

ENVIRONMENTAL ISSUES AND BEST PRACTICES FOR THE FORESTRY SECTOR



A. REFORESTATION--PLANTATION DEVELOPMENT, FOREST ENHANCEMENT

Brief Description of the Sector

In many countries of Latin America and the Caribbean, reforestation is an important part of forestry sector activities-between 1980 and 1995, the region's total replanted area doubled from 4.5 million to 9.1 million hectares.¹ Wood is increasingly harvested from plantation sources in a number of South American countries (Brazil, Chile, Ecuador). Deforestation or significant changes in forest cover continue to be issues, though the reasons for forest loss have shifted largely from conversion for subsistence agriculture-still an issue in Africa and parts of Asia to changes resulting from large-scale economic development programs (resettlement, agricultural expansion, infrastructure).

Any attempt to understand and address deforestation will need to recognize that reforestation is not the solution to deforestation. FAO statistics estimate global deforestation at about 15 million hectares a year, while reforestation efforts barely reach 1 million hectares a year. The balance sheet is difficult to reconcile. High opportunity costs for lost ecosystems, biodiversity, and timber are compounded by the high cost of tree planting, lower productivity on sites under rehabilitation, and likely lower values for plantation-grown wood. One roadblock to the development of natural forest management is the mistaken notion-usually among policy- and decision-makers, but occasionally among foresters themselves-that the worldwide wave of deforestation can be contained or reversed through reforestation efforts. This misconception has led to a surfeit of plantation forestry solutions throughout the region, including seed banks, tree seed orchards, centrally operated nurseries, and reforestation incen-

¹ The bulk of these forestry statistics are drawn from the FAO publication, *State of the World's Forests 1999*, available in PDF format online at <http://www.fao.org/forestry/FO/SOFO/SOFO99/sofo99-e.stm>. This report can be a useful source of information on the forestry sector situation in a given country.

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tive schemes. Successful reforestation programs targeting large-scale block plantations require a clear vision of market demand and product potential. Although there have been some success stories with reforestation incentive programs in South America (notably Chile and Brazil), global experience demonstrates that such schemes need to be extremely well planned and carefully managed to avoid distortions and misuse.

Still, small-scale community reforestation programs aimed at providing farmers and smallholders with appropriate land-use choices for marginal on-farm sites continue to be worthwhile options. Typically such programs introduce fast-growing tree species—often exotics such as pine or eucalyptus—to meet basic needs for fuelwood, building materials, and fodder (as opposed to more intricate, multi-purpose agroforestry programs discussed below). Small-scale programs involve temporary local or farmstead nurseries and minimal technical advice for interested farmers. They are most prosperous when they take advantage of the lower opportunity costs of off-season labor and marginal lands. Finding an appropriate site/species match and ensuring that farmers perform required maintenance and protect from grazing animals and fire are the keys to these programs' success.

Another variation on reforestation approaches is to restock cut-over or secondary forests through enrichment planting. The technique involves clearing strips or gaps and replanting them with nursery-raised seedlings, normally of high value native species—mahogany (*Swietenia spp.*) or Spanish cedar (*Cedrela odorata*). Experience from the past two decades suggests that enrichment planting can be difficult to justify economically. Slow-growing valuable tree species require high labor inputs over several years to keep them free of competing weeds and vines and ensure their survival—mahogany and Spanish cedar, the species most often tested in enrichment planting, are often subject to attacks of a shoot borer that all but ruins their timber values. Although the planting density may be relatively low, the higher capital costs associated with the early years of intense maintenance, compounded over a long rotation age, may undermine net benefits.

Potential Environmental Impacts

Most USAID-funded regional small-scale reforestation or tree-planting currently targets rehabilitating degraded upland and sloping areas or meeting basic community needs—fuel, food, wood, and fodder. If done correctly, they can have a positive impact on environmental stability by containing erosion and resulting in sustainable land use. The following issues bear scrutiny during the environmental review of reforestation and plantation programs.

Integrated approaches to improving the land-use mosaic. It is important to take an integrated view of reforestation that aims to rehabilitate degraded areas since there is some potential for displacing other uses of the land—even if they were the cause of the degradation in the first place. The primary causes of the degradation must be addressed; one cannot simply assume that reforesting a degraded area will solve its problems. In the Andes, reforestation solutions for over-grazed or eroded land often fail to alleviate grazing pressure, effectively shifting it to other areas where the potential for degradation is then exacerbated. Where slope and soil fragility are causes of erosion and flooding in deforested steep areas, a careful and measured approach is required if the intent is to use plantations established there for production.

Community displacement. Reforestation schemes that displace people or communities without compensation for the land create significant human impacts. Fortunately, it rarely happens. But reforestation programs need to take full account of their impact on local land-use strategies. Taking land out of fallow for reforestation could lead to production shortfalls for nearby communities. Degraded lands or wastelands chosen as plantation sites may still be areas where local people gain part of their subsistence requirements. Women collecting fuelwood on highly degraded brush lands could be affected if the land is converted to a plantation. Degraded areas may also be grazing resources, no matter how limited, that cannot be taken out of production without impacting the herds and their owners.

Conversion of natural forests. Reforestation programs can potentially alleviate the pressure on threatened natural forest resources by providing a more sustainable source of wood and forest products. But this positive impact can be reversed if reforestation programs—because of strong promotion, extension efforts, or attractive incentives—inadvertently lead to the conversion of secondary natural forests that might have been brought under management, often at lower costs with even more positive environmental benefits. In the Andes, there is ample reason to be extremely cautious about reforestation schemes that target

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very high areas. Efforts to convert the paramo (grasslands occurring above 3,000 meters) to production plantations is a challenging if not environmentally impossible feat: in Ecuador, pine plantations at these altitudes were stunted, unproductive, and prone to fires as a result of cold, rainy climatic conditions on steep and shallow soils.

The dilemma of exotic species. No discussion of the impacts of these activities would be complete without addressing the matter of exotic species—which, of late, often arises as part of the debate on reforestation or plantation programs. Typically, concerns are voiced about using exotic species in lieu of local species that may be disappearing. An outright ban on the use of exotic species for plantations makes little sense and sets a difficult precedent—after all, many agricultural crops are, in effect, exotic species. There is a need to examine whether a local species might be used with the same success, producing the desired products, quickly and at a reasonable cost, and thereby meeting the demands of the local people.

Reforestation and biodiversity conservation. Large-scale plantation programs that lead to the establishment of an extensive area of a monoculture may restore the protection functions of forest cover on a site and lead to the production of valuable timber and even non-wood forest products (for example, pine mushrooms harvested under plantation conditions). Typically, plantations are spread widely across the land without much attention to the basic topography thereby eliminating special sites (stream bottoms, ravines or similar naturally occurring niche areas that provide the edge effect so essential for wildlife habitat conservation).

