NPP Boreal Forest: Consistent Worldwide Site Estimates, 1965-1995, R1

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Revision date: September 31, 2012

Summary:

This data set provides estimates of above- and below-ground biomass, above- and below-ground NPP (ANPP and BNPP), and total NPP(TNPP) for selected North American and Eurasian boreal forests located between 66.37 degrees N and 47.5 degrees N. Each stand was selected through a review of published literature and classified into one of three classes, depending upon completeness of NPP budget, ancillary site data, and stand information. Within the overall 1965-1995 temporal range, data available for individual sites varies widely.

There are two ASCII files (comma-separated-value format) of NPP data.

- The first file provides carbon distribution in above- and below-ground vegetation biomass, above- and below-ground net primary production, and mean annual biomass increment for twenty-four (24) Class I sites which have complete NPP budgets (ANPP + BNPP). Information about site characteristics and NPP measurement approaches are also provided.
- The second file provides stand information, carbon distribution in above-ground vegetation biomass, and ANPP data for forty-five (45) Class II boreal forest stands that have incomplete NPP budgets.

Revision Notes: Above- and below-ground biomass, ANPP, and TNPP values for several sites have been corrected to agree with primary published sources and related data sets. The temporal coverage for both has been corrected to agree with primary published sources. Please see the Data Set Revision section of this document for detailed information.

Additional Documentation

The Net Primary Productivity (NPP) data collection contains field measurements of biomass, estimated NPP, and climate data for terrestrial grassland, tropical forests, temperate forest, boreal forest, and tundra sites worldwide. Data were compiled from 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 (Olsen 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.shtml.

Data Citation:

Cite this data set as follows:

Gower, S.T., O. Krankina, R.J. Olson, M. Apps, S. Linder, and C. Wang. 2012. NPP Boreal Forest: Consistent Worldwide Site Estimates, 1965-1995, R1. Data set. Available on-line [http://daac.ornl.gov] from the Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. doi:10.3334/ORNLDAAC/611.

This revised data set was originally published as:

Gower, S.T., O. Krankina, R.J. Olson, M. Apps, S. Linder, and C. Wang. 2001. NPP Boreal Forest: Consistent Worldwide Site Estimates, 1965-1995. Data set. Available on-line [http://daac.ornl.gov] from the Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A.

Table of Contents:

1. Data Set Overview:

Project: Net Primary Productivity (NPP)

This data set provides two ASCII files (comma-separated-value format) for selected circumpolar North American and Eurasian boreal forests. There is one file for Class I sites which have complete NPP budgets and another file for Class II sites which report ANPP only.

The three objectives of this study were to (1) summarize NPP and carbon allocation patterns for boreal forests, (2) examine relationships between climatic and biological variables and NPP, and (3) examine carbon allocation coefficients for all boreal forests or types of boreal forests that can be used to estimate NPP from easily measured components of NPP.

The main criterion for including published NPP data in this data set were adequate documentation of field and analytical measurements and completeness of NPP budget (above- and below-ground NPP for trees, understory, and ground cover vegetation). Each stand was classified into one of three classes, depending upon completeness of NPP data and ancillary site and stand characteristics. Twenty-four (24) Class I stands with complete NPP budgets (ANPP + BNPP) and forty-five (45) Class II boreal forest stands with above-ground biomass and ANPP budget only are included in the data set. [An additional two hundred and ninety-nine (299) Class III stands were compiled, but lacked complete ANPP budgets or had incomplete information on NPP methodology and/or site characteristics and therefore are not included in this data set.]

Total NPP within Class I sites ranged from 214 to 865 gC/m^2/year and averaged 424 gC/m^2/year. Above-ground NPP (ANPP) was consistently larger for deciduous forests than for evergreen boreal forests in each of the major boreal regions, especially for boreal forests in Alaska. Below-ground net primary production to total net primary production ratios (BNPP : NPP) were consistently larger for evergreen (0.36) than deciduous (0.19) boreal forests. NPP of different-aged stands in age sequence varied from 44% to 77%, a magnitude equal to or greater than that of climatic factors or vegetation type. NPP and ANPP were positively correlated (r2 = 0.66-0.68) to mean annual above-ground increment for Class I stands, and this empirical relationship explained 81% of the observed variation of ANPP for Class II stands. These robust relationships provide an approach for increasing the number and spatial coverage of boreal forest NPP data needed to evaluate NPP estimates from ecosystem models. Notable deficiencies of boreal forest NPP data were ground layer vegetation and below-ground NPP data, NPP data for boreal forest age sequences, and NPP data for boreal larch ecosystems in Eurasia. See Gower et al. (2001) for more details.

