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Q&A About Forests and Global Climate Change

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What Can Be Done About the Build-up of "Greenhouse Gases" in the Atmosphere?

Concerns over the potentially negative effects of prolonged global warming have generated interest in restraining the buildup of "greenhouse gases" in the atmosphere. Currently, human-generated emissions of carbon dioxide and other greenhouse gases total about 8.2 billion metric tons of carbon per year (about 1.35 metric tons per capita per year). Global carbon dioxide emissions contained about 8.2 billion metric tons of carbon in 2000 and, with "business as usual," could reach 14.5 billion metric tons in 2050.

Despite many remaining uncertainties in scientific understanding of climate change, most initiatives propose to slow or stop the buildup of greenhouse gases by reducing fossil fuel use. Such policy options are likely to have little positive impact on climate, but could result in negative impacts on energy production, national economies, and personal autonomy.

An alternate approach that is gaining more attention is removing—"sequestering"—carbon dioxide, a major greenhouse gas, from the atmosphere and storing it in a variety of ways in forests and other large masses of plant life.

Forest sequestration offers a "win-win" approach to global warming. Enhancing sequestration would slow any climate change that might occur due to greenhouse gas emissions, while offering immediate environmental benefits.

What Role Do Forests Play in Carbon Dioxide Sequestration?

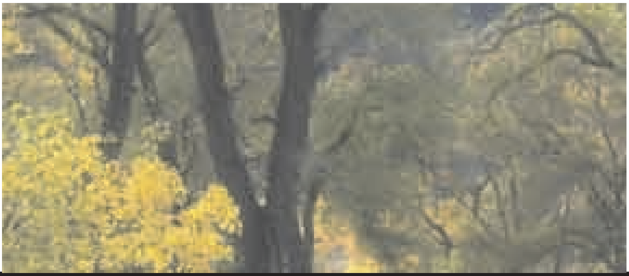
The concept of carbon removal, or sequestration, is scientifically grounded. In its simplified form, sequestration is based on the process of photosynthesis, whereby green plants remove carbon dioxide (CO_2) from the atmosphere and separate the carbon atom from the oxygen atom. The tree or plant returns the oxygen to the atmosphere but uses the carbon to build its own structure in the form of roots, trunk, stems, and leaves. Thus, a healthy forest can continue to grow and remove yet more carbon dioxide from the atmosphere.

Trees, wood, and paper products are natural, renewable resources that help reduce greenhouse gases by removing and storing carbon dioxide and providing carbon dioxide-neutral sources of energy. They are part of a natural cycle that can help meet the challenge of global climate change.

Based on evaluation of published studies, the potential amounts of carbon emissions that can be stored in forests and reduced through the use of the biomass fuel that is a natural by-product of forest harvesting are as follows:

1. Improvements in Forest Management. This could result in about 2 billion metric tons of carbon stored per year, at an average cost around $4 per ton of carbon stored.

2. Use of Biomass Fuels. This could substitute for 2 billion metric tons of annual fossil fuel emissions at a cost similar to the replaced fossil fuels.



What Forest Management Techniques Need to be Implemented?

The life cycle of carbon is tied to forest management techniques, as well as to the eventual disposition of forest products. The forest carbon cycle does not end when a forest is harvested because, unlike in other manufacturing sectors, carbon from forests is not immediately emitted. It is stored for long periods of time in wood and paper products and can be used for energy as a substitute for fossil fuels. The process can remain in perpetual balance through tree planting.

There are three principal ways to sequester carbon in forests:

- Maximizing carbon retention;
- Increased tree-planting on agricultural land; and
- Preventing deforestation.

1. Maximizing carbon retention. Advanced forest management techniques-including forest thinning, "stand" improvement, fire protection, competition control, nutrient application, and pest management-can maintain and enhance the removal of carbon dioxide from the atmosphere by improving forest growth. Over the long haul, such practices can sequester and store more carbon in forests, displace more non-renewable fossil fuel energy, and store greater amounts of carbon in products than simple forest preservation alone can.

According to the Department of Agriculture's U.S. Forest Service, managed forests in the U.S. remove approximately 310 million metric tons of carbon, or 17 percent of U.S. greenhouse gas emissions, per year. This is equivalent to removing the carbon dioxide emissions from 235 million automobiles on the road per year.

However, there is no guarantee that these benefits will be maintained in the future. Mounting pressures on U.S. forestlands, including suburban growth, threaten the continuous carbon sequestration loop by converting forests to other uses. The management of forests for multiple environmental objectives will happen only if forests are managed with sequestration—as well as habitat and species preservation—as one of its specific goals.

2. Increased Tree-planting on Agricultural Lands. In addition to increasing management and productivity of today's forests, more tree-planting on agricultural lands will provide an opportunity to further remove carbon dioxide from the atmosphere.

The establishment of new forests—afforestation—is an environmentally beneficial activity. In the United States, 75 percent of all forests are privately owned. At present, new tree plantings are currently confined to two federal programs: the Conservation Reserve Program and the Wetlands Reserve Program. These programs convert vulnerable cropland to grass or forests. Forests on 7.5 million hectares (18.53 million acres, or 1 percent of the continental United States area) in these programs could offset about 0.25 percent of global "business-as-usual" greenhouse gas emissions for the next 30 years. While this is only a very small part of the emission reductions that would be needed, much more land in the continental United States (32 to 90 million hectares, or 79 to 222 million acres) and other countries may be suitable for such planting.

