Paper Forests

Billions of trees are being planted to meet the world's soaring appetite for paper, but pulp plantations are hardly forests.

by Ashley T. Mattoon

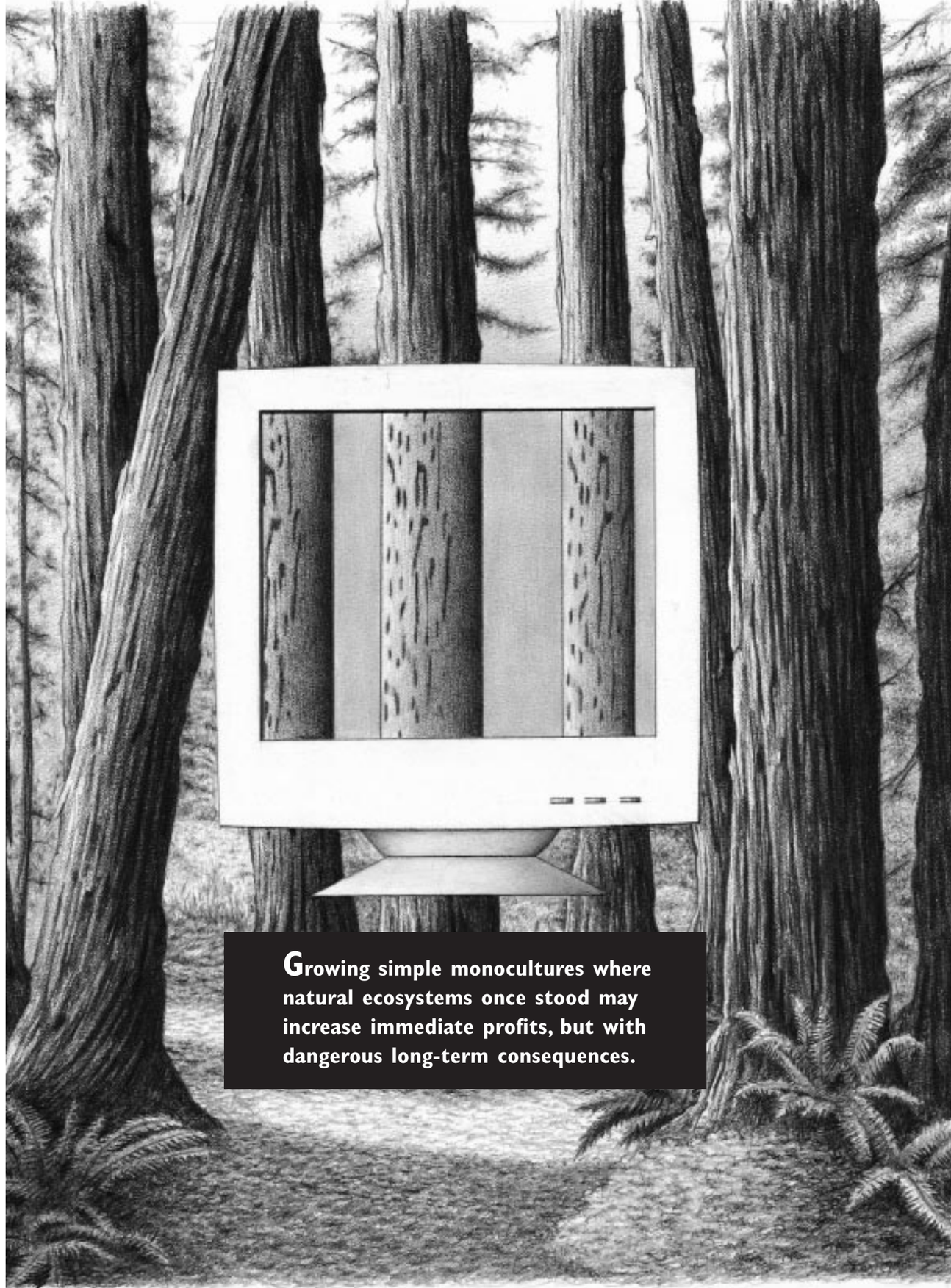
Open up International Paper's web page and the first thing you see, in large bold print, is: "We Plant an Average of 50 Million Trees Annually." International Paper bills itself as the world's largest private seedling grower: the company produces more than 300 million "genetically-improved" SuperTree® seedlings per year. Those aren't just trees they're planting—they're super trees. IP may be the biggest planter, but it is hardly unique in either word or deed. All over the world, large pulp and paper operations are cutting—and planting—trees at a record pace. And in an effort to convince the public that they are not only using forests responsibly, but improving them, the companies are continually churning out feel-good slogans like: "for every tree harvested, two are planted," "there are 20 percent more trees in the United States today than there were in 1970," "managed forests will help prevent global warming by absorbing carbon," and so on.

