NPP Multi-Biome: Production and Mortality for Eastern US Forests, 1962-1996, R1

Get Data

Revision date: August 28, 2013

Summary:

There are two data files (tab-delimited .txt format) with this data set that provide estimates of above-ground biomass per county; county-level annual above-ground biomass growth, removals (harvest), and mortality of woody biomass per hectare; county-level total annual above-ground woody biomass production per hectare; forest area per county; mortality (%) in forests within each county; and total annual production and mortality per county. The data provide annual mean above-ground wood increments for temperate forests in 1,956 counties of the 28 eastern US states.

The data are derived from forest inventory data from 1960s to 1990s that were collected from an extensive network of permanent inventory plots as part of the US Department of Agriculture Forest Service Forest Inventory and Analysis (FIA).

Based on the analysis of the above-ground production data (Brown and Schroeder, 1999), above-ground production of woody biomass (APWB) for hardwood forests ranged from 0.6 to 28 Mg/ha/yr and averaged 5.2 Mg/ha/yr. For softwood forests, APWB ranged from 0.2 to 31 Mg/ha/yr and averaged 4.9 Mg/ha/yr. APWB was generally highest in southeastern and southern counties, mostly along an arc from southern Virginia to Louisiana and eastern Texas. No clear spatial pattern of mortality of woody biomass (MWB) existed, except for a distinct area of high mortality in South Carolina as a result of Hurricane Hugo in 1989. For hardwood forests, MWB ranged from 0 to 15 Mg/ha/yr and averaged 1.1 Mg/ha/yr. The average MWB for softwood forests was 0.6 Mg/ha/yr with a range of 0 to 10 Mg/ha/yr. The rate of above-ground MWB averaged <1%/yr for both hardwood and softwood forests.

Revision Notes: Only the documentation for this data set has been modified. The data files have been checked for accuracy and are identical to those originally published in 2003.