ANPP, BNPP, and TNPP estimates for many of the Class I and Class II sites are also reported in DeAngelis et al. (1997), Olson et al. (2012a; b), and Scurlock and Olson, 2012), however the values from these publications may differ slightly from the values in this data set because different assumptions were used.

2. Data Characteristics:

This data set provides two ASCII files (comma-separated-value format) for selected North American and Eurasian boreal forests located between 66.37^o N and 47.50^o N. One file provides stand characteristics, carbon distribution in above- and below-ground vegetation biomass, ANPP, BNPP, and TNPP estimates, and mean annual biomass increment for twenty-four(24) Class I sites that have complete NPP budgets (ANPP + BNPP). Information about NPP measurement approaches is also provided. The second file provides stand characteristics, carbon distribution in above-ground vegetation biomass, and ANPP data for forty-five (45) Class II boreal forest stands that have incomplete NPP budgets.

Spatial Coverage

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Elevation (m)
Global	-148.25	128.27	66.37	47.50	120 - 1,700

Site Information

Background. Boreal forests and woodlands cover 14.5% of the Earth's land surface occupying a nearly contiguous circumpolar band in the northern hemisphere. Estimates of the total area of boreal forest vary from 12.2 to 15.9 x 10^8 ha, depending upon the definition used to define boreal forest. The southern boundary occurs as far south as 50 degrees N in continental regions and as far north as 60-65 degrees N in maritime regions. The largest contiguous area of boreal forest extends from Scandinavia to eastern Siberia, and the second largest boreal forest region is a 500-600 km wide zone that extends from eastern Canada to northern British Columbia, Canada and Alaska, U.S.A. The southern boundary of the boreal forest transitions into cool temperate conifer, deciduous, or mixed forests in eastern North America and Europe, while in other regions there is a relatively abrupt transition from boreal forest to prairie or dry steppe.

The floristic diversity and composition of boreal forests varies with climate and soil, but the composition of tree species is simple compared to other forest biomes. There are only nine (9) dominant tree species in North America and fourteen (14) in Fennoscandia and the former Soviet Union. Siberian larch in central Siberia and far eastern Russia and northeast China are the dominant tree (3) species on > 50% of all forest lands in northeastern Asia.

The canopy architecture of boreal forests differs from many other forests in three respects: LAI is smaller for boreal forests than many other forests, the foliage distribution is highly clumped, and soil surface is often covered with bryophytes. These characteristics influence light interception and, in turn, NPP. Nutrient availability influences LAI of forests.

The climate of boreal forests varies with latitude and geographic location. The latitudinal range of boreal forests is highly variable. Boreal forests at the southern boundary have 120 days that the air temperature is > 10 C vs. 30 days at the northern boundary of the boreal forest. The boreal maritime climate has smaller temperature amplitude than the boreal continental climate, which in extreme locations can range from > 30 C in the summer to -70 C in the winter.

Boreal forests contain a disproportionately large amount of carbon in the soil compared to other biomes. Boreal vegetation and soil together contain 300 Pg of carbon equivalent to 50% of the carbon in the atmosphere. The large amount of carbon stored in the cold or frozen soils makes boreal forests extremely important to climate change model scenarios.

Several environmental, structural, and ecological characteristics that influence NPP are unique, or very important, to boreal forests. The depth to permafrost affects the length of the growing season suitable for root growth and soil processes that regulate water and nutrient availability. Cold or frozen soils restrict decomposition, leading to deep accumulations of surface organic layers that sequester nutrients, resulting in low nutrient availability in most boreal forests.

Natural disturbances such as fire and insect and pathogen infestation also influence NPP. Human-related disturbances such as land clearing, logging, and

pollution are also important. Age-related changes in NPP are well documented, therefore, changes in disturbance regime (frequency or intensity) may affect the capacity of the boreal forests to sequester carbon.

