NPP Boreal Forest: Mississagi, Canada, 1969-1973, R1

Get Data

Revision Date: July 15, 2013

Summary:

This data set contains two files (.txt format) for study sites in the Mississagi River area of Ontario, Canada (46.35 N -83.38 W elevation 860 m). One file summarizes the results of a series of investigations on the nutrition of jack pine ecosystems, including stand characteristics, above-ground biomass, and where available, litterfall amount and nutrient content of vegetation, litterfall, and soil horizons. Field data were collected in three jack pine (*Pinus banksiana*) study plots between 1969 and 1973. The stands were 20, 30, and 65 years of age.

The second file contains climate data recorded at two weather stations near the Mississagi sites. Precipitation data were obtained from Saulte Sainte Marie, Michigan, USA (46.5 N -84.4 W elevation 218 m) and temperature data were obtained from Saulte Sainte Marie, Ontario, Canada (46.5 N -84.5 W elevation 188 m).

Net primary productivity (NPP) was not directly measured, but is estimated based on above-ground tree growth and litterfall. For the different aged stands, above-ground tree growth was estimated at 262 g/m^2/yr (0-20 years), 289 g/m^2/yr (20-30 years), and 93 g/m^2/yr (30-65 years). Annual tree litter production for the 30-year-old stand averaged 372.9 g/m^2/yr over the course of 3 years. Understory litterfall production for the 30-year-old stand in one year was 33.1 g/m^2/yr.

Revision Notes: The NPP and climate data files for Mississagi have been revised to correct previously reported temporal coverage and litterfall data. Please see the Data Set Revisions 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 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:

Morrison, I. K., and N. W. Foster. 2013. NPP Boreal Forest: Mississagi, Canada, 1969-1973, R[evision]1. 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/572

This data set was originally published as:

Morrison, I. K., and N. W. Foster. 2001. NPP Boreal Forest: Mississagi, Canada, 1970-1973. 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)

Biomass and nutrient content of different vegetation components and soil layers were determined for a 30-year-old pine forest in northern Ontario, Canada, and a detailed nutrient budget published. The 30-year-old stand was compared with nearby 20-year-old and 65-year-old stands, all of which were growing on a glaciofluvial flat. NPP was not directly estimated, but data exist on above-ground tree growth and litterfall.

The Mississagi study site (46.35 N -83.38 W) is situated in the Mississagi River area, within section L-10 of the Great Lakes / St. Lawrence forest region, about 150 km due west of Sudbury, Ontario. Based upon a 4 degrees Celsius index, the growing season lasts 175 days from April to mid-October. The forest consists of even-aged, fire-origin stands of jack pine (*Pinus banksiana*), with an understory of shrubs and herbs. Despite fire cycling and logging, the soil and the forest floor layer are thought to contain sufficient reserves of nutrients to sustain productivity of this species, with its apparently modest nutrient requirement.

Nutrient content (N, P, K, Ca, Mg) of leaves, live and dead branches, stem bark, trunk, cones, and roots, and total above- and below-ground biomass are available for the 30-year old stand which was clear-cut around 1970-1973. Comparable data for stands aged 20 years and 65 years are available, normalized to a standard stocking density. Additional detailed data are available in the literature for the complete estimated nutrient budget of the ecosystem, including inputs from precipitation.

Climate data are available from weather stations at Saulte Sainte Marie, Michigan, USA (46.5 N -84.4 W elevation 218 m) and Saulte Sainte Marie, Ontario, Canada (46.5 N -84.5 W elevation 188 m).

Table 1. ANPP, BNPP, and TNPP values reported by various published data sources

File Name or Description	Data Source(s)	Sub-Site	ANPP	BNPP	TNPP
			$gC/m^2/year$		
mss_npp_r1.txt	Foster (1974)[1,2]	mss	283.6	NA	NA
GPPDI_ClassB_NPP_2363_R1.csv	Olson et al. (2012z) based on ORNL calculations	Class B 1123 (MI 1707)	290	NA	NA
EMDI_ClassA_NPP_81_R2.csv	Olson et al. (2012b)	Class B 1123	290	NA	NA

Notes: NA = Not available. MI = Measurement identification number. The differences in NPP values reported in this table are mainly due to differences in calculation methods, as explained in these notes. Please consult original references for details. Revised data sets (R1, R2, etc.) are accompanied by ORNL DAAC Data Set Change Information files. Please see the corresponding documentation for reasons why the data values were revised.