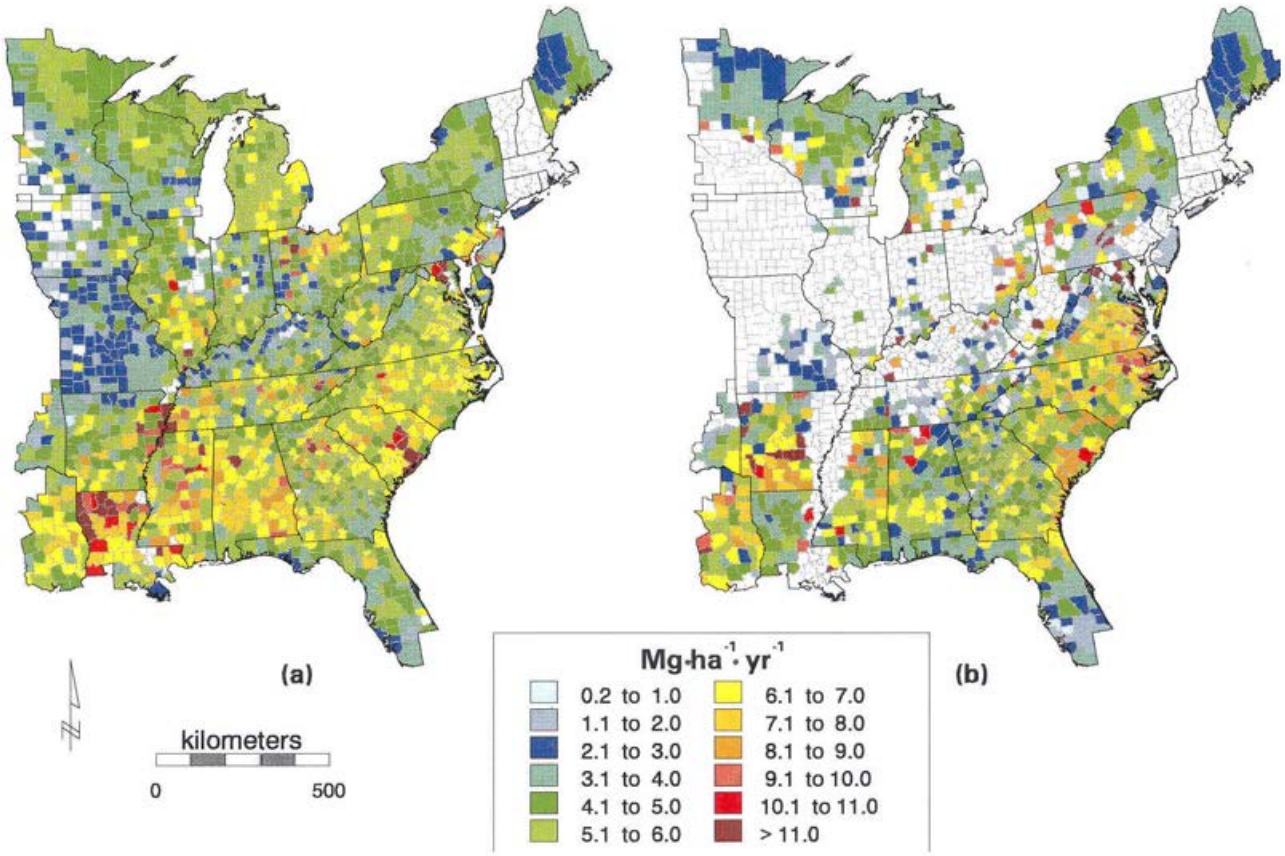

Figure 1. Map of aboveground production of woody biomass for (a) hardwood and (b) softwood forests of the eastern United States. Counties with no color are those for which data are missing. Source: Brown, S.L., and P.E. Schroeder. 2000. Spatial patterns of aboveground production and mortality of woody biomass for eastern US forests: Erratum. Ecological Applications 10(3): 937. This is the corrected version of Figure 2 from Brown, S.L., and P.E. Schroeder. 1999. Spatial patterns of aboveground production and mortality of woody biomass for eastern US forests. Ecological Applications 9(3): 968-980.

Additional Documentation

The Net Primary Productivity (NPP) data collection contains field measurements of biomass, estimated NPP, and climate data for terrestrial grassland, tropical forest, temperate forest, boreal forest, and tundra sites worldwide. Data were compiled from the published literature for intensively studied and well-documented individual field sites and from a number of previously compiled multi-site, multi-biome data sets of georeferenced NPP estimates. The principal compilation effort (Olson et al., 2001) was sponsored by the NASA Terrestrial Ecology Program. For more information, please visit the NPP web site at http://daac.ornl.gov/NPP/npp_home.html.

Data Citation:

Cite this data set as follows:

Brown, S.L., and P. E. Schroeder. 2013. NPP Multi-Biome: Production and Mortality for Eastern US Forests, 1962-1996, R1. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA. doi:10.3334/ORNLDAAC/655

This data set was originally published as:

Brown, S.L., and P. E. Schroeder. 2003. NPP Multi-Biome: Production and Mortality for Eastern US Forests, 1962-1996. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA.

Table of Contents:

1. Data Set Overview:

Project: Net Primary Productivity (NPP)

The main goals of this study (Brown and Schroeder, 1999) were to use the extensive US Forest Inventory and Analysis (FIA) data base for the forests of the eastern United States to (1) determine the magnitude and patterns of above-ground production of woody biomass (APWB), which is a key component of ANPP, and mortality of woody biomass (MWB) for hardwood and softwood forests, and (2) produce geographically referenced estimates of APWB and MWB for hardwood and softwood forests at the county scale of resolution.

2. Data Description:

There are two data files with this data set in tab-delimited .txt format. The files provide annual mean above-ground wood increments for temperate forests in 1,956 counties of the 28 eastern US states. There is one file hardwood forests and one file for softwood forests. The files provide estimates of above-ground biomass per county; county-level annual above-ground biomass growth, removals (harvest), and mortality of woody biomass per hectare; county-level total annual above-ground woody biomass production per hectare; forest area per county; mortality (%) for total forest area within each county; and total annual production and mortality per county.

Spatial Coverage

Site: Eastern United States

Site Boundaries:(All latitude and longitude given in decimal degrees)

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Eastern United States	-100	-60	50	25

Site Information

This study focused on eastern US forests because the FIA data for this part of the country are consistent and complete, and is readily available from the World Wide Web. Data for four northeastern states (Massachusetts, New Hampshire, Rhode Island, and Vermont) were not included in this data set because the data were not available at the time this study was undertaken.

In the eastern US, there has been a long history of forest clearing, forest management, and disturbance. Virtually all of the forests have been altered by humans to some degree at some time in the past. Today, many of these forests are recovering from past agricultural use and are actively managed. Thus, the resulting forest landscape is dominated by forests at different stages of recovery (Brown et al., 1997) and with different carbon budgets.

Spatial Resolution

The study area covers 1,956 counties in the 28 Eastern states. Data for four northeastern states (Massachusetts, New Hampshire, Rhode Island, and Vermont) are not included in this data set.

Temporal Coverage

1962-1996

Temporal Resolution

The eastern state-based FIA inventories were conducted between 1962 and 1988. Remeasurements were conducted 6 to 23 years later, between 1985 and 1996 (with an average interval of 12 years).

