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# Sustaining the World's Forests

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For millennia, humankind has influenced forests, although much of the impact was hard to see. In recent decades, however, the scale and impact of our footprint on the world's forests has changed. Almost half the forests that once covered the Earth are gone, and deforestation is expanding and accelerating. The health and the quality of remaining forests are declining.

Mechanization of forestry and agriculture has allowed large areas to be harvested quickly and converted to other uses, so old frontiers are being abandoned and new ones are being exploited. Globalization and free trade allow corporations to roam the world seeking more profitable forest opportunities. Huge fires—conflagrations visible from space—are destroying vast areas and sickening millions of people. Pollution blows in from distant autos and industries, and the buildup of greenhouse gases has ushered in an era of climate change that further threatens forests.

A major force driving these trends is the explosive growth in the global consumption and trade in forest products, in part due to rising affluence. Since 1950, the demand for wood has doubled, and paper use has increased more than fivefold. In the next 15 years, demand for paper is expected to almost double again as industrial countries continue their already high levels of consumption and as demand in developing countries grows.[1]

Our relationship to forests has evolved in some positive ways as well, however. In some places there has been a shift from unrestrained boom-and-bust forest exploitation and conversion to more sustainable forest management for a wider range of goods and services. People who have lived in and near the forest for generations are being recognized as forest managers in many places, not forest destroyers. New ways of satisfying the need for forest products less wastefully are also being pursued.

Sustaining forests for the next century

and beyond calls for changes in the way forestry is practiced on the ground. It also calls for reforming policies and pricing, reducing waste and overconsumption, and strengthening land tenure and equity. And it will mean recognizing that the real wealth of the forests lies in healthy forest ecosystems—and appreciating how much we depend on them.

## Trends in Forest Area and Quality

Today, forests cover more than one quarter of the world's total land area (excluding Antarctica and Greenland). Slightly more than half of the world's forests are in the tropics; the rest are in temperate and boreal (coniferous northern forest) zones. Seven countries hold more than 60 percent of the world's forests: in order of forest area, they are Russia, Brazil, Canada, the United States, China, Indonesia, and the Democratic Republic of Congo (formerly Zaire).[2]

The world's forest estate has declined significantly in both area and quality in recent decades. As noted earlier, almost half the forests that once blanketed the Earth are gone. Each year another 16 million hectares of forest disappear as land is cleared by timber operations or converted to other uses, such as cattle ranches, plantations, or small farms.[3]

The extent of forest loss and fragmentation was made clear in a recent study by the World Resources Institute that identified what it calls "frontier forests"—areas of "large, ecologically intact, and relatively undisturbed natural forests." The study found that only 22 percent of the world's original forest cover remains in these large expanses, about evenly divided between boreal and tropical forest. More than 75 percent of the frontier forest is in three large areas: the boreal forest of Canada and Alaska, the boreal forest of Russia, and the tropical forest of the northwestern Amazon Basin and the Guyana shield (Guyana, Suriname, French Guiana, northeastern Brazil, Venezuela, and Colombia). (See Figure 2–1.)[4]

Until recent decades, most forest loss occurred in Europe, North Africa, the Middle East, and temperate North America. By the early part of the twentieth century these regions had been largely stripped of their original cover. Now forest cover in Europe and the United States is stabilizing, as secondary forests and plantation forests fill in. In the last 30–40 years, in contrast, the vast majority of deforestation has occurred in the tropics, where the pace has been accelerating. Indeed, between 1960 and 1990, one fifth of all tropical forest cover was lost. Asia lost one third of its cover, and Africa and Latin America lost about 18 percent each.[5]

Broad regional overviews such as these can mask even more severe forest loss that is taking place in some countries and forest types. Half of the tropical deforestation during the 1980s took place in just six countries: Brazil, Indonesia, the

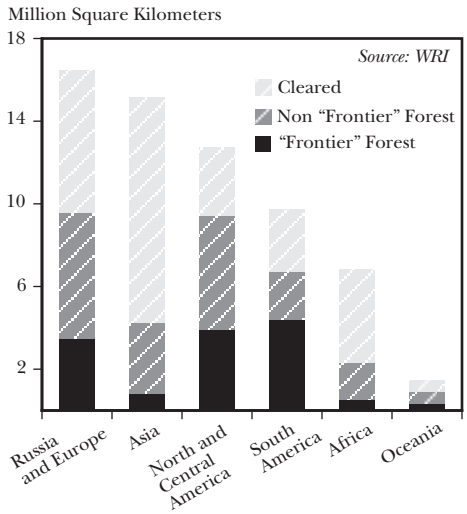


**Figure 2–1. Forest Area, by Region, 1996**

Democratic Republic of Congo, Mexico, Bolivia, and Venezuela. Tropical dry forest types, mangrove forests, and the temperate rainforests of North America have also experienced very high losses.[6]

Deforestation is not the only threat. Serious declines in forest quality are affecting much of the world's forests. Ironically, while many people in northern countries look at tropical forests with concern, they may be unaware that the temperate forests in their own backyards are the most fragmented and disturbed of all forest types. For example, 95–98 percent of forests in the continental United States have been logged at least once since settlement by Europeans. And in Europe, two thirds of the forest cover is gone, while less than 1 percent of old growth remains.[7]

The secondary forest and plantations that are filling in are a very different type than the original. The mix of tree and understory species has changed, and the age is more uniform. The forests are highly manipulated and highly fragmented. Plantations and even-aged stands occupy substantial areas of forestland. In the last 15 years, the area covered by forest plantation has doubled globally. And it is expected to double again in the next 15 years. Worldwide, at least 180 million hectares of forest have been converted to forest plantations. These altered ecosystems usually cannot support the full array of native species and ecological processes that characterize natural forests. Many nonnative species—from tree species to vines to insect and animal pests—have invaded these woodlands.[8]

Atmospheric pollution is also taking a toll on forest quality. Exposure to pollution weakens trees and makes them more vulnerable to the effects of pests, diseases, drought, and nutrient deficiencies. This is especially evident in Europe, North America, Asia, and cities throughout the world. More than a quarter of Europe's trees show moderate to severe defoliation from these stresses, according to regular surveys by the U.N. Economic Commission for Europe.[9]

As troubling as the statistics on forest loss and declining quality are, the true picture of the global forest situation is undoubtedly much worse. A major obstacle to assessing forests is the quality of the data assembled by U.N. Food and Agriculture Organization (FAO), the most widely used source. FAO relies on self-reporting by governments, and many countries do not have the capacity to carry out systematic forest assessments. Nor is there a system of independent monitoring in place—either by satellite or by ground-truthing.

