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Forests are major carbon sinks and providers of environmental services which are currently not paid for. Payment of such services can make many forms of forest conservation and sustainable forest management viable and provide stable employment and income for local populations.



6. Forestry

In 2006, the U.N. Food and Agriculture Organization (FAO) reported that forests cover nearly 4 billion hectares (about 30 percent of the world's land area), half of which is located in just five countries: Brazil, Canada, the United States, China, and Russia.⁹⁶⁴ Forests serve as carbon sinks, absorbing carbon from the atmosphere and storing it in the wood, soil, and other organic material. Reducing the world's forested area permanently decreases the Earth's capacity to store future carbon emissions.

According to the IPCC, deforestation and forest degradation already contribute more than 18 percent of all greenhouse gas emissions, an amount larger than both the agriculture and transportation sector.⁹⁶⁵ Perhaps more significantly, the world's forests store an estimated 4,500 gigatons of carbon dioxide in their ecosystems, an amount larger than all carbon currently found in the atmosphere.⁹⁶⁶ A release of this stored carbon into the atmosphere, even over a long period of time, would have catastrophic effects on the planet.

Despite the increasing awareness in recent years of the unique and crucial role that forests play in climate stabilization, not to mention their capacity to protect water, soil, and biodiversity, deforestation continues at an alarming rate. Between 2000 and 2005, an average of 12.9 million hectares of forests were destroyed each year, of which 6 million hectares were primary forest, biologically diverse forests that remain relatively unharmed by human activities.⁹⁶⁷ This rate was down only slightly from 13.1 million hectares per year in the 1990s.⁹⁶⁸ The greatest losses have occurred in tropical forest regions of Africa, Southeast Asia, and South America. At the current rates, most of the top 10 deforesting countries are likely to have completely diminished their forest cover by 2100.⁹⁶⁹

Deforestation rates are somewhat offset by new forest growth and the replanting of trees (afforestation and reforestation), natural expansion of existing forests, and landscape restoration—bringing the most recent estimate of net forest loss to 7.3 million hectares per year.⁹⁷⁰ Temperate countries have seen an expansion of both natural forests and new plantations, while the new



growth in tropical countries is mainly a result of new plantations. This new forest growth is extremely important for carbon mitigation scenarios, but it does not compensate for the profoundly negative effects brought about by the destruction of primary forests.

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Workers carrying logs to stack. Overexploitation and lack of proper management have left 23 tropical nations in a position where they now have to import manufactured forest products, paying out in excess of \$50 million a year. Malaysia.

Future projections show a slight increase in forest cover of 60 to 230 million hectares of land, primarily in the industrialized countries, and a decrease of 200 to 490 million hectares in developing countries.⁹⁷¹ The increase in forest areas in developed countries is therefore not enough to offset the decline in developing countries. The picture that emerges is a continued decrease in forest area, especially in the tropical forests, where rapid deforestation is occurring. Without drastically slowing the rates of deforestation while promoting smart land-use practices, it becomes nearly impossible to stop global climate change. The IPCC has identified several key land-use changes for carbon mitigation in the forestry sector, including: reduced deforestation and forest degradation, conservation, afforestation/reforestation, and sustainable forest management.⁹⁷²

Land-use changes in the forestry sector will likely result in economic implications for the people who depend on forests for employment, income, and subsistence.⁹⁷³ Although the data on employment in the forestry sector are sparse, the forestry sector likely employs tens of millions of people and provides subsistence and income for hundreds of millions of others. This section of the report will discuss the current levels of employment in the forest sector and analyze possible economic and employment implications associated with a shift toward sustainable practices.

Employment Estimates

The forestry sector is considered to be a significant source of wealth and employment, especially in developing countries. Overall, the sector provides 1.2 percent of global GDP, with more than 10 percent of GDP in the poorest countries and about 5 percent in many developing countries.⁹⁷⁴ Exact employment numbers in the forestry sector are, however, difficult to ascertain.

Forestry-sector employment should include all of the work required to plant, harvest, sustainably manage, renew, and protect forests as well as to process both wood and non-timber forest products (NTFP)—but it rarely encompasses all of these areas. Instead, forestry related employment often includes only the forestry workforce (roundwood production, reforestation, harvesting, fuelwood production) and wood-related industries (wood processing, pulp and paper) and often excludes NTFP such as building materials, medicine, food, and crafts. These latter products also generate employment, increase income, and improve health, and should be considered part of the forestry sector's employment zone.

Formal Employment

The most reliable data on formal employment in the forestry sector was collected between 1990 and 2000 and includes employment data for roundwood production, wood processing, and the pulp and paper industry. This information was recently re-published in the FAO's 2007 *State of the World's Forests* report. According to the report, total global employment in forestry in 2000 was 12.9 million, a 4 percent increase from 1990.⁹⁷⁵ This employment was more or less divided equally among the three subcategories; however, the proportions differed by region.⁹⁷⁶ (See Table II.6-1.) Developing countries tended to have a larger fraction of jobs in roundwood production, while developed countries dominated in wood-processing industries and the pulp and paper industry.

