U.S. forest greenhouse gas emissions and sinks inventory, 2008

Along with 188 other nations, the USA ratified the United Nations Framework Convention for Climate Change (UNFCCC) in the mid-1990s. The UNFCCC is a non-binding treaty aiming to address climate change. Countries agreed to work together to stabilize the amounts of greenhouse gases in the atmosphere and prevent dangerous human interference in the global climate. The USDA Forest Service has contributed to or provided the estimates and text for forests since the start of the inventories.

Forests in the conterminous US are sequestering about 700 Tg CO2 Eq. (Teragrams, or million metric tons) in 2006, with uncertainty of ± 23% at the 95% confidence interval.

The summary table for the 2008 stock change estimates is:

Net annual changes in US C stocks (Tg CO2/yr) in forest and harvested wood pools

Carbon Pool	1990	1995	2000	2002	2003	2004	2005	2006
Forest	**(489.1)**	**(540.5)**	**(436.8)**	**(598.0)**	**(635.1)**	**(635.1)**	**(635.1)**	**(635.1)**
Abovegrd Biomass	(287.6)	(318.4)	(335.4)	(384.4)	(406.5)	(406.5)	(406.5)	(406.5)
Belowgrd Biomass	(54.2)	(62.4)	(67.2)	(76.9)	(80.9)	(80.9)	(80.9)	(80.9)
Dead Wood	(40.1)	(57.5)	(44.9)	(53.0)	(56.9)	(56.9)	(56.9)	(56.9)
Litter	(63.3)	(34.9)	(17.3)	(47.7)	(56.2)	(56.2)	(56.2)	(56.2)
Soil Organic Carbon	(43.9)	(67.5)	28.0	(36.0)	(34.5)	(34.5)	(34.5)	(34.5)
Harvested Wood	**(132.6)**	**(119.4)**	**(113.9)**	**(99.2)**	**(95.9)**	**(106.3)**	**(108.5)**	**(110.0)**
Products in Use	(64.8)	(55.2)	(47.0)	(35.1)	(35.4)	(45.5)	(47.3)	(45.3)
SWDS	(67.9)	(64.1)	(66.9)	(64.2)	(60.4)	(60.8)	(61.2)	(64.7)
Total Net Flux	**(621.7)**	**(659.9)**	**(550.7)**	**(645.7)**	**(688.1)**	**(687.0)**	**(697.3)**	**(698.7)**
Forest Area (million ha)	245.8	249.0	252.3	253.4	254.2	254.9	255.6	256.4

Notes: Does not include forest stocks in AK, HI, or US territories, or trees on non-forest land. Parentheses indicate net sequestration (that is, a net removal of C from the atmosphere). Estimates are based on interpolation and extrapolation of inventory data to use dates of inventory. Total net flux is an estimate of the actual net flux between the total forest C pool and the atmosphere. Harvested wood estimates are based on results from annual surveys and models. SWDS= Solid Waste Disposal Sites. Additional harvested wood burned for energy which offsets fossil fuel use is not reported in this section.

Source: US Environ. Protection Agency (2008) Forest sections of Land use change and forestry chapter, and Annex by Smith, JE; LS Heath, KE Skog, and EPA consultants.

Methods: For forest ecosystem carbon, we use Forest Inventory and Analysis data, augmented by estimates in the literature to calculate carbon stocks, and then subtract the stocks to estimate carbon stock change (also see Smith et al 2007). Estimates of harvested wood products are based on methods described in Skog (2008) using the WOODCARBII model. The US uses the production accounting approach to report the HWP contribution. This means that C in exported wood is estimates as if it remains in the US, and C in imported wood is not included in Inventory estimates. (The production approach has been used historically.)