FAO also uses inconsistent and confusing definitions, which in turn can result in some misleading conclusions. "Natural forest" is estimated, and forest quality is not measured at all. Deforestation is defined by FAO as the conversion of forests to other uses such as cropland and shifting cultivation. Forests that have been logged and left to regenerate are not counted as deforested, nor are forests converted to plantations. Thus, some of the land reported by countries as forest actually has no trees on it at all. According to FAO definitions, 80–90 percent of forest cover can be removed by logging without "deforesting" an area. Then when small-scale farmers reduce the remaining forest cover the next few percent they have, according to the official definition, "deforested" the land. This is why "slash-and-burn" farmers are often blamed for deforestation for which they are not responsible.[10]

## Rising Pressures on Forests

Widespread reports that poor agriculturalists and fuelwood gatherers are responsible for the rapid loss of the world's forests are greatly exaggerated. Closer examination reveals a different—and

more complex—picture. The rising appetite for forest products and trade is a major driving force behind the logging and conversion of many of the world's forests to other uses. Policies and subsidies that encourage conversion (for timber harvest or agriculture and settlements) also drive the process. This holds true in the temperate and boreal forests of Canada, the United States, and northern Siberia as well as in the tropical forests of the Amazon, Central Africa, and Southeast Asia.[11]

Trade in forest products—both legal and illegal—is a strong economic force. Although less than 8 percent of timber and 26 percent of paper production are traded internationally, the legal and recorded trade of $114 billion a year in timber, pulp, and paper makes forest products one of the most valuable sectors in the global marketplace. Tropical timber has received much attention, but nearly 90 percent of the legal and recorded international timber trade comes from temperate and boreal forests.[12]

The demand for forest products has grown rapidly in recent decades. The global production of roundwood—the logs cut for industrial lumber and paper products or used for fuelwood and charcoal—has more than doubled since 1950. Population growth, however, is not the primary cause of rising demand. In fact, most industrial roundwood use takes place in wealthier countries, where population is relatively stable. Over half of the world's timber harvested for industrial use is consumed by the 20 percent of the world who live in Western Europe, the United States, and Japan.[13]

According to FAO statistics, about half of the wood cut worldwide is used for fuelwood and charcoal, mostly in developing countries. In some areas, especially in the dry tropics, the portion is even higher, up to 80 percent. But in moist tropical nations such as Malaysia, the vast majority of trees cut are for industrial timber. Most of the live trees that are cut for fuel are used to make charcoal or in other industrial applications, such as brick-making and tobacco-curing, and in cities. This commercial fuelwood collection, especially when concentrated near cities, can cause significant local deforestation. On the other hand, the fuelwood collected by rural households is usually dead wood, which does not contribute to deforestation.[14]

Consumption of paper (including newspaper and paperboard) is increasing faster than any other forest product. The world uses more than five times as much paper today as it did in 1950, and consumption is expected to double again by 2010. About two thirds of the paper produced worldwide is made from virgin logs; only 4 percent is made from nonwood sources such as cotton or rice straw. The rest comes from wastepaper. Soon paper production is expected to account for more than half of the global industrial wood harvest.[15]

Paper consumption is not evenly distributed around the globe. (See Figure 2–2.) More than 70 percent of the world's paper output is used by the 20 percent of the world living in North America, Western Europe, and Japan. While global per capita use of paper stands at about 46 kilograms a year, the U.S. average is 320 kilograms (the world's highest), Japan's is 232, and Germany's is 200, while in Brazil the figure is 31 kilograms, in China it is just over 24, and in India the average is only 3 kilograms.[16]

Forest management for commercial exploitation is causing a number of fundamental changes in the world's forests and adding to the pressures already described. Clear-cutting and selective harvesting, and the activities used to support them, result in simplification, fragmentation, and degradation of forests. So, too, does conversion to forest or agricultural plantations and pasture. These changes diminish the ability of forests and lands to provide the full range of goods and ser-

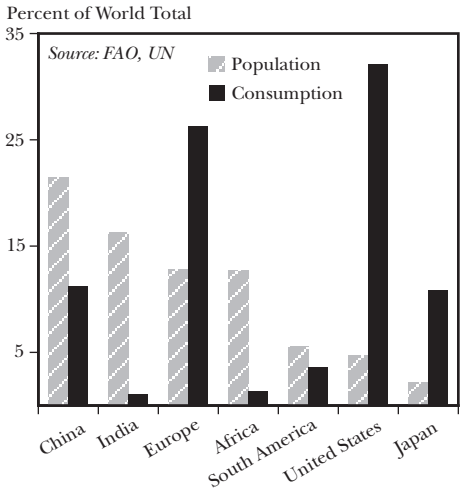


**Figure 2–2. Global Distribution of Population and of Paper and Paperboard Consumption, Selected Countries and Regions, 1994**

vices humankind depends on—from non-timber forest products to the regulation of water supplies and climate.[17]

Many of these fundamental changes are brought about as harvesting and roads create a checkerboard of disconnected forest fragments. And roads, highways, waterways, and pipelines all open the forest for exploitation and change brought by timber and agriculture operations, mining, hunters, landless settlers, and invasive species.[18]

The network of roads built into forests is extensive. One square kilometer of forest can have up to 20 kilometers of roads. In federally managed U.S. National Forests, for example, there are more than 600,000 kilometers of roads—enough to circle the globe nearly 15 times, and 2.4 times the length of the national highway system. And in one large timber concession in Indonesia, building 500 kilometers of logging roads cleared 40,000 hectares more than was directly logged.[19]

Throughout Brazil, as elsewhere, the rapid and extensive deforestation of recent decades has been concentrated near roads. During the 1950s and 1960s the Brazilian government began building roads and infrastructure to spread population and economic activity into its vast, untapped interior. The first big project was the highway to Brasília, the new national capital. Several million settlers were encouraged to relocate along the highway, and soon vast areas were cleared for cattle. At first, little of the wood was marketed, and billions of dollars of timber was simply burned. As settlement and infrastructure developed, and as transportation costs fell in the 1980s, timber extraction began to play a major role in the deforestation process. Since then, timber production in the Brazilian Amazon has increased 34 times. Transportation corridors are also facilitating the conversion of forests to produce agricultural commodities bound for Europe. As a result of the ambitious road building and integration program, the area deforested in the Amazon increased from 30,000 square kilometers in 1975 to at least 600,000 square kilometers today, with twice as much area affected biologically.[20]

As forests are opened up by roads and logging, they become drier and more prone to fires. Over the last 20 years a new phenomenon is occurring in the moist tropical forests: forest fires, previously rare in wet forest types, have become common. Fires that raged in Indonesia and Brazil in 1997 are part of this new ecological pattern.[21]