Study Sites. The overall objective of this study was to compare NPP budgets for boreal forests. The availability and completeness of data differ among the major boreal forest regions. After examination of the literature, a tiered approach was developed for compiling climatic and biological variables and NPP estimates based on the completeness of the data records and description of the study methods.

Twenty-four (24) Class I stands were identified within nine boreal forest sites based on their complete NPP budgets. The Class I stands have field measurements for above- and below-ground biomass and estimates of NPP for overstory, understory, and in most cases, ground cover. The Class I stands include boreal forests of contrasting climates (e.g., continental and maritime), evergreen and deciduous leaf habit, and broad-leaf and needle-leaf morphology. The geographic distribution of the Class I stands was not uniform, however. Fifty percent of the Class I stands are from two North American studies (Alaska and central Canada), and an additional seventeen percent of the stands are from one study site in Finland. Only one stand was from the important larch forests of Eurasia. The age distribution of Class I stands is skewed towards older stands. Class I stands span a broad range of boreal climatologies, ranging from the mild maritime boreal climates in Sweden with a mean annual temperature of 2.4-3.0 C to extreme continental boreal climates with mean annual temperatures of -4.6 C for northern Manitoba, Canada.

Forty-five (45) Class II boreal forest stands were identified based on their above-ground biomass estimates and ANPP budget. In some studies understory NPP is missing. These stands also tended to be old age.

An additional 299 Class III stands were compiled by Gower et al. (2001) but are not included in this data set. Class III stands lacked complete ANPP budgets or had very sketchy information on NPP methodology and/or site characteristics.

With the notable exception of the larch forests in Eurasia, the Class I and II sites include most of the dominant boreal forest ecosystems in each of the major boreal regions.

Site characteristics for the Class I sites are summarized in the NPP data files and described in Gower et al. (2001). The primary published literature should be consulted for details about all of the sites. See references in Gower et al. (2001) and listed at the end of the NPP data files.

Spatial Resolution

There are 24 Class I stands with complete NPP budgets. The Class I study plots varied in size (Table 1). There are 45 Class II sites. Spatial resolution of Class II sites is available in the primary published literature.

Temporal Coverage

Biomass and NPP measurements were made at the Class I sites between 1965 and 1995 (Table 1). Temporal coverage of Class II sites is available in the primary published literature.

Table 1. Spatial resolution and temporal coverage of studies at the Class I sites

Site (Region)	Plot Size	Temporal Coverage
Canada: Southern BOReal Ecosystem Atmosphere Study (BOREAS SSA)	25 x 25 m stands of old jack pine	1993-1995
	30 x 30 m stands of mature quaking (trembling) aspen	
	15 x 15 m stands of black spruce	
Canada: Northern BOReal Ecosystem Atmosphere Study (BOREAS NSA)	25 x 25 m stands of old jack pine	1993-1995
	25 x 25 m stands of mature quaking (trembling) aspen	
	15 x 15 m stands of old black spruce	
Russia, Siberia	0.3 to 0.4 ha stands of Scots pine with 0.25 m^2 subplots for ground cover/understory, 0.5-1.0 m^2 leaf litterfall traps, and 4 m^2 branch litterfall plots	1968-1974
Russia, Karelia	Norway spruce and Scots pine stands; study design similar to that used at Siberian sites	Information not available; assumed to be same temporal coverage as for Siberian sites
Finland, Ilomantsi	0.09 to 0.12 ha stands each of Scots pine, Norway spruce, and white birch with 0.5 m^2 litterfall traps	1979-1985
Sweden, Jadraas	20 x 20 m stands of Scots pine	1973-1983
United States of America, Alaska	50 x 60 m upland stands of (1) paper birch-trembling aspen and (2) white spruce and 50 x 60 m floodplain stands of (3) balsam poplar-thin leaf alder, (4) balsam poplar, and (5) black spruce, each with 10 x 10 m tree plots, 1 m^2 vegetation plots, 4 m^2 shrub/seedling plots, 0.25 m^2 litterfall traps, and 25 x 25 soil core plots	1989-1993
China, Daxing'anling	355 sample plots within 17 areas; size not available	Information not available; assumed to be 1980s

Temporal Resolution

The primary published literature should be consulted for details.