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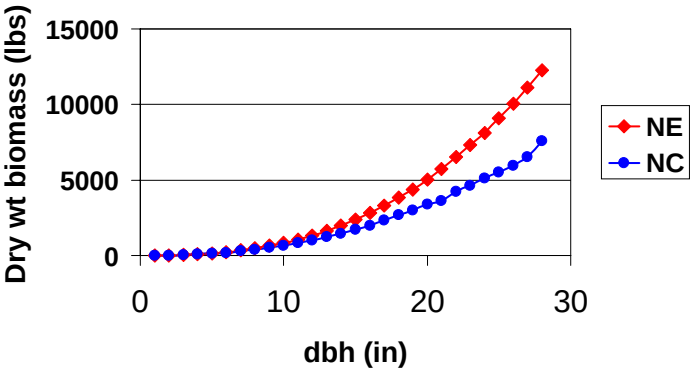
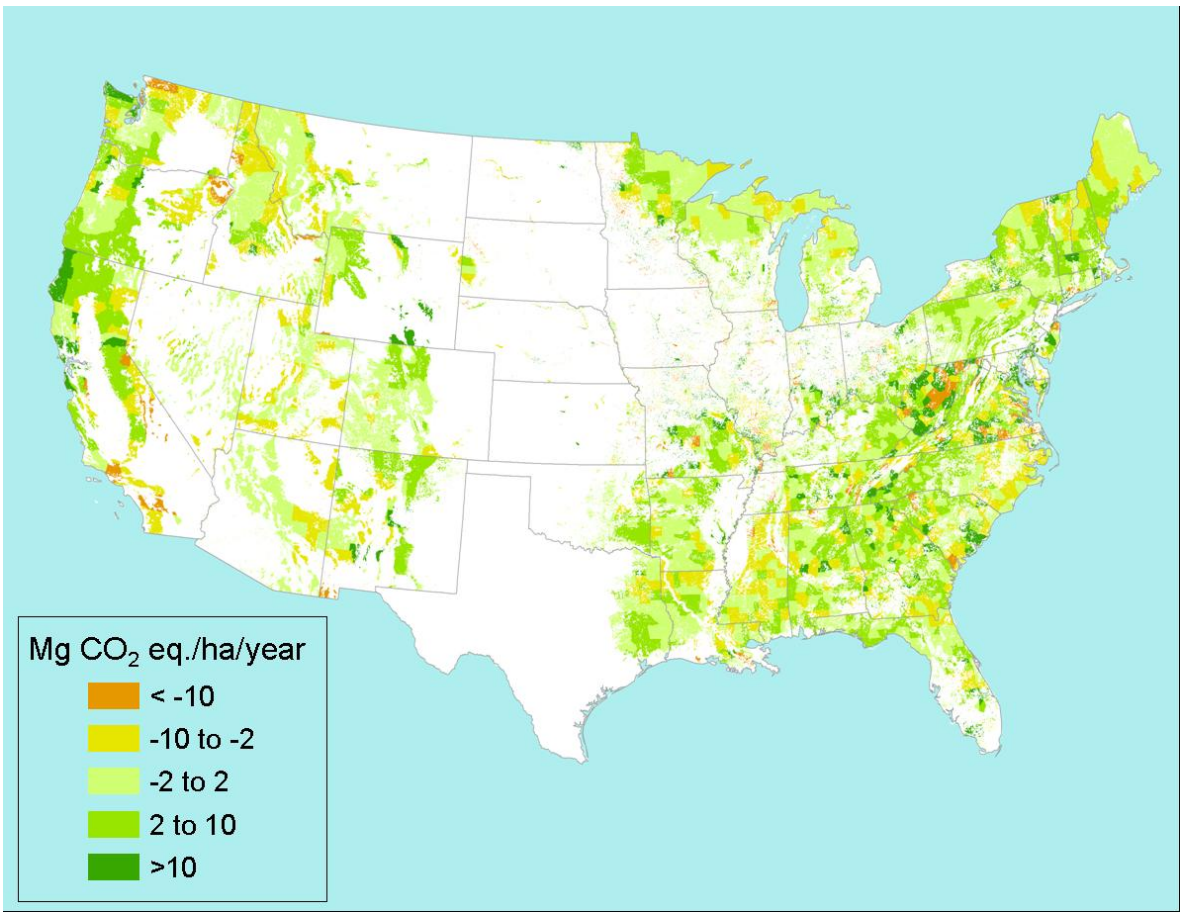
Note that Jenkins et al (2003) biomass equations are used to provide belowground biomass estimates, as well aboveground because FIA biomass equations can show inconsistencies across the regions. For instance, this figure shows the FIA biomass equations for aboveground red oak in the North Central (NC) and Northeast (NE) regions.



