Dollars *in the* Dirt

The Economic Value of Living Trees

BY BETTY JOYCE NASH

Engineered efficiently by nature to produce a superb building material, a felled tree's worth has been well documented—the United States produces $230 billion in wood products annually. But it has taken awhile for the silent contributions of living trees to be quantified.

Trees are now recognized for performing all sorts of environmental services. They trap carbon dioxide, a chief culprit in global warming. They absorb and filter water—Fifth District residents drink from waters that originate in the most biologically diverse forests outside of the tropics. And, they clean the air we breathe, trapping particles believed to cause respiratory diseases. That's especially useful in Fifth District states, which are among those with the highest mortality rates from pollution-related respiratory ailments.

As the boundaries between urban and rural areas blur, the economic benefits of living trees are coming into sharper focus. "Urban dwellers have different values towards nature," says Ed Macie, a regional urban forester for the USDA Forest Service's Southern Region. "Timbering might become less acceptable and air and water quality might become more important."

American Forests, a Washington, D.C., nonprofit group established in 1875, is working to quantify these economic benefits. "We're trying to find ways to incorporate [them] into daily decision making," says Gary Moll, vice president of urban forestry. This would be a big improvement from what Moll saw while working as a state forester 20 years ago. Local officials made policy decisions without realizing how nature contributes to air and water quality.

The Carbon Sink

Trees collect carbon for a living. Some companies are picking up on this process and planting forests to combat global warming.

Trees absorb carbon dioxide from the atmosphere and convert it into carbon-based compounds through photosynthesis. Some of the carbon is used for food and the rest is stored. The amount of carbon retained depends on a forest's health and age, among other factors. An acre of mature trees can store from 150 tons to more than 400 tons of carbon annually.

"Many utilities are looking for ways to offset the carbon they produce," notes Macie. And planting trees is a good way to do it—carbon remains in wood until fire or decomposition releases it.

The United States hasn't approved the Kyoto Protocol, a 1997 international agreement to reduce atmospheric carbon dioxide. Still, companies have decided to start offsetting carbon emissions now because they see some sort of regulatory requirement as inevitable, explains John Rogers of the Conservation Fund, an Arlington, Va.-based nonprofit.

Energy companies have been among the first to come to the table. "Their overt motivation is recognizing their con-

tribution to greenhouse gases, and that there's a high scientific likelihood it is causing global warming," says Rogers.

In Mississippi, Entergy Corp. helped the Conservation Fund buy 600 acres for the new Red River National Wildlife Refuge. The firm hired Atlanta-based Environmental Synergy Inc. to plant bottomland hardwoods that will absorb an estimated 275,000 tons of carbon dioxide over the next 70 years. In Louisiana, the Conservation Fund bought 700 acres near the Tensas River with Chevron/Texaco's money. The land was reforested and then turned over to the U.S. Fish and Wildlife Service as a National Wildlife Refuge. A similar deal reforested 1,800 acres in Louisiana using funds from American Electric Power Company.

Reforestation is a long-term proposition, says Joe Wisniewski, who heads Environmental Synergy. In its five-year history, his company has planted 18 million trees over 60,000 acres in the South, none in the Fifth District.

Wisniewski believes a carbon trading mechanism in the United States is looming as countries across the globe adhere to the Kyoto agreement and states like North Carolina ponder the possibility of limiting carbon emissions. Global energy companies want to play by one set of rules, and that creates incentives for them to act now.

Storing carbon today could pay off for companies tomorrow if Congress provides them with pollution credits in return. Such credits could be used to meet pollution goals or be sold to other companies (see sidebar).

Carbon storage is already becoming useful to some landowners. For example, the U.S. Department of Agriculture has said it will consider carbon storage when evaluating applications for incentive programs and conservation initiatives.

While companies plant forests to absorb carbon dioxide, the uprooting of trees elsewhere adds to the global warming problem. An estimated 25 percent of the increase in atmospheric carbon dioxide is blamed on tree losses due to changing land-use patterns, notes Rogers. Metropolitan areas, especially those in the fast-growing Southeast, continue to bulldoze forests and lay down pavement. Northern Virginia, for example, loses 28 acres a day to development.

Carbon Counts

In the United States, an estimated 1,560 million tons of carbon dioxide enters the atmosphere each day. Energy use accounts for more than 80 percent of these emissions, according to the Pew Center on Global Climate Change, a nonprofit group formed in 1998 to study global warming.