Data File Information

Table 2. Data files in this data set archive

FILE NAME	TEMPORAL COVERAGE	FILE CONTENTS
borfor1_npp_r1.csv	1968/01/01-1995/12/31	Summary of site and stand characteristics, NPP methodology, leaf area index, biomass distribution, and above- and below-ground net primary productivity for Class I boreal forest sites
borfor2_npp_r1.csv	1965/01/01-1995/12/31	Summary of site and stand characteristics and above-ground biomass and net primary productivity for Class II boreal forest stands

NPP Data. NPP estimates for the Consistent Worldwide Sites are provided in two files, one for Class I sites and one for Class II sites (Table 2). The data sets are ASCII files in comma-separated-value (.csv) format. The data records begin on line 4. The value -999 is used to denote missing values. All NPP units are in gC/m^2/year (dry matter weight). As a general rule, field measured biomass and productivity values were converted to carbon equivalent using ratios of 0.5 for woody tissue and 0.45 for foliage and fine roots. Exceptions are footnoted in the data files.

Table 3. Column headings and parameter definitions in NPP file for Class I sites **borfor1_npp_r1.csv**

COLUMN HEADING	PARAMETER DEFINITION	UNITS
Country	Country where study site was located	Text
Site	Site where study plots were located	Text
References	Footnote to primary and secondary references / data sources (citation listed at the end of the file)	Numeric
Latitude	Latitude of site where data were collected in decimal degrees	Decimal Degrees
Longitude	Longitude of site where data were collected in decimal degrees	Decimal Degrees
Precipitation	Annual precipitation amount	mm
Mean annual T	Mean annual temperature	degrees C
Method LAI	Methods used to estimate leaf area index (i.e., site-specific allometry, litterfall, and estimates from foliage biomass using specific leaf area values)	Text
Method tree NPP	Methods used to estimate above-ground net primary production of trees (i.e., site-specific allometry)	
Method understory NPP	Methods used to estimate above-ground net primary production of understory (i.e., clip plot or not measured)	
Method moss NPP	Methods used to estimate above-ground net primary production of moss (i.e., moss ingrowth plot, flux, none or not available)	
Method coarse roots NPP	Methods used to estimate below-ground net primary production of coarse roots (i.e., site-specific allometry or none)	
Method fine roots NPP	Methods used to estimate below-ground net primary production of fine roots (i.e., mini-rhizotrons, longevity census, soil cores)	
Dominant species	Dominant tree species in stand	
Stand age	Age of stand	years
Tree density	Density of trees in stand	tree/ha
Basal area	Basal area of trees	m^2/ha
LAI	Leaf area index	m^2/m^2
Aboveground biomass	Estimated above-ground biomass components (stem, new and old branch, and new and old foliage) based on site-specific allometric equations from destructive harvest of sample trees	gC/m^2
Belowground biomass	Root biomass calculated using site-specific and non-site-specific allometric equations, excavating root systems of sampled trees, and weighing root components from soil cores	
MAI aboveground	Mean annual increment of aboveground biomass	$gC/m^2/yr$
MAI Total	Mean annual total biomass increment	
NPP tree wood	Annual tree wood (stem + branch) production	
NPP tree foliage	Annual tree foliage production	
NPP understory	Annual understory production	
NPP moss	Annual moss production	
NPP aboveground	Annual above-ground net primary production (sum of above)	
NPP coarse roots	Annual coarse root production	
NPP fine roots	Annual fine root production	
NPP belowground	Annual below-ground net primary production (sum of above)	
Total NPP	Total annual net primary production (ANPP + BNPP)	

Basal area is reported as m^2/ha, LAI as m^2/m^2, and biomass as gC/m^2. NPP estimates are based on plant dry matter accumulation, expressed as gC/m^2/year (dry matter weight). As a general rule, field measured biomass values were converted to carbon using ratios of 0.5 for woody tissue and 0.45 for foliage and fine roots. Exceptions are footnoted in the data files. Climate data are expressed as annual precipitation amounts (mm) and mean annual temperature (C).