3. Preventing Deforestation. Up until the early 1900s, deforestation emitted more carbon dioxide than fossil-fuel use. Since that time, forests in North America and Europe have recovered. However, deforestation in the tropics has accelerated since the 1950s. In fact, since 1990 almost all worldwide deforestation has occurred in the tropics, and tropical deforestation now accounts for 18 percent of greenhouse gas emissions worldwide. (This is roughly equivalent to the U.S. share of global emissions.)

All forests can remove carbon dioxide from the atmosphere if properly managed. Recognition of the intrinsic carbon sequestration value of today's tropical forests can encourage wiser resource management and help halt needless deforestation.

How Do Forest Products Contribute to Carbon Sequestration?

A tree standing in the forest is approximately 50 percent water, 25 percent carbon, and 25 percent other minerals. When a tree is harvested, not all the carbon contained in the tree is released. A substantial portion of the tree is converted into carbon-based products—including books, furniture, lumber for housing, and a myriad of other items.

Wood is an energy-efficient building material. It takes 50 percent less energy to produce a wood product than a similar product made from sheet metal, 60 percent less energy than a similar product made from concrete, and 75% less energy than a similar product made from steel. In addition to its energy-efficient attributes, wood can store carbon dioxide in the form of carbon for long periods of time. According to researchers, failure to account for the long-term storage of carbon in wood-based products has caused overestimates of worldwide carbon dioxide emissions by 10 percent.

How Does Biomass Fuel Fit Into the Equation?

The benefits of forest absorption of carbon dioxide continue after trees are harvested. In fact, carbon-containing, energy-rich material from the forest is already used to power much of the lumber- and paper-product industry's manufacturing processes.

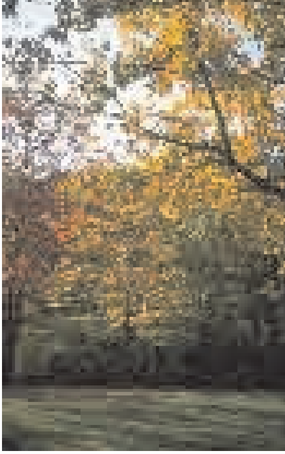
When a tree is processed to make a variety of consumer goods, residual production material remains in the form of bark, sawdust, and chips. This material is known as biomass fuel because it is biological in nature and contains a mass of energy that has been produced by the sun.

Biomass fuels are renewable through active and sustainable forest management. Biomass energy is consicered a net-zero contributor of greenhouse-gas emissions, because the carbon dioxide released during biomass combustion is later withdrawn from the atmosphere by forest regrowth. Through forest management practices, the carbon dioxide is reabsorbed, creating a closed-loop system that has zero effect on the atmosphere.

The following domestic and international agencies agree that biomass fuels represent a valid alternative to non-renewable fossil fuels:

The Intergovernmental Panel on Climate Change's Guidelines for National Greenhouse Gas Inventories: "Within the energy module, biomass consumption is assumed to equal its regrowth. Any departures from this hypothesis are counted within the Land-use Change and Forestry Module." In other words, biomass contribution to greenhouse gases is equal to zero because all carbon accounting is conducted within the practices of forestry management.

The U.S. Department of Energy (DOE): "Another way to reduce carbon dioxide emissions is to displace some of the carbon that is now emitted to the atmosphere from the combustion of fossil fuels (an irreversible process) with carbon derived from renewable resources. There is no net atmospheric carbon buildup because carbon dioxide released in combustion is compensated for



by that withdrawn from the atmosphere during photosynthesis." The DOE's guide for voluntary reporting of greenhouse gas emissions states that "biofuels contain carbon that is part of the natural carbon balance and that will not add to atmospheric concentrations of carbon dioxide."

The Environmental Protection Agency (EPA)'s Inventory of U.S. Greenhouse Gas Emissions and Sinks: "The combustion of biomass and bio-based fuels…emits greenhouse gases. Carbon dioxide emissions from these activities, however, are not included in national emissions totals…because biomass fuels are of biogenic origin. It is assumed that the carbon released when biomass is consumed is recycled as U.S. forests and crops regenerate, causing no net addition of CO_2 to the atmosphere."

Currently, the wood-products industry derives approximately 63 percent of its energy requirements from wood waste. The pulp and paper industry derives about 57 percent of its energy needs from wood waste and wood by-products—representing about 205 million barrels of oil equivalent per year, or the equivalent of taking almost 19 million cars off the road annually.

Conclusion

There are still many unknowns regarding climate change, and it is unclear that active greenhouse gas reduction policies are prudent at this stage of understanding. Still, if greenhouse gas reduction policies are to be implemented, they should be policies that offer benefits in the near-term, as well as potential climate change protection in the long term. Improvements in forest and forest-product management can accomplish both objectives, and the benefits are already scientifically understood. Carbon sequestration by forests can both slow climate change should it prove to pose serious threats to humans and the environment, while dovetailing with other important environmental concerns, such as air quality, habitat and species preservation, and resource conservation.

About the Author

Kenneth Green, D.Env., is Director of the Environmental Program at Reason Public Policy Institute and an expert reviewer for the Intergovernmental Panel on Climate Change (IPCC)'s most recent report on climate change. Dr. Green has published several peer-reviewed policy studies on climate change for RPPI, including *A Plain English Guide to the Science of Climate Change*, *Climate Change Policy Options and Impacts*, *Evaluating the Kyoto Approach to Climate Change*, and *A Baker's Dozen: 13 Questions People Ask About the Science of Climate Change*. He received his doctorate in environmental science and engineering from UCLA in 1994.

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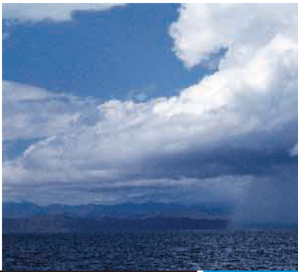

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