Table II.6-1. Formal Forest Sector Employment by Region, 2000

Region	Employment (million workers)	Employment Trends (1990–2000)
Asia and the Pacific	5.6	Overall, employment levels increased. The highest year was 1997 with an estimated 6.4 million workers.
Europe	3.5	Employment levels have been declining. Labor productivity is rising faster than production.
North America	1.5	Employment levels rose slightly at the beginning of the 1990s and have leveled off.
Latin America and the Caribbean	1.2	Total employment increased.
Africa	0.55	Employment levels increased by 30,000, from 520,000 persons in 1990 to 550,000 in 2000. This rise is attributed to an increase in wood processing.
Near East (Northern Africa, Central Asia, Western Asia)	0.4	Employment levels have been fairly stable.
World	12.9 million	

Source: See Endnote 976 for this section.

These data on formal-sector employment in the forestry sector are limited to the three subsectors and may not account for all formal-sector employment. An often-quoted estimate by Peter Poschen of the International Labor Organization puts the number of forest-sector workers in the formal sector at 17 million.⁹⁷⁷

Informal Sector and Subsistence Work

Jobs in the forestry sector are generally considered to be underreported. This is mainly due to the nature of the work, which is seasonal, often part time, and does not translate well into full-time employment. Countries with strong forestry industries, such as Canada and Indonesia, do report employment figures, but most other countries lump their forestry employment data together with agriculture, hunting, and fishing. Because of this, a large number of self-employed workers or farmers do not get counted by national statistics, or they get subsumed under larger catch-all categories. This is especially true of agroforestry, where global employment estimates soar as high as 1.2 billion people, which is a direct overlap with the number of people who are recorded as agricultural workers.⁹⁷⁸

National statistics of income and employment do not measure jobs in the informal sector. The FAO relies on microlevel studies for information on informal sector employment. These microlevel studies often suggest that the number of jobs in the informal sector far surpasses those reported in the formal sector, particularly in Africa, Asia, and Latin America. Informal employment data in the forestry sector fluctuate widely by source. Poschen's research identifies 30 million workers

in the informal sector, for a total of 47 million for formal and informal combined.⁹⁷⁹ The World Bank estimates that the forestry sector employs 60 million people both formally and informally.⁹⁸⁰ Another estimate is as high as 140 million workers.⁹⁸¹ Despite these dramatic variations in employment estimates for informal sector workers, all three sources underscore the significance of informal workers in the forestry sector, pointing to the need for more research in this area.

Importantly, the vast majority of people whose livelihoods are dependent on forestry are not wage earners or even informal workers, but people who rely on the forest for subsistence. These people use the forest as a source of food, fuelwood, and income and are not considered in official forestry employment numbers. The World Bank estimates that roughly 1.6 billion people depend to varying degrees on the forest for their livelihoods, including 60 million indigenous people who are fully dependent on the forest and another 350 million people who live within or near forests and depend on them to a high extent for income and subsistence.⁹⁸² More than a billion of these people are engaged in agroforestry and are most likely counted as agriculture workers and forest-dependent people. These workers depend on the forest for food, income, shelter, and fuel and should be included in any discussion pertaining to the forestry sector.

The Role of Small and Medium Sized Forest Enterprises (SMFEs)

The forestry sector is characterized by both large, vertically integrated multinationals and thousands of small and medium-sized forest enterprises known as SMFEs. Not surprisingly, the data for SMFEs is very rough. These enterprises are thought to contribute more \$130 billion to the global economy.⁹⁸³ Mayers and Macqueen (2006) estimate that 50 percent or more of forest employment in many countries is found in SMFEs, and as high as 80–90 percent in some developing countries.⁹⁸⁴ They speculate that at least 20 million people are employed in SMFEs, and estimates soar as high as 140 million when the informal sector is included.⁹⁸⁵ These enterprises also employ the majority of people who produce small wood products. SMFEs are especially significant because they tend to be very labor intensive and can be a growing source of employment, especially in developing countries.

Trends in Employment

Despite the slight increase in employment over the past decade, as reported by the FAO, formal employment in the forestry sector has most likely decreased during this time. It is clear that there has been a decline in formal employment in the global North due to increases in productivity, outsourcing, and mechanization—but trends in the informal sector are much less apparent. For the informal sector, there is a shift toward informalization, but also toward mechanization. As the forestry sector becomes more highly mechanized, it is likely to see an overall decrease in both formal and informal employment.

Income in the forestry sector varies greatly by type of job, location, and employer, but there are general trends that exist within each subcategory. It is widely agreed that pulp-and-paper manufacturing jobs are the highest paid in the industry, followed by engineered wood-panel production and then sawmill jobs. Aside from a few developed countries, the logging industry is associated with very low wages. Many forestry jobs provide sporadic, part-time, and seasonal

employment. This is especially true for informal-sector workers, who also lack benefits that may accompany formal sector work.

There has been a shift away from vertically integrated forest products companies toward global corporations that compete for capital in the global economy. Because of this, companies in the forest industry are under increasing pressure to generate a competitive rate of return.⁹⁸⁶ One response to this market pressure is to reduce costs by reducing the number of workers with who have a formal employment relationship.. Such a response is a significant driver for a growing trend for forest workers to be defined as “independent” contractors rather than wage employees. By shifting this portion of production costs from the company to the contractor, the company is able to increase its return on investment (ROI). Such company business practices also relieve the employer from a number of social costs and can contribute to other governance issues.