Sample NPP Data Record **borfor1_npp_r1.csv**

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Country, Location, References, Latitude, Longitude, Precipitation (mm), Mean annual T (C) ....
NPP aboveground (gC/m2/yr),NPP coarse roots (gC/m2/yr),NPP fine roots (gC/m2/yr), NPP belowground (gC/m2/yr),
Total NPP (gC/m2/yr)
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Canada, Saskatchewan, BOREAS SSA, 1,2, 53.99, -104.99, 405, -1.1 ... 146, 13, 106, 119, 265

Table 4. Column headings and parameter definitions in NPP file for Class II sites **borfor2_npp_r1.csv**

COLUMN HEADING	PARAMETER DEFINITION	UNITS
Country	Country where study site was located	Text
Site	Site where study plots were located	
Species	Dominant tree species in stand	
Latitude	Latitude of site where data were collected in decimal degrees	Decimal Degrees
Longitude	Longitude of site where data were collected in decimal degrees	Decimal Degrees
Precipitation	Annual precipitation amount	mm
Mean annual T	Mean annual temperature	degrees C
Stand age	Age of stand	years
Aboveground biomass	Estimated above-ground biomass components (stem, new and old branch, and new and old foliage) based on site-specific allometric equations from destructive harvest of sample trees	gC/m^2
NPP aboveground	Annual above-ground net primary production (sum of stem + branch + foliage + understory + moss)	$gC/m^2/yr$
Reference	Footnote to primary and secondary references / data sources (citation listed at the end of the file)	Numeric

Sample NPP Data Record **borfor2_npp_r1.csv**

Country, Site, Species, Latitude, Longitude, Precipitation (mm), Mean annual T (C), Stand age (yr), Aboveground biomass (gC/m2), NPP aboveground (gC/m2/yr), Reference

China, Daxing'anling, Larix gmelinii, 49.00, 123.00, 425, -4.0, 29, 4269, 474, 1
China, Daxing'anling, Larix gmelinii, 50.00, 121.30, 425, -4.0, 54, 3617, 299, 1
China, Daxing'anling, Larix gmelinii, 50.00, 121.30, 425, -4.0, 29, 2837, 352, 1 ...

3. Data Application and Derivation:

The accumulation of biomass, or NPP, is the net gain of carbon by photosynthesis that remains after plant respiration. While there are many fates for this carbon, this data set accounts for carbon distribution in above- and below-ground vegetation biomass and estimates of NPP for overstory, understory, and ground cover where available.

The objectives of this data set was to summarize NPP and carbon allocation patterns for boreal forests. Recent studies suggest that high-latitude temperate and boreal ecosystems are currently a net carbon sink. However, climate change models suggest that boreal forests will experience the greatest warming of any forest biome, with the greatest increases occurring in the continental interiors. The large size of the boreal forest, the large amount of carbon contained in the soil, the sensitivity of NPP and net ecosystem exchange (NEE) to small climatic variation, and anticipated climate warming make the boreal forest biome a key components of global carbon models.

4. Quality Assessment:

In theory NPP can be estimated as the difference between gross primary production (GPP) and autotrophic respiration (RA). However, NPP is not estimated using this approach because GPP cannot be measured directly and RA is difficult to measure, especially in large-statured or multi-species forests.

The studies reported in this data set measured NPP as the sum of annual biomass production of tissue (e.g., stem, branch, foliage, reproductive tissue, coarse and fine roots) and herbivory. Allometric equations are used to estimate the annual biomass of each component (except for fine roots), and biomass increment is calculated as the difference between measurement periods.

In the original literature sources, NPP is expressed in either units of dry biomass or carbon per unit area and unit time. In this data set, NPP is reported as carbon grams per square meter per year. As a general rule, biomass and NPP values were converted to carbon equivalent using ratios of 0.5 for woody tissue and 0.45 for foliage and fine roots. Exceptions are footnoted in the data files.

Sources of Error

There are several potential sources of error associated with the NPP measurements. Some scientists estimated foliage production from leaf litterfall biomass data because new foliage biomass allometric equations were not available. This approach assumes the foliage mass of the canopy is in steady state (i.e., new foliage production = leaf litterfall). Using leaf litterfall to estimate foliage production for an aggrading evergreen forest may underestimate new foliage production because new foliage production exceeds leaf litterfall during early stand development. Assuming "steady state" may be erroneous, especially for forests subject to drought and windstorms.

