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Carbon

Tools for carbon inventory, management, and reporting

Accurate estimates of carbon in forests are crucial for forest carbon management, carbon credit trading, 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 state and regional greenhouse gas registries and programs.

Our scientists have contributed to developing a toolbox full of basic calculation tools to help quantify forest carbon for planning or reporting. The following tools are currently available:

- PRESTO: an online tool to estimate carbon in harvested wood products
- Measurement guidelines for the sequestration of forest carbon
- Field Measurements for Forest Carbon Monitoring: A Landscape-scale Approach
- Standard tables of forest ecosystem and harvested wood carbon
- Carbon OnLine Estimator (COLE)
- FORCARB2: An updated version of the U.S. Forest Carbon Budget Model
- U.S. Forest Carbon Calculation Tool (CCT)
- Forest Vegetation Simulator (FVS)
- CVal
- i-Tree
- CarbonPlus Calculator: A locally customizable emissions calculator for individuals and businesses

PRESTO: An online tool to estimate carbon in harvested wood products

UPDATE

PRESTO has a new home! PRESTO, an online tool for estimating the carbon stored in harvested wood products, has joined the i-Tree family. It's now called i-Tree PRESTO and can be found at: https://presto.itreetools.org/ . You do not need to download any software or register for an account in order to use this calculator. The user guide can be found on the website; go to Menu → Help → How to Use to find an overview and a link to download the manual (GTR NRS-141). The manual was written for the original version of PRESTO; while the current version looks and functions the same, some features such as the batch upload are no longer available.
Visit https://presto.itreetools.org/ today and check it out

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Estimating carbon in harvested wood products has been challenging for landowners and managers, especially when multiple harvests and stands are involved. PRESTO is an easy to use web-based tool that allows users to estimate the carbon stored in harvested wood products. Output is available in a variety of units and several reporting formats. Users may enter stand specific harvest data or experiment with lump sum data entry (ideal for "what if?" analyses). A free account is needed to use the tool; instructions and website address are included in the User Guide, available at: https://www.nrs.fs.fed.us/pubs/47240

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: **https://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: **https://www.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. COLE originated as 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://www.ncasi2.org/COLE/**

FORCARB2: An updated version of the U.S. Forest Carbon Budget Model

FORCARB2, an updated version of the U.S. FORest CARBon Budget Model (FORCARB), produces estimates of carbon stocks and stock changes for forest ecosystems and forest products at 5-year intervals. FORCARB2 includes a new methodology for carbon in harvested wood products, updated initial inventory data, a revised algorithm for dead wood, and now includes public forest land, reserved forest land, and forest land of low productivity. The program is written in FORTRAN and is text based, though virtually every parameter is defined by input text-based files that can be modified or built by the user. We expect users who are fairly advanced in terms of knowledge about computers will be most capable in using this model.

All electronic files for download, including the model source code, executable files, and input and output files are available at https://www.nrs.fs.fed.us/pubs/35613.

U.S. Forest Carbon Calculation Tool (CCT)

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UPDATE

CCT was updated in October 2017. Please contact Mike Nichols for the updated version.

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The Carbon Calculation Tool 4.0, CCTv40.exe, is a computer application that reads publicly available forest inventory data collected by the U.S. Forest Service's Forest Inventory and Analysis Program (FIA) and generates state-level annualized estimates of carbon stocks on forest land 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. This user's guide includes instructions for use, example data sets, and a discussion of methods and assumptions.

User's Guide, and Example Data Sets: **https://www.nrs.fs.fed.us/pubs/2394**

Updated CCT software - **Please contact Mike Nichols**

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.

If you are considering using the FVS carbon reports, please read "Forest carbon estimation using the Forest Vegetation Simulator: Seven things you need to know" to see if FVS is the right tool for your needs. This publication answers commonly asked questions regarding the use of the FVS carbon reports, including data requirements.

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: **https://www.fs.fed.us/fmsc/fvs**

CVal: Assess the Economics of Participating in Carbon Markets

CVal is a powerful spreadsheet tool that will help foresters, managers, and project developers work with private forest landowners to assess the economic profitability of participating in carbon markets. CVal provides a discounted cash flow analysis based on a full accounting of variables, including tract size, carbon sequestration rate, carbon price, and enrollment and trading costs. Automated financial break-even analyses in the macros version quickly assess threshold values of key variables for profitable projects, and the program readily performs "what if" calculations after storing starting values. CVal was designed to evaluate managed forest and afforestation projects traded on the Chicago Climate Exchange, but its methodology could be adapted for other trading mechanisms and agricultural sequestration projects. Documentation is provided in the program itself and in General Technical Report 180, published by the U.S. Forest Service, Forest Products Laboratory. CVal was conceived by Peter Becker (Eastern Ozarks Forestry Council), and Tim McAbee (LandMark Systems, formerly with Clearwater Forest Consultants, LLC). Programming and documentation were in conjunction with E.M. (Ted) Bilek (Forest Products Laboratory). **...more information>>**

CVal and GTR-180 can be downloaded at no cost from http://www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr180.html

i-Tree: Identify, Understand, and Manage Urban Tree Populations

The i-Tree suite of software tools was developed to help users—regardless of community size or technical capacity—identify, understand and manage urban tree populations. Better awareness of the benefits and services provided by the urban forest resource leads to increased attention to stewardship, appreciation of operations, and investment in maintenance. Carbon is one of the variables estimated using i-Tree models. UFORE (Urban Forest Effects) model is one of the featured models. **...more information>>**

Software and Documentation: **http://itreetools.org/**

Forest Service CarbonPlus Calculator

The Forest Service CarbonPlus Calculator can help you calculate the emissions generated by local operations at an individual office, district, or National Forest. This calculator is based on the structure of the EPA Personal emissions calculator. The default parameters for the FS CarbonPlus Calculator have been adapted from a set of data initially

calibrated for New England. If you are able to identify your local emission factors based on information from your utilities and energy suppliers, your calculations will be more accurate. We have also added calculations of the energy benefits of trees plus other information about the roles trees play in urban settings. The calculator includes sections with detailed descriptions of how the numbers are determined for each emissions factor, plus references to the sources for each calculation. All calculations are converted to metric tons per year of CO_2-equivalent for display.

Tool: **http://www.itreetools.org/forestcarboncalculator/**

CarbonPlus Calculator: A locally customizable emissions calculator for individuals and businesses

The CarbonPlus Calculator can help you calculate your local impact on the environment by summarizing carbon emissions due to your energy use. Currently being used by several cities from New England to the Mountain West, the CarbonPlus calculator is an educational tool to enhance citizen awareness of carbon emissions from energy use. Municipalities can arrange to solicit donations to offset those emissions through local tree planting or other energy conservation projects, or just use the tool to encourage emissions reductions.
This calculator is based on the structure of the EPA Personal emissions calculator. The default parameters for the FS CarbonPlus Calculator have been adapted from a set of data initially calibrated for New England. If you are able to identify your local emission factors based on information from your utilities and energy suppliers, your calculations will be more accurate. We have also added calculations of the energy benefits of trees plus other information about the roles trees play in urban settings. The calculator includes sections with detailed descriptions of how the numbers are determined for each emissions factor, plus references to the sources for each calculation.

Tool: **http://www.itreetools.org/carboncalculator/entry.cfm**

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