Data File Information

Table 1. Data files in this data set archive

FILE NAME	TEMPORAL COVERAGE	FILE CONTENTS
Hardwood_production_East_US_Brown.txt	1962/01/01-1996/12/31	ANPP estimates for hardwood and softwood forests in the eastern portion of the United States
Softwood_production_East_US_Brown.txt		

NPP Data. ANPP estimates for hardwood and softwood forests in the eastern United States are provided in two files, one for each forest category (hardwood or softwood) (Table 1). The spreadsheet files are stored as tab-delimited (txt) files. Missing values are represented by -9999. Biomass units are expressed as Mg/ha (dry matter weight). ANPP components and total ANPP units are expressed as Mg/ha/year (dry matter weight). Mortality is also expressed as percentage of forest area within the county and Mg/county/year. Total above-ground wood production is also expressed as Mg/county/year.

Table 2. Column headings in NPP file

COLUMN	DEFINITION	UNITS

HEADING		
State	State in which data were collected	Text
County	County in which data were collected	
Forest category	Hardwood or Softwood	
Aboveground Biomass	Above-ground woody biomass	Mg/ha
Aboveground Growth	Above-ground woody growth	Mg/ha/yr
Removals (harvest)	Removals (harvest) of woody biomass	
Mortality of woody biomass (MWB)	Mortality of woody biomass	
Aboveground Production of Woody Biomass (APWWB)	Above-ground production of woody biomass (sum of net annual growth and mortality of woody biomass)	
Mortality	Woody mortality as a proportion of forest area within the county	percent
Forest Area within the County	Forest area within the county	ha*1,000
Total APWB per county	Total above-ground woody production per county (sum of net annual growth and mortality of woody biomass)	Mg/county/yr
Total MWB per county	Total woody mortality per county	

Sample NPP Data Record [**Hardwood_production_East_US_Brown.txt**]

State County Forest Category Aboveground Biomass Aboveground Growth Removals (harvest) Mortality of woody biomass (MWB) Aboveground Production of Woody Biomass (APWWB) Mortality Forest Area within the County Total APWB per county Total MWB per county | | Hardwood / Softwood [Mg] [ha^-1] [Mg] [ha^-1] [yr^-1] [Mg] [ha^-1] [yr^-1] [Mg] [ha^-1] [yr^-1] [Mg] [ha^-1] [yr^-1] % [ha] [10^3] [Mg] [county^-1] [yr^-1] [Mg] [county^-1] [yr^-1] Alabama
Autauga Hardwood 90.62 4.87 7.09 0.89 5.76 0.98 61.9 356.36 438.59
Alabama Baldwin Hardwood 108.95 4.66 4.83 1.03 5.7 0.95 153.77 875.78 742.69
Alabama Barbour Hardwood 102.47 6.48 7.37 0.84 7.32 0.82 103.36 757.02 761.37 ...

Sample NPP Data Record [**Softwood_production_East_US_Brown.txt**]

State County Forest Category Aboveground Biomass Aboveground Growth Removals (harvest) Mortality of woody biomass (MWB) Aboveground Production of Woody Biomass (APWWB) Mortality Forest Area within the County Total APWB per county Total MWB per county ||Hardwood / Softwood [Mg] [ha^-1] [Mg] [ha^-1] [yr^-1] [Mg] [ha^-1] [yr^-1] [Mg] [ha^-1] [yr^-1] [Mg] [ha^-1] [yr^-1] % [ha] [10^3] [Mg] [county^-1] [yr^-1] t[Mg] [county^-1] [yr^-1] Alabama
Autauga Softwood 62.80 3.30 1.76 0.27 3.57 0.44 50.45 180.27 13.87
Alabama Baldwin Softwood 58.85 3.16 1.73 0.49 3.66 0.84 112.19 410.46 55.47
Alabama Barbour Softwood 91.13 4.05 3.29 0.54 4.59 0.59 62.43 286.40 33.85 ...

3. Data Application and Derivation:

The accumulation of biomass, or NPP, is the net gain of carbon by photosynthesis that remains after plant respiration. This study used the biomass estimates of average net annual growth and mortality to calculate a major component of above-ground NPP (ANPP), i.e., the accumulation of live above-ground woody biomass over a given time interval.

The results of this study were used to construct a first-order carbon budget for above-ground components of eastern US forests (Brown and Schroeder, 1999). The carbon budget is the sum of the change in the carbon pool of living trees, change in the carbon pool of dead wood, and change in the carbon pool of long-lived wood products. Similar forest inventory data have been used successfully to produce spatially explicit estimates of biomass density (biomass per unit area) and pools (total standing crop) for forests of the eastern US (Brown et al. 1999; 2003).