Average annual change in carbon stock density (Mg CO2/ha) for live trees by county
Negative numbers indicate sequestration into forest. (Manuscript in preparation)



Details: US EPA. 2008. Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2006. EPA 430-R-08-005. Forest sections of the Land use change and forestry chapter, and Annex by Smith, JE; LS Heath, KE Skog, and EPA consultants. http://www.epa.gov/climatechange/emissions/usinventoryreport.htm (10 July).

Smith, JE, LS Heath, and MC Nichols. 2007. U.S. forest carbon calculation tool: forest-land carbon stocks and net annual stock change. Gen. Tech. Rep. NRS-13. Newtown Square, PA: USDA Forest Service, Northern Research Station. 28 p. Software, User's Guide, and Example Data Sets: http://www.nrs.fs.fed.us/carbon/tools/

Skog, KE. 2008. Sequestration of carbon in harvested wood products for the United States. For Prod J 58(6):56-72.

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Additional tables—

Forests and harvested wood products currently contain 43, 376 Tg carbon.

Table A. Carbon stocks in US (Tg C) in forest and harvested wood pools

Carbon Pool	1990	1995	2000	2003	2004	2005	2006	2007
Forest	**40,106**	**40,810**	**41,535**	**41,962**	**42,135**	**42,308**	**42,481**	**42,654**
Abovegrd Biomass	14,547	14,955	15,405	15,701	15,812	15,923	16,034	16,145
Belowgrd Biomass	2,896	2,974	3,063	3,123	3,145	3,167	3,189	3,211
Dead Wood	2,453	2,515	2,592	2,633	2,648	2,664	2,679	2,695
Litter	4,557	4,641	4,680	4,707	4,723	4,738	4,753	4,769
Soil Organic Carbon	15,652	15,725	15,795	15,798	15,807	15,817	15,826	15,835
Harvested Wood	**1,862**	**2,033**	**2,193**	**2,277**	**2,303**	**2,332**	**2,362**	**2,392**
Products in Use	1,231	1,311	1,382	1,413	1,423	1,436	1,448	1,461
SWDS	631	722	810	863	880	896	913	931
Total C Stock	**41,968**	**42,843**	**43,728**	**44,238**	**44,438**	**44,640**	**44,843**	**43,376**
Forest Area (million ha)	245.8	249.0	252.3	253.4	254.2	254.9	255.6	256.4

Notes: Does not include forest stocks in AK, HI, or US territories, or trees on non-forest land. Parentheses indicate net sequestration (that is, a net removal of C from the atmosphere). Estimates are based on interpolation and extrapolation of inventory data to use dates of inventory. Total net flux is an estimate of the actual net flux between the total forest C pool and the atmosphere. Harvested wood estimates are based on results from annual surveys and models. SWDS= Solid Waste Disposal Sites. Additional harvested wood burned for energy which offsets fossil fuel use is not reported in this section.
Source: US Environ. Protection Agency (2008) Forest sections of Land use change and forestry chapter, and Annex by Smith, JE; LS Heath, KE Skog, and EPA consultants.

Table B. Estimates of CO2 emissions

Year	CO2 emitted in the Lower 48 States (Tg/yr)	CO2 emitted in Alaska (Tg/yr)	Total CO2 emitted (Tg/yr)
1990	36.8	12.0	48.8
1995	51.1	0.2	51.3
2000	196.9	10.3	207.2
2003	92.4	3.0	95.4
2004	43.4	32.1	75.5
2005	111.4	22.9	134.3
2006	266.6	1.3	267.9

Note that these emissions have already been accounted for in the estimates of net annual changes in carbon stocks, which accounts for the amount sequestered minus any emissions.
Source: US Environ. Protection Agency (2008)

Table C. Estimated non-CO2 emissions from forest fires (Tg CO2 eq/yr) for US forests

Gas	1990	1995	2000	2002	2003	2004	2005	2006
CH4	4.5	4.7	19.0	16.4	8.7	6.9	12.3	24.6
N20	0.5	0.5	1.9	1.7	0.9	0.7	1.2	2.5
Total	**4.9**	**5.2**	**20.9**	**18.0**	**9.6**	**7.6**	**13.6**	**27.0**

Source: US Environ. Protection Agency (2008)

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