Workers are often paid by piece rate, which frequently requires long hours under harsh working conditions to exceed poverty-level wages. This ongoing breakdown of the employment relationship and the growing decent work deficit brings a host of additional safety and health concerns to a sector that is already associated with hazardous working conditions. Jobs in the forestry sector, especially logging jobs, are in the top three most dangerous jobs in almost all countries.⁹⁸⁷ According to the Building and Woodworkers International Union (BWI), “tropical loggers stand a one in ten chance of being killed over a working lifetime.”⁹⁸⁸ Informalization brings unskilled, untrained workers and high turnover rates which increase injuries and fatalities in the industry. Other jobs in forestry, like sawmill jobs, are described by Building and Woodworkers International (BWI) as “increasingly subcontracted and hazardous” and woodworking as constantly depending “on the workers’ skills to avoid injuries, rather than on any prevention measures.”⁹⁸⁹

Global Employment Estimates

Despite growing informality and mechanization, forestry is still a very significant sector, with roughly 1–2 percent of the global workforce and over a billion people dependent upon forests for their income and livelihoods. The forestry sector is also an important source of income and employment for developing countries and for rural communities where there are few available economic activities.⁹⁹⁰

The majority of workers in the formal forestry sector are men, but certain types of jobs, such as reforestation, fuelwood gathering, and agroforestry include an increasing number of women.

The lack of precise data on employment is reflected by the large variance between estimates, especially in the informal sector. The estimates for indigenous people who rely on forests for income and subsistence are also very rough extrapolations. By comparison, the data that exist for formal-sector employment appear to be much more reliable, although these data are also somewhat inconsistent compared to other sectors outside of forestry. There is a genuine need for better employment data in the forestry section, particularly in the informal sector and for people relying on the sector for their livelihoods. Table II.6-2 briefly summarizes the types of jobs that comprise the forest sector, along with highlighted characteristics and trends in the industry.⁹⁹¹ Table II.6-3 summarizes employment estimates for the sector.⁹⁹²

Table II.6-2. Employment Characteristics and Trends within the Forestry Sector

Category	Types of Jobs	Employment Characteristics and Trends
Forestry Workforce	Wood Harvesting Jobs (also called Logging or Forest Harvesting) Includes: chain saw operators, machine operators for tractors, loaders, cranes, harvesters and logging trucks, truck drivers, choker setters, etc.	<ul style="list-style-type: none"> Over the past several decades, overall decreasing trends in employment due to increasing mechanization. Increasingly contract and informal labor. Considered one of the most hazardous types of work.
	Reforestation and Afforestation jobs (work includes: tree planting, fertilization, nursery jobs, weed and pest control, and pruning)	<ul style="list-style-type: none"> Mainly seasonal employment. Women comprise 10–15 percent of the tree-planting workforce.
	Fuelwood Gathering	<ul style="list-style-type: none"> Generally informal work for subsistence, but may provide some additional income for households. 80–85 percent of all wood processing in developing countries is for fuel. Mostly performed by women.
	Agroforestry	<ul style="list-style-type: none"> 60–80 percent of farmers in the developing world are women and could benefit from agroforestry.
Wood Related Industries	Wood Processing: panel production and sawmill jobs and misc. wood products (furniture, crafts, construction materials, etc.)	<ul style="list-style-type: none"> Panel production wages are second only to paper and pulp manufacturing, making them relatively high compared to other forestry jobs. Wood processing comprises about one-third of all formal jobs, but also employs a huge amount of informal sector workers in developing countries.
	Paper and Pulp Manufacturing	<ul style="list-style-type: none"> Generally provide the highest wages in the sector
Non-Timber Forest Products (NTFP)	Generally informal, small-scale, and subsistence work that includes gathering and picking of food products, medicine/chemical products, and non-wood (bamboo, cork, thatching grasses) for construction and structural purposes	<ul style="list-style-type: none"> Large numbers of informal and subsistence workers, predominantly in tropical areas and developing countries. Generally excluded from forestry employment data. Mostly non-mechanized work. Work tends to be located in remote forest areas.

Sources: See Endnote 991 for this section.

Table II.6-3. Global Employment in the Forest Sector, by Type

Category	Number of Workers (millions)
Formal Sector Employment	12.9 –20
Informal and formal sector forest-based enterprises	47–140
Indigenous people who primarily depend on natural forests for their livelihoods (hunting, gathering, shifting cultivation)	60
People who live in or near forests and depend on forest for additional income	350
Smallholder farmers who use agroforestry practices	500 million–1.2 billion
Total (Rough Estimate)*	957 million–1.75 billion

*It is extremely difficult to find accurate totals for the stated categories because:

1) there is a large range of estimates, and,

2) some of the categories are likely to overlap. The 1.75 billion is likely an overestimate.

Sources: See Endnote 992 for this section.

Land-use changes will result in economic and employment implications. There may be new socioeconomic benefits provided by the new use of land, but there may also be lost economic opportunities from previous land uses, especially if the land was currently used for agriculture and provided income and subsistence for the farmers and workers. According to the IPCC, “the net effect of land-use change on employment, income, and equity cannot be determined *a priori*; it must be evaluated on a case-by-case basis. The social systems in each country will strongly influence the socioeconomic impacts associated with any given activity.”⁹⁹³ Even though each country or locality will have differences in how these land-use changes affect employment, there are also commonalities among specific land-use changes.