Greenhouse gases like carbon dioxide have been blamed for heating the globe by about one degree F over the last century. Scientists predict a global increase of 2.5 degrees F to 10.4 degrees F by 2100, which will likely raise sea levels and change rainfall patterns. Economists at the Pew Center say markets can yield innovative solutions to these looming problems and change the behavior of private firms.

Although, the United States doesn't regulate carbon dioxide emissions, legislative proposals regarding climate change have increased from seven in the 1997-1998 session to more than 31 in the current session. Two lawmakers, Sens. Joseph Lieberman (D-Conn.) and John McCain (R-Ariz.), introduced a bill in 2003 that calls for a market-based solution. And that appeals to economists, says Neil Strachan, senior research fellow at the Pew Center. (The bill was defeated in October, although Lieberman views the 43-55 vote to be an "important moral victory.")

"In an emissions trading system, there is a cap on the total amount of pollutants that can be emitted—if you want to emit any tons of carbon dioxide you have to obtain a permit," Strachan explains. Permits are either given away or auctioned off in a one-time offering, but become valuable because supply is limited. "Because you have a cap on the number of tons of pollution, these permits have value. If you want to join the market and open a power station, you have to go out and buy these permits."

Companies have the option of continuing to purchase permits to meet standards, or reducing pollution. Firms with extra permits can sell them to those for whom it's tougher to cut emissions. Or, the permits could be banked. "The most important aspect of an emissions trading scheme…is that it allows for flexible compliance," notes Strachan. "Rather than telling power plants you all have to reduce [emissions] by 10 percent, if you set up a market, a firm can decide to reduce by 10 percent or 50 percent or nothing."

An emissions trading system has already been successful in reducing the production of sulfur dioxide, which combines with other pollutants to create acid rain (see *Cross Sections*, Winter 1996/1997). Between 1995 and 1999, a trading system enabled power plants to slash sulfur dioxide emission levels by 22 percent below required levels.

While a national trading scheme for carbon dioxide may be some years away, states are acting now. The governors of 10 northeastern states announced in July they will work together to develop a regional cap and trade program for carbon dioxide emissions from power plants.

—Betty Joyce Nash

Pollution Prevention

Replacing lost forestland can have another benefit as well—a tree behaves like an elaborate pollution control device. Its leaves absorb and filter rainwater, while its roots cleanse stormwater runoff before it reaches waterways and reservoirs, the source of most peoples' drinking water.

Forests usually produce cleaner water than developed land, so cities throughout the United States are defining watershed areas and acquiring forested land or conservation easements to protect their water supplies. New York City, for example, has maintained the largest, unfiltered water supply in the world by protecting its source high in the Catskill Mountains. Similarly, Asheville, N.C., has used easements with property owners to protect over 17,000 acres surrounding its water supply.

Protecting source water by preserving the surrounding forestland may be more cost effective than removing pollutants after the fact, according to Doug Ryan, a forest service analyst. Until about 1990, water treatment was regarded as an engineering problem, focused on removing impurities instead of preventing pollution at the source.

"What we're discovering now is that more rigorous treatment can leave more residues in the water that are harmful to people…," Ryan noted in a 2002 Forest

Forest Area in the United States[a] (In Thousands of Acres)

State	1997	1987[b]	1977[c]	1963[d]	1953[e]	1938[f]	1907[g]	1630[h]
Maryland	2,701	2,632	2,653	2,920	2,920	2,595	2,200	5,730
North Carolina	19,298	19,281	19,913	20,662	20,113	18,400	19,600	29,630
South Carolina	12,651	12,257	12,569	12,250	11,943	10,704	12,000	17,570
Virginia	16,047	16,108	16,387	16,412	16,032	14,832	14,000	24,480
West Virginia	12,108	11,942	11,669	11,469	10,327	10,074	9,100	14,610
Washington, DC*								

*Data unavailable

a Estimates for 1938 include forest area for regions that would become the States of Alaska and Hawaii. All data prior to 1953 are based on partial inventories or estimates from surveyors data. Estimates for 1907 include forest area for regions that would become the States of Alaska, Arizona, Hawaii, and New Mexico. Estimates for 1630 represent the forest area in North America for regions that would become the 50 States within the current United States.

b Data for 1987 based on Waddell et al (1989).

c Data for 1977 based on USDA Forest Service (1982).

d Data for 1963 based on USDA Forest Service (1965).

e Data for 1953 based on USDA Forest Service (1958).

f Data for 1938 based on U.S. Congress (1938).

g Data for 1907 based on Kellogg (1909).

h Data for 1630 were also from Kellogg (1909) as an estimate of the original forest area based on the current estimate of forest and historic land clearing information. These data are provided here for general reference purposes only to convey the relative extent of the forest estate, in what is now the United States, at the time of European settlement.