Plantations and agrochemicals. Like their counterparts in agriculture, plantations of single species often require enhanced measures to protect the crop from pests and diseases, starting in the seedling nursery. On highly degraded sites, achieving good productivity may also require fertilization, which could lead to non-point source pollution situations.

Sector Design--Some Specific Guidance

Reforestation and plantation technology can be an exceedingly complex and costly activity with many steps involved—from seed collection and supply to nursery production and plantation protection and maintenance. A number of critical junctures should be considered to optimize results, including site/species match, proper genetic selection of seed source, good site preparation, timely planting, proper weeding, and protection from fire and grazing animals. Several excellent country-specific field manuals on reforestation tech-

nologies are available and should be consulted to ensure that the best practices for local conditions are used. Some specific guidelines on avoiding adverse environmental impacts when planning and implementing reforestation and plantation activities should be noted:

- Under no circumstances should plantation goals be used as a reason to eliminate natural forests, even if they are secondary forests that have already been harvested or high-graded.
- Reforestation plans, particularly those of a larger scale, should consider their impact on the land-use mosaic in the area around the plantation. Management objectives should address potential impacts on natural forests, biodiversity conservation, and alternative land uses.
- Native species should be preferred to exotics in plantation establishment. Any exotic species should be fully tested in an introductory trial with conditions similar to those at the site to ensure its adaptability and avoid the introduction of a noxious weed.
- Every effort should be made to avoid large-scale, contiguous blocks of monoculture plantations. Design of the planting site should take into account natural changes as a result of topography—such as the margins of watercourses, ridges, and valleys—and, where possible, provide for natural corridors of native vegetation.
- All plantation efforts need not involve the classic approach of containerized seedlings raised in nurseries out-planted on land fully cleared for site preparation and uniform spacing of the overall plantation design. On steep marginal areas in need of rehabilita-

DEFORESTATION AND LAND USE

Deforestation is often a larger land-use issue driven by factors outside the forestry sector, including:

- ◆ ***Distorted subsidies*** that lead to forest loss or degradation though, clearly, forest degradation caused by high-grading and failing to manage forests sustainably is often an internal issue.
- ◆ ***Policy attitudes and decisions*** driven by population pressures and employment needs resulting in resource mining, rather than management and conservation.
- ◆ ***Under-developed capabilities*** for land-use planning and mapping that blur the distinctions between area potential and the need for land stewardship.
- ◆ ***Under-funded, under-staffed forestry organizations*** unable to manage the forest resource base and its activities.
- ◆ ***Narrowly conceived development strategies*** that fail to recognize the integrated nature and ecological and economic impacts of land-use decisions.
- ◆ ***Faulty understanding*** of the international timber market, resulting in low timber royalties and inefficient, and often destructive, exploitation of forest resources
- ◆ ***Flawed forest revenue systems*** that allow or induce the concessionaire to adopt cost-cutting measures that disregard post harvest sustainability of the resource base.
- ◆ ***Corrupt practices*** and rent-seeking behavior by forestry and other authorities that sell off national forests and timber to the highest bidder.
- ◆ ***Suppression of local community rights*** in forest areas in favor of outsiders, undermining local initiatives for conservation of forest resources.

tion, closure to protect from fire, grazing animals, and illicit tree cutting should be a first step toward seeing whether nature itself can restore the vegetative cover, with the ancillary benefit of much lower costs per unit of area treated. Other lower-cost options include direct seeding, use of vegetative cuttings, and bare-root planting stock, which may make it possible to greatly expand the annual area treated.

- As plantations grow in size, the possibility of near-term adverse environmental impacts from site preparation becomes more severe. Mitigation measures are required to counter the possible temporary impact of land clearing, which may result in increased erosion, uncontrolled run-off from the site, changed hydrological cycle, soil compaction, or fertility loss. Although these issues will disappear once the trees are established, they can be catastrophic if appropriate measures are not taken as part of plantation design. Consider contour planting or bunding, buffer strips of native vegetation, and gully plugging.

AN APPROACH TO GREATER PARTICIPATION IN ENVIRONMENTAL ASSESSMENTS

In northwestern Ecuador, the Sustainable Uses for Biological Resources (SUBIR) Project has been experimenting with an innovative approach to incorporate the benefits of traditional EA procedures with greater participation by implementing partners and affected local communities. SUBIR engages professional technicians from each of the three national project implementation organizations and para-biologists or experienced individuals from participating

communities to carry out the EA. Almost all of the assignments are focused on an assessment of the environmental sustainability of community forest management plans. The community participation ensures local input, guidance, support for the EA process, and a wealth of local knowledge inherent in local communities.

The results of the innovative SUBIR approach demonstrate that participating technicians and

community members develop a strong commitment to using the EA results in conflict resolution, planning processes and decision making. EA results are used in community meetings and workshops enabling the EA to become an important adaptive management tool.

A digital version of SUBIR's *Manual for Environmental Assessments for Forest Management* is included in reference CD-ROM of this manual.

- To enhance the plantation's robustness, its design should include a mosaic of plantation areas of different ages to modify the eventual impact of harvest once it begins. The layout of the plantation should also include considerations that facilitate future timber extraction and avoid adverse impacts, such as soil erosion or siltation, from adjacent watercourses.
- In plantation areas where there is a propensity for wildfires, adequate measures should be taken to ensure that they can be prevented (fire-breaks and general layout) or contained (fire suppression crews trained and available).

All use of agrochemicals should follow the procedures set forth in Chapter 22 of the Code of Federal Regulations, Section 216 (Reg. 216), which provides specific guidance for projects that include the procurement and use of pesticides. Section 216.3 (10) (b) of Regulation 216 defines pesticide procedures for pesticides registered by the USEPA with and without restrictions. See Annex B for further guidance in preparing initial environmental examinations and subsequent environmental assessments or environmental impact statements. Where possible, every effort should be made to foster integrated pest management approaches, as discussed in Chapter 8 of this manual.