In Southeast Asia, the fires ignited regional and global concern as Indonesia, Malaysia, Singapore, Brunei, and southern Thailand and the Philippines were blanketed in smoke and haze for many months in 1997. The fires were started by pulp, palm oil, and rubber plantation owners to clear natural forest in Indonesia, and then they spread to at least 2 million hectares of forest and underground peat deposits. Tens of millions of people were sickened, hundreds died,

and schools, transportation, and businesses were shut down. Enormous amounts of carbon dioxide—perhaps as much as emitted in the United Kingdom in one year—were added to the atmosphere. The fire recalled the first great humanmade conflagration on the island of Borneo in 1983, when Indonesia alone lost more than $5 billion in standing timber.[22]

**Governments often look to their forests as a standing asset that can be liquidated to solve financial problems.**

As tree cover is lost, a forest's watershed protection services are impaired. Year-round water supplies can become seasonal streams, flooding during some periods and dry during others. The costs of lost services can illustrate just how valuable forests' free services really are. Deforestation in India's Ganges river valley has caused heavier flooding and property damage of $1 billion per year. In the U.S. Pacific Northwest, where many hundreds of landslides now occur each year, a study found that 94 percent originated from clear-cuts and logging roads. The torrents of water and debris from degraded watersheds caused billions of dollars in damage in 1996 alone.[23]

A major force behind the large-scale forest exploitation and infrastructure developments just described are large transnational logging corporations, which have long been heavily involved in the timber trade, and which are now expanding their reach. As noted earlier, most internationally traded timber comes from temperate and boreal forests, and it is harvested by companies from those nations. A new trend, however, is the increasing role of companies based in southern countries, especially in Asia.[24]

As some Asian nations have depleted their forest resources, they have turned elsewhere to satisfy their domestic consumption needs and the demands of their forest industries. Some of the timber comes from northern temperate and boreal forests—as in the logging of Siberian forests by South Korean firms and of Canadian forests by Japanese companies—but much of it comes from other southern nations. In 1996 alone, the area of Amazonian forest under concession to Asian timber companies quadrupled to more than 12 million hectares.[25]

There are several reasons for the rising influence of roving international companies. First, in the past decade international trade restrictions and tariffs have been eased and global and regional trade agreements have expanded. Domestic policy measures—such as logging and log export bans, subsidies to timber processing industries, and even better law enforcement and tax collection—have led companies to look beyond their home countries to find raw materials and higher profits. By operating in nations with less restrictive laws, lower fees, and lax enforcement, timber companies can reap higher profits from their legal—and sometimes illegal—timber harvest.[26]

The size and power of the timber companies and the often desperate economic situation of host countries allows the companies to dictate very favorable terms. In the Solomon Islands, for example, landowners were paid $2.70 per cubic meter for timber that foreign companies then sold for $350 per cubic meter. In Suriname, companies from Indonesia, Malaysia, and China proposed investments of more than $500 million—an amount nearly the size of that nation's annual economic output. Yet what may appear to be a short-term boost to the national economy (and to the few individuals who benefit legally or illegally) often turns out to be both an economic

and an ecological loss long after the logging operations have departed.[27]

## The Impact of National Policies

National laws, policies, and attitudes have enormous influence on how forests are managed, and on who benefits from their use or misuse. Where governments control a significant portion of the forest estate—such as in Canada, where 94 percent of forestland is publicly owned, or in Indonesia, where the state controls 74 percent—the role of government is obvious. But even without direct ownership, government trade and economic policies, management regulations, and agriculture and land tenure polices exert significant influence over the fate of forests.[28]

One common attitude that profoundly influences the future of this life-support system is the undervaluing of benefits provided by intact natural forests. These are often viewed as vast uninhabited spaces that are valuable only when converted to agriculture or mined for timber. Standing forest is seen as wasted and unproductive. The economic benefits of forest exploitation or conversion are routinely overestimated, in large part because the ecological and economic costs of the exploitation are ignored. Ironically, while governments consistently overestimate the benefits of the extractive timber industry, at the same time they underprice timber and other forest resources. The combined effect is to encourage rapid forest exploitation, depletion, and waste, and to sacrifice public revenues and benefits from intact forest.[29]

Forests are routinely sold at prices far below what the timber alone is worth. In Canada, stumpage rates are half of what they are in the United States, with large companies paying even less than small ones. And in Indonesia, an independent assessment of timber concessions concluded that in 1990 alone the government collected less than one fifth of the potential revenues—a loss of $2.5 billion.[30]

Just as a small landowner will sell a few trees for cash during hard times, governments often look to their forests as a standing asset that can be liquidated to solve financial problems. In Russia, some cash-strapped municipalities are paying creditors with forestland, and its Far East has been opened up to resource exploitation by outside companies. The economically desperate South American nations of Suriname and Guyana considered bids that would give away half of their forests to Asian timber companies for pennies per hectare. When Indonesia's military government came to power in the late 1960s, it took over a country with massive debt and high inflation. The new leaders put in place a series of policies—from underpricing logs to subsidizing timber processing to give-away concessions—that precipitated the deforestation of Indonesia. By 1991, concessions to 41 percent of the nation's forestland had been granted to a small number of companies.[31]

The extent of underpricing and lost revenue from timber on public land even in wealthy countries would astound most people. The subsidies can be so large that governments are in effect paying private interests to take public timber. In the United States, for example, 117 of 122 National Forests returned less money to the treasury than the Forest Service spent preparing the concessions for sale in 1995. From 1992 to 1994, the timber sales program lost $1 billion in direct costs alone. And this figure does not include the costs of reforestation, stream erosion, loss of fisheries and water supply, loss of recreation, and so on. The most heavily subsidized logging is in the coastal rainforests of Alaska. Even though timber sales from federal lands have turned a profit in only 3 of the last 100 years, Congress continu-

ally mandates high harvest levels.[32]

Governments also underprice their forests by levying a flat charge for timber rather than differentiating between more and less valuable timber species. And they may base fees on the volume of timber removed from a site rather than the volume available. This encourages concessionaires to remove and pay for only the most valuable species. Meanwhile, more forest is degraded and less revenue is returned to the government. Short concession terms, where the loggers have no incentive to ensure that forests regenerate because they will not be there to re-harvest, also encourage a cut-and-run approach.

One way that governments have attempted to raise revenues and promote employment from forest industries has been to encourage value-added domestic timber processing. This can also be a way to reduce the pressure on forests. Unfortunately, in too many cases, the effect has actually been to reduce revenues and fuel deforestation.