The claims go even further than that. Even as the Earth's natural forest area continues to shrink by as much as 16 million hectares per year, the major pulp and paper companies present themselves as a sort of antidote to the trend. The industry, which posted 1995 sales in excess of $337 billion, argues that it's actually creating forests. And while it sometimes acknowledges that these artificial forests house very little biological diversity, it generally claims that the spread of intensively managed tree plantations is good news for the natural forests that remain. Plantations, the argument goes, are potentially so productive that they could largely satisfy the demand for wood products, thereby relieving pressure on natural forests. Proponents of this view argue that the world's entire pulpwood demand could be met by a relatively small area of plantations. One recent study, based on 1993 data, concluded that plantations covering 40 million hectares could have met the world's total wood fiber demand for pulp in that year. That's an area less than 30 percent the amount of cropland usually planted in corn (about 140 million hectares).

Pulp and paper companies are not alone in their high expectations for industrial tree plantations. Many forestry consultants, governments, and even environmental groups see large-scale plantation forestry as the key to a sustainable wood supply for what is the most rapidly growing portion of the forest products sector: the production of woodchips and pulp to make paper, particle board, and other reconstituted wood products. Some argue that the global shift to tree farming is the forester's equivalent to the agricultural "Green Revolution" which favored high-yield crop varieties and large, mechanized farms at the expense of smaller, more diverse operations.

The planting of trees as crops is hardly a recent phenomenon. Brazil, which now boasts the world's largest planted area of eucalyptus (a group of popular plantation trees native to Australia), undertook its first extensive eucalyptus plantings around the turn of the century, as a fuel supply for the São Paulo railway. And given the pressures on the world's surviving natural forests, it's obvious that plantations must play a major role in the industrial wood supply. But there is growing evidence that the prevailing methods of plantation development are doing serious damage—both to natural forests and to the people who live in or around them.

To understand the problem, it's necessary first to grasp the rate and scale of current developments. In



Growing simple monocultures where natural ecosystems once stood may increase immediate profits, but with dangerous long-term consequences.

ILLUSTRATION BY BRIAN BATTLES

the past, the world's pulp mills got their pulpwood primarily from old-growth forests and second growth stands in the northern United States, Canada, and Scandinavia. Over the past 20 years, however, the wood fiber supply has begun to shift southward, to the southern United States and to a group of relatively new players, such as New Zealand, Indonesia, Chile, Brazil, and South Africa. In many southern countries, the prospect of a pulp and paper bonanza has resulted in lavish government subsidies and a rush of foreign investment. Of course, the underlying goal of the investments—both public and private—is not to save forests but to make money, by producing wood fiber as quickly and cheaply as possible. Ready money and an apparently insatiable market have led to enormous increases in plantation cover. In Latin America, for example, plantation area has increased 50 percent in just the last 12 years, to a current total of 7.5 million hectares—an area slightly larger than Panama. Many countries with large plantation estates plan to double their plantation area by the year 2010. Indonesia is planning to *triple* its plantation area within the next 15 years.

Despite the huge amounts of land involved, actually quantifying plantation extent is not an easy task. The global data on forest cover and land-use patterns are incomplete and often unreliable—the term "plantation" itself has no universally accepted definition. But a rough picture is available from the United Nations Food and Agriculture Organization, the only institution that regularly attempts to assess the extent of natural and plantation forest on a global scale. In its most recent survey, *State of the World's Forests 1997,* the FAO estimated that between 1980 and 1995, global plantation cover doubled in size, expanding from approximately 90 million hectares to 180 million hectares—just 10 million hectares less than the total land area of Mexico.

Certain limitations in the FAO survey, however, mean these numbers must be handled with care. The survey provides only very rough estimates of plantation cover in developed countries, for example, because of the difficulty of distinguishing natural forests from plantations in those regions. In developing countries, the survey doesn't include the extensive agricultural tree plantations, such as palm oil or rubber crops. Nor are industrial plantations distinguished from those that serve non-industrial purposes, such as community fuelwood supply, agroforestry, and environmental protection (through erosion control, watershed management, and so on). Also omitted is a key factor for understanding current trends: the distinction between plantations established in areas deforested long ago and those established in areas deforested as a prelude to plantation development.