[1]For this table, NPP data from the original data source were converted from grams of dry weight per meter square per year to grams of carbon per meter square per year using a conversion factor of 0.475.

[2] For the different aged stands, above-ground tree growth was estimated at 124.5 $gC/m^2/yr$ (0-20 years), 137.3 $gC/m^2/yr$ (20-30 years), and 44.2 $gC/m^2/yr$ (30-65 years). Annual tree litter production for the 30-year-old stand averaged 177.1 $gC/m^2/yr$ over the course of 3 years. Understory litterfall production for the 30-year-old stand in one year was 15.7 $gC/m^2/yr$. Above-ground NPP, therefore, may range between 237 and 330.1 $gC/m^2/yr$.

2. Data Description:

This data set contains two text files for study sites in the Mississagi River area of Ontario, Canada (46.35 N -83.38 W elevation 860 m). One file summarizes the results of a series of investigations on the nutrition of jack pine ecosystems, including stand characteristics, above-ground biomass, and where available, litterfall amount and nutrient content of vegetation, litterfall, and soil horizons. The second file contains climate data recorded at two weather stations near the Mississagi sites.

Spatial Coverage

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Elevation (m)
Mississagi, Ontario, Canada	-83.38	-83.38	46.35	46.35	860

Site: Mississagi, Ontario, Canada

Site Information

The study area is located in the Mississagi River area of northern Ontario, Canada in sec. L.10 of the Great Lakes-St. Lawrence Forest Region and in the Thessalon Site District of Site Region 5E. The climate is modified continental and the growing season, based on a 4 degree C index, lasts from late April to mid-October, an average of 175 days. Mean annual precipitation according to records of the weather station at Saulte Sainte Marie, Ontario is 798 mm (1948-1990 mean).

The study area was mapped as Petawawa land type, being an extensive glaciofluvial flat, comprised of coarse-to-medium sand of very low base status derived from granite and quartzite. The soil belongs to the Wendigo series (Ontario Soil Survey Blind River Map Sheet 41J, unpublished) and is classed as a humo-ferric podzol, being generally equivalent to an entic haplorthod.

The stands, which are described in Table 2, were even-aged, fire-origin, naturally occurring *Pinus banksiana*. The forest floor was covered by a continuous carpet of *Pleurozium schreberi* and *Hypnum crista-castrensis*. Abundant low shrubs and herbs included *Vaccinium angustifolium*, *Diervilla lonicera*, *Aster macrophyllus*, *Maianthemum canadense*, and *Waldsteinia fragarioides*.

Monthly and annual precipitation data are available from a weather station at Saulte Sainte Marie, Michigan, USA (46.5 N -84.4 W elevation 218 m) and average temperature data are available from a weather station at Saulte Sainte Marie, Ontario, Canada (46.5 N -84.5 W elevation 188 m).

Table 2. Basic mensurational data for *Pinus banksiana* stands based on trees with dbh of 1.52 cm

AGE (yr)	HEIGHT OF DOMINANTS (m)	MEAN DBH (cm)	BASAL AREA (m2/ha)	TREE DENSITY (stems/ha)
20	7.2	5.9	4.0	1,529
30	12.2	11.4	22.7	2,431
65	20.1	21.1	16.1	448

Spatial Resolution

Above-ground biomass and N, P, K, Ca, and Mg concentrations in biomass components and soil layers were measured in four 0.08-ha plots in each age class. Below-ground root dry matter and element content values were similarly derived. Ground vegetation was sampled in five randomly located 0.25 m^2 subplots in each of the four 0.08-ha plots in the 30-year-old stand. Litterfall from the forest canopy was collected in 10-cm high, 0.25 m^2 traps, placed on the forest floor. Ground vegetation litterfall was collected in five 0.25 m^2 areas in the plot. Mean soil horizon thickness was estimated from 20 random measurements per 0.08 ha plot, and mean organic horizon weight (excluding roots) was measured in five 0.09 m^2 randomly located subplots per 0.08 ha plot.

Temporal Coverage

Temporal coverage of biomass collection and nutrient content analysis data is uncertain, but presumably 1970-1973. Tree litterfall was monitored over a 3-year period (July 1969 to June 1972). Understory litterfall was determined in 1969. Precipitation data are available from 1889/01/01 through 1990/12/31, and average temperature data from 1962/01/01 through 1990/12/31.

