toxic to terrestrial and aquatic invertebrates in the short term; in some places they have led to higher fish and wildlife kills (OECD 1996, Schmitt 1998). In some agricultural regions, the intensity of pesticide use has grown in the last decade. In California, which produced 11.7 percent of total US market value of agricultural products in 1997 (NASS 1997) and accounted for 25 percent of its pesticide use between 1991 and 1995 (Liebman 1997), the quantity of applied active ingredients per unit area rose 60 percent between 1991 and 1998 (Kegley, Orme and Neumeister 2000).

Pests have also become resistant to pesticides. One report estimates that more than 500 insect pests, 270 weed species, and 150 plant diseases are now resistant to one or more so that more applications are needed today to accomplish the same level of control effected by one application made in the early 1970s (Benbrook 1997). While crops of Genetically Modified Organisms (GMOs) have the potential to enhance yields while using fewer pesticides, the consequences for non-target organisms and the development of pest resistance to the toxic effects of some bioengineered crops are still being debated. The United States and Canada are leaders in the production and export of GMOs.

In response to pest resistance, consumer concerns, scientific advice, and environmental regulation of chemical pesticides, recent government programs encourage the development and use of biological and cultural methods, including Integrate Pest Management (IPM) and national organic standards (USDA 2000a). IPM combines a range of different control options: biological tools in which pests are controlled by the release of predator insects, for example; cultural tools such as crop rotation; physical tools such as cultivating corn weeds; genetic tools such as planting disease-resistant varieties; and chemical tools, such as conventional pesticides (NIPMN, Western Region

Box 38: Cosmetic Use of Pesticides in Canada

In June 2000, Canada's Supreme Court unanimously ruled that towns and cities have the right to enact bylaws banning the purely cosmetic use of pesticides (Makin 2001). The Quebec community of Hudson initiated a court case leading to the decision, which was followed by Toronto's Board of Health endorsing a similar bylaw, making it the first large city to begin steps to phase out the use of pesticides on lawns for cosmetic purposes. Against concerns that weeds will proliferate and jobs will be lost, municipalities across the country now have the right to impose the restrictions long sought after by residents worried about the health consequences of lawn and park applications of herbicides and insecticides, particularly on children (Mittelstaedt 2001b).

2000). One of IPM's key characteristics is that action is not taken against pests routinely, but rather when their numbers or effects warrant it (PMRA 2001). IPM therefore continues to rely, to a reduced extent, on chemical pesticides. In the biointensive IPM approach, the most stringent form, reduced-risk chemical pesticides are used only when other methods fail (Benbrook 1997).

Canada's PMRA is working through Partnership Projects and other initiatives to help establish IPM as the basis of pest management in a variety of pesticide user sectors. The US goal is to implement IMP on 75 percent of its crops (Jacobsen 1996, PMRA 2001). Strategies are based on voluntary implementation and a participatory process involving many stakeholders (Jacobsen 1996; PMRA 1998).

These governmental initiatives allow for greater flexibility than organic agriculture, in which chemical pesticides are shunned. North

Box 39: Organic Produce

Organic produce is usually understood to be foods grown without the use of chemical fertilizers and pesticides, and not derived through genetic engineering or treated by irradiation. It also refers to food grown with sustainable agricultural practices, including the promotion of soil health and biodiversity (AAFC 2001b; Cunningham 2001).

Active since the 1970s, the market in organics is growing in North America. The organic sector was the fastest-growing agricultural sector in the 1990s in the United States, with private and state certified organic cropland more than doubling between 1992 and 1997 (see Figure 37) (ERS 2000). In 1999, the value of retail sales of organic foods was an estimated US $6 billion. By 2000, the number of organic farmers in the United States was rising by about 12 percent per year, with about 12,200 mostly small-scale producers nationwide (USDA 2000b). Still, the area of certified organic cropland accounts for only about 0.2 percent of all US cropland (Halweil 2001). At the end of 2000, the US Department of Agriculture released its final version of national standards to govern the certification of farming and production practices and regulate the use of the term 'organic' on foods. The standards create a uniform definition of organic foods and standardize product-labeling guidelines, bringing consistency to a network of private and public organic certification agencies' standards. It specifically prohibits the use of genetic engineering methods, ionizing radiation, and sewage sludge for fertilization (USDA 2000b).

The Canadian organic market has also expanded since the 1970s, growing at a rate of 15 percent per year between 1989 and 1999. Organic items accounted for 1 to 2 percent of all food sales at the end of that period (Roberts, MacRae, and Stahlbrand 1999). Canada had about 1 million ha under organic production in 2000. The industry anticipates it will represent 10 percent of the country's retail market by 2010 (AAFC 2001b). Certified organic cropland accounts for about 1.3 percent of Canada's cropland (Halweil 2001). Canada's National Standard for Organic Agriculture, published in 1999, is voluntary and does not mandate certification or endorse any one certifying body, but two Canadian provinces have established organic standards (Quebec and BC) that require third-party certification (AAFC 2001b; ERS 2001; Shaw 2001).

American consumers are increasingly seeking organic produce, however, because many of them are concerned about potential pesticide residues in food (see Box 39).

Now that strong legislation for point source pollution has been enacted and gross emissions to the land have declined, it is becoming clear that more needs to be done to curb non-point pollution from pervasive and long-lasting agricultural chemicals—both nutrients from fertilizer and pesticides—which travel in the air and water to environments far from emission sources. North America's soil conservation measures and its commitment to the continued phase-out of POPs are positive trends. However, there is a lack of reliable data on soil erosion and other measures of land degradation, and improved tracking of pesticide use and impact monitoring are still needed.

Expansion in US Organic Agriculture, 1991-1997

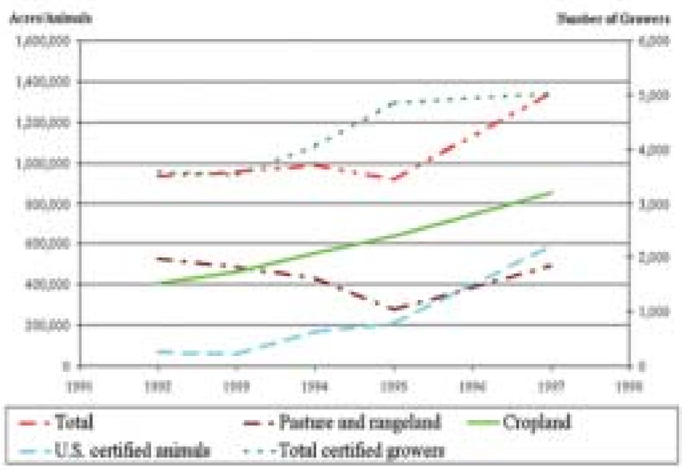


Figure 37
Expansion in US organic agriculture, 1991-1997.

Source: ERS 2000

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