U.S. Forests and Carbon:
Some Important Facts

Climate Change Advisor's Office
USDA Forest Service

Our Nation's forests cover an estimated 797 million acres. About 35% of US land (including Hawaii and Interior Alaska) is forested, and the majority of forestland is privately owned. About 22% of our nation's forestland is National Forest, and other public forests make up an additional 16% of forestland (note that does not include urban forest land, Hawaii or interior Alaska).

Our Nation's forests play a critical role in the global carbon cycle, given their large capacity for carbon uptake and storage. Forests on public lands, including state and national forests, and private lands help mitigate greenhouse gas emissions by taking up carbon dioxide and storing carbon in trees and soil.

America's forests are currently a carbon "sink." In total, forests in the United States currently take up more carbon via photosynthesis and store it in living trees and soil than they release through decay and respiration. It is important to note that this is a net amount: some individual forests may act as sinks, while others act as "sources" (releasing more greenhouse gases than they provide).

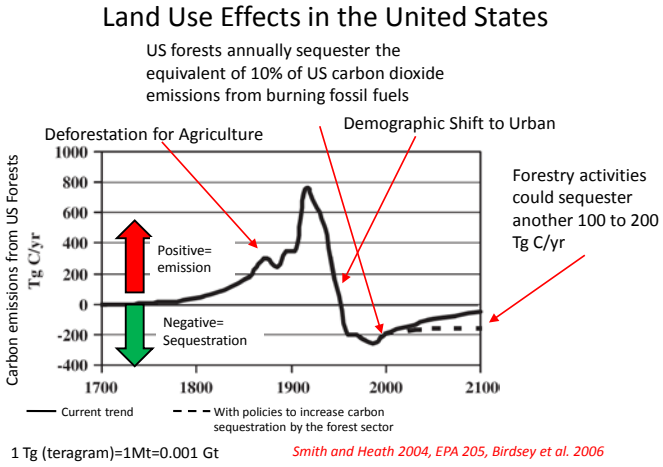

Figure 1: How sequestration rates have changed in our Nation's forests since European settlement

America's forests provide carbon benefits while also providing other important benefits. In addition to storing carbon, the Nation's forests provide services such as clean water, flood control, outdoor recreation opportunities, wildlife habitat, and aesthetic enjoyment.

There is a difference between the amount of carbon stored in a forest and its "sequestration rate". Carbon stock estimates only tell us the amount of carbon stored in a forest at a particular time. It does not tell us whether that is an increase or decrease from the past. When thinking about offsetting fossil fuel emissions, we want to look at the "sequestration rate" or the change in carbon stocks over time. If the amount of carbon is increasing, it is offsetting emissions; if the amount is decreasing, it is contributing to emissions.

Estimating carbon stocks for our Nation's forests is an essential first step in assessing the potential for forests to mitigate greenhouse gas emissions. Assessing mitigation potential requires an understanding of how much carbon is currently stored in forests and the potential for storage in the future.

The Forest Service's Forest Inventory and Analysis (FIA) Program is the authority for estimates of forest carbon stocks in the United States. FIA is the nation's forest census, continuously collecting data on trees, soils, and forest land area in private and public lands in all 50 States. Annual estimates of forest carbon stocks at the national level have been prepared by FIA scientists each year since 1993 as the official forest carbon numbers to EPA for international reporting (EPA, 2010). Recently, FIA scientists have developed new methods for breaking these national estimates down into regional and state-level estimates and are developing estimates for individual national forests.

While FIA is the authority on carbon stock estimates, these estimates do have some limitations that should be kept in mind. These estimates are only for forestland, and do not include the carbon stored in grasslands or other non-forest areas. They also do not include urban trees, which store about 700 million tons of carbon in the lower 48 states (Nowak and Crane 2002). The spatial scale at which the FIA inventories are conducted limits the reliability of estimates of carbon stocks at smaller spatial scales. There is also greater confidence in the estimates of aboveground tree biomass than other carbon pools, such as belowground biomass and soil.

The average amount of carbon stored per acre on our Nation's forests varies regionally and by type of forest.

- The wet temperate conifer forests along the Pacific Coast from northern California to southeast Alaska have a high density of large trees. Not surprisingly, forests across all ownerships in this zone have the highest average carbon per acre.
- The arid forests of the desert southwest (AZ, NM), such as the pinyon-juniper forests, typically have fewer trees per acre and the individual trees tend to be small. So forests in this zone have the lowest average carbon per acre.

National forests contain an average of 69.4 metric tonnes of carbon per acre: **a greater density than on private or other public forest lands.**

- National forests contain an average of 22.8% more carbon per forested acre than private land, which stores an average of 56.5 metric tonnes/acre.
- On average, national forests contain 10% more carbon per forested acre than other public land (such as state forests and national parks), which stores an average of 63.1 metric tonnes/acre
- In the Pacific Northwest, however, the average amount of carbon on other public lands exceeds the average on national forests by 14%, partly because of a large concentration of state and federal forests and parks along the wet Pacific coast.

Private forestlands store more total carbon than National Forests.

- Although the national forests have higher *per-acre* carbon storage than private lands, private forestlands make up a much larger total area.
- Because of the larger area coverage, private forestlands store 59% of the carbon compared to 25% on national forests.
- Private forestlands dominate the Eastern US, but national forest lands make up a large proportion of forests in the Western US, leading to differences in carbon storage among ownerships from east to west.

These estimates do not tell us anything about the effects of carbon management.

- It cannot be determined from these data whether particular management practices are having an effect on carbon storage.
- The carbon storage estimates do not include the carbon stored in forest products. Research on a full life-cycle analysis of carbon stored in wood and paper products is underway.

The estimates only describe the current stocks in forests. They do not reveal anything about past change or future storage.

- They do not show how carbon stocks have changed over time, which would allow us to estimate sequestration rates.
- They do not tell us the effects of future climate changes or greenhouse gas emission levels on future forest carbon stocks.
- The effects of future climate change or emissions **policies** on future carbon stocks.

More information can be found here:

- EPA. 2010. 2010 U.S. Greenhouse Gas Inventory Report: Landuse, Land-use Change, and Forestry.
- Forest Inventory and Analysis Program: http://fia.fs.fed.us/
- Nowak, D., and D. Crane. 2002. Carbon storage and sequestration by urban trees in the USA. *Environmental Pollution* 116: 381–389
- Ryan, M.G., et al. 2010. A Synthesis of the Science on Forests and Carbon for U.S. Forests. *Issues in Ecology* 13:1-17.
- US. Forest Carbon Calculation Tool briefing paper: http://www.nrs.fs.fed.us/carbon/local-resources/downloads/CCT_NRS13.pdf