SOURCE: USDA Forest Service

Service publication. "New methods of treatment are also becoming more expensive, and passing those costs on to consumers is not a popular move."

In an effort to quantify the pollution control benefits of forests for policymakers, American Forests used satellite data to document tree cover in urban areas. Then, the group analyzed the effects of tree cover on stormwater runoff, air quality, carbon storage, and other factors.

For example, 46 percent of the Washington, D.C., area is covered in trees, while 27 percent of the land is under impervious surfaces that accelerate runoff and boost temperatures during hot weather. The metro area's tree cover is estimated to kick in $49 million in air pollution services and $4.7 billion in stormwater retention benefits each year.

By itself, the District of Columbia doesn't have as many trees working for it. About 22 percent of the city's 36,500 acres are trees and 46 percent are impervious surfaces. The remainder is water and open space. Still, the tree cover annually provides $2.1 million in air pollution services and $137.5 million worth of stormwater control.

American Forests calculated the value of a tree's air pollution removal by estimating the amount of certain pollutants deposited on tree canopies, then multiplying by the dollar values assigned by state public service commissions to those pollutants. The group derived stormwater control amounts by calculating runoff volume in varying land covers.

American Forests also analyzed the 351,000 acres that comprise the Charlotte, N.C., metropolitan area. In Mecklenburg County, which encompasses Charlotte and a few small towns, 22 percent of urban forest disappeared between 1984 and 2001. The county has grown by 72 percent since 1980 and is one of the 10 fastest growing areas in the nation.

Still, the county's tree canopy provides $1.9 billion dollars annually in stormwater retention services, money that would otherwise have been necessary for infrastructure to handle runoff. It also absorbs about 17.5 million pounds of air pollutants each year, a value estimated at $43.8 million, plus nearly 62,000 tons of carbon.

"The more forest cover in an urban environment, the less water runs off and the more money you save," says Macie of the U.S. Forest Service. It's not rocket science. "What happens is…we have three inches of rain, it fills our creeks and we have flooding. To compensate for that, we widen the creeks and pave them with concrete. That has a cost."

That's why Charlotte paid $150,000 from state, city, and private funds to assess its tree cover, says Rick Roti, chairman of Charlotte's tree commission. The information will allow planners to consider tree canopy as a "green layer" in decisionmaking.

"There's also a huge benefit from a water quality perspective," adds Roti. The rapidly growing Southeast faces water quality issues in a big way because of excessive sedimentation caused by land clearing.

Somebody's paying attention. When Ford Motor Company renovated its historic Rouge assembly plant on the banks of the Rouge River in Dearborn, Michigan, the $2 billion project included the world's largest "living roof." About 500,000 square feet of vegetation will hold several inches of rainfall. The factory complex also includes massive tree plantings and porous paving as well as shallow ditches seeded with indigenous plants to filter 10-20 million gallons of rainwater annually. The natural roof cost $15 million, compared to the estimated $50 million cost for a conventional tar roof, gutters, pipes, sewers, and water treatment systems.

Leveraging Mother Nature to save money is still in its infancy. Businesses will likely find other ways to extract economic value from trees. For example, shade trees next to a building reduce the need for climate control in the summer, cutting electricity demand and carbon dioxide emissions from power plants.

"If you shade your house, you use less air conditioning," says Macie. "Even the cows know that, but as humans we have to remind ourselves." **RF**

READINGS

Sedjo, Roger A. "Harvesting the Benefits of Carbon 'Sinks.'" *Resources*, Fall 1998, Issue 133, pp. 10-13.

Shore, Michael, et al. "Blueprint for Breathing Easier: Southeast Energy Strategy for Clean Air." New York: Environmental Defense, 2002.

Wear, David N. and John G. Greis. "The Southern Forest Resource Assessment: Summary Report." Asheville, N.C.: USDA Forest Service, October 2002.

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