Environmental Mitigation and Monitoring Issues

Table 9.1 Monitoring and Mitigation of Reforestation and Plantation Forestry Activities

Adverse Impacts	Indicators	Causes	Mitigation Measures	
			Specific	General
Forest ecosystem quality losses	<ul style="list-style-type: none"> Natural forests and ecosystems replaced by artificial plantations Over-dependence on exotic plantation species Changes in the supply of essential products and services of the forested areas 	<ul style="list-style-type: none"> Misunderstanding of the potential returns from natural forest management Lack of community inclusiveness that leaves out certain segments of society women, herders Misguided incentive programs or subsidies Market failures that under-value native species and timber 	<ul style="list-style-type: none"> Improved integrated program planning, resource assessments, and site stratification Clear criteria on selection of suitable sites Additional promotion of methods and values of natural forest management Testing and development of native species as part of reforestation programs 	<ul style="list-style-type: none"> Reforestation master plan or program strategy Research and development to promote native species for reforestation programs Examination of the micro and macroeconomics of sustainable forest management Enhanced national governmental capabilities for land-use planning
Unsafe or unauthorized agrochemical use in seedling nurseries	<ul style="list-style-type: none"> Program records and physical evidence Poisoning or pollution accidents 	<ul style="list-style-type: none"> Failure to carry out environmental assessment on pesticide use Poorly trained staff or participants Improper storage of chemicals or disposal of byproducts 	<ul style="list-style-type: none"> Greater reliance on IPM solutions for pest problems Improved training packages and pesticide handling guidelines Training and fielding additional para-technicians from within farmer community to advise peers 	<ul style="list-style-type: none"> National agro-chemical use guidelines that include forest nursery technologies
Unintended land-use changes or shifting of use pressures to other areas	<ul style="list-style-type: none"> Current users of degraded lands displaced by reforestation programs 	<ul style="list-style-type: none"> Symptoms rather than causes of degradation treated Misguided incentive programs or subsidies 	<ul style="list-style-type: none"> Improved integrated program planning, resource assessments, and site stratification 	<ul style="list-style-type: none"> Enhanced national governmental capabilities for land-use planning

B. FOREST MANAGEMENT, INCLUDING FIRE CONTROL

Brief Description of the Sector

Awareness about the plight of natural forest cover has grown significantly since the UN Conference on Environment and Development in Rio de Janeiro focused the world's attention on this critical issue. A few years later, the establishment of the Intergovernmental Panel on Forests (IPF) by the UN Commission on Sustainable Development was specifically intended to encourage sustainable forest management. Latin America and Caribbean, with more than 27 percent of the world's forest area (950 million hectares), compared with Africa at 15.1 percent (520 million hectares) or the developing countries of Asia with 14.2 percent (491 million hectares), is a primary battleground for tackling this global issue (SOFA 1999).

Despite the slowing pace of deforestation, the region still has the highest rates in the developing world. Dourojeanni points out, "The statistics on forest degradation hardly exist but the trends are similar to those of deforestation (1999)."² Against this backdrop, and, in particular, given the almost one billion hectares of natural forest cover in the LAC region, it is not surprising that sustainable natural forest management has great potential.

Sustainable natural forest management is an effort to develop these forests as managed ecosystems that maintain the rights of their owners (states, communities, individuals) to the benefits streams from commodity production, while at the same time ensuring biodiversity conservation and guaranteeing environmental services. The extraction of forest products, wood and non-wood, is expected to take place on a sustained yield basis, assuring natural regeneration of the species affected by harvesting and avoiding any depletion of the natural productive capital of the forest. In North American precepts, management is also expected to upgrade the forest resources in quantitative and qualitative terms through thinning, culling, and selective harvest.

² The FAO defines *deforestation* as a change in forest cover with a depletion of tree crown cover to less than 10 percent. Changes from open to closed forest, which negatively affect the stand or site and ... lower the production capacity, are termed forest degradation (SOFA 1999).

Table 9.2 Forest Cover in the LAC Region (thousands of hectares)

Region/Country	Total Land Area	Area	Forests, 1995		Forest Cover 1990-95		
			As Percent of Land Area	Natural Forest Area	Total Change	Annual Change	Annual Rate (%)
<i>Central America</i>	241,942	75,018	31.0	74,824	-4,794	-959	-1.2
Belize	2,280	1,962	86.1	1,960	-33	-7	-0.3
Costa Rica	5,106	1,248	24.4	1,220	-207	-41	-3.0
El Salvador	2,072	105	5.1	101	-19	-4	-3.3
Guatemala	10,843	3,841	35.4	3,813	-412	-82	-2.0
Honduras	11,189	4,115	36.8	4,112	-511	-102	-2.3
Mexico	190,869	55,387	29.0	55,278	-2,540	-508	-0.9
Nicaragua	12,140	5,560	45.8	5,546	-754	-151	-2.5
Panama	7,443	2,800	37.6	2,794	-318	-64	-2.1
Caribbean	22,832	4,425	19.4	4,134	-391	-78	-1.7
Cuba	10,982	1,842	16.8	1,597	-118	-24	-1.2
Dominican Republic	4,838	1,582	32.7	1,575	-132	-26	-1.6
Haiti	2,756	21	0.8	13	-4	-0	-3.4
Jamaica	1,083	175	16.2	160	-79	-16	-7.2
<i>Tropical South America</i>	1,385,678	827,946	59.8	822,385	-23,277	-4,655	-0.6
Bolivia	108,438	48,310	44.6	48,282	-2,907	-581	-1.2
Brazil	845,651	551,139	65.2	546,239	-12,772	-2,554	-0.5
Colombia	103,870	52,988	51.0	52,862	-1,311	-262	-0.5
Ecuador	27,684	11,137	40.2	11,092	-945	-189	-1.6
French Guiana	8,815	7,990	90.6	7,990	-4	0	
Guyana	19,685	18,577	94.4	18,569	-43	-9	
Paraguay	39,730	11,527	29.0	11,518	-1,633	-327	-2.6
Peru	128,000	67,562	52.8	67,378	-1,084	-217	-0.3
Suriname	15,600	14,721	94.4	14,713	-61	-12	-0.1
Venezuela	88,205	43,995	49.9	43,742	-2,517	-503	-1.1
<i>Temperate South America</i>	366,030	42,648	11.7	40,930	-595	-119	-0.3
Argentina	273,669	33,942	12.4	33,395	-447	-89	-0.3
Chile	74,880	7,892	10.5	6,877	-146	-29	-0.4
Uruguay	17,481	814	4.7	658	-2		
Total	2,016,482	950,037	47.1	942,273	-29,057	-5,811	-0.6

Source: SOFA 1999.

Recently, considerable attention paid has been to the use of reduced impact logging principles, which seek to avoid damage to the residual stand or site as a result of timber extraction. More recently, there has been a growing acceptance of certified forest management schemes that are environmentally responsible, socially beneficial, and economically viable. A global network of standards for certified natural forest management is spreading—Bolivia, with almost a million hectares certified as sustainably managed, is the leader among the developing countries.

This growing interest in natural forest management has parallels in US development programs. Natural forest management activities in seven countries in the LAC region were reviewed recently by USAID.³ The review noted that since the promulgation by the U.S. Congress of Sections 118 and 119 of Part I of the Foreign Assistance Act (amended in 1998 and 1999) there has been some ambivalence and misunderstanding about providing funding for harvesting in tropical forest areas.

Section 118 clearly and specifically prohibits the use of USAID funding for the procurement or use of logging equipment...unless an environmental assessment indicates that all timber harvesting operations involved will be conducted in an environmentally sound manner which minimizes forest destruction. It also calls for denying assistance for the following activities unless an environmental assessment indicates that the proposed activity will contribute significantly and directly to improving the livelihood of the rural poor and will be conducted in an environmentally sound manner which supports sustainable development:

- Activities which would result in the conversion of forest lands to the rearing of livestock.
- The construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively un-degraded forest lands.
- The colonization of forest lands.
- The construction of dams or other water control structures which flood relatively un-degraded forest lands.

