

Tools for forest carbon inventory, management, and reporting on federal lands

Accurate estimates of carbon in forests are crucial for forest carbon management, national reporting of greenhouse gas inventories to the [United Nations Framework Convention for Climate Change](#), calculating estimates for the [Montreal Process criteria and indicators](#) for sustainable forest management, and registering forest-related activities for the national 1605(b) [Voluntary Reporting of Greenhouse Gases Program](#) and other greenhouse gas registries for States and regions. The following tools are currently available:

Measurement guidelines for the sequestration of forest carbon

Measurement guidelines for forest carbon sequestration were developed to support reporting by public and private entities to greenhouse gas registries. These guidelines are intended to be a reference for designing a forest carbon inventory and monitoring system by professionals with knowledge of sampling, statistical estimation, and forest measurements. This report provides guidance on defining boundaries; measuring, monitoring, and estimating changes in carbon stocks; implementing plans to measure and monitor carbon; and developing quality assurance and quality control plans to ensure credible and reproducible estimates of the carbon credits. Expected users include individual landowners, industrial forestry companies and managers of utility company lands who are interested in implementing forestry activities and projects designed to generate carbon credits that could be traded as an offset, or for registering carbon dioxide reductions using the U.S. Department of Energy 1605(b) voluntary reporting registry. Users should be familiar with specific protocols required by the registry to which the forest-carbon estimates will be reported. By carefully referencing these guidelines and other sources of information, reporters can meet targeted levels of precision. [...more information>>](#)

Publication: <http://www.nrs.fs.fed.us/pubs/3292>

Field Measurements for Forest Carbon Monitoring

This volume is a comprehensive handbook of methods and techniques used in forest carbon measurement and monitoring, focused on the stand and landscape scales. Techniques used to characterize standing stocks of carbon in a forest, measure key carbon fluxes, and collect related data necessary to drive process models and upscale carbon estimates are described in detail. In addition to measurement methods, each chapter includes background information, necessary calculations, and equipment requirements. Chapter authors are scientists with extensive experience in the techniques described and include Forest Service and university scientists. Of particular interest is a "lessons learned" chapter written by researchers who installed landscape-scale forest carbon monitoring sites using the protocols detailed in the volume in three very different landscapes. [...more information>>](#)

The volume is available through springer.com

ISBN 978-1-4020-8505-5

Standard tables of forest ecosystem and harvested wood carbon (NE GTR-343)

The complete set of forest carbon tables from the revised 1605(b) guidelines is available in electronic format. Tables are from a study that presents techniques for calculating average net annual additions to carbon in forests and in forest products. Forest ecosystem carbon yield tables, representing stand-level merchantable volume and carbon pools as a function of stand age, are available for 51 forest types within 10 regions of the United States. For each region and type, separate tables are presented for afforestation and reforestation. Because carbon continues to be sequestered in harvested wood, approaches to calculate carbon sequestered in harvested forest products are included in the accompanying publication. The estimates and methods in this report are consistent with guidelines being updated for the U.S. Voluntary Reporting of Greenhouse Gases Program and with guidelines developed by the Intergovernmental Panel on Climate Change. The complete set of tables is available in spreadsheet form. [...more information>>](#)

Publication and download electronic version of tables: <http://nrs.fs.fed.us/pubs/8192>

COLE (Carbon OnLine Estimator): Web-based Tool for Forest Carbon Analysis

COLE is an online tool used to generate carbon estimates based on forest inventory data for any area of the continental United States chosen by the user. COLE currently produces results for areas of a county or larger, with the uncertainty of the estimates decreasing for larger areas. Reports can be produced which calculate carbon "growth and yield" curves for 1605b reporting, based on averages across the selected area. Estimates may also be produced corresponding to the format for the inventory of US greenhouse gas emissions and sinks, and can be useful for the carbon criterion in the Montreal Process criteria and indicators for sustainability. COLE, CCT, and NE GTR-343 are based on similar data and conversion factors. As tool development proceeds, COLE will take the place of CCT.

COLE is a collaborative project between the US Forest Service, Northern Research Station and the National Council for Air and Stream Improvement, Inc. [...more information>>](#)

Software and Documentation: <http://ncasi.uml.edu/COLE>

U.S. Forest Carbon Calculation Tool (CCT)

The Carbon Calculation Tool 2007, *CCT.exe*, is a computer application that reads publicly available forest inventory data collected by the USDA Forest Service's Forest Inventory and Analysis Program (FIA) and generates state-level annualized estimates of carbon stocks on forestland based on FORCARB2 estimators. Estimates can be recalculated as new inventory data become available. The input set of FIA data files available on the Internet (as well as some older inventory files used to fill in gaps) are summarized by the application, converted to carbon stocks, and saved as part of a state or substate level "survey summary" file. This is used to produce state-level and national tables with annualized carbon stocks and flux (or net stock change) beginning with the year 1990. [...more information>>](#)

Software, User's Guide, and Example Data Sets: <http://nrs.fs.fed.us/pubs/2394>

Stand Level Carbon Management and Reporting with the Forest Vegetation Simulator

Carbon reporting has been fully integrated into the Forest Vegetation Simulator (FVS) as part of the Fire and Fuels Extension (FFE), allowing users to produce carbon reports along with traditional FVS output. This added capability can be easily used by managers who are current FVS users; carbon impacts of any simulated management, including prescribed fire, thinning, or salvage logging can be assessed. Carbon pools tracked include: live tree biomass (above-and belowground), dead tree biomass (above-and belowground), down dead wood, forest floor, and herbs and shrubs. Calculation methods are consistent with US carbon accounting rules and guidelines.