But it is clear that as much as 100 million hectares of the global plantation estate is for industrial use. About three-quarters of that area is planted in relatively slow growing species—everything from the slower growing pines to teak. These stands are used primarily for producing timber in the ordinary sense of the term—the sawnwood and panels used in building construction and furniture making. (Their primary contribution to the pulp market is through scrap wood.) The remaining quarter of plantation area is planted in fast-growing species, mostly eucalyptus and the faster-growing pines. These are used mainly for pulpwood, and to a lesser extent for fiberboard and other reconstituted wood products.

From Timber to Fiber, From North to South

Even though the fast-growing plantations thus far comprise only a quarter of total industrial plantation cover, they are, for a couple of reasons, the trend-setting sector of the forest products industry. There is, first of all, the continuing growth in the paper and reconstituted wood products markets. While the production of sawnwood has roughly plateaued since the 1970s, wood pulp production has grown by almost two-thirds and particle board production has increased nearly three-and-a-half times. In addition, manufacturing improvements now allow the use of lower-quality immature woods—and in some cases, even wood fiber—in furniture and construction material, without compromising the strength or durability of the products. Forest management is therefore shifting away from its old focus on high quality *timber* and increasingly towards the production of high quantities of *fiber*.

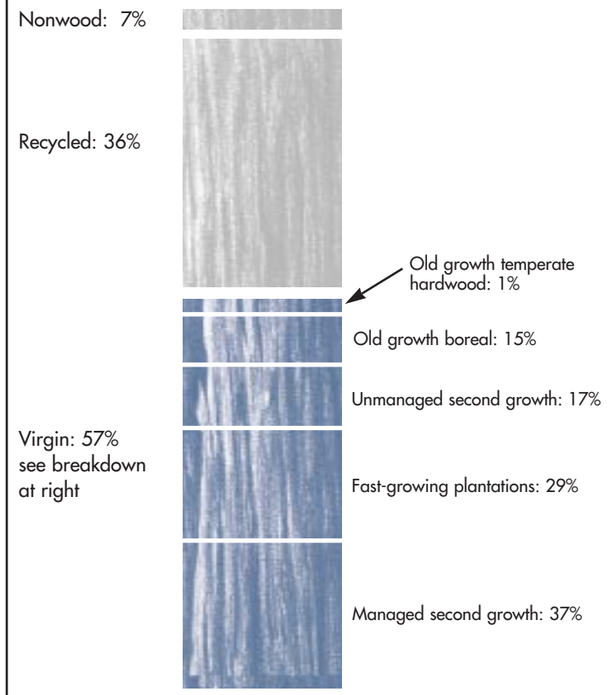
Currently, approximately 57 percent of the fiber used in paper production comes from virgin wood pulp; the rest comes from recovered paper (37 percent) and nonwood fibers such as wheat straw (6 percent). Roughly one-quarter of the world's industrial wood harvest goes directly for pulpwood, but the pulp stream absorbs an additional 15 percent of the harvest as waste from other processes. At present only about 29 percent of virgin pulp is coming from the fast-growing plantations, according to a 1996 study by the International Institute for Environment and Development (IIED), a London-based research group (see figure, page 23). But the enormous increases in plantation cover virtually guarantee that the percentage will rise rapidly over the next decade.

The pulp boom is not just a forestry trend; it is also an expansion of heavy industry. The southeastern United States, for example, is rapidly expanding its pulp mill capacity: the expanded mills—some of which cost over $1 billion—have boosted the region's pulp production nearly 20 percent over the last decade. In response to the new pulp capacity, the number of wood chipping mills has increased from 40 to 140 over the same period. The chip mills, in turn, have allowed the industry to penetrate the forests in ways that had not previously been profitable—shipping whole logs out of forests can be expensive, but transporting chips is relatively cheap. The insatiable appetite of these 140 log-chewing behemoths has transformed the landscape of the region, consuming more than 485,000 hectares of plantation and natural forest per year. Experts predict that in order to meet the industry's increasing demand for fiber, 70 percent of the native pine forests in the southern United States will be converted to monoculture pine plantations by 2020—a doubling of the region's current plantation area. The current harvesting rate of pine is probably surpassing the growth rate by 12 to 14 percent. And as the pine supply diminishes, the industry has increased its reliance on hardwood pulp. At mid-century, hardwoods accounted for 13 percent of the region's pulpwood; today they account for 37 percent, and the hardwood harvesting rate is expected to overtake the growth rate by 2010. In the meantime, an increasing share of the chips is being exported, to feed pulp mills in Japan. Between 1989 and 1995, southern hardwood chip exports increased five-fold.