There has been a growing acceptance of certified forest management schemes that are environmentally responsible, socially beneficial, and economically viable.

³ See Review of USAID's *Natural Forest Management Programs in Latin America and the Caribbean* (forthcoming), prepared by IRG under the Environmental Policy and Institutional Strengthening Indefinite Quantity (EPIQ) contract. Projects include activities in Bolivia, Brazil, Costa Rica, Ecuador, Guatemala, Honduras, and Peru.

THE FOREST STEWARDSHIP COUNCIL

An independent, non-profit NGO that supports environmentally appropriate, socially beneficial, and economically viable management of the world's forests, the Forest Stewardship Council (FSC) evaluates and accredits certifiers by encouraging the development of forest management standards and providing information about independent certification as a tool for ensuring that the world's forests are protected for future generations. Certification of forest management practices and conditions is a first step toward the green marketing of forest products. Consumers buying products that carry an FSC label can be assured that the purchase comes from a forest that has been responsibly managed according to FSC principles. The FSC defines forest stewardship with a set of principles and criteria for forest management:

1. Compliance with Laws and FSC Principles. Forest management shall respect all applicable laws of the country where they occur and international treaties and agreements to which the country is a signatory, and comply with all FSC principles and criteria.

2. Tenure and Use Rights and Responsibilities. Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented, and legally established.

3. Indigenous Peoples Rights. The legal and customary rights of indigenous peoples to own, use, and manage their land, territories, and resources shall be recognized and respected.

4. Community Relations and Workers Rights. Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.

5. Benefits from the Forest. Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.

6. Environmental Impact. Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and

landscapes, and, by so doing, maintain the ecological functions and integrity of the forest.

7. Management Plan. A management plan appropriate to the scale and intensity of operations shall be written, implemented, and kept up to date. The long-term objectives of management, and the means of achieving them, shall be clearly stated.

8. Monitoring and Assessment. Monitoring shall be conducted appropriate to the scale and intensity of forest management to assess the condition of the forest, yields of forest products, chain of custody, management activities, and social and environmental impacts.

9. Maintenance of Natural Forests. Primary forests, well-developed secondary forests and sites of major environmental, social, or cultural significance shall be conserved. Such areas shall not be replaced by tree plantations or other land uses.

10. Plantations. Plantations shall complement, not replace, natural forests. Plantations should reduce pressures on natural forests.

While these regulations are often remarked on because of their evident prohibitions, this amendment to the Foreign Assistance Act is actually quite affirmative in fostering measures that will have a positive impact on the conservation and sustainable management of tropical forests. It calls for policy dialogue with recipient USAID partner countries to address the importance of conserving and sustainably managing forest resources for the long-term economic benefit of those countries and stresses the need for the agency to support projects and activities that increase national institutional capacity to formulate and implement forest policy and improve the management of their forests. Additionally, and statutorily, USAID missions are now instructed to include analysis in each of their country development strategies of the actions necessary to achieve conservation and sustainable management of tropical forests (Section 118) and to conserve biological diversity (Section 119) and the extent to which their proposed programs meet these needs and opportunities.

Sector activities of many kinds—especially natural forest management—should continue to play an important role in the development of land-use systems in Latin America and the Caribbean, not only in the lowland tropics but also as part of the package of interventions that make good sense where there is a need to protect vital watershed resources in the region's highlands. Natural forest management addresses several rural development needs and opportunities, namely:

- They represent *a viable and productive land-use alternative* that in many instances and under a variety of otherwise marginal site conditions can be directly responsive to basic human needs, as well as a source of primary raw materials for the development of wood and non-wood forest-based industries that add employment, income, and export earnings.
- *Economically, natural forest management offers significant advantages* because it avoids the environmental and social losses associated with land degradation, it eliminates the higher costs required to rehabilitate degraded forest areas, and it is likely to provide opportunities for an earlier and steadier benefits stream.
- Forest protection and management on a large scale will be *essential to enhancing the critical watershed function* needed to upgrade agricultural production systems through irrigation, develop hydropower generating opportunities, and provide potable water supplies for growing populations and emerging urban centers.
- Rational, participatory forest protection, management, and use offers *the best chance to engage local people in the stewardship and conservation* of large areas

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of habitat needed to sustain the globally important, unique biological diversity of the region.

In the United States, the importance of tropical forests as a global resource base has been further reinforced with House of Representatives Bill No. 2870-Debt Reduction for Developing Countries with Tropical Forests, also known as the Tropical Forest Conservation Act of 1998.

A Word about Forest Fires

The growing experience with and promising outcomes from USAID-funded forestry programs have amply served to confirm the feasibility of natural forest management interventions and investments in the region.

Although forest fires have been traditionally viewed as an issue internal to the forestry sector, the past few years have changed this perspective. Worldwide, in 1997 and 1998, dramatic increases in the occurrence of forest fires became headline news. While fire is endemic to many of the forests of the drier regions of the world, (including parts of Latin America), the extended dryness associated with El Niño caused even some of the traditionally fireproof lowland tropical forests to burn. Between 1997 and 1998, weather patterns led to large-scale outbreaks of fires in Brazil, where over 2 million hectares burned-including parts of the Yanomami Indian reserve near the border with Venezuela and in Brasilia National Park, near the country's capital. Smoke from fires in Mexico and Central America that burned more than 1.5 million hectares wafted to the heartland of the United States, adding significantly to international concern about forest fires.

In the forests of Latin America, farmers and ranchers traditionally use fire to clear land for their activities. But over time these practices have become more of an issue as the growing mosaic of degraded and fragmented forest areas in the lowland tropics become more readily susceptible to fire. In dry years, they burn fierce and far, eating into the edge of, and sometimes overrunning and destroying, otherwise untouched primary forests. During the fire season of 2000, a large part of the protected areas in the Maya Biosphere Reserve of Guatemala that USAID had worked to protect was ravaged by forest fire.

The link between forest fires and global climate change is also prompting concern and action-particularly because spectacular forest fires become international media events. Forest fires release large amounts of carbon into the atmosphere, stunting international efforts at carbon sequestration thought essential to halting global warming. Large-scale forest fires have become so widespread that the World Health Organization recently issued guidelines for coping with smoke-related health hazards during forest fire emergencies.

The growing experience with and promising outcomes from USAID-funded forestry programs—most notably, BOLFOR in Bolivia, SUBIR in Ecuador, and the Forestry Development Project in Honduras—have amply served to confirm the feasibility of natural forest management interventions and investments in the region. There are, nevertheless, key issues that bear scrutiny by any USAID mission interested in adding its support for these practices.