Avoiding Deforestation

Deforestation leads to increased levels of carbon emissions and continued loss of biodiversity. The IPCC has identified several key land-use changes for carbon mitigation, which will likely have an economic impact on the people who are dependent upon the forestry sector.

Avoiding deforestation remains by and large the biggest challenge in the forestry sector. Deforestation is widely believed to be the result of converting forests to agricultural land, resettlement, fuelwood collection, and unsustainable industrial logging practices. But the key underlying force behind deforestation is poverty and lack of economic alternatives. Low wages, unemployment, and lack of income for farmers and landless people force people to convert forestland for basic income and subsistence needs.

There is a direct link between poverty and deforestation. The poorest countries have the highest deforestation rates, both in terms of the total amount of forest lost and as a percentage of the country’s forest cover. The top five countries with the greatest overall loss of forest cover from 2000

to 2005 were Brazil, Indonesia, Russia, Papua New Guinea, and Peru.⁹⁹⁴ During the same period, Nigeria, Vietnam, Cambodia, Sri Lanka, and Malawi had the highest percentage of forest loss, with Nigeria and Vietnam destroying over half of their forest cover.⁹⁹⁵

Deforestation is by far the leading contributor to greenhouse gas emissions in developing countries. The third and fourth largest emitters in the world are Indonesia and Brazil, respectively (after China and the United States), with the vast majority of their emissions attributed to deforestation.

Reduced Emissions for Deforestation and Forest Desertification (REDD) Schemes

Most of the “Avoiding Deforestation” discussions at the December 2007 U.N. Climate Change Conference in Bali, Indonesia, revolved around Reduced Emissions from Deforestation and Forest Degradation, also known as REDD schemes. The basic premise behind REDD schemes is that deforestation can only be avoided by creating economic incentives or compensation for conservation. Payments travel via carbon markets or through direct aid money. Under these schemes, highly industrialized countries pay less-developed countries predominately in the Global South an amount commensurate to the emissions that are reduced. In theory, these avoided deforestation or REDD schemes would provide additional income for indigenous forest people and landless farmers as large sums of money are shifted from developed to developing countries.

There is general agreement that developing countries with forest area need financial assistance from the developed nations in order to reduce deforestation. The Stern Review on the Economics of Climate Change estimates that the amount of money needed for deforestation avoidance or prevention would equal roughly \$5–10 billion annually.⁹⁹⁶ Advocates of REDD believe that this money will directly benefit rural populations by generating increased employment and incomes. If this scenario unfolds, then the programs would be a source of much-needed green jobs for rural and forest economies.

The REDD schemes are not without their critics, however. Concerns have been expressed that the unequal structure of land ownership, as well as corruption, may prevent the economic benefits from actually reaching the intended recipients. These critics also warn that the World Bank, NGOs, and governments will make decisions without consultation with local forest people, who in many cases have historically been stewards of the forest. Some believe that reliance on market-based mechanisms will simply continue the problems that now plague overseas development assistance in general.

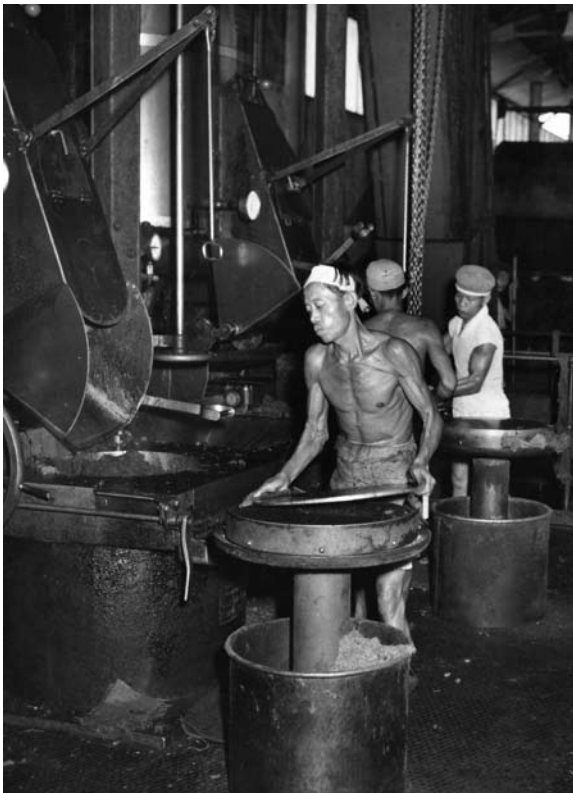
At this time, there are very few examples of REDD schemes and little empirical data on whether these programs actually provide additional sources of employment and income for indigenous people in forest communities. For this reason, an analysis of the economic benefits of these schemes is beyond the scope of this report. Assuming that the number of avoided deforestation and REDD schemes are likely to continue during the U.N. climate negotiations process, more information is needed on the economic and employment implications of these and similar programs and how funds would actually be distributed to the intended recipients.