The most common bias of the NPP data encountered was the exclusion of one or more vegetation components, the most common being fine root and mycorrhizae. This data set includes only direct estimates of below-ground net primary production (BNPP). Since no studies estimating mycorrhizae NPP for boreal forests were available, total NPP estimates are likely to be underestimates. Vogt et al. (1982) estimated mycorrhizae NPP comprised 15% of NPP in a cold temperate conifer forest.

Few studies quantified the loss of NPP from herbivory in forests. The few studies that have quantified NPP have concluded that < 10% of NPP of forests is consumed, except during insect outbreaks (Schowalter et al., 1986). The treatment of tree mortality in NPP estimates is also problematic, especially since few studies describe how mortality is measured.

In some cases, the calculation methods used by Gower et al. (2001) differ from those used in the original field investigations. Therefore, the results published in this data set may not agree with the values published in the original data sources.

5. Data Acquisition Materials and Methods:

The main criteria for including published NPP data in this data set were adequate documentation of the measurements and completeness of NPP budget (above- and below-ground NPP for trees, understory, and ground cover vegetation). Each stand was classified into one of two classes, depending upon completeness of NPP data and ancillary site and stand characteristics. Class I stands contain above- and below-ground biomass and NPP data for overstory, understory, and in most cases, ground cover if it was deemed to be important. Excluded were studies that calculated BNPP as a fraction of above-ground biomass or ANPP, although there were several studies where it was unclear what methodology was used to estimate BNPP. Class II stands lack BNPP data, and in some studies understory NPP is missing. A third class (Class III) was identified in Gower et al. (2001) as stands lacking complete NPPA budgets or had very sketchy information on NPP methodology and/or site characteristics. Class III sites are not included in this data set.

NPP measurement approaches used for each Class I site are summarized in the NPP data file [borfor1_npp_r1.csv]. Gower et al. (2001) provide a brief description of the methods used to estimate NPP for each Class I study site. In some cases, the calculation methods used by Gower et al. (2001) differ from those used in the original field investigations. Therefore, the results published in this data set may not agree with the values published in the original data sources.

The Gower et al. (2001) and the primary published literature should be consulted for details about the methods employed at the Class I and Class II sites. See citations listed at the end of each NPP data file.

6. Data Access:

This data is 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:

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Van Cleve, K., F.S. Chapin III, P.W. Flanagan, L.A. Viereck, and C.T. Dyrness (eds.). 1986. Forest Ecosystems in the Alaskan Taiga : A Synthesis of Structure and Function. Ecological studies, v. 57. New York : Springer-Verlag.

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8. Data Set Revisions:

Revision Summary:

The data files within this data set were revised September 30, 2013. They have been converted to ASCII comma-separated-value (csv) format. The overall temporal coverage for both data files has been corrected. Above-and below-ground biomass and ANPP values for several sites have been corrected to agree

with the primary sources.

Data File Changes:

The data files, **borfornpp1.xls** and **borfornpp2.xls**, have been converted to ASCII common-separated-value format and corrected as described below.

The temporal coverage for both data files has been corrected to agree with primary published sources.

Parameter Field*	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv
Temporal coverage (years)	1977-1994	1968-1995	1977-1994	1965-1995

ANPP data values in **borfornpp1.xls** for *Populus tremuloides* (quaking aspen) and *Pinus banksiana* (jack pine) sites located at Boreas SSA in Saskatchewan, Canada have been corrected to agree with values in Table 4 on pages 1,404-1,405 of Gower et al. (2001). The data values for these parameters in **borfornpp1_r1.csv** are now correct.

Parameter Field*	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv
	Populus tremuloides		*Pinus banksiana*	
Above-ground NPP ($gC/m^2/yr$)	116	121	273	352

Below-ground biomass values in **borfornpp1.xls** for *Picea abies*, *Pinus sylvestris* (45 years), *P. sylvestris* (50 years), and *Betula pubescens* stands at Ilomants, Finland have been corrected to agree with values in Finer (1989) using conversion factors of 0.5 for coarse roots and 0.45 for fine roots. The data values for these parameters in **borfornpp1_r1.csv** are now correct.