Policy and institutional framework. USAID's study reviewing experience with regional natural forest management noted that the policy and institutional framework in which forest management activities operate can have a substantially negative impact on their sustainability, leading to over-exploitation, carelessness in how products are harvested, or failure to invest in management. Indeed, many of the more significant instances of forest destruction and negative environmental impacts are the result of short-sighted or mistaken government policies that undervalue forest cover and its potential productivity in favor of development options in agriculture or livestock that turn out to be unsustainable because of the inherent fragility of the sites. It is a complex situation because the areas that remain in forests have, almost by definition, been little studied or analyzed and doing so takes time, resources, and institutional and human resource capabilities that may not have been adequately developed.

There are few countries in Latin America and the Caribbean where USAID missions interested in forestry development options should not also engage the government in policy dialogue and studies on a parallel, field-informed basis. This dialogue takes time and resources, but national awareness and abilities will be essential to over-

POLICY ISSUES AFFECT THE FORESTRY SECTOR

- *Attitudes and decisions* driven by population and employment pressures that result in resource mining rather than management and conservation.
- *Governmental policies* geared to providing cheap energy to urban areas that undermine the economics of forest management and plantation operations.
- *Under-developed capabilities* for planning and mapping that blur the distinction between area potential and the need for stewardship.
- *Under-funded, under-staffed forestry organizations* unable to manage the resource base and its activities.
- *Narrowly conceived development strategies* that fail to recognize the integrated nature of land-use decisions and their ecological and economic impact.
- *Faulty understanding of the international timber marketplace* that lead to low timber royalties and inefficient and often destructive exploitation of valuable forest resources.
- *Flawed forest revenue systems* that allow or induce the concessionaire to adopt cost-cutting measures that disregard post-harvest sustainability of the resource base.
- *Corrupt practices* and rent-seeking behavior by authorities that sell off national forests and timber to the highest bidder.
- *Suppression of community land and tree tenure rights* in forest areas in favor of outsiders that undermine local initiatives for conservation of local forest resources.

coming the recurring policy errors that undermine the sustainability of forest production and conservation programs.

Over-harvesting and forest depletion. A pivotal principle of the science of forest management is sustained yield, which emphasizes managing—including both harvesting and tending—a forest to produce a steady yield of desired products and services over the medium to long term. Yield can be measured both quantitatively (in volume of existing stock and extraction) and qualitatively (in services). Activities that undermine sustained yield, such as over-harvesting, high-grading, and clear-cutting, cause adverse environmental impacts that affect both the forest and the species it harbors. Ensuring a regular flow and conditions for the provision of goods and services provides the best guarantee for maintaining the value of forest ecosystems in the eyes of society, communities, and landowners—thus assuring its continuing integrity. Protection and management have costs, and it is the standing forests that have value to people and society that fare better in decisions about appropriate land-use and stewardship of the resource base.

Disturbance of fragile plant and animal communities. Timber and non-wood forest product harvesting plans must take account of biodiversity conservation imperatives, avoiding fragile or endangered plant and animal species and their habitats. This includes avoiding over-exploitation leading to forest fragmentation, interruption of animal movement corridors, and direct (using water courses for log transport) and indirect impacts on aquatic habitats and wetlands.

Soil and site degradation. Disturbances from technically unsound logging or forest product extraction practices, depending on slope, soil depth, soil type, and proximity to water courses, can lead to erosion, soil compaction, run-off problems, and contamination or siltation in water courses. Where this becomes acute and extensive, its cumulative effects could have an impact on watershed stability and lead to significant sedimentation and downstream flooding.

Damage to the residual stand after logging. Improper logging practices, including poor felling of trees, excessive skidding of logs through the forest, and logging equipment moving through the forest, can leave remaining tree and plant communities damaged and open to pest invasion. Similarly, leaving logging residues (lops and tops) in the forest could impede natural regeneration or increase the danger of forest fire. Removal of individual species may eliminate seed sources necessary for natural regeneration and provoke a change in stand composition.

Forest roads and access (skidding) trails. Improperly constructed roads in the forest—particularly those that do not take account of water courses and the need for drainage—will quickly lead to erosion and run-off problems. Poorly constructed forest roads can generate as much as ten times more erosion than properly engineered roads. And unless properly controlled, service roads established for management and harvesting may open the forest to unintended uses such as spontaneous colonization and conversion—agriculture, livestock, hunting, and mining.

Human environmental impacts. Forest management and harvesting in previously unmanaged forest areas can have serious impacts on local communities that use these areas for traditional hunting and gathering activities for subsistence and livelihoods. The influx of outsiders associated with forest management and harvesting can lead to social and cultural conflicts and social disintegration in local communities dependent on adjacent forests.

Sector Design--Some Specific Guidance

A full-blown treatise on the means to designing, planning, and implementing sustainable natural forest management is well beyond the intent of the present guidance. However, as USAID missions consider their options in light of Regulation 216, some key issues include:

USAID forest policy--misunderstanding and ambivalence. Current attitudes about forestry, particularly natural forest management, in USAID programs in Latin America and the Caribbean are a microcosm of the US situation. Although not everyone is fully convinced, forestry in the United States is being rehabilitated as a sector worthy of serious consideration. Natural forest management can be an appropriate land-use option, capable of meeting a variety of development goals—social, productive, environmental.

Still, there is some residual ambivalence, especially where it involves harvesting timber. For example, there seems to be little appreciation of the opportunities for natural forest management as part of alternative agriculture activities. Part of the abiding ambivalence may be the inadvertent result of misconceptions about the intent of Section 118 on tropical forestry. Although this amendment is largely an affirmation of sustainable forest management as a development option that should be promoted, language about restrictions on the use of USAID funding for logging in tropical forests seems to have affected perceptions of agency policy. These perceptions may have been further exacerbated by the Section 533 (c)(3)(B) certification, required of USAID missions for almost a year before being subsequently withdrawn. But although Section 118 empha-

Natural forest management that proactively aims to maintain forest cover and, with it, natural habitats, can have wide-ranging positive impacts on biodiversity conservation.

sizes the need for an environmental assessment to guarantee the sustainability of natural forest management, recent experience has amply demonstrated the very real potentials of these practices as appropriate and productive land-use options.

Natural forest management--a proactive measure for biodiversity conservation. At one point, supporters of natural forest management, particularly if it involved logging, seemed to be in direct conflict with proponents of biodiversity conservation. But in recent years, growing field experience has led to important findings that belie this supposed dichotomy. While forest management is decidedly neither pure biodiversity conservation nor absolute protection, it is much better than the typical next choice for tropical forestlands--conversion, often irrational and destructive, for agriculture and livestock.