In addition to forest carbon budgets, geographically referenced analyses of ANPP and mortality are also useful to (1) understand and predict the consequences of large-scale phenomena like global climate change, and (2) provide a database for verification of regional and continental-scale ecosystem models. Also, for mixed-age eastern US hardwood forests, above-ground biomass density of the tree component (megagrams per hectare) is a useful surrogate measure for stage of forest development (Brown et al., 1997).

4. Quality Assessment:

The FIA data for the eastern US forests are consistent and complete. The FIA uses a statistically based sampling scheme designed to provide growing-stock volume estimates with a sampling error of 5% for 28.3 x 10^6 m^3, and forest area estimates with a sampling error of 3% for 0.4 x ha. Larger forest areas and volumes have smaller relative standard errors, and vice versa. For the southeastern United States, for example, analyses of measurement error, sampling error, and regression error indicated that the annual change in growing-stock volume over the 6–8 yr period between inventories had a 95% confidence interval of ±10%. Brown and Schroeder (1999) expected that the annual change in biomass would have a somewhat higher confidence interval than this due to an increase in the regression error (Clark et al., 1986). The sampling error was the largest component of the total error in this example, accounting for 87% of the total. Analysis of the data at the county level, as done in Brown and Schroeder (1999), would result in a larger confidence interval, mostly due to the increase in sampling error at this smaller scale. For example, the sampling errors for volume growth at the state level for Virginia and North Carolina (1.3 and 1.2%, respectively), increase by about an eight-fold factor or more at the county level (Brown, 1993; Thompson and Johnson, 1994). How the various sources of error compound into total error for production and mortality of woody biomass at the county level is not known, and clearly indicates an area of research deserving more attention.

The estimates of ANPP in this study are generally comparable, although the range is wider, to other published estimates for eastern US temperate forests based on ecological studies (Busing et. al., 1993; Whittaker, 1966, and Whittaker et al., 1974). It is difficult to compare MWB results with other studies in temperate forests because most other studies examined mortality in terms of numbers of stems, not biomass.

5. Data Acquisition Materials and Methods:

Estimates of aboveground production and mortality of woody biomass for forests of the eastern United States were based on data collected from an extensive network of permanent inventory plots maintained by the US Department of Agriculture Forest Service Forest Inventory and Analysis (FIA). Estimates of growing stock volume by forest type and stand size-class were compiled for 1,956 counties in 28 eastern US states on the basis of state-based inventories conducted between 1962 and 1988 and remeasurements conducted 6 to 23 years later, between 1985 and 1996 (with an average interval of 12 years) (Brown and Schroeder, 1999). Data for four northeastern states (Massachusetts, New Hampshire, Rhode Island, and Vermont) were not available on-line at the time Brown and Schroeder (1999) conducted their analysis and thus are not included in this data set. Details of field data collection, subsequent FIA data manipulation and analysis, and the FIA database itself are available at the FIA site, and in Birdsey and Schreuder (1992) and Hansen et al. (1992).

Inventory data were aggregated by county into three broad forest categories (hardwood, pine, and spruce-fir) and three stand-size classes and expressed per unit area of forest land. Forest area is defined by the Forest Service as land producing, or capable of producing, in excess of 20 cubic feet per acre per year of industrial roundwood products. Stand volume was converted to aboveground biomass with regression equations for biomass expansion factors (BEF, ratio of aboveground biomass density of all living trees to merchantable volume). The change in biomass and mortality between the two inventories was converted to an average net annual change in growing stock and mortality (MWB, mortality of woody biomass). APWB (aboveground production of woody biomass) was calculated as the sum of net annual growth and mortality of woody biomass. APWB is a major component of aboveground net primary production (ANPP). Statistics were presented for hardwood and softwood (pine plus spruce-fir) forest categories. The approach accounted for production of commercial and noncommercial tree species with diameters greater than 2.5 cm and included noncommercial tree components (branches, twigs, and leaves) but did not account for annual leaf production.

The estimation methods were based on work by Schroeder et al. (1997) and were also used to estimate woody biomass (Brown et al., 1999). The woody biomass data are archived at the ORNL DAAC as "Woody Biomass for Eastern US Forests, 1983-1996" (Brown et al., 2003).

6. Data Access:

These data are available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

Data Archive Center:

Contact for Data Center Access Information:
E-mail: uso@daac.ornl.gov
Telephone: +1 (865) 241-3952

7. References:

Olson, R.J., KR. Johnson, D.L. Zheng, and J.M.O. Scurlock. 2001. Global and Regional Ecosystem Modeling: Databases of Model Drivers and Validation Measurements. ORNL Technical Memorandum TM-2001/196. Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA.

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Additional Sources of Information:

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