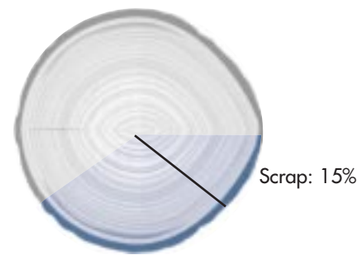
On the whole, however, northern countries have grown increasingly less hospitable to that kind of wholesale exploitation (with the exception of the chaotic logging in eastern Siberia, the extent of which is very difficult to determine). That reticence has created an opening for southern producers, who are also capitalizing on a natural advantage: warmer climates. In the moist tropics, where tree growth is continual year-round, large pulp mills can be supported by a much smaller land base than in the North. Annual growth rates of 3 to 5 cubic meters per hectare (m^3/ha) in eastern Canada and 10 m^3/ha in the southern United States pale in comparison to rates as high as 25 m^3/ha in Indonesia and 30 to 40 m^3/ha in Brazil. And while it takes at least 15 years to grow pine large enough to cut in Alabama, rotations of eucalyptus in Brazil can be as short as six to eight years. The plantation area required to feed a 500,000 ton-per-year pulp mill in a Nordic country may be up to 16 times the area required in Brazil.

In addition to the faster growth rates, both land and labor are often much cheaper in southern countries—a combination that can greatly reduce overall production costs. In September 1997, it cost $449 to produce a ton of bleached hardwood pulp in the United States, while in Brazil the average is $357. One Brazilian company, Aracruz Celulose S.A., the world's largest producer of bleached eucalyptus market pulp, has reduced its production costs to just $279 per ton. With costs as low as this, it is no surprise that industry giants from the North are rapidly flocking to the South to buy up land and engage in joint-venture projects with southern companies.

The Global Pulp Stream: Where is the Fiber Coming From?



Virgin wood pulp accounts for roughly 40% of the industrial wood harvest. (The other 60% goes mainly for lumber.) About 25% of industrial wood is cut directly for pulp; the remainder of the virgin pulp stream consists of scrap from other processes.



Source: Forest type percentages are from IIED (see text). Other percentages are from a variety of sources. All percentages are approximate.

Between 1995 and 2000, woodpulp capacity in the United States and Canada is projected to increase by a mere 1.5 percent and 3.5 percent respectively, while in Thailand this increase is expected to be 166 percent, in Indonesia 123 percent, and Chile 51 percent. Brazil, already a well-established producer, nearly doubled its pulp exports in the first half of the decade, from 1,035,000 tons to 1,950,000 tons. The country's 5 million hectares of plantation now account for approximately 60 percent of its industrial wood production. According to journalist Bill Finch, "the joke in the forest industry is that the lobby of the Rio de Janeiro airport looks like a convention of the Society of American Foresters."

Leaf through any of the industry journals these days, and you'll find all sorts of examples of this North-South consolidation. The Japanese New Oji Paper Co. has recently invested in plantations in Vietnam, Fiji, and New Zealand. By the year 2000, New Oji's investments in "Australasian" tree plantations are expected to reach approximately $218 million. Champion International of Stamford, Connecticut, recently added to its Brazilian holdings with a purchase of a 174,000-hectare tree farm in the state of Amapa. In addition to providing a supply of woodchips to Champion's paper mills in Florida and Alabama, the newly acquired lands will also supply woodchips to the global market. Champion is considering investing another $1.5 billion in pulp and paper capacity in Brazil. And as the money flows in, the wood chips and pulp flow out. Over the past four decades, international trade in wood fiber has quadrupled. Today, approximately 20 percent of pulp production, and 25 percent of paper production is traded internationally.

Few countries illustrate the trend toward globalized markets better than Japan. Japan is second only to the United States as a producer and consumer of paper and paperboard: in 1995, the most recent year for which figures were available, Japan accounted for 10.7 percent of world paper production and 10.9 percent of consumption. Yet unlike the United States, which produces the majority of its own fiber, Japan's raw material production is practically insignificant. It is not surprising, then, that the country is the world's biggest importer of wood chips (accounting for 70 percent of the international market in 1994), and a major importer of pulp (almost 12 percent of the international trade). In addition to importing from the United States and Canada (its traditional sources), Japan is now buying more and more fiber from Australia, Chile, Indonesia, South Africa, and Brazil. Had this article been published on Japanese paper, you might now be holding in your hands a piece of material woven from the forests of perhaps half a dozen different countries on at least three continents.