In many tropical countries, biodiversity conservation needs--beyond some important keystone like endangered species--are not well known. Even less is known about how to manage for biodiversity conservation or the more delicate matter of reconstitution of biodiversity assets. For this reason, natural forest management that proactively aims to maintain forest cover and, with it, natural habitats, can have wide-ranging positive impacts on biodiversity conservation.

The forest resource base as a key to wise stewardship. Also manifest in natural forest management systems is the importance of their impact on valuing the resource base. In Guatemala in the past year, neither the community nor industrial concession areas experienced the same amount of forest fire or invasion as the protected areas--parks, biotopes, or reserves. This premise of value is extremely important: where local people or companies realize that they stand to benefit from the outcome of investments in management, protection, and pro-

REDUCED IMPACT LOGGING ACHIEVEMENTS

Reduced impact logging technology is demonstrating that it is more than just a means to reduce the impact of timber harvesting on tropical forests. Its achievements include:

- Upgrading the operational capabilities and internal efficiency logic of timber harvesting crews, which improves the competitiveness of the employer.
- Leaving behind a residual stand with less damage and inherently higher future value thereby validating future efforts to protect the forest from subsequent incursions or conversion to other uses (agriculture or livestock husbandry).
- Ensuring minimal impact on the ecology of the forest ecosystem, favoring biodiversity conservation.

duction trade-offs, they quickly realize that it is also in their best interest to protect the forests.

Paying mind to economics. The economics of natural forest management should be given more attention to ensure that communities and concessionaires are optimizing their investment returns (microeconomics) and that unit cost per area is treated as a factor that affects the choice of sector and the larger land-use planning options facing a country (macroeconomics). In the developed world, the key to pre-commercial timber stand improvement activities—however beneficial to the stands and future product quality—has been decided on a sound understanding of the costs involved. Because it is so difficult to project timber prices at the end of the next rotation 30–60 years down the road, many European countries, Canadian provinces, and American states offer modest subsidies and incentive programs to convince forest owners to make such investments.

If innovative natural forest management programs are to be proven effective, there will need to be more attention paid to the microeconomics of their use. Can present activities finance such investments? Do local people in government-promoted, community-oriented natural forest management projects understand the costs and benefits in real terms? Studies of financial returns should be a more routine part of the analysis of technology development requirements.

Certification—a golden opportunity. The emerging worldwide acceptance of sustainable forest management and certification for green marketing is a golden opportunity to bridge the gap between conservation and forest production. Although the extent of this comparative advantage has yet to be fully felt in the form of premium prices for certified timber products, certification has given several countries a much-needed edge in the marketplace.

Certification costs money in financing the enhanced forest management measures to meet sustainability criteria and in paying for certification assessments and regular monitoring. Until a premium price structure on the world market becomes more routine, the payoff for such investments will be longer term, in greater operational efficiency from a satisfied work force and the growing capital of a well-managed forest. USAID missions concerned with developing sustainable forest management need to examine whether sound plans can be used for multiple purposes—for certification, for compliance with the mandates of Regulation 216, for analysis of their sustainability as development activities, and as a template for monitoring results associated with program performance. Repetitive examination of these plans should not be necessary and may constitute too much of a cost burden.

Watershed--the important next step. USAID programs in natural resource management have moved out of the highlands in many countries--Bolivia, Ecuador, Guatemala, Honduras, and Peru. But is there an unfinished agenda? One that creates constraints and challenges for long-term lowland sustainability? Maintaining forest cover guarantees the critical watershed function, which in Latin America is of growing importance as demand for hydropower, potable water, and irrigation increases. It is the logical sequence for a program aimed at rationalizing and intensifying agriculture on a country's best lands and finding alternative employment opportunities that assist small farmers in leaving marginal mountain lands.

Reduced impact logging. Much of what has been accomplished in natural forest management is a matter of controlling degradation and extraction practices, such as with reduced impact logging. Is that enough? Probably for the moment. But the real challenge will be to maintain and even enhance the productivity of these forests. The fact that many wood industries are asking for personnel training in reduced impact logging, understanding that it can improve their effectiveness and cost competitiveness, is testimony to its success.

Brazil's Tropical Forest Foundation has produced clear and emphatic economic analyses comparing reduced impact logging with conventional practices that

AGROFORESTRY PRODUCTS AND SERVICES

Products

Beyond timber, trees in agroforestry systems can yield many valuable products, such as:

- Food
- Fodder
- Fuelwood
- Poles and rustic building materials
- Fiber

- Mulch
- Medicines and cosmetics
- Oils and resins

Services

In addition to their role in improving degraded sites, agroforestry trees may serve important functions in the farming system, including:

- Improving crop field microclimate
- Conserving soil and enhancing soil fertility and suppressing weeds
- Anchoring a living fence or demarcating a field boundary
- Sequestering carbon
- Protecting biodiversity
- Stabilizing watersheds

cost less per cubic meter of wood extracted. To further solidify these findings, it will be fundamental wherever reduced impact logging technology is being promoted to state the basic assumptions on costs and examine whether under the project modality with external funding there are not hidden subsidies that an industrial operator might not enjoy. Additionally, part of the economic analysis should include the cost of rehabilitating degraded forest land after irrational logging—or worse, the cost of restoring land that has been overrun by small holders shifting agriculture and burning forests.

Factors affecting the adoption of reduced impact logging include: the perception that reduced impact logging systems are more expensive than conventional practices; the failure of conventional systems to account for direct and indirect costs of wasted wood and damaged residual stands; the lack of trained personnel to implement these practices; high net profit margins that emphasize through-put over profit; adjustment costs of machine replacement and opportunity costs of worker training; undervalued standing timber prices; and existing environmental regulations that are not enforced.

Rules, roads, and realism. Despite considerable hype and media coverage to the contrary, roads do not lead to forest destruction. The lack of political will and capabilities for guiding and controlling what happens after a road penetrates an area is far more destructive. Too often, incentives and controls for sustainable forest management are not in place or are distorted by the political process. Much time and energy are wasted fighting the battle against roads, which should rather be spent conceiving and building roads with a view to contributing to sustainable local development.

If agricultural production interests win the battle to establish roads in primary or previously inaccessible tropical areas without appropriate environmental safeguards it will mean that no one had the tools to guide the process. These tools include an understanding of the cost of building roads while managing the subsequent colonization process and a recognition of the economics of mechanized farming that factor in the social and ecological costs of improved transport systems. The microeconomics of agriculture should not be the only economic analysis of the costs and benefits of road construction.

Similarly, illegal and unsustainable logging—and these are different concepts—often contribute to the deterioration of poorly made roads. They often channel water and mud from skid trails or interior forest roads onto the poorly designed surface of the main road. Heavily laden logging trucks then abuse the road base, making conditions worse. Because of difficult road conditions that delay and damage trucks extracting timber, loggers must look for every way possible to cut

Similarly, illegal and unsustainable logging and these are different concepts often contribute to the deterioration of poorly made roads.

costs-high-grading the forests and paying minimal amounts to local people who extract timber, which degrades the forest and limits the development of the local economy.

