United States Environmental Protection Agency

Office of Policy, Planning, and Evaluation

EPA230-F-92-009
May 1992

EPA

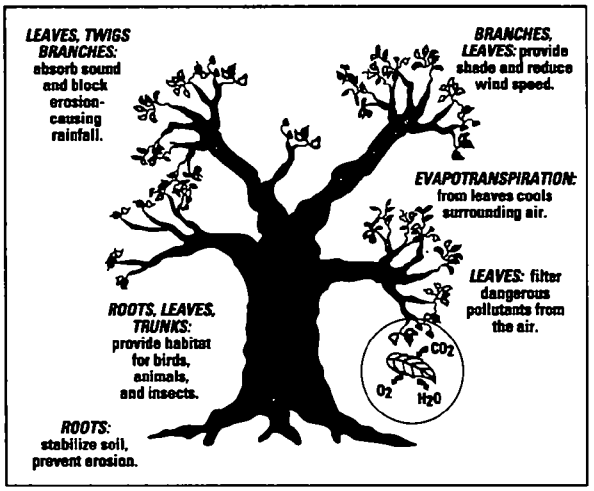
Climate Change
Discussion Series

Forestry

Forests occupy one-third of the land area of the United States. Trees provide wood products, improve air and water quality, provide wildlife habitat, and, through photosynthesis, remove carbon dioxide (CO_2) from the atmosphere. Human alterations of forest ecosystems now account for CO_2 emissions equal to about 10 to 30 percent of total global emissions from human activities (anthropogenic emissions). Carbon stored in vegetation and soils is released by clearing, fire, or decay. The deforestation of Europe and North America in the past contributed to current global CO_2 levels. Now deforestation of 17 million hectares of tropical forests each year—an area larger than Austria or Tennessee—is eroding the planet's photosynthetic base and adding roughly 1 to 2 billion tons of carbon (in the form of CO_2) to the atmosphere annually. Limiting forest loss and planting new trees are immediately available, proven technologies, as well as potentially cost-effective means of reducing the build-up of CO_2 in the atmosphere. Also, tree growth reduces erosion, improves water quality (decreases pesticide and herbicide use on cropland) provides alternative uses for marginal croplands, increases timber supply, and creates potential wildlife habitat. A 1990 study by the Intergovernmental Panel on Climate Change, involving several hundred scientists, concluded that a doubling of CO_2 in the atmosphere would most likely lead to a warming of 3° to 8°F (1.5° to 4.5°C) by the end of the century. This warming and resulting shifts in precipitation could have a substantial impact on the quality of forest ecosystems. In addition to temperature and precipitation changes, forests are sensitive to other factors (e.g., pests, fire, CO_2 levels), influenced by potential of climate change.

Reducing "Greenhouse Gas" Emissions

The Benefits of Trees



Increasing tree planting in community areas

Every tree planted in an urban area not only takes up CO_2, but it also shades buildings and pavement in hot weather and shields buildings from winds in cold weather. Thus, the trees reduce energy needed for air conditioning and heating and thereby reduce associated CO_2 emissions. Three well-placed trees around a house can cut home air-conditioning energy needs by 10 to 50 percent.

Increasing tree planting on privately owned lands and improving management of private non-industrial forest lands

Private forest lands—excluding land in industrial ownership—accounts for 57 percent of all U.S. forest lands. Many crop and pasture lands, highly erodible and marginally productive, are suitable for tree planting. The America the Beautiful Program, if fully implemented, would plant one billion trees per year on private lands for 20 years to achieve a few percent offset in U.S. fossil fuel emissions. This planting program will also be a component of the U.S. Action Plan to mitigate greenhouse gas emissions.