Many southern countries are liquidating a substantial share of their natural forests to feed the international woodchip market. In Chile, for instance, the forest products export sector has grown from $334 million in 1985 to $2 billion by 1995, largely on the strength of a heavily subsidized plantation program. Monterey pine (*Pinus radiata*), the plantation tree of choice in Chile, now covers an estimated 1.3 million hectares. Yet much of the chips and pulp exported thus far have come, not from plantation wood, but from the natural forests displaced by the plantations. Between 1978 and 1987, approximately 48,600 hectares of native forest were clearcut or burned so that plantations could be installed. In recent years, an estimated 20,000 hectares of native forest have been logged each year, largely to make way for pulp plantations. Two exotic pine and eucalyptus species now cover close to one fifth of Chile's total forest area. The same trend is apparent in some parts of the developed world as well, such as the southern United States, or the Australian island of Tasmania, where 140,000 hectares of pine and eucalyptus plantation have been installed, much of it after native old growth forests were felled and chipped. About 80 percent of Tasmania's wood chips are shipped to Japan.

How green is the plantation economy?

Plantations, for pulp and for other purposes, are now a necessary and permanent part of the forest economy. But a number of factors associated with the current boom—the loss of native forest in countries like Chile, the tremendous growth of the international paper market, the pulp and chip mill building frenzy—all of these factors invite a critical reassessment of the industry's current practices. Here are some of the standard industry claims:

Claim 1: *Plantations ease the pressure on remaining natural forests.*

The industry and governments involved in plantation development frequently claim that most, or all, or at least a substantial portion of their plantations are installed on lands that are already degraded, and that by bringing these lands into production, less cutting will be necessary in surviving natural forests. Some plantations are indeed growing on previously degraded sites, but the suggestion that the industry generally seeks out degraded land to grow trees is simply not credible. In the first place, the logic of high-volume investment wouldn't permit this: no executive who wants to keep his job is going to tie a billion-dollar pulp mill to the fate of degraded land if he can avoid doing so. Instead, he's likely to look for the best soils and the best water supply available—even if they happen to be underneath natural forests.

In the second place, there is plenty of hard, on-the-ground evidence from countries like Chile that plantations have been installed immediately after the felling of native forests, although few governments admit that such activities are a matter of policy. Indonesia, however, is an important exception. A 1995 report by the World Wide Fund for Nature observes that "Indonesia is perhaps the only country where the planned expansion of the pulp and paper industry openly involves the clearfelling of substantial areas of rainforest." As much as 60 percent of Indonesia's roughly 2 million hectares of plantation is thought to have directly displaced natural forest. The country plans to increase its pulpwood plantation area to about 6 million hectares by 2010.

This issue gained some international prominence in the fall of 1997, when fires set to clear land for palm oil and pulpwood plantations resulted in a conflagration that consumed an estimated 2 million hectares of forest. The Indonesian government initially laid the blame for the fires on slash-and-burn farmers, but satellite images showed that approximately 80 percent of the fires originated in lands controlled by industry. The fires are apparently being used to circumvent regulations that restrict plantation development to lands containing fewer than 20 cubic meters of merchantable timber per hectare—once burnt, the forest is "degraded" and available for development. In part, the Indonesian pulp crisis is driven by mill over-capacity: the plantations established to feed the country's new mills are not yet mature and mill owners are reported to be purchasing an average of 25 percent of their fiber from sources that may be operating—in one way or another—outside the law.

On a global level, it's very difficult to assess what proportion of plantation area is a direct, immediate displacement of natural forest. Such developments often involve some sort of subterfuge like burning or pirate logging, to bring a tract of land out of protected status. But according to some conservative estimates, 15 percent of all tropical plantation area was established directly over natural forest.

Claim 2: *Plantations allow unused land to be productive.*

Industry officials often claim that plantations have been established on land that was not being "used." Often, the argument is advanced with reference to forests or mixed landscapes inhabited by peoples who are not fully integrated into the mainstream economy. To the executives of a large company, whose operation requires the planting and harvesting of trees over thousands of hectares, the degree of "use" imposed upon a landscape by small-scale farmers and hunters may well seem hardly worth notice. Indeed, in some cases, it could be a kind of backhanded compliment to brand an area that has been occupied for thousands of years by indigenous peoples as "unused"—an unintentional recognition of how well used such areas actually are. But when the lands end up as plantations, the former occupants are often displaced. Their new homes are likely to be either urban shanty towns or much smaller areas of surviving natural forest where, eventually, even traditional use may reach an intensity too great for the land to bear.