Biofuels Boom

Tackling deforestation is likely to become more challenging as forests come under increasing pressure from the boom in biofuels. Biofuels production has been heralded in the past few years as a way for countries to reduce their carbon emissions, reduce their dependency on oil, and stimulate their local and rural economies. However, biofuels are now under increasing scrutiny from researchers and environmentalists for contributing to rising food prices and the loss of biodiversity, and for failing to reduce overall carbon emissions. Recent studies on biofuels have shown that if forests are cleared to produce biofuels, there is actually an increase in lifecycle emissions.⁹⁹⁷ The reason for this is two-fold: first, when forests are cleared to make room for biofuels, carbon is emitted into the atmosphere; second, forests absorb more carbon than agricultural land and thus reduce the carbon absorption of the land.

The growth in palm oil production in Indonesia and Malaysia is particularly alarming. By 2005, global production of palm oil totalled 12 million hectares. Indonesia has the fastest rate of increase in the conversion of forest-covered land into large palm oil plantations. Despite the rising social and scientific opposition to palm oil and other biofuels, production is likely to continue because these fuels remain a highly profitable and relatively inexpensive source of energy.

The status of biofuels as a source of clean and renewable energy is presently a source of some controversy. Those who take a full lifecycle approach to this question often maintain that, when the



deforestation and other land-use changes are considered, along with the quality of employment, the impact on emissions levels, and the energy inputs involved, then biofuels are far from green. Others hold a brighter view of biofuels, especially “second-generation” fuels derived from sources like switchgrass. But for now, workers engaged in the production of biofuels cannot yet be categorized as green in any definitive sense, and more work needs to be done in this area.

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Oil palm fruit is loaded into presses and the oil collected in large tanks underneath, at this factory in North Sumatra, Indonesia.

Afforestation and Reforestation

Afforestation and reforestation projects replace non-forest land with new forest cover. Afforestation differs slightly from reforestation in that it uses land that was not formerly forestland. Both projects are effective ways to increase carbon absorption and reverse desertification, which is often caused by deforestation and poor agricultural practices.

The United Nations Environment Programme (UNEP) recently launched a major tree-planting campaign called the Plant for the Planet: Billion Tree Campaign with the goal of planting 1 billion new trees each year. The number of trees already planted exceeds 2.1 billion, while the number of pledged trees is 3.6 billion. Due to the success of the program, UNEP has expanded its goal to plant 7 billion trees by the end of 2009.⁹⁹⁸ Participating countries include Ethiopia, Mexico, Turkey, Kenya, Cuba, Rwanda, South Korea, Tunisia, Morocco, Myanmar, and Brazil.⁹⁹⁹

While it may seem obvious that these afforestation and reforestation projects would be considered green employment, it is important to consider what type of work is generated from these activities. Currently, the industry standard is dominated by seasonal, contract work. The planting season is very short, particularly in temperate forests, where workers may be employed for as little as 8–12 weeks. Tree planting is also generally low paid with few-to-no benefits. Payment is commonly determined by piece wages, which often leads to rushed work and long hours on the job. Creating “green” jobs may necessitate more-vigorous project requirements to ensure that decent work is created with above poverty-level incomes.

The amount of new employment generated will also depend largely on the size of the project and whether the work is manual or mechanized. Mechanized tree planting has a much lower labor intensity than manual planting. Machines are able to plant between 400 and 1,500 trees per hour depending on the type of machine, the size and species of the seedling, and the skill level of the crew.¹⁰⁰⁰ Manual reforestation is physically challenging and is done at a much slower pace. Manual forestry workers literally dig holes and plant tree seedlings in the ground. On the positive side, mechanization generally increases safety and the ability for companies to pay higher wages.

Other afforestation and reforestation work includes cutting down extra trees, removing brush around the trees, slash burning, and pruning the new trees to maximize tree growth. Afforestation and reforestation jobs also include the workers who grow seedlings in nurseries and people who transport trees to the forest.

Afforestation and reforestation projects that remove carbon from the atmosphere have recently been included under the Clean Development Mechanisms (CDM) of the Kyoto Protocol. The first project, officially registered in November 2006, involves restoring 2,000 hectares of eroded land in the Pearl River Basin in China in order to develop a sustainable harvesting industry for local communities.¹⁰⁰¹ Over the next several decades as countries and companies try to grapple with how to reduce their carbon emissions, more and more CDM afforestation and reforestation projects are likely. Because decent work standards are not required under the current CDM rules, the work created by these projects is likely to follow the industry standard. This could change

over the next several years if governments are willing to discuss minimum work rules required for CDM eligibility. Certainly there is no way of knowing with any degree of certainty whether or not these afforestation and reforestation projects will have positive or negative consequences for communities, but it is more likely to have positive benefits if these jobs provide decent employment for workers.

Agroforestry

Agroforestry, a type of afforestation project, is the process of planting integrated tree systems on agricultural land in order to diversify and increase the productivity of the land. Agroforestry practices include: agrosilvicultural (planting trees with crops), silvopastoral (trees with livestock), and agrosilvopastoral (trees with both crops and livestock). There are a multitude of environmental benefits associated with agroforestry, including watershed protection, enhanced biodiversity, and improved soil quality. These practices extend the period of agricultural production on the land, therefore reducing the need to clear additional forestland. For this reason, it is considered a practice that can help slow tropical deforestation.