Parameter Field*	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv
	Picea abies		*Pinus sylvestris* (45 years)		*Pinus sylvestris* (50 years)		*Betula pubescens*	
Below-ground biomass (gC/m^2)	2305	2277.3	727	704.4	678	671.4	408	400.5

Tree foliage NPP values in **borfornpp1.xls** for *Picea abies*, *Pinus sylvestris* (45 years), *P. sylvestris* (50 years), and *Betula pubescens* stands at Ilomants, Finland have been corrected to agree with values in Finer (1989) using conversion factors of 0.45 for leaves and 0.5 for cones. The data values for these parameters in **borfornpp1_r1.csv** are now correct.

Parameter Field*	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv
	Picea abies		*Pinus sylvestris* (45 years)		*Pinus sylvestris* (50 years)		*Betula pubescens*	
Foliage NPP (leaves + cones) ($gC/m^2/yr$)	88	60.5	125	67	80	32.2	93	27.3

Total above-ground NPP values in **borfornpp1.xls** for *Picea abies*, *Pinus sylvestris* (45 years), *P. sylvestris* (50 years), and *Betula pubescens* stands at Ilomants, Finland have been corrected to agree with values in Finer (1989) using conversion factors of 0.45 for leaves and 0.5 for tree wood and cones. The data values for these parameters in **borfornpp1_r1.csv** are now correct.

Parameter Field*	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv
	Picea abies		*Pinus sylvestris* (45 years)		*Pinus sylvestris* (50 years)		*Betula pubescens*	
Total above-ground NPP (tree wood + leaves + cones) ($gC/m^2/yr$)	193	165.5	217	159	112	112.2	169	103.5

Total NPP values in **borfornpp1.csv** for *Picea abies*, *Pinus sylvestris* (45 years), *P. sylvestris* (50 years), and *Betula pubescens* stands at Ilomants, Finland have been corrected to agree with values in Finer (1989). The data values for these parameters in **borfornpp1_r1.csv** are now correct.

Parameter	Uncorrected	Corrected in borfornpp1_r1.csv	Uncorrected in	Corrected in	Uncorrected in	Corrected in	Uncorrected in	Corrected in

Field*	in borfornpp1.xls		borfornpp1.xls	borfornpp1_r1.csv	borfornpp1.xls	borfornpp1_r1.csv	borfornpp1.xls	borfornpp1_r1.csv
	Picea abies		*Pinus sylvestris* (45 years)		*Pinus sylvestris* (50 years)		*Betula pubescens*	
Total NPP (ANPP + BNPP) (gC/m^2/yr)	351	323.5	334	276	215	167.2	214	148.5

Tree foliage NPP and total above-ground NPP values in **borfornpp1.xls** for *Picea abies* in the Karelia region of Russia have been corrected to agree with values in Table 4 on pages 1,404-1,405 of Gower et al. (2001). The data values for these parameters in **borfornpp1_r1.csv** are now correct.

Parameter Field*	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv
	Tree foliage NPP		Total above-ground NPP (tree wood + tree foliage + understory)	
NPP (gC/m2/yr)	108	102	247	185

ANPP data values in **borfornpp1.xls** for 70- and 95-year-old stands of *Pinus sylvestris* in the Irkutsk region of Russia (Siberia) have been corrected to agree with values in Table 4 on pages 1,404-1,405 of Gower et al. (2001). The data values or these parameters in **borfornpp1_r1.csv** are now correct.

Parameter Field*	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv	Uncorrected in borfornpp1.xls	Corrected in borfornpp1_r1.csv
	70-year-old stand of *Pinus sylvestris*		95-year-old stand of *Pinus sylvestris*	
Above-ground NPP (gC/m^2/yr)	353	370	330	370

ANPP and BNPP values for 20-year-old and 120-year-old stands of *Pinus sylvestris* at Jädraås, Sweden in **borfornpp1_r1.xls** do not agree with ANPP and BNPP values for the same stands in NPP Boreal Forest: Jädraås, Sweden, 1973-1983, R1 [http://daac.ornl.cgi-bin/dsviewer.pl?ds_id=202] because Gower et al. (2001; 2012) used different allometric equations to calculate above- and below-ground productivity.