The condition of many roads throughout the tropical region make rational forest management-and, for that matter, many other production systems-difficult since the resulting high transport costs erode the potential for forest management investments. Badly made roads with inadequate drainage structures despite typically high rainfall cannot be considered development; they are an economic, social, and environmental liability. Similarly, opening roads into primary forest areas as an alternative agriculture option should not be considered progress if illegal logging results. These activities weaken the real alternative development potential of the area, which because of land capability limitations should be administered using sustainable forest management.

Road development might proceed more smoothly if there were a requirement to plan and implement forest management in the areas through which the road will pass. This was the recommendation of a recent environmental review of road improvements implemented by the alternative agriculture program in the Chapare of Bolivia.

Environmental Mitigation and Monitoring Issues

Table 9.3 Mitigation and Monitoring of Natural Forest Management

Adverse Impacts	Indicators	Causes	Mitigation Measures	
			Specific	General
Forest degradation from unsustainable harvesting practices	<ul style="list-style-type: none"> Harvesting records or physical condition of the residual stand Changes in the availability of forest-supplied basic needs such as fuelwood or medicinal plants Damage to remaining trees Erosion along skid trails and logging roads Trees cut but not removed from forest Poor regeneration of key species for wood or non-wood products Continued occurrence of forest fires 	<ul style="list-style-type: none"> Land tenure uncertainties- High costs, low benefits Market failures Lack of community inclusiveness leaving out segments of society women, herders Errors in resource assessment Failure to respect annual cutting plan or harvest tree selection criteria Poorly trained logging and harvest crews, forest owners, concessionaires or participants Poorly laid-out road or skid trail system Unauthorized use by third parties not included in plan or management agreement Lack of understanding of silvicultural practices 	<ul style="list-style-type: none"> Ensure monitoring results are factored into revisions of the management and annual operational plans Enhance training in reduced impact logging for forest management staff Train and field additional para-technicians from farmer community to advise peers Enhance record keeping of compartments and the causes and effects of stand response to interventions Develop forest fire prevention program 	<ul style="list-style-type: none"> Examine micro and macroeconomics of sustainable forest management to ensure incentives for investments of this nature Routinely revise forest management plans and monitoring records Conduct research and development on growth, yield, and impact of sustainable forest management
Increased threats to endangered species or biodiversity assets	<ul style="list-style-type: none"> Logging or forest disturbance in protected areas or on compartments set aside for biodiversity values in production forests Composition and observed changes in flora and fauna 	<ul style="list-style-type: none"> Failure to take values into account during forest management planning or execution Uncontrolled hunting Forest fires Roads that allow improved access to sites 	<ul style="list-style-type: none"> Conduct additional participant training and field-based inspections by supervisory staff Control forest access Develop forest fire monitoring, prevention, and control systems 	<ul style="list-style-type: none"> Review basic assessment for forest management plan and ensure proper prescriptions in place Increase training in the local community about conservation rights and responsibilities

C. AGROFORESTRY

Brief Description of the Sector

Agroforestry, simply stated, involves adding a tree component to farming systems to better mimic the diversity of natural systems and enhance sustainability and productivity. As such, it is particularly suitable as a better use of land on less fertile or marginal sites than traditional open-furrow agriculture. Trees in the farming system can provide an array of environmental products and services.

There are two basic types of agroforestry system: simultaneous and sequential. As this distinction implies, the differentiation is based on whether trees and crops occupy the land at the same time. For each type, tree characteristics should change to reflect its different competitive setting. Under a simultaneous system, fast tree growth should be limited to the agricultural off-season, and crowns should be light to minimize shade impacts on the crops. In a sequential system, fast tree growth, an ability to recycle nutrients from deep soil layers, and fixing nitrogen and a heavy canopy to shade out weed growth are desirable characteristics for the trees.

Agroforestry practices represent a purposeful response for many smallholder farming situations in the more densely populated areas of Latin America and the Caribbean where people, seeking to meet their food security needs, have expanded the agricultural frontier onto fragile, sloping, or hillside areas. These activities are a near- to medium-term response for mitigating demographic pressures on areas where excluding people to restore the site would increase human suffering and make local people environmental refugees.

There are two basic types of agroforestry system: simultaneous and sequential.

Agroforestry Systems

Simultaneous	Sequential
♦ Boundary plantings	♦ Shifting cultivation
♦ Live hedges on the contour	♦ Relay inter-cropping
♦ Live fences or hedges	♦ Fodder banks
♦ Alley cropping	♦ Improved bush fallows
♦ Parkland or tree canopy systems	♦ Taungya plantation system
♦ Silvopastoral systems	♦ Multistrata systems
♦ Home gardens	
♦ Shaded perennial crops	
♦ Windbreaks	

Potential Environmental Impacts

As might be expected from the description of agroforestry systems and the stated intent of these activities to develop sustainable farming systems, the chances of adverse environmental impacts are minimal. There are, however, a number of things to be careful about with agroforestry activities that bear mention.

Making the Right Choice. Production goals and ecological conditions combine with the many options of agroforestry, making the choice of species and technological approach a complex challenge in new programs. Erstwhile efforts to introduce agroforestry floundered when they became fixated on the search for the miracle tree. Experience has now demonstrated that a sound understanding of farming systems and their constraints and opportunities is the key to identifying the technological approach and tree species that will optimize the system's productivity and sustainability.

Competition between Trees and Crops. Despite its many advantages, agroforestry can have a negative impact on productivity and human welfare if not properly designed. Issues that may cause trees to compete with, rather than support, agricultural crops include: shade from tree crowns, scarce nutrients or water, reduced growing space, farming operations such as plowing and tilling the crops, pests and diseases, and long-term soil fertility depletion from overuse.

Labor Intensity and Cost/Benefit Awareness. Much like the soil and water conservation technologies with which it is often combined, agroforestry increases labor requirements in the farming system so they are most effectively applied. These additional labor requirements can appear too burdensome for the farmers and returns from their efforts may not seem quick or tangible enough. In the absence of suitable incentives, farmers may cease to apply agroforestry solutions appropriately and return to less sustainable land-use patterns.

Recognizing the Limitations. Some projects and programs use agroforestry systems as a tentative intervention to mitigate the impact of smallholders on fragile land. While that may be appropriate under certain conditions, agroforestry proponents need to avoid falling into the trap of attempting to institutionalize subsistence agriculture or maintain an unacceptable status quo where more radical solutions are needed. If extreme site conditions mean the use of an agroforestry system will only slow an ongoing process of natural resource degradation, other alternatives should be considered. The gradual degradation of the natural resource base will inevitably lead to a downward spiral of productivity and production options, exacerbating the conditions underlying rural poverty and making environmental and social rehabilitation that much harder.