Take the case of Aracruz Celulose, the Brazilian company producing the extremely low-cost pulp. Aracruz began developing its plantations in the mid-1960s, on the strength of a government decree that called for the "afforestation" of 80,000 hectares of the state of Espírito Santo. By 1994, Aracruz owned 15 percent of Espírito Santo's fertile coastal plain and had installed 132,000 hectares of eucalyptus in that state and in the neighboring state of Bahia. The land Aracruz appropriated in the 1960s was initially said to be uninhabited, but it has now been established that nearly 7,000 families were displaced—in some cases forcibly—when Aracruz took control of the land. Many of these people received no compensation for the lands they lost. The Tupinikim and Guarani indigenous peoples, two groups that lost land to Aracruz, have since launched an international campaign to have their traditional territories restored.

In some cases, plantations have displaced not traditional but modern agricultural regimes. Spain, for example, experienced a plantation boom following its entry into the European Community in 1985. The country now has more than 5 million hectares of pulp plantation, much of it growing on former farmland. In Hawaii, Japan's New Oji Paper Company is interested in taking a 55-year lease for 10,000 hectares of an old sugar cane plantation (the proposal is currently on hold due to public opposition). Plantation encroachment on productive farmland is likely to increase the pressure that *agriculture* is putting on natural forests. According to the FAO, an additional 90 million hectares of cropland will be needed by 2010 to feed the world's growing population; at least half of that is already expected to come from the conversion of forest.

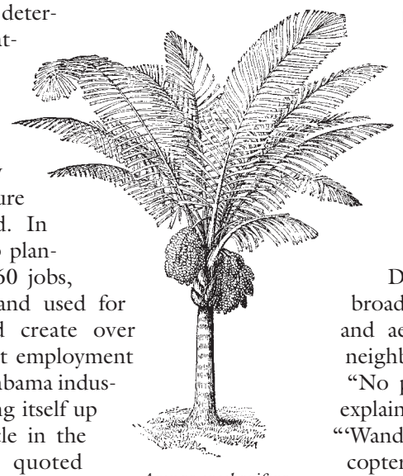
Cedrus Atlantica (Atlas Cedar)

Claim 3: ***Plantations create jobs and help local communities.***

The industry frequently claims that industrial plantations create jobs for local people and generate much-needed income for local communities. Given the number of operations required to run a plantation—preparing land, planting, tending the trees, operating the mills—it's not hard to understand why many governments have been willing to accept this argument, and to offer substantial financial incentives to plantation developers in the hope of economic growth. But plantation work is generally grueling, dangerous, and very low-paying; the hours are long and job security is often minimal. Yet where plantations have displaced communities—thereby creating a class of landless, jobless poor—plantation labor may be the only remaining option. On the Aracruz plantations, for instance, some of the displaced people opted to return to their lands as Aracruz employees.

As far as employment is concerned, industry trends are not encouraging. Increasing mechanization is steadily reducing the labor force. From installing the trees, to felling them, to producing pulp—all the new equipment is engineered to require as few people as possible. Since 1993 Aracruz has reduced its workforce from 7,000 to 2,700 employees (including the loss of 2,500 jobs that were contracted out). Bahia Sul Celulose, another Brazilian pulp giant, employs one plantation worker for every 45 hectares of trees, while local diversified agriculture provides 18 jobs per hectare, according to a 1993 study. In terms of investment capital, each of the 5,500 jobs provided by Bahia Sul in the early 1990s cost between $226,000 and $338,000—and much of that investment was public. In Indonesia, robots are being designed to handle seedling operations.

The same labor trends are at work in developed countries. In the United States, a recent study of Alabama pulp mills determined that only one job is created for every million dollars invested in pulp mills. In contrast, for every million invested in sawmills, nine jobs are created, and for every million invested in the furniture industry, 40 jobs are created. In Hawaii, a 10,000 hectare pulp plantation would produce 40 to 60 jobs, while the same amount of land used for diversified agriculture would create over 4,000 jobs. Even at its present employment level, many observers of the Alabama industry fear that the sector is setting itself up for major job losses. An article in the *Mobile Register* newspaper quoted Robert Lawton, an ecology professor at the University of Alabama in Huntsville, on the situation: "'We've got another 20 to 40 years of pine cropping before we are blown out of the water by cheap cropping in the tropics'…In the game of low-quality, high-volume production, 'Alabama is gonna get its pants beaten off.'"



Arenga saccharifera

Claim 4: ***Plantations are "sustainable."***

One of the most common and seductive suggestions that the industry offers in favor of plantation development is that plantations are essentially forests. If a plantation is like a natural forest, then it is essentially a healthy ecosystem, and it should therefore be possible to maintain that health indefinitely. It should, in other words, be "sustainable." But the ecological differences between industrial plantations and natural forests are so vast that comparing them in detail would be pointless: apart from the presence of trees, plantations bear almost no resemblance to real forests.