Please note that FVS is a large and complex model, and prior FVS experience is strongly recommended in order to use the carbon reporting functions. [...more information>>](#)

Software, Documentation, and Training Information: <http://www.fs.fed.us/fmsc/fvs>

Literature Resources for Carbon Inventories

Basic Overviews

How to estimate carbon sequestration on small forest tracts

Journal of Forestry. Hoover, C. M.; Birdsey, R.A.; Heath, L. S.; Stout, S. L. 2000. September: 13-19.

How to estimate forest carbon for large areas from inventory data

Smith, J. E.; Heath, L. S.; Woodbury, P. B. 2004. Journal of Forestry. July/August: 25-31.

Equations: Volume to Biomass Approach

Forest volume-to-biomass models and estimates of mass for live and standing dead trees of U.S. forests

Smith, J. E.; Heath, L. S.; Jenkins, J. C. 2003. Gen. Tech. Rep. NE-298. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 57 p.
Regression based equations to convert merchantable volume to biomass.

Equations: Biomass Approach

Comprehensive database of diameter-based biomass regressions for North American tree species

Jenkins, J. C.; Chojnacky, D. C.; Heath, L. S.; Birdsey, R. A. 2004. Gen. Tech. Rep. NE-319. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 45 p. [1 CD-ROM].
Listing of specific equations for North American tree species.

National-scale biomass estimators for United States tree species

Jenkins, J. C.; Chojnacky, D. C.; Heath, L. S.; Birdsey, R. A. 2003. Forest Science (49):12-35.
Generalized biomass equations by species groups.

Other useful information

A model of forest floor carbon mass for United States forest types

Smith, James E.; Heath, Linda S. 2002. Res. Pap. NE-722. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 37 p.

Methods for calculating forest ecosystem and harvested carbon with standard estimates for forest types of the United States

Smith, James E.; Heath, Linda S.; Skog, Kenneth E.; Birdsey, Richard A. 2006. Gen. Tech. Rep. NE-343. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 216 p.

Climate Change Continuing Education Webinar Series

This webinar series ran from January - May 2009 and featured presentations geared to help land managers, consulting foresters, and private forest landowners stay informed on the latest science and tech transfer tools related to forest-based adaptation and mitigation of climate change. Each webinar is an hour long, including Q & A, although there will be an optional additional 15 minute Q & A period. Questions? Contact [Sarah Hines](#) (610.557.4218)

January 14, 2009

Interactions Between Carbon, Climate, and Forests

Presenter: [Chris Swanston](#) (Research Ecologist, Northern Research Station, USFS)

This presentation will set the stage for a broader discussion on climate change and forests by briefly examining interactions between climate change, carbon cycling, and forest sustainability. First, we'll cover some key mechanisms and major trends in climate change, and then explore forecasts of future climate and associated uncertainty. Next, we'll survey the global carbon cycle and the distribution of carbon in major forest ecosystems. We'll then consider several general ecophysiological concepts and how projected changes in climate may interact with forest ecophysiology. Finally, we'll discuss how all these considerations may combine to affect forest carbon storage and productivity in the Lake States and Northeast.

- [Watch the archived Web Cast](#) (Windows Media Player, 131 MB)
- [Presentation Slides](#) (PDF, 5.2 MB)

February 11, 2009

Forest Management During Climate Change

Presenter: [Maria Janowiak](#) (Outreach Scientist, Northern Institute of Applied Carbon Science)

Climate change is expected to have significant effects on the condition and function of forested ecosystems; however, the exact nature of the stressors, their intensity, and the ensuing impacts on forests are quite uncertain. Forest managers will need to cope with this uncertainty, balancing the paucity of detailed information on future conditions against the demands of active and sustainable resource planning and management. In this context, sustainable forest management must recognize the need for ecosystems to adapt to changing climatic conditions in order to achieve desired objectives including, among other things, maintenance of habitat, production of wood, and mitigation of increased levels of atmospheric greenhouse gases. This presentation synthesizes available information on forest management options in the northeastern United States to provide a background for working with an uncertain climate future.

- [Watch the archived Web Cast](#) (Windows Media Player, 52.6 MB)
- [Presentation Slides](#) (PDF, 1.4 MB)
- [Presentation Bibliography](#) (PDF, 16 KB)

April 15, 2009

FIA Data and Forest Carbon Policy

Presenter: Neil Sampson (President, Sampson Group Consulting)

- [Watch the archived Web Cast](#) (Windows Media Player, 100 MB)
- [Presentation Slides](#) (PDF, 1.5 MB)

May 13, 2009

Introduction to the "Climate Wizard" - a web-based tool for local climate change forecasting

Presenter: Chris Zhangjar (The Nature Conservancy)

[Watch the archived Web Cast](#) (Windows Media Player, 160 MB)

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