In Indonesia, for instance, the government banned the export of raw logs in 1985 and gave heavy financial incentives to stimulate the development of processors such as plywood mills. Without these inducements and tax concessions, timber processing in Indonesia would not have been profitable. The effort to add value to timber exports backfired as logs were reduced in value in inefficient mills, and more forest was needed to meet mills' demands. Even with illegal logging, some mills cannot operate at full capacity. Despite clear timber shortages and a 1993 World Bank assessment that harvests were 50 percent above sustainable levels, the Indonesian government continues to encourage domestic processing, plans to raise harvest levels by 57 percent, and is pushing its timber companies into remaining forest frontiers and into looking overseas for additional timber.[33]

Another manifestation of the failure to recognize the value of intact forest is laws that grant ownership and tax and credit benefits to those who "improve" forest by clearing it, and even provide subsidies to do so. A series of policies begun in the 1960s to spur investment in the interior of Brazil sparked the deforestation that has affected so much of that nation's forests. Roads built deep into the country's interior, generous tax holidays, credit with negative interest rates, and other subsidies encouraged the conversion of millions of hectares of forest to cattle ranches that would otherwise not have been profitable. By 1980, 72 percent of the forest conversion detected by satellite was due to cattle pasture. After 1990, four times as much deforestation came from subsidized ranches as from nonsubsidized ranches, and about a quarter of the pasture was already abandoned. Brazil lost more than valuable forest. By 1988, the fiscal cost of all 470 subsidized ranches was $2.5 billion. Despite some tax reforms, taxes are still higher and less credit is available on land with forest cover, and Brazil is pushing even more ambitious infrastructure and agriculture expansion plans.[34]

Governments also use forests as safety valves, to reduce pressure in heavily populated areas by siphoning people off to new areas. Indonesia's transmigration program moved settlers from Java to the nation's less populated islands. During the 1970s and 1980s, 6 million people were relocated. Nearly all these people were settled in forested areas, much of it already occupied by native Dayak tribes. An estimated 3 million hectares—5 percent of the country's forest—were converted during this scheme. The cost to the government was about $10,000 per family, an enormous amount in a nation where the per capita gross national product was only $530. Despite the massive infusion of funds, the ill-conceived resettlement scheme fell far short of its objectives. Many of the settlements have already been abandoned, and the people have

moved on or returned to Java. Similar resettlement programs have also failed in Malaysia and Brazil.[35]

Too often, forests are seen as vast uninhabited spaces. When forest dwellers are acknowledged at all, they are usually considered impediments to development and encroachers in the forest. Rarely is the distinction made between shifting cultivators—who have a long history of successful forest management, like the Dayak of Indonesia—and shifted cultivators, settlers who have been relocated to forest areas often without knowledge of how the forests should be managed.[36]

Few forest communities have been successful in gaining recognition for their customary rights to the very resource they have often managed sustainably for generations. Their occupancy has been made illegal in some cases, and disregarded in others. Even when laws are passed allowing for the demarcation of tribal lands (as in Brazil) or community forest management (as in India), they are often not enforced, and encroachment by individuals and industry is tacitly allowed. In Brazil, hard-won indigenous reserves have been invaded by miners and loggers. Sometimes loggers, miners, and settlers will rush to stake a claim on land in anticipation of indigenous claims. In nation after nation, communities have lost their ability to control access to their forestlands, to the detriment of both.[37]

In Indonesia, the government declared in 1967 that it had sole legal jurisdiction over the nation's forests—74 percent of the land area. Customary rights, which had evolved as a complex and sustainable management system over many generations, were not legally recognized. As elsewhere, by removing power from local communities, a real life "tragedy of the commons" was created—the government, which has the authority, is unable to police the nation's vast forests, and the communities who are in the forest have no power to stop exploitation by outsiders. One analysis concluded that "the traditional...rights of millions of people...have been handed over to a relatively small number of commercial firms and state enterprises."[38]

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**Despite clear timber shortages, the Indonesian government is pushing its timber companies into remaining forest frontiers.**

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Little of the economic benefits from forest exploitation in Indonesia or elsewhere return to the communities who lost access to forest resources. In fact, their standard of living has declined. Most of the profits benefit a few powerful industries or families. The liquidation of 90 percent of the Philippines' primary forest during the Marcos regime, for instance, made a few hundred families $42 billion richer, but impoverished 18 million forest dwellers.[39]

Domestic policies can also have unintended consequences on the forests of other nations. After the devastating floods and landslides of 1985 that originated in its deforested highlands, Thailand enacted a logging ban. Although legal domestic logging ended, domestic consumption did not, fueling logging (much of it illegal) in neighboring Myanmar and Cambodia. Some of the activity was aided by the army. Indonesia's and Malaysia's policies that encouraged rapid and wasteful exploitation of domestic timber spurred the growth of large companies and overcapacity in the industry. Now the companies roam the world looking for timber to feed their mills and coffers.[40]

All too often, governments do not have the capacity or the will to enforce their own forest laws and policies. Logging beyond the boundaries of concessions and in sensitive river and stream areas, tax evasion, and falsification of boundaries,

log volume, and grades are all common practices in timber concessions around the world. So too are the harvesting of protected species, exceeding quotas, and not mapping and reforesting as required. Penalties, such as they are, are too light and too rarely applied and paid to be a genuine deterrent. Companies see bribes and fines as a very minor business cost.[41]

**Two thirds of Canada's coastal rainforest has been degraded by logging and development.**

Many nations lose significant portions of their forests and potential revenues as a result of failure to enforce existing laws. Papua New Guinea's losses from unmonitored log exports alone, for example, were estimated at $241 million a year in 1994. In Ghana, about one third of timber is harvested illegally. If the current situation continues, Ghana will lose $65 million a year and 10,000 jobs. The Brazilian government reports that 80 percent of timber extraction in the Amazon is done illegally.[42]

In Cambodia, the amount lost to the national treasury as a result of illegal logging alone is equal to the entire national budget. The co-prime ministers and the military control the nation's forests and timber trade—most of which is illegal. Profits bypass the official budget, and go directly to a parallel budget that funds the factions in the ongoing civil war. The two prime ministers awarded timber concessions for the nation's remaining forests in 1995, also in violation of the law. And logging restrictions have been violated by the Khmer Rouge guerrillas, who were making $10–12 million a month selling timber to Thai logging firms from the areas under their control. Based on the amount of timber known to be exported in 1995 and 1996, for example, $400 million should have been generated, yet only $10 million came to the treasury. The losses to the people of Cambodia who depend on the forests and fisheries is far higher. The forests are expected to be depleted in the next decade, and the Tonle Sap—the great lake, which is one of the world's richest fishing grounds and the source of much of the nation's water and protein—will be silted up in 25 years if deforestation continues.[43]