International Reforestation

Millions of hectares of degraded land are potentially available for reforestation, especially in the tropics. Although over one hundred million hectares would have to be planted to offset 10 percent of the world's current annual fossil fuel emission, preliminary estimates suggest that the cost of absorbed carbon could be competitive with other options. If planting schemes can be designed to meet the need for forest products and offset deforestation pressure on primary forests, they will have an added carbon benefit. Furthermore, a reforestation strategy could offer a stream of valuable ecological and economic benefits in addition to reducing CO_2 concentrations, such as production of forest products, maintenance of biodiversity, watershed protection, non-point pollution reduction, and recreation.

Increasing paper recycling

By lowering demand for new paper, recycling could decrease energy related greenhouse gas emissions from paper production and reduce greenhouse gas emissions by slowing forest harvesting.

NOTE: Climate change refers to potential modification of the earth's climate resulting from increasing atmospheric concentrations of greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and chlorofluorocarbons (CFCs). Through a naturally occurring process known as the "greenhouse effect," these gases act to warm the earth by trapping heat in the atmosphere. This process plays an important role in maintaining the earth's current temperature and climate. By increasing concentrations of greenhouse gases, human activities are trapping more heat in the atmosphere and potentially changing the earth's climate.

Potential Impacts

Changes in the range, productivity, and species composition of forests
Future climates may no longer support the current mix of species found in different regions of the United States.

Forests may experience northward shifts in ranges of species, as well as dieback of species along the southern reaches as a result of higher temperatures, drier soils, and other climatic changes or shifts in the climatic belts of temperature and precipitation.

Changes may begin soon
A faster rate of mortality among mature trees, a decline in seedlings, and a decline in growth of new species may be visible in a few decades.

Climate change alters factors affecting forest health
Drier soils could lead to more frequent fires.

Warmer climates may cause the range of forest pests and diseases to expand.

Climate change could also exacerbate stress on forests caused by air pollution and continued depletion of stratospheric ozone.

Higher CO_2 concentrations can increase growth and reduce water demand. The combined effect of this with higher temperatures is uncertain.

Adaptation

The response of forests to climate change will not only affect timber supplies, but will also affect biodiversity, runoff, recreational opportunities, and the climate through feedback scenarios. Anticipatory actions are necessary to prepare for the potential impacts of climate change. Today's forest management decisions will determine the location and composition of forests during the next century when changes in climate are likely. Potential adaptive responses include:

Maintaining forest diversity and extent
Potential mechanisms for maintaining large and diverse forests include strengthening and enlarging protected natural areas and creating conservation corridors (migratory pathways) between protected areas to accommodate range shifts. Maintaining diversity and extensiveness should improve the resilience of forests by increasing their ability to adapt to a wide range of climate changes.

Modifying harvesting practices and forest and pest control programs
Harvesting practices that preserve existing forest diversity, increase species and age class diversity and allow for rapid removal of dead or dying trees, especially along southern and lower-elevation boundaries, could increase diversity and resilience of forests.

Changes in current programs for fire and pest monitoring and control may be warranted in response to new and more severe threats.

Developing and planting heat-, drought-, pest-resistant, fast-growing species and varieties
Planting heat-, drought-, and pest-resistant varieties in areas vulnerable to dieback could also increase resilience to climate change. In recent years, some companies began planting such species on some of their lands. Faster-growing trees would enhance the ability of foresters to shorten rotation times in response to rapid changes in the climate.

Based upon the two EPA Reports to Congress, *The Potential Effects of Global Climate Change On The United States*, Washington, DC, 1989; and *Policy Options for Stabilizing Global Climate.*, Washington, DC, 1989; and EPA's *Adapting to Climate Change: What Governments Can Do*, Washington, DC, 1991; and *World Resources 1990-91* by World Resources Institute, Washington, DC, 1991

EPA's Climate Change Outreach Program is designed to raise awareness about climate change and provide assistance to state and local governments, industry, and non-governmental organizations in the evaluation of cost-effective response strategies. For further information about this program, please contact Joel Smith at 202/260-8825.

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Global Climate Change
Adaptation to Climate Change
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Order from: CLIMATE CHANGE INFORMATION
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Washington, DC 20460
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