

## ECOLOGY

# Temperate Forests Gain Ground

A variety of factors, including reversion of farmlands to forest and better technologies and conservation, are contributing to the gains

Too often, the news about the world's forests is relentlessly bad. For example, both Mexico and Indonesia are losing about 1% of their forest lands every year to logging and to slash-and-burn agriculture. But although no one denies that tropical forests are in dire straits, another story is often lost in the headlines about their plight: Many woodlands outside the tropics are quietly prospering.

One recent example comes from Iddo Wernick of Columbia University, Paul Waggoner of the Connecticut Agricultural Experiment Station in New Haven, and Jesse Ausubel of The Rockefeller University in New York City. Based on an analysis of decades of Forest Service data, these researchers conclude that forest growth in the United States has outpaced forest clearing over the last 50 years, increasing the country's total timber volume by 30%. "Forests have been reborn, despite increased tree harvests," says Ausubel.

Enhanced forest growth is important, because it helps soak up carbon dioxide, offsetting some of the increase due to human activity, which many experts think fosters global warming. Indeed, a recent report suggests that that may be happening (*Science*, 16 October, pp. 386 and 442). Forests also provide habitat for wildlife, help prevent flooding and erosion, and contribute to the production of rich soils. But Wernick, Waggoner, and Ausubel have gone beyond simply documenting the increased forest growth. Their study, which appeared earlier this year in the *Journal of Industrial Ecology*, identified the factors that have led to this reversal of fortune.

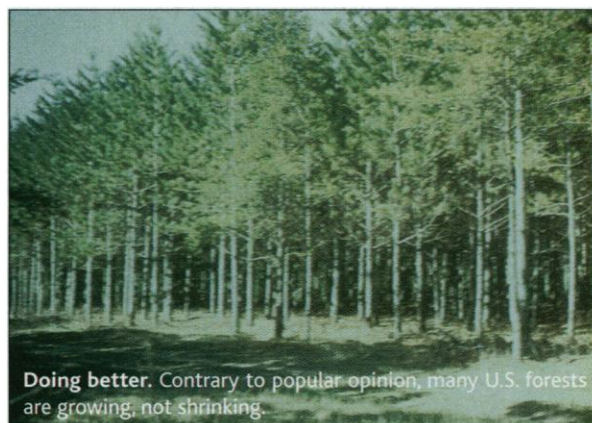
Among these are reversion of marginal farmlands to forests; improvements in tree-harvesting, paper-milling, and other technologies; paper and wood recycling; and the substitution of other materials for construction lumber. The analysis, says University of British Columbia forest economist Clark Binkley, "is a realistic assessment that we can grow more trees with less land. It is not speculative. They have pulled together the facts."

The first widely reported evidence of revitalized forest growth outside the tropics came from Pekka Kauppi of the University of Helsinki and Kullervo Kuusela and Kari Mielikäinen at the Finnish Forest Research In-

stitute in Helsinki (*Science*, 3 April 1992, p. 70). They estimated that in Europe, including European Russia, the growing stock of wood increased 25% between 1971 and 1990.

But the increase didn't put much of a dent in the global forest decline because Europe grows only 4% or so of the world's wood. Changes in North America will have much more of an impact, because the United States and Canada grow a lot more wood, at least 13% of worldwide stocks. And the Wernick-Waggoner-Ausubel analysis shows that U.S. forests are flourishing.

The researchers came to this conclusion by looking at data, mostly compiled by the U.S. Forest Service, dealing with the amount of wood harvested, sizes and densities of forests, and other indicators of forest use. These figures revealed that while some areas have seen declines—between 1952 and 1992, wood stocks in the Pacific Northwest went down by 20%, for example—during that



Doing better. Contrary to popular opinion, many U.S. forests are growing, not shrinking.

same period, wood stocks almost doubled in other areas of the northern United States, including the Great Lakes region, New England, and New York, where abandoned farmlands have reverted to forests. They also went up by 70% in the American South, where softwood plantations now thrive on soils degraded by decades of cotton farming, and by 18% in the Rocky Mountains.

Logging didn't erase the gains, even though consumption of all timber products grew 70% between 1900 and 1993, because existing woodlands are producing more efficiently, harvest data show. This has been achieved by better spacing of trees in plantations, planting rapidly growing species and harvesting them on a shorter life cycle, and

taking advantage of early, faster growth.

Various conservation strategies also seem to be paying off. For example, much of the previously wasted wood residues, such as twigs and branches, sawdust, and wood chips, that once cluttered the forest floor are now gathered and fabricated into fiberboard, veneers, and insulation. Also, better cutting blades in sawmills have increased lumber recovery by 5% to 10%. Without these savings, every year U.S. mills would need 120 million more cubic meters of hardwood, more than all the wood taken in 1993 from Alaska, California, Oregon, and Washington.

Other savings have come from recycling paper and other wood products, which increased by 150% between 1970 and 1993. And throughout the 20th century, Americans have been substituting for wood-based products, for example, gathering their news and information from electronic media, instead of from printed pages, and building their homes and businesses largely from plastic, glass, steel, and concrete, instead of from wood.

In the future, though, the savings achieved by such conservation measures are likely to be counterbalanced by continued population growth, coupled with increasing wealth. "Right now, we are growing more [trees] than we are cutting," says forester Robert Hagler, who heads his own consulting firm in Reston, Virginia. But, he adds, that situation is likely to reverse, especially for conifers, which are in high demand for construction and paper.

But, as the report points out, future measures could foster forest growth. Particularly promising is the application of modern agriculture to forestry. Peter Ince of the U.S. Forest Service in Madison, Wisconsin, says, "We are nowhere near the maximum biological productivity of trees. We've done a lot with agricultural crops, and that's where we'll wind up with trees." Such efforts might include breeding trees for rapid growth, as well as the application of genetic engineering to promote resistance to pests or herbicides or to endow trees with special traits, such as low-lignin content, valued for paper-making (*Science*, 9 February 1996, p. 760). Another possibility is to develop better fiber crops, such as kenaf and hemp, that can substitute for trees as the raw products for paper and pulp mills.

Indeed, Ausubel sees opportunities all around. He says that a modest, 1% annual increase in forest growth compounded by steady or slightly reduced demand "would shrink the extent of logging [in the U.S.] by one-half in 50 years," a prediction likely to please, and amaze, many environmentalists.

—ANNE SIMON MOFFAT