Sector Design--Some Specific Guidance

In almost every case, the choice of an agroforestry intervention will be the result of a combination of site amelioration and productivity enhancement goals. There are many situations where different agroforestry technologies can be used, and the potential for complexity should not be underestimated. The following design principles apply:

- Careful assessment of the needs and opportunities of the farming system and its agro-ecological conditions is fundamental to making the right choice of agroforestry technology and the species adapted for it.
- The combination of trees and crops should yield a net benefit for the farmers using the system and the environment in which it is being implemented.
- Agroforestry may actually compete directly with productive forestry and agriculture for suitable land. This potential economic trade-off must be examined by all concerned, especially the communities where it is being promoted.
- In hilly areas with broken topography, the application of agroforestry technologies may require micro-site adjustments combined with soil and water conservation technologies.
- Agroforestry is not a panacea that can solve the process of degradation where smallholders use marginal or fragile lands unsuitably. While it is possible to push the envelope in land-use capabilities, these practices are typically more labor intensive, costly, and limited.

Environmental Mitigation and Monitoring Issues

Agroforestry technologies are, in and of themselves, mitigation measures to counter the adverse environmental impacts of traditional or conventional agricultural production practices on marginal land. Properly designed, their outcome supposes increasing productivity over time (the sustainability of the farming system) at acceptable costs. Two important points need to be made about monitoring agroforestry systems:

- The emphasis on careful assessment of the needs and opportunities of the farming system and agro-ecological conditions needs to be thoroughly documented with good baseline data. The fragmented nature of farm plots and the sequential approach to harvest can make data collection for mixed smallholder farming systems difficult. It is also important to have some indication of the ecological degradation process—soil erosion measures, fertility loss, climatic extremes that affect productivity, and so on.

- The ultimate test of the sustainability of agroforestry technologies is farmer satisfaction, which will derive from farmer perception of an acceptable cost/benefit ratio. Because of the many variables in a mixed farming system, two measures are suggested to facilitate this monitoring. Program proponents should identify lead farmers for closer attention who will eventually serve as para-technicians in disseminating technology among their peers. They should also be expected to take greater care in holding the variables constant so they are better able to analyze the application and outcome of agroforestry technologies. Their know-how and attention should be enhanced with an annual post-harvest evaluation among all participating farmers to gauge their perceptions of the technology. Such events can be built into the extension program and also serve as training and promotional activities.

D. REFERENCES

Given the breadth of the topic, there are innumerable publications and references available to the interested reader. Those with Internet access will find it easy to locate worthwhile documentation to support their efforts, though there are several noteworthy published resources as well.

General Resources

CATIE (Centro Agronomico Tropical de Investigacion y Ensenanza).

Located in Turrialba, Costa Rica, CATIE has a Web site in English and Spanish with excellent information on forestry and agroforestry, particularly for Central America. It is also the home of the Agroforestry Systems Network and the Mesoamerican Tree Seed Network, both of which can be reached through links on the CATIE site. Of particular interest is the CATIE Clearing House Directory, set up specifically to link the site with Internet sites of mutual interest and information. Online: www.catie.ac.cr/catie/.

CIFOR (Center for International Forestry Research).

CIFOR, in Bogor, Indonesia, is now part of the CGIAR system and can be a useful source of up-to-date information on sustainable forest management. Online: www.cgiar.org/cifor.

FAO (UN Food and Agriculture Organization).

The FAO's Forestry Department in Rome has long been a center of excellence for the development of the forestry sector in the developing world. The INFOSYLVA database offers country-by-country forestry statistics and information. Online: www.fao.org/infosylva.

The Forests, Trees, and People Programme is a community forestry-oriented FAO program. Online: www.fao.org/waicent/faoinfo/forestry/ftpp/default.htm; for Latin America: <http://polux.sdn.org.pa/~rfc>.

ICRAF (International Center for Research in Agroforestry).

Located in Nairobi, ICRAF is a primary source of information on the potential for including a tree component in farming systems. It is also now a full member of the CGIAR system. Their offerings include an agroforestry database that can be a useful tool for screening tree species suitable for application in different countries. Online: www.cgiar.org/icraf.

ITTO (International Tropical Timber Organization).

The ITTO is an excellent source of information about tropical timber use and its relationship with sustainable forest management. Established in Yokohama, Japan as a framework organization for consultations between producer and consumer member countries on all aspects of the world timber economy, its Web site gives access to up-to-date market information on tropical timbers and criteria for sustainable management. Online: www.itto.or.jp.

U.S. Forest Service.

The USFS Office of International Programs has a long-term working relationship with USAID to provide technical support to forestry programs. Online: www.fs.fed.us/global.

U.S. Forest Stewardship Council

This Web site has information on the principles and criteria for sustainable forest management, including for plantation technology. Online: www.fscus.org.

World Wildlife Fund-World Bank Forest Alliance.

This new partnership promotes forest conservation and best practices in forest management. www.esd.worldbank.org/wwf.

Publications

Dourojeanni, M.J. 1999. *The Future of Latin American Natural Forests*. Environment Division Working Paper, Inter-American Development Bank, Washington, DC.

A recent projection by one of the Bank's leading foresters about the needs to conserve and manage the forest estate in Latin America.

FAO (Food and Agriculture Organization). 1999. *State of the World's Forests 1999*. Rome: FAO.

The place to begin for anyone looking for basic information on forestry sector statistics. Online: www.fao.org/forestry/FO/SOFO.

Kenny-Jordan, C.B., C. Herz, M. Anazco, and M. Andrade. 1999. *Construyendo Cambios: Desarrollo Forestal Comunitario en Los Andes*. FAO Project for the Support of Community Forestry Development in the Andes, Quito.

A comprehensive, albeit longwinded, report on 15 years of experience promoting community forestry development activities in the Andes. This document is not available electronically, but it can be ordered from the Centro de Documentación de la Fundación Natura, Moreno Bllido E6-167 y Avenida

Amazonas, Quito, Ecuador, Tel: 593-2-553-600, Fax: 593-2-553-594, Email: natquid@natqui.ecuanex.net. A preview of the document can be viewed online: www.ecuanex.net.ec/natura/documenta/novedad.htm.

Proyecto SUBIR. 1999. *Procedimientos para la Preparación de Evaluaciones Ambientales (EA) de Planes de Manejo Forestales Comunitarios*. Quito, Ecuador

US Forest Stewardship Council. 1999. *Principles and Criteria for Forest Management: Pocket Guide*. Forest Stewardship Council, Washington, DC.

A very useful guide to the operational meaning of certified forest management and the requirements for it.

Zimmerman, R.C. 1982. *Environmental Impact of Forestry: Guidelines for its Assessment in Developing Countries*. FAO Conservation Guide No. 7, Rome.

Zimmerman offers an early study on the potential impacts of forestry development activities on the human environment. Copies can be ordered from the FAO, online: www.fao.org.