Nations with weak laws or enforcement capabilities or prone to corruption are vulnerable targets for domestic or foreign companies looking for cheap timber. Suriname—where the forest service has a budget of $20,000–30,000, a few staff, and just one vehicle to monitor nearly 150,000 square kilometers of forest—has little capacity to enforce even minimal contractual and environmental standards on the proposed timber concessions that would have covered up to 40 percent of the country had they gone through. Even in nations with a relatively well staffed, funded, and monitored forest service, enforcement problems can occur. In the United States in early 1990s, it was discovered that timber companies were stealing hundreds of millions of dollars in trees from federal lands each year, sometimes with the knowledge of Forest Service agents. The Forest Service eventually won a multimillion-dollar lawsuit in court, but the money recovered was a small fraction of the value of the timber lost.[44]

In many nations, timber concessions, subsidies, and contracts are used to ensure political and familial patronage. They enrich powerful families, strengthen political power, and maintain the support of the military. Philippine dictator Ferdinand Marcos granted vast timber concessions to his allies, who deforested the nation in the 1960s and 1970s. The Philippines went from being the second largest log exporter in the world to a net timber importer today. Strong ties between politicians and

their families, the military, and extractive industries thrive in many nations today, including Malaysia and Indonesia.[45]

Government policies and enforcement can be easily influenced or subverted by powerful interests. Money from Indonesia's reforestation fund is routinely diverted by President Soeharto for non-forest uses, such as aircraft manufacturing, or for projects that benefit loggers. In 1997, he ordered $115 million transferred from the fund to build a paper factory for timber magnate "Bob" Hasan, who also had a hand in crafting Indonesia's forest policy and is a business partner of the president's son. In Cambodia, forest department officials who have tried to implement legally mandated forest reforms have been dismissed, intimidated, and murdered.[46]

In Canada, especially in the forest-rich province of British Columbia, the forest industry is a powerful force in the economic and policy arena. More than $30 billion worth of forest products are exported each year—making Canada by far the world's largest exporter. Government-owned "crown lands" account for 94 percent of the forests, and more than three quarters of all timber revenues from Canadian crown lands come from British Columbia. Forests are leased to timber companies, and high-volume logging is stipulated.[47]

In 1995, British Columbia enacted a Forest Practices Code in response to widespread international concern over the rapid degradation of the province's rich temperate rainforest through industrial clear-cutting. Cutting has tripled in the last 30 years and is well above sustainable levels—earning the province the label of "Brazil of the North." Two thirds of Canada's coastal rainforest, which is a rare and threatened ecosystem, has already been degraded by logging and development. The province also serves as an important habitat for salmon—of which 140 stocks are already extinct and 624 are at high risk. Salmon depend on intact forested watersheds and streams for survival and reproduction.[48]

An audit by Canada's Sierra Legal Defense Fund of timber cutting plans for 10,000 forest blocks approved by the Ministry of Forests after the Forest Practices Code became law found a vast difference between the letter of the code and the plans approved. Contrary to the code, clear-cutting was the harvest method on 92 percent of the blocks, including landslide-prone slopes; 83 percent of streams were clear-cut to the banks; fish-bearing streams were misclassified or unidentified by the companies; and destructive yarding—dragging logs through streambeds—was approved and common. The annual cut was not reduced as promised, and harvest blocks were more than twice the allowable size. None of the special areas for wildlife and biodiversity protection or old-growth management called for in the code had been designated. Of the million-dollar fines promised, only 9 of 120 fines levied were over $10,000.[49]

These findings and others led many to conclude that the Forest Practices Code's standards were inadequate and that too much of the responsibility for identifying and protecting sensitive areas was left to the discretion of logging companies, who abused this obligation. Despite the lax rules and apparently laxer enforcement, the industry complained that the code was too burdensome and was hurting its profits and market share. In June 1997, the government eased the Forest Practices Code.[50]

## Sustainable Forest Management

Management for timber commodities and conversion of forests to other uses has reduced or curtailed the ability of forests

to provide many other benefits and services. These include producing nontimber materials such as food, fodder, fish, and medicines; purifying and regulating water supplies; absorbing and decomposing wastes; cycling nutrients; creating and maintaining soils; providing pollination, pest control, habitat, and refuge; regulating disturbances; and regulating local and global climates. Forests also provide educational, recreational, aesthetic, and cultural benefits. They provide sustenance and livelihoods for hundreds of millions of people, including those who are excluded from the formal economy.[51]

**Many consumers want their buying habits to be part of the solution to forest decline rather than its cause.**

Despite this array of benefits and beneficiaries, all too often it is assumed that the greatest value that can be derived from a forest is maximizing timber and pulp production or converting it to agriculture. In fact, not only are other uses more valuable, they can also be sustained over the long term and benefit more people. In one illustration of this truth, alternative management strategies for the mangrove forests of Indonesia's Bintuni Bay were compared. When fish, locally used products, and erosion control were included in the calculations of the economics of forest use, the most profitable strategy was to keep the forest standing, yielding $4,800 per hectare. In contrast, cutting the timber yielded only $3,600 per hectare. Not cutting down the forest would also ensure continued local uses of the area worth $10 million a year, providing 70 percent of local income, and would protect fisheries worth $25 million a year.[52]

Still, it is clear that the world will continue to need timber products, and that much of that need will be satisfied through commercial forest management. Thus a major focus of attention by foresters, ecologists, and economists has been reforming forest practices. When many foresters use the term "sustainable forestry" today they usually mean "sustained yield"—that is, a continuous supply of timber and fiber. Even by that weak standard, so far forestry has been failing to sustain the resource base. For example, when the last estimate was made, in the late 1980s, less than one tenth of 1 percent of tropical forests were managed for sustained yield. Since then, some in the industry have accepted principles of sustainable forestry that incorporate other goals, yet timber production remains the bottom line.[53]

Sustainable forest management (SFM), on the other hand, recognizes that forests must be managed as complete ecosystems to supply a wide array of goods and services for current and future generations. As Kathryn Kohm and Jerry Franklin of the University of Washington College of Forest Resources put it: "If 20th century forestry was about simplifying systems, producing wood, and managing at the stand level, 21st century forestry will be defined by understanding and managing complexity, providing a wide range of ecological goods and services, and managing across broad landscapes...managing for wholeness rather than for the efficiency of individual components." In recent years, progress has been made in understanding the complexity of forests, defining SFM, and describing how it can be applied in various forest types and nations. Some of this effort has gone into developing international criteria and indicators to assess conditions in tropical, temperate, boreal, and dry forests, such as the Helsinki and Montreal Criteria and Indicators of Sustainable Forest Management, the Tarapoto Proposal of the Amazonian Cooperation Treaty, and the Dry-Zone Africa Initiative.[54]