Agroforestry has a greater potential to sequester and store carbon than most land-use changes. The potential exists not in the level of carbon stored, but in the vast amount of underutilized land that can be enhanced by adopting this practice. Depleted agricultural and recently deforested land can be transformed into high productivity cropland and store an average of 80 tons of carbon per hectare or more.¹⁰⁰² According to the World Agroforestry Center, there are 600 million hectares of unproductive cropland that could be converted into high-productivity farming with a medium-level carbon sequestration potential. Additionally, 300 million hectares of agricultural land could become more sustainable through agroforestry.¹⁰⁰³ As global climate change leads to rising temperatures accompanied by increased storm intensity and changes in rainfall patterns, the adoption of agroforestry practices will become increasingly important in helping farmers adapt to changes in the environment.

Integrating trees with crops and livestock is not a new concept. Farmers have practiced agroforestry to varying degrees for hundreds of years. Because of the myriad environmental benefits, farmers who effectively adopt or enhance their agroforestry practices could be considered green agricultural workers. In recent times, more and more poor farmers have used agroforestry practices to help sustain their livelihoods. The World Bank estimates that there are nearly 1.2 billion people who already depend on agroforestry to some extent for food, fuelwood, and non-timber forest products (NTFP) for subsistence and additional sources of income.¹⁰⁰⁴

Many large agroforestry projects have been developed in Africa, Asia, and Latin America. There is a general consensus that agroforestry has a positive impact upon farmers, but there is limited data on individual projects. The following is a brief snapshot of recent agroforestry projects in Africa, as compiled by the World Agroforestry Centre:

- ❑ In East Africa, about 200,000 smallholder dairy farmers use agroforestry to produce fodder as an additional source of food for their livestock. Cost analysis showed that farmers who planted an average of 500 trees increased their farm income by over 25 percent, from \$95 annually to \$120. These funds are generally used for household improvements and school fees for children.¹⁰⁰⁵
- ❑ In Tanzania, more than 300,000 hectares of degraded soil were renewed through the indigenous ‘ngitili’ system, a method where native trees are planted on grazing land in order to protect the land during the dry season. This process was shown to increase earnings, provide better nutrition, increase crop production, and reduce time spent collecting fuelwood.¹⁰⁰⁶
- ❑ In 2003, an estimated 200,000 farmers in Eastern and Southern Africa were using leguminous trees instead of fertilizers on their maize farms.¹⁰⁰⁷

Despite the fact that many smallholder farmers already practice agroforestry to some extent, its potential still has not been met. Comprehensive agroforestry programs—which include some combination of fruit trees, medicinal trees, timber, fertilizer trees, and fodder for animals—have the capacity to alleviate poverty, improve health, and help meet the Millennium Development Goals. Agroforestry also contributes to food security and improved health by increasing the amount of food and farm products available for consumption. This helps fulfill the subsistence requirements of agricultural households and has been shown to reduce hunger, improve nutrition, and increase accessibility to medicinal trees.

Agroforestry can also help alleviate fuelwood shortages by growing timber on agricultural land, which is especially significant for women who make up 60–80 percent of small farmers and are often burdened with traveling far distances to collect wood. The increased production and diversification of farm products can also lead to supplementary sources of income as farmers are able to sell additional products in local markets. Agroforestry also has a great potential for employment generation, especially for rural areas.

One study that looked at 200 farms in India showed an income increase from \$56–\$60 an acre per year to \$598–\$786 an acre per year through the integration of multiple types of trees.¹⁰⁰⁸ The increased income was attributed to selling fruit and timber as well as other activities such as basket weaving and raising livestock. Employment for the farmers also increased from seasonal to year-round work, thereby eliminating the need for farmers to migrate in search of additional work. While it is widely accepted that developing comprehensive agroforestry practices increases income, these projects are limited by the lack of funds available. These projects have large upfront costs and an extremely long payback period, and therefore must rely on external funding sources. Unless there are large, ongoing, sustainable sources of funds designated for agroforestry, they are unlikely to be scaled up in a way that makes a significant impact on deforestation and greenhouse gas emissions.

Sustainable Forest Management (SFM)

Illegal logging remains one of the major barriers toward achieving sustainability in this sector. Illegal logging practices range from avoiding taxation to extracting wood from a protected area. These practices undercut the prices of sustainably managed forests and make it difficult for

companies engaged in sustainable forest management (SFM) to compete. While weak governance and corruption in forest countries are often blamed for illegal logging practices, the demand for lower-priced wood products in developed countries is also a main driver behind illegal logging as countries or regions like the United States, European Union, Japan, and China have done little to stop the purchase and import of illegal logs.

Table II.6-4 shows some of the highest estimates of illegal logging in selected countries.¹⁰⁰⁹ The practice is pervasive throughout developing countries, but it also exists in the European Union, Canada and the United States to a somewhat lesser extent. The World Bank estimates the total market value of timber lost to illegal logging to be more than \$10 billion per year. It also estimates that an additional \$5 billion in uncollected taxes and royalties is lost due to corruption.¹⁰¹⁰

Table II.6-4. Estimates for Illegal Logging, Selected Countries

Country	Share of Logging that is Illegal (percent)
Cambodia	90–94
Bolivia	80
Brazil	20–47, as high as 80 percent in some regions
Indonesia	60–70
Peru	80
Ecuador	70
Gabon	70
Papua New Guinea	70
Ghana	60
Cameroon	50
Myanmar	50
Russia	50 in Russian Far East 10–15 in North-West Russia

Sources: See Endnote 1009 for this section.