The key difference, of course, is diversity. Natural forests are some of the most diverse ecosystems on earth, but plantations—especially industrial plantations—are generally monocultures. Obviously, plantations have virtually no plant diversity; they have little wildlife value either because they lack habitat diversity and forage. Natural forests offer a huge range of "natural goods and services"—everything from fruit production, to habitat for crop pollinators, to flood control (see Janet Abramovitz, "Putting a Value on Nature's 'Free' Services," January/February). These aspects of a natural forest are also largely absent from plantations.

It is true that in recent years, some companies (Aracruz among them) have taken steps to reduce their environmental impacts, but industrial plantations still generally inflict a huge insult on the land. Like virtually all large-scale monocultures, plantations are susceptible to disease and pest outbreaks, so they commonly require heavy applications of insecticides and fungicides. Herbicides are also frequently used to prevent invasion of competing vegetation. New Zealand's plantation managers have used over 30 different pesticides, including highly toxic organochlorines (the class of chemicals that includes DDT). The pesticides are generally broadcast from airplanes or helicopters, and aerial spraying virtually insures that neighboring land will be contaminated. "No pilot can really fly a straight line," explains one New Zealand helicopter pilot. "'Wandering' is a recognized part of helicopter work and complete accuracy with spray coverage or seeding when flying by eye is nearly impossible…. Areas missed have to be reflown, adding to chemical costs and flying time."

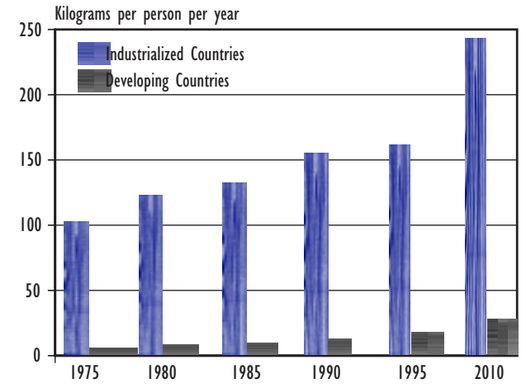
In addition to the pesticides, chemical fertilizers are required to compensate for the nutrients lost when whole trees are removed from the system every ten years or so. Site preparation and harvesting is done by heavy equipment that compacts soils, increasing runoff and erosion. While a company may endorse the need to manage its lands sustainably, profit, not ecological health, is the bottom line. And in many countries, the current regulatory and social climate offers the biggest profit to operations that crop trees as intensively as possible, with the prospect of moving on to fresh soils once the current land is exhausted.

Rethinking the Paper Economy

Industrial plantations could do much to reduce the environmental impacts associated with the production of raw material for industry. Farming trees in a concentrated area, in a sustainable way, is clearly preferable to mining the world's last remaining old-growth stands. But in their present form, pulp plantations are driven almost entirely by short-term commercial considerations, at tremendous social and ecological costs. Reforming plantation management is therefore crucial to the survival of the real forests. Several "stakeholder" coalitions are developing plans for better plantation management; they include the Forest Stewardship Council's "Principles and Criteria for Forest Stewardship" and the International Tropical Timber Organization's "Guidelines for the Establishment and Sustainable Management of Planted Tropical Forests." Plans such as these generally emphasize conservation, local economic health, integrated land-use planning, watershed protection, the need to reduce fertilizer and pesticide use, and clearer definitions of loaded terms like "degraded lands."

But no matter how carefully crafted it is, no plan has much of a chance if the world's growing appetite for wood fiber is not reduced. At least as important as forest management is the management of consumption. If it is hard to believe that consumption can (or should) be managed, that's testimony to the power of three assumptions, which are largely guiding the present course of development—and which are toxic to natural forests.

The most dangerous assumption is that growth in paper demand is inevitable. The FAO projects that global consumption of paper and paperboard will rise from 276 million tons per year in 1995 to 480 million tons in 2010. While developing countries are beginning to absorb a larger share of the world's paper, industrialized countries still account for over 75 percent of global consumption. On average, per capita consumption in industrialized countries is 158 kilograms per year—over eight times the developing world average of 18 per year. The United States, with approximately 4.7 percent of the world's population, consumes over 31 percent of the world's paper and paperboard. The United States, Japan, and Western



Per Capita Consumption of Paper and Paperboard, with FAO Projections to 2010

Europe combined represent less than 20 percent of the world's population and account for nearly 70 percent of its paper consumption. Even so, it is in the industrialized countries that most of the growth in consumption is expected to occur. By 2010, per capita consumption in the world's richest countries is expected to reach 241 kg per year (see figure above).