While the concept of sustainable forest

management continues to evolve, some elements are common to most definitions. First is that forests should be managed in ways that meet the social, economic, and ecological needs of current and future generations. These needs include nontimber goods and ecological services. Management should maintain and enhance forest quality, and look beyond the stand to encompass the much larger landscape so that biodiversity and ecological processes are maintained. When trees are cut, the rotation period should follow the longer natural cycle of a forest rather than a shorter financial cycle.[55]

Sustainable forest management seeks to mirror the conditions in natural forests that are heterogeneous, with many species, ages, and sizes. Natural disturbances are enabled and mimicked. (While industry often claims that its management and harvesting practices mimic natural disturbances, such claims generally cannot be supported.) Sensitive areas like streams and important habitat such as dead tree "snags" are protected. Since forest species are interdependent, species that were once considered "pests," such as fungi and insects, are kept because they are important to ecosystem functioning. Finally, sustaining forests requires the active and meaningful participation of all stakeholders, especially local communities.[56]

At the same time that foresters and ecologists have been redefining the science of forestry, many consumers have indicated they want their buying habits to be part of the solution to forest decline rather than its cause. This concern is shared by a growing number of commercial buyers and retailers. In response, there has been a proliferation of "ecolabels" for forest products and self-certification schemes by industry and government, some of which amount to little more than "greenwashing." Many claims have been made—"five trees planted for each one harvested," "made from plantation grown trees," "environmentally friendly," "sustainable"—that create confusion in the marketplace. Unsupported claims also put producers using more sustainable methods at a competitive disadvantage.[57]

It became clear that for claims to be meaningful and credible, independent auditing and verification were necessary. To accomplish this, environmental groups, foresters, timber producers and traders, indigenous peoples' groups, and certification institutions established the Forest Stewardship Council (FSC) in 1993. This group has developed "Principles and Criteria for Forest Stewardship" (see Table 2–1) that apply to tropical, temperate, and boreal forests managed for forest products. Detailed standards based on these principles are being developed by national and local councils. FSC accredits certifiers who, at the request of companies wishing to use the FSC logo, audit forest management practices and certify products for the entire chain of custody, from forest to transport to processing. By using globally consistent principles and an easily recognizable single label, FSC certification can help ensure consumer confidence and improve market access for timber from well-managed forests around the world.[58]

The FSC is a promising initiative that has had a small but growing impact in its first few years. In 1996, just under 3 percent of the wood traded internationally was certified timber, double the amount in 1994. Since worldwide demand for certified wood exceeds supply, there is room for considerable growth.[59]

Companies that pledge to produce, market, and purchase wood products certified to FSC standards have said they do so because they believe their customers expect it and because they believe it makes good business sense. Commitment by industry can in turn promote better forest management by their suppliers. The 75 companies in the "UK-1995 Plus" buyers group, for example, that have pledged to phase out wood products that

**Table 2–1. Principles and Criteria for Forest Stewardship**

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| Forest management shall respect all applicable laws of the country in which they occur, and international treaties and agreements to which the country is a signatory, and comply with all FSC Principles and Criteria. |
| Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established. |
| The legal and customary rights of indigenous peoples to own, use and manage their lands, territories, and resources shall be recognized and respected. |
| Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities. |
| 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. |
| 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 the integrity of the forest. |
| A management plan—appropriate to the scale and intensity of the 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. |
| 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 their social and environmental impacts. |
| 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. |
| Plantations shall be planned and managed in accordance with [these] Principles and Criteria.... While plantations can provide an array of social and economic benefits, and can contribute to satisfying the world's needs for forest products, they should complement the management of, reduce pressures on, and promote the restoration and conservation of natural forests. |

SOURCE: Forest Stewardship Council, in WWF-UK, *World Wildlife Fund Guide to Forest Certification 1997*, Forests for Life Campaign (Godalming, Surrey, U.K.: 1997).

do not come from well-managed forests as defined by FSC principles represent about 25 percent of the U.K. market.[60]

So far the greatest impact of certification has been in the United States and Europe—which is significant because these regions are major producers and consumers. Consumer demand for certified forest products has barely surfaced in the important Asian market. The certification concept has recently been introduced in Japan, which is by far the world's largest importer of industrial roundwood—37 percent of all wood traded internationally ends up there. Raising awareness and demand for certification in this region could have a major positive impact on the world's forests.[61]

Certification is not a panacea, of course. It is not a substitute for reducing wasteful consumption or for sound legislation and policies. It does provide a voluntary market-based approach to fostering sustainable forest management and trade. It also provides a positive alternative to bans, which can boomerang and make alternative land uses, such as ranching or agriculture, more profitable than maintaining forests. These voluntary standards can complement the other

national and international initiatives noted earlier.[62]

## Forging a New Relationship with Forests

Clearly, people need forest products. But the majority of the world's forests are managed in a way that precludes the other goods and services that people also need and value from forests. Governments, citizens, and nature pay too high a price for the continued misuse and undervaluation of forests. With the demand for forest products expanding and forests declining in area and quality, how can we ensure that our needs for forest resources and services are met? By forging a new relationship with forests—one that ensures conservation, sustainable use, and the fair and equitable sharing of benefits from forests.

Elements of this new relationship include halting forest degradation and conversion, restoring forest health, improving management, reducing waste and overconsumption combined with making consumption more equitable, getting the market signals right, returning the control of forests to communities, reforming and strengthening national policies as well as international agreements, and improving research and monitoring.

An overarching goal of the new relationship is to halt degradation of remaining primary forest and restore forest cover and health. Mining new frontiers and clearing natural forests to establish tree plantations or agricultural land has no place in the twenty-first century relationship. Sustainable forest management is a long-standing practice in some communities, and now in some small commercial forest enterprises. These practices need to be expanded in scale. A proposal to raise the area under certifiable sustainable management from 4.5 million hectares today to 200 million hectares by 2005 has recently been endorsed by environmental and business groups as well as by the World Bank.[63]

One strategy for maintaining and restoring healthy forests is to expand the protected areas network to ensure adequate ecological representation of all forest types. Protected areas today serve a much broader array of social and ecological functions than the scenic beauty parks of the past. The World Wide Fund for Nature and the World Conservation Union have proposed that a minimum of 10 percent of each forest type be in protected areas by 2000. Currently only 6 percent of the world's forests fall in this category, and in many cases that protection is in name only. (See also Chapter 3.)[64]

Rehabilitating and restoring forests will become increasingly important as nations seek to regain the social and environmental benefits that forests provide. To be successful, rehabilitation will need to be different from current practices of planting large areas of single (often exotic) species with little consideration to local needs or environmental services. The restored forests of tomorrow should use a mix of native species and provide multiple benefits. Preventing the accidental or intentional introduction of exotic species is also an important part of restoring forest health. Intensive plantations have a role to play, if they follow these guidelines and are established on degraded land. One of the stated rationales for plantations—that they reduce pressure on natural forests—does not hold true if they convert natural forest or push people who depended on the land further into remaining forestland.