Temporal Resolution

Temporal resolution of biomass collection and nutrient content analysis data is uncertain. Above-ground biomass and soil samples were collected once in the month of August (year unknown). Tree litterfall was removed from traps monthly. Tree litterfall values are year-end totals (reported for the month of June of each year). Understory litterfall was collected once, in August 1969.

All NPP estimates are based on plant dry matter accumulation, expressed as g/m^2 (dry matter weight). Climate data are expressed as monthly and annual precipitation amounts (mm) and monthly and annual average temperature (C).

Data File Information

Table 3. Data files in this data set archive

FILE NAME	TEMPORAL COVERAGE	FILE CONTENTS
mss_npp.txt	1969/01/01-1973/12/31?	Stand characteristics, above-ground biomass, litterfall, and nutrient content of vegetation, litterfall, and soil horizons for study plots at Mississagi, Canada
mss_cli.txt	1889/01/01-1990/12/31	Monthly and annual precipitation amount and average temperature data from weather stations at Saulte Sainte Marie, Michigan, USA and Saulte Sainte Marie, Ontario, Canada, respectively, near Mississagi

NPP Data. NPP estimates for the Mississagi site are provided in one file (Table 3). The data set is a text file (.txt format). The variable values are delimited by semicolons. The first 18 lines are metadata; data records begin on line 19. The value -999.9 is used to denote missing values. All NPP units are in g/m^2 (dry matter weight).

Sample NPP Data Record

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Site; Treatmt; Year; Month; Day; parameter; amount; units; Reference/commentsmss; age20yrs; -999.9; -999.9; -999.9; height; 7.2; m; All data from
mss; age20yrs; -999.9; -999.9; -999.9; mean_DBH; 5.9; cm; Foster and Morrison (1976)
mss; age20yrs; -999.9; -999.9; -999.9; basal_area; 4; m2/ha; except where stated
mss; age20yrs; -999.9; -999.9; -999.9; treedensity; 1529; trees/ha otherwise
mss; age20yrs; -999.9; -999.9; -999.9; Tot_tree_biomass(n)1; 5241.7; g/m2
...
mss; age30yrs; -999.9; -999.9; -999.9; height; 12.2; m
mss; age30yrs; -999.9; -999.9; -999.9; mean_DBH; 11.4; cm
mss; age30yrs; -999.9; -999.9; -999.9; basal_area; 22.7; m2/ha
mss; age30yrs; -999.9; -999.9; -999.9; treedensity; 2431; trees/ha
mss; age30yrs; -999.9; -999.9; -999.9; Tot_tree_biomass; 9070; g/m2
mss; age30yrs; -999.9; -999.9; -999.9; Tot_tree_biomass(n)1; 8128.9; g/m2
...
mss; age65yrs; -999.9; -999.9; -999.9; height; 20.1; m
mss; age65yrs; -999.9; -999.9; -999.9; mean_DBH; 21.1; cm
mss; age65yrs; -999.9; -999.9; -999.9; basal_area; 16.1; m2/ha
mss; age65yrs; -999.9; -999.9; -999.9; treedensity; 448; trees/ha
mss; age65yrs; -999.9; -999.9; -999.9; Tot_tree_biomass(n)1; 11367.8; g/m2
...
```

Table 4. Column headings in NPP file

COLUMN HEADING	DEFINITION	UNITS
Site	Site where data were gathered (code refers to site identification)	Text
Treatmt	Study area where measurements were made; treatment of study plots are described in metadata in data files	Text
Year	Year in which data were collected	Numeric
Month	Month in which data were collected	
Day	Day on which data were collected	
parameter	Parameters measured (see definitions in Table 3)	Text
amount	Data values	Numeric
units	Unit of measure	Text
References / comments	Primary references plus explanatory comments	Text

Table 5. Parameter definitions in NPP file

PARAMETER	DEFINITION	UNITS	SOURCE[1]
height	Forest canopy height	m	Table 1
mean-DBH	Mean DBH, based on trees with DBH 1.52 cm	cm	
basal_area	Basal area of stand	m^2/ha	
treedensity	Tree density	stems/ha	
Tot_tree_biomass	Total tree biomass	g/m^2	
Tot_tree_biomass(n)1	Total tree biomass normalized to standard stocking density; roots included (normal stocking density is given in Table 1 of Foster and Morrison, 1976)	g/m^2	Table 4
organic_horizon_thick	Mean organic soil horizon thickness, based on 20 samples per plot	