Timber industry analysts generally treat the prospect of consumption increases as a sign of healthy economic growth—as an improvement in the quality of life. But in real life, the quality isn't always so obvious. In the United States, the world's biggest paper consumer, per capita consumption increased from 312 kg in 1990 to 332 kg in 1995, the most recent year for which figures were available. Yet that 20-kg increase, which boosted U.S. per capita consumption to nearly seven times the global average, would probably be regarded by much of the U.S. population as, on reflection, a mild *deterioration* in the quality of life. If you doubt this and you live in the United States, try an experiment: save a week's worth of junk mail, weigh it, and multiply the results by 52. (The average U.S. household receives 553 pieces of junk mail in a year.)

While the prevailing economic view still envisions consumption increasing *ad infinitum*, there is already a small but growing body of literature devoted to the practical problems of reducing consumption. And the consensus is that reduction—even radical reduction—is possible. For example, a 1994 con-

ference on the issue, held in Tomales Bay, California, suggested a goal of a 75 percent reduction in U.S. wood consumption over the course of a decade. (See Atossa Soltani and Penelope Whitney, eds., *Cut Waste, Not Trees*, San Francisco: Rainforest Action Network, 1995.) A broader assessment is available in the work of analysts like Friedrich Schmidt-Bleek, an economist with the Wuppertal Institute, a German think tank, who argues that industrialized countries could ultimately cut their materials consumption in general by 90 percent. (Schmidt-Bleek was a member of the "Factor 10 Club," which developed this thesis in 1994.) These theories have received relatively little public attention, but they merit serious attention from policymakers looking for a fresh approach to economic and environmental problems. And in the current context, it's hardly a question of radical reduction: even stabilizing paper demand would be an enormous improvement over the status quo.

The second toxic assumption guiding present development is that virgin wood fiber must continue to be the primary raw material source for the paper industry. Two other readily available sources of fiber, recycled paper and nonwood fibers, have yet to be tapped at anywhere near their full potential. The use of recycled paper has increased substantially, from 23 percent as a global average in 1970, to 36 percent in 1994, but there is still plenty of room for growth. The rap against recycled fiber is that it's substantially weaker than virgin fiber, which limits the recycled content of a blend. But of course, not all papers require great strength. Germany and Japan have already shown that it is feasible to push the recycled contribution to the fiber stream, as a national average, above 50 percent, and there may not be any reason to stop there. After all, it required significant engineering know-how to make a consistently strong pulp out of eucalyptus fiber, so perhaps additional attention to recycled fiber would pay off in a similar way.

No plantation tree will ever look like this. The Baobab tree of Madagascar (Adansonia Madagascariensis) was illustrated in a dictionary entry a century ago, but wonders that were commonplace then are rare or nonexistent today.

Nonwood fibers—including agricultural residues such as wheat straw and crops such as kenaf and hemp—currently account for close to 7 percent of fiber input as a global average, but the proportion varies dramatically from one country to another. In the United States, for example, nonwoods contribute less than 1 percent to total fiber, while in China, they contribute 60 to 65 percent (primarily in the form of straw). There are a number of serious questions about the role that nonwood fibers should play in paper production. Should crop residues, for example, be diverted to the mills instead of being recycled on the farm? How much cropland is it reasonable to divert into paper production? Nonwood fibers probably shouldn't replace wood fiber entirely—far too much cropland would have to be used, and the production wouldn't necessarily be kinder to the land than the current pulp plantations are. Nevertheless, it's clear that in some circumstances, nonwood fibers can make sense for particular farming communities—and they can be used effectively to take some of the pressure off the forests. Maureen Smith, an independent paper analyst based in California, argues that the U.S. industry, now dependent on wood pulp for roughly 70 percent of its fiber, could eventually work with a fiber stream that is at least 50 percent wastepaper and 20 percent agricultural residues.

The third toxic assumption might be called the "SuperTree" ideal. This is the notion that intensively managed plantations covering a relatively small area will provide a sustainable source of pulp for generations to come. They won't, because no soil on earth can take that kind of repeated depletion, and because pulp demand is continually growing. These "40 million hectare solutions" have a kind of sound-bite glibness to them. They suggest that there is some sort of collective decision-making process that neatly divvies up portions of the earth's land cover for different uses. This is clearly misleading and results in a false sense that there are no practical limits to the supply of "renewable" resources such as trees.

The pulp plantation boom is likely to encourage a dangerous complacency in industrialized societies—an ignorance of the true costs of paper production. As more and more chipping and pulp operations move to southern countries, consumers in the north are less and less likely to be aware of the negative impacts of wasteful overconsumption. Before we can get pulp plantations on a really sustainable footing, we will have to reduce the demands that we make of them.

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