Improving management techniques will be of limited success unless the excessive levels of waste during harvesting and processing are lowered and overconsumption and waste by consumers is reduced. One source of valuable wood is

the high percentage of trees that are currently damaged and left on the ground in many commercial forest operations around the world—50 percent collateral damage is common. Better road placement and mapping of tree location and felling direction can reduce damage in the forests.[65]

**A study in Brazil found that only one third of each harvested log is turned into sawn wood; the rest is discarded.**

Many species that are currently discarded have high potential value. In the tropics, only a few of the many hardwood species are currently marketed. One forest consultant stated that the "junk" woods that are used to make rough shipping crates for forest products in the tropics are often more valuable than the contents of the crate and have promise as valuable specialty woods. In the forests of the U.S. Pacific Northwest, the yew tree once discarded as trash was found to yield taxol, an important cancer-fighting drug.[66]

Reducing the waste in processing also has enormous potential for diminishing pressures on the forest and improving economic returns at the same time. In the United States, more than half the wood brought to a sawmill leaves as "waste" such as chips and sawdust, and about three fourths of this is used for pulp or fuel. Globally, there has been some success in increasing industrial output with less roundwood input by recycling more materials and residues, according to FAO. The organization suggests that if developing countries used this approach, it could provide for growth in consumption "without placing unnecessary stress on the forest resource." A study by IMAZON in Brazil found that only one third of each harvested log is turned into sawn wood (the wood used to make finished products); the rest is discarded. Improving equipment maintenance and training workers alone could increase processing efficiency by 50 percent. Combined with better forest management practices, companies could use one third as much forestland to produce the same amount of lumber.[67]

Lowering waste and overconsumption by consumers would yield substantial benefits for forests and economies without sacrificing quality of life. As noted earlier, more than half of the world's industrial timber and more than 70 percent of the paper is consumed by the 20 percent of the world who live in the United States, Western Europe, and Japan. Reducing their consumption and waste by even a small fraction would ease pressures on forests significantly. In the United Kingdom, for example, 130 million trees' worth of paper is discarded each year. A German survey found that 98 percent of secondary product packaging is unnecessary. Nearly a fifth of all lumber in the United States is used to make shipping crates and pallets, most of which are discarded after use. In fact, they account for 40 percent of all wood waste.[68]

Unless industrial nations reduce waste and overconsumption as developing nations expand their use of paper, even greater pressures will be placed on the world's forests. If everyone in the world consumed as much today as the average American (who consumes more than anyone else in the world—320 kilograms a year), the world would be using nearly seven times as much paper. And by 2050 it would need more than 11 times as much. If, on the other hand, paper use stabilizes at today's global average—47 kilograms a year per person—and it were distributed more equitably, paper consumption in 2050 could be held to 1.7 times today's level.[69]

Recycling has been expanding and there is plenty of room for continued growth. In the United States, 45 percent

of paper and paperboard is now recovered and recycled, up from 29 percent in 1987 (when industry began to record these statistics), thanks to high participation rates by homeowners and municipalities. The U.S. industry has a goal of 50-percent recovery by 2000, a standard already met in many countries. The major obstacles to meeting this target is low participation by offices and businesses, who are the largest source of high-quality wastepaper, and uneven enforcement of laws mandating recycled content. Not recovering and recycling waste paper also stresses waste disposal systems—in the United States, for example, paper accounts for 30–40 percent of the waste sent to landfills and incinerators.[70]

Reducing the amount of wood consumed for fuel is also possible. As noted earlier, most of the live trees cut for fuel in developing countries are for industrial and urban fuel users. Shifting these sectors to clean, renewable energy sources (such as wind and solar) could greatly reduce the pressures on the forests and improve air quality.

Much forest mismanagement, waste, and overconsumption results from the fact that only a fraction of forest goods are counted when they enter the marketplace, and that forest services—the life-support systems—are not counted at all. The profit from deforesting land is counted as an addition to the national economy, but the depletion of timber, fisheries, or watershed and climate services is not subtracted. This sends misleading economic signals to decisionmakers at all levels. As environmental consultant Norman Myers puts it, "our tools of economic analysis are far from able to apprehend, let alone comprehend, the entire range of values implicit in forests."[71]

Incorporating the full costs of management and production into the cost of forest products would encourage more judicious use by producers and consumers. To do this, many perverse incentives and subsidies need to be eliminated, such as below-cost timber sales, give-away forest concessions, and subsidized forest conversion. These subsidies waste money and degrade the environment. Other policies, such as granting land titles to those who clear the forest, also need serious reform in order to ensure that they do not contribute to forest degradation.[72]

In the last few years, a new breed of economists—ecological economists—has been trying to find ways to correct misleading economic signals and better estimate the contributions of nature. Alternative measures of gross domestic product and methods for calculating the benefits from forests and nature are being developed. Capturing the value of a forest's ecological services to support sustainable rural development in places like the Amazon represents an important step forward. These new tools can help the market better reflect the value of nature and guide decisionmaking.[73]

A recent landmark study helps illuminate the importance of nature's services in supporting human economies. It provides a first-ever overall estimate of the current economic value of the world's ecosystem services and natural capital. The findings of more than 100 studies were synthesized to compute the value of each of the services that the world's major ecosystem types provide. Robert Costanza of the University of Maryland and colleagues from around the world calculated that the current economic value of the world's ecosystem services is at least $16–54 trillion per year, exceeding the gross world product of $28 trillion (in 1995 dollars). If every service for each ecosystem type were measured, the figure would by much higher. Fixing a more accurate price for the benefits from forests is essential, but so too is acknowledging that not everything has a price. Much of a forest's value is quite literally beyond measure.[74]

Frequently the financial benefits from

forest exploitation go to private individuals or entities, while the economic, social, and environmental losses are distributed across society. Economists call this "socializing costs." Simply put, while a small segment of society profits from unsustainable forest exploitation, the rest of society (and future generations) pays the costs. Thus there is little economic incentive for those exploiting a resource to use it judiciously or in a manner that maximizes public good. In addition to the reasons noted earlier, one explanation for this is that over time, control over the forests has shifted from communities who have a direct stake in the health of forests to the state and to corporate entities, where short-term thinking often prevails.[75]