From an employment and income perspective, illegal logging relies on cheap labor and would not be considered decent work. In addition, local communities and governments are further hurt by the loss of large sums of tax revenue that could be used to improve basic infrastructural needs (schools, hospitals, roads, water, energy, etc.).

Roundwood Production

Roundwood production, which includes industrial wood products such as pulp for paper, lumber and wood panels, as well as wood for fuel, is on the rise. From 1961 to 2005, roundwood production has increased steadily from 2,342 million cubic meters to 3,503 cubic meters per year.¹⁰¹¹

Industrial wood and fuelwood each share about half of total roundwood production, but these wood products vary widely between developed and developing countries, with industrial products used mainly in the developed countries and fuelwood used predominantly in the developing countries.

In 2005, the United States, India, China, Brazil, Canada, and Russia produced about half of the total global roundwood production.¹⁰¹² Even though China is one of the top producers, it is also the largest importer of roundwood.¹⁰¹³ China's overall imports of roundwood have tripled and its trade with Russia has increased 21-fold over the past decade.¹⁰¹⁴ Rising fuel prices have contributed to the growing demand for wood as a cheaper alternative to fossil fuels.

Roundwood production is expected to continue on this growth pattern as the global population increases and as the growing demand for paper, building materials, and cheap sources of fuel continues. Approximately one-third of the world's forests are already used mainly for wood production, fiber, and non-timber wood products.¹⁰¹⁵ This increased demand for wood and other non-timber forestry products (NTFP) puts additional pressure on a system that is already compromised by deforestation and illegal logging—underscoring the need for a sustainable forestry sector.



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Land desecration in the Amazon in the name of progress. Venezuela

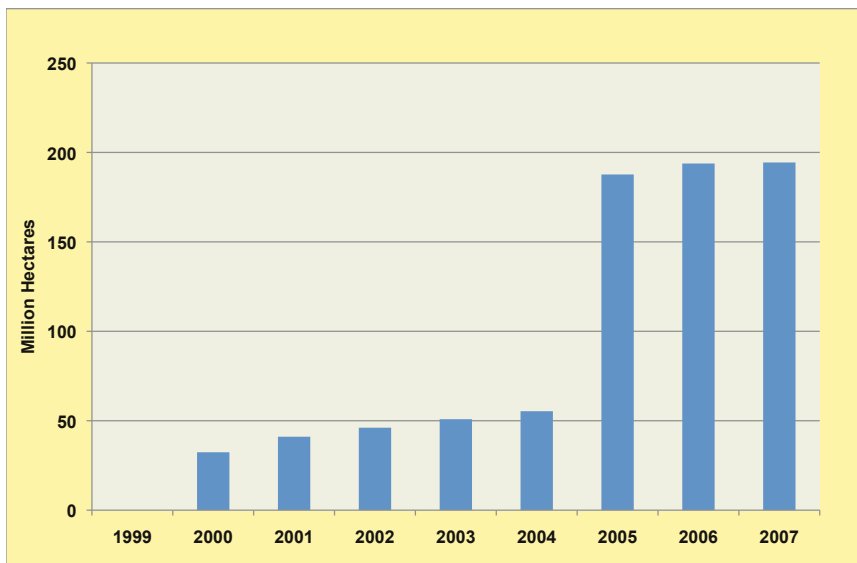
Sustainable Forest Management and Certification Schemes

Following a series of failed intergovernmental agreements in the 1970s and 1980s, sustainable forest management (SFM) emerged in the early 1990s as a method to combat deforestation and illegal logging. The basic premise behind SFM is that the production of forest products must be balanced with maintaining forest ecosystems in order to ensure that forests are available for future generations. It is based on three pillars of sustainable development: economic, environmental, and social. Although there are no universal standards, there are several key elements for SFM focusing on biological diversity, conservation and the health of forests, soil and water resources, carbon mitigation, socio-economic benefits, and the productive capacity of forests.

Certification standards have been developed in many countries and regions of the world to enhance sustainable forest management at the forest level. There are currently over 50 different certification schemes, but the most commonly used ones are the Forest Stewardship Council (FSC) and Programme for Endorsement of Forest Certification (PEFC) schemes. Certification schemes work by providing labels on wood and wood products that guarantee to purchasers and customers that the products were produced in a sustainable manner.

Certification represents only a fraction of the total global wood market and forestry sector, but has been growing especially rapidly in the last few years.¹⁰¹⁶ (See Figure II.6-1.) These schemes are being driven by governments like the European Union and by major retailers like IKEA and Home Depot, who are increasingly requiring certification as a cost of doing business. Certification schemes are currently limited by consumer demand and by the willingness among corporations and countries to demand certified projects. The cost of certification can also be a major barrier for small landowners and those in developing countries. Despite these limitations, certification represents a substantial portion of internationally traded timber. Even though certification is a voluntary system, it appears that it may become a prerequisite for the international timber trade.