Above-ground biomass values for 17 stands of *Picea abies* at Karelia, Russia in **borfornpp2.xls** have been corrected to agree with Deangelis et al. (1981; 1997) using conversion factors of 0.45 for leaves, fruits, and flowers and 0.5 for tree wood (branches, bole bark, and bole wood). Does not include standing dead wood. The data values for these parameters in **borfornpp2_r1.csv** are now correct.

Parameter Field*	Stand Age	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv
Above-ground biomass (leaves + fruit & flowers + branches + bole bark + bole wood) (gC/m^2)	138	7703	10007.8
	37	1414	1385.5
	126	8304	10411.6
	22	1245	1267.5
	42	1725	1692.4
	109	7619	9584
	41	2088	2050.4
	45	1146	2255
	98	7386	9220.6
	37	2007	3054.5
	82	5505	7164.1
	45	2741	3861
	68	5051	6576.6
	54	3524	4850.5
	39	2228	3432
	43	2629	3971.5
	38	3031	4324.5

Above-ground biomass values in **borfornpp2.xls** for 250-, 130-, and 49-year-old stands of *Larix gmelinii* in the Yakutsk region of Russia have been corrected to agree with values in Schulze et al. (1995). The data values for these parameters in **borfornpp2_r1.csv** are now correct.

Parameter Field*	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv
	250-year-old stand of *Larix gmelinii*		130-year-old stand of *Larix gmelinii*		49-year-old stand of *Larix gmelinii*	
Above-ground biomass (leaves + wood) (gC/m^2)	2011	2159	2272	4364	1070	4448

Total above-ground NPP values in **borfornpp2.xls** for 250-, 130-, and 49-year-old stands of *Larix gmelinii* in the Yakutsk region of Russia have been corrected to agree with values in Schulze et al. (1995). The data values for these parameters in **borfornpp2_r1.csv** are now correct.

Parameter Field*	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv
	250-year-old stand of *Larix gmelinii*		130-year-old stand of *Larix gmelinii*		49-year-old stand of *Larix gmelinii*	
NPP aboveground ($gC/m^2/yr$)	3	0	58	29	107	40

Total above-ground NPP values in **borfornpp2.xls** for a 71-year-old "raised" stand of *Picea mariana* and a 106-year-old "perched" stand of *Picea mariana* in Minnesota (United States) have been corrected to agree with values in Grigal et al. (1985). The data values for these parameters in **borfornpp2_r1.csv** are now correct.

Parameter Field*	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv
	71-year-old "raised" stand of *Picea mariana*		106-year-old "perched" stand of *Picea mariana*	
NPP aboveground ($gC/m^2/yr$)	143	149.5	166	178.3

Above-ground biomass values in **borfornpp2.xls** for 51-, 55-, and 130-year-old stands of *Picea mariana* in the Bonanza Creek Experimental Forest of Alaska (United States) have been corrected to agree with values in DeAngelis et al. (1981; 1997). The data values for these parameters in **borfornpp2_r1.csv** are now correct.

Parameter Field*	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv
	51-year-old stand of *Picea mariana*		55-year-old stand of *Picea mariana*		130-year-old stand of *Picea mariana*	
Aboveground biomass (gC/m^2)	1275	1477.2	1609	1646.4	9995	7594

Total above-ground NPP values in **borfornpp2.xls** for 51-, 55-, and 130-year-old stands of *Picea marianai* in the Bonanza Creek Experimental Forest of Alaska (United States) have been corrected to agree with values in DeAngelis et al. (1981; 1997). The data values for these parameters in **borfornpp2_r1.csv** are now correct.

Parameter Field*	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv	Uncorrected in borfornpp2.xls	Corrected in borfornpp2_r1.csv
	51-year-old stand of *Picea mariana*		55-year-old stand of *Picea mariana*		130-year-old stand of *Picea mariana*	
NPP aboveground ($gC/m^2/yr$)	25	26	55	56	79	80

* = Column heading. See data set Guide document for parameter definitions.

Data User Action:
If you downloaded this data set from the ORNL DAAC on-line archive before September 30, 2012, you should download it again from the ORNL DAAC.

Revision History:

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