A proven way to reconnect the costs and benefits of forest management is by returning—or devolving—control of forests to communities. Community control can improve the prospects for the sustainability of the forests and the quality of life of people in and near the forest. In India, for example, when the state assumed control over forests from local communities over a century ago, they removed the only successful safeguard from overexploitation, and the condition of forests declined. After the policy was modified in the late 1980s, thousands of communities regained control over state forestlands. Communities now protect and control—and benefit from—the forests that they manage and rehabilitate. In Indonesia, reinstating customary rights could help reverse the degradation and poverty caused by the last few decades of state and industrial control over the forests.[76]

Community forest control can also improve the quality of forests and communities in industrial countries. In British Columbia, a shift from the current corporate control of public forestlands to community-based control has been proposed. Current laws and regulations require high-volume, commodity-export-driven forestry, which has led to the problems described earlier. A proposed "Forests in Trust" act would allow communities and First Nations in British Columbia to determine management practices and objectives and allow them to manage forests for ecosystem health and long-term economic and community stability.[77]

There is significant room for improvement in national laws and policies governing forests, as noted earlier. Eliminating subsidies that encourage forest degradation or conversion, reforming tenure policies, and improving revenue collection from public lands are important elements. So, too, is better enforcement of existing national laws, including preventing illegal logging and trade. These changes make good economic and ecological sense.

Yet too often, illogical and inequitable resource use continues in the face of evidence that it is ecologically, economically, and socially unsustainable. The reason is that powerful interests are able to shape or ignore government policy by legal or illegal means, through corruption and favoritism. Future progress will be difficult if the current breakdown in the rule of law governing forests and forest products is allowed to continue.

Although most of the action on forests needs to take place at the national level, there is also a role for international agreements, institutions, and initiatives. Forests are a global issue. They cross political boundaries, as do many of the threats and problems. And many of the services forests provide—such as storing carbon, regulating the climate, and sustaining biodiversity—are shared globally.

Governments need to renew the commitments made in Rio de Janeiro in 1992 and to accelerate action. In the years leading up to the 1992 Earth Summit, tropical forests were a major focus of international concern. When it came time to negotiate a binding forest convention, southern nations were concerned that northern governments would use a convention to

impose controls on tropical forests that northerners were unwilling to accept at home—a tension that persists today. At the eleventh hour a set of non-legally binding "Forest Principles" that applies to all forests was adopted.[78]

Nations did agree to two legally binding instruments that provide significant opportunities for cooperation and meaningful action on forests—the Framework Convention on Climate Change and the Convention on Biological Diversity. The latter treaty, signed by 169 nations in the five years since the Earth Summit, has the conservation and sustainable and equitable use of biodiversity—including forests—as its mandate. Forests will be a major agenda item when the signatories meet in May 1998.[79]

Agenda 21—the plan of action that emerged from the Earth Summit—contains a chapter called "Combating Deforestation" that also provides guidance for action. Nations agreed to sustain the multiple roles of all types of forests, to enhance sustainable management and conservation, to rehabilitate degraded forests, to value and use forest goods and services more fully, and to improve the quality and availability of information about forests.[80]

Given the lack of progress on combating deforestation since Rio—indeed, the situation has grown worse—the United Nations set up an Intergovernmental Panel on Forests (IPF) in 1995. Its goal was to facilitate discussion by governments on a broad—some say too broad—range of issues and provide concrete recommendations for moving forward. A separate World Commission on Forests and Sustainable Development was also set up, consisting of scientists, policymakers, and others.[81]

At the United Nations' five-year review of progress since the Earth Summit, a successor to the IPF was designated to implement its proposals for action and deal with issues left pending. After its first meeting in October 1997, the new Intergovernmental Forest Forum urged nations to examine the underlying causes of deforestation and develop strategies to address them.[82]

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**Powerful interests are able to shape or ignore government policy by legal or illegal means, through corruption and favoritism.**

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One initiative still under consideration is a global forest convention. Ironically, a forest convention could delay action, as negotiating and ratifying an international treaty can take a decade, plus further years for substantive action to begin once the treaty is "in force." With few exceptions, governments have been unwilling to accept international agreements that have "teeth," so it is likely that a forest convention would formalize weak, non-binding standards. Not coincidentally, many of the nations that now support a forest convention have powerful timber industries. Given the political realities and the urgency of the forest problem, the most effective course of action is to use existing mechanisms and legal instruments, such as the biodiversity and climate change conventions.[83]

There are also opportunities for international cooperation in regional environmental and trade agreements and forums. To date, many of these trade alliances have been driving forest destruction. In the future, they could be used to secure a better future for their economies and environments. Existing trade treaties such as the International Tropical Timber Agreement, for example, could be reformed to cover the entire timber trade, not just tropical timber—a step that the parties failed to take when it was renegotiated in 1994. Likewise, the laudable

goals of its Guidelines for the Sustainable Management of Natural Tropical Forests by the year 2000 could be expanded to apply to the temperate and boreal forest products trade, and be made binding. The Convention on International Trade in Endangered Species of Wild Flora and Fauna has had some success in halting the decline of a few listed species (such as elephants), but the record for tree species has not been as good.[84]

International lending and donor agencies also have a role to play by ensuring that their loans and grants encourage positive reforms and sustainable practices rather than deforestation. So, too, do the private investors who are now responsible for the majority of financial transfers. (See Chapter 9.) Loans for dams, road building, and agriculture and resettlement schemes are examples of projects that contribute to deforestation. On the positive side, however, the World Bank announced that it will help client nations meet the goals of having 10 percent of each forest type in protected areas and expanding the area under certified sustainable forest management by 200 million hectares by 2005. Recently, the United Nations, the International Monetary Fund, and the World Bank made their future aid to Cambodia conditional on reforming and adhering to national forest laws and not violating the laws of neighboring nations.[85]

More investment in forest research and management is also needed. Funding for forest-related research is a small fraction of agriculture research, and both are inadequate to meet the challenges of tomorrow. There is still much to learn about forest species, functioning, and dynamics and about the best management practices. Many nations do not have the budgets or resources to monitor and manage their forest estates adequately. More investment and a building up of these nations' capacities for forest management would reap substantial benefits in ensuring the long-term health of the world's forests.[86]

A key opportunity for international cooperation is through improving monitoring of global forest conditions and threats. As noted earlier, major weaknesses exist in the data on forest conditions and extent gathered by national governments and FAO. In order to assess the state of the world's forests accurately, data collection procedures and classifications need to be improved, satellite monitoring used, in-country capacity strengthened, and an independent monitoring mechanism put in place.

Ultimately, the effectiveness of policy, management, and market reforms will be determined by whether the decline of the world's forests is arrested and reversed, and the quality of life of people who depend on them is improved. And by whether future generations inherit healthy forests.

# Notes

## Chapter 2. Sustaining the World's Forests

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