Figure II.6-1. Growth of PEFC-Certified Forests, 1999–2007



Source: See endnote 1016 for this section

Source: PEFC

Certification schemes are still largely concentrated in the Global North. Table II.6-5 shows the global distribution of Forest Stewardship Council certificates.¹⁰¹⁷ Although there are 79 countries that participate in FSC certification, more than 80 percent of the certified forest cover is concentrated in North America and the European Union.¹⁰¹⁸ PEFC's certificates are similarly concentrated in the Global North, with Canada at 76 million certified hectares out of PEFC's total 194 million hectares while Brazil has less than 1.0 million certified hectares.¹⁰¹⁹ (See Table II.6-6.) In 2005, the International Timber Trade Organization reported that less than 5 percent of tropical forests (2.4 percent of protected forests, 7.1 percent of productive forests) were sustainably managed.¹⁰²⁰

Table II.6-5. Forest Stewardship Council Participation by Region, 2008

Region	FSC-Certified Area (hectares)	Number of Certificates	Share of Total FSC Certification (percent)
Europe	51,738,120	409	50.01
North America	33,568,390	143	32.45
South America and Caribbean	11,541,973	251	11.16
Africa	3,011,293	40	2.91
Asia	1,974,650	59	1.91
Oceania	1,621,973	31	1.57
Total	103,456,399	933	100

Source: See Endnote 1017 for this section.

Table II.6-6. PEFC-Certified Forests, 2007

Country	Endorsed Certified Forest Area (hectares)	Chain of Custody Certificates (number)
Canada	76,022,900	90
United States & Canada (SFI*)	54,565,945	23
Finland	20,719,735	113
Australia	8,674,169	15
Norway	7,537,102	10
Germany	7,272,106	601
Sweden	4,289,287	72
Austria	3,960,200	239
France	3,318,556	957
Czech Republic	1,849,754	221
Chile	1,681,578	15
Spain	1,047,989	108
Brazil	973,830	2
Slovak Republic	862,067	6
Italy	641,774	71
Switzerland	403,916	228
Belgium	255,122	105
Denmark	206,395	18
Latvia	80,761	3
Luxemburg	25,469	6
United Kingdom	0	523
Netherlands**	0	53
Japan**	0	42
China**	0	8
Portugal	0	7
Hungary**	0	3
India**	0	1
Ireland**	0	1
Malaysia**	0	1
Morocco**	0	1
New Zealand**	0	1
Philippines**	0	1
Total	194,388,657	3,545

*SFI = Sustainable Forestry Initiative. **A number of timber and paper processing or trading companies in the country hold the international PEFC Chain of Custody certification where there is no national PEFC-endorsed certification scheme. Source: See Endnote 1019 for this section.

Employment Consequences of Sustainable Forestry Management

There are several key employment benefits provided by sustainable forestry management and certification schemes. Practicing sustainable forest management means that the forests will be maintained for as long a period of time as there is a market value or legal protections, which provides long-term employment opportunities for rural economies. Certain certification schemes also have very specific standards for employment. For example, the PEFC, FSC, and the Malaysian Timber Certification Council (MTCC) require that in order to be certified, certain employment standards must be met including compliance with national labor laws and international agreements, minimum health and safety rules and protective equipment for workers, guaranteeing the right to join a union, training and education programs, and no child labor.¹⁰²¹

A major study by Yale University looked at certification schemes in several developing countries and found that the overall economic and employment consequences of certification were mixed. The outcomes differed by country, but in general the positive outcomes were additional tax revenue, increased wages, improved working conditions, and market transparency, which led to compliance with contracts and less illegal logging. There were varied results with regard to how certification affected the number of jobs. In some cases, there were increased levels of employment, but for others there was an overall decline in the number of jobs. Certification puts limitations on the production of timber, which can lead to a decrease in the number of hectares harvested, and decreased volume can, at least in the short term, reduce the number of jobs.¹⁰²²

Conclusion

Jobs in the forestry sector should be more broadly defined to include all work that provides income and helps alleviate poverty. These jobs include the formal sector, informal sector, and subsistence workers. Currently, it is unknown how many people are employed in the forestry sector, but a rough estimate of those who are dependent upon forests to some extent for income and subsistence is likely to be between 1 and 1.75 billion.

It is widely accepted that land-use changes in the forestry sector are desperately needed and that these land-use changes will result in economic changes. Due to the lack of information about employment in this sector, it is impossible to give a global quantification of green jobs that might be created through agroforestry, afforestation and reforestation, sustainable forest management (SFM), and avoided deforestation projects. These sustainable land-use changes are likely to have positive long-term impacts on employment measured both in the quality and quantity of jobs. These sustainable land-use changes may, however, have some immediate negative consequences, but sustaining this sector is likely to have a long-term positive effect on employment as jobs are extended over a much longer period of time.

Much of this uncertainty around green employment in the forest sector is due to a lack of information about general employment in the forestry sector. The next Global Forest Resource Assessment (GFRA), published by the FAO, will be released in 2010. This report presents an opportunity to compile a clearer and more consistent picture of forestry employment data. According to the 2005

GFRA report, “a focused effort should be made to improve the quality of employment statistics in a few key countries in which the reported statistics are missing, or are very high but may be based on minimal survey data or very simple estimation techniques.”¹⁰²³ The 2005 report included information from 138 countries; the 2010 report hopes to include 235 countries and territories. The 2010 survey will also “generate unprecedented information on deforestation, afforestation, and natural forest expansion.”¹⁰²⁴ In order to understand green employment in the forestry sector, it is imperative that the 2010 GRFA and similar studies analyze the employment and other socioeconomic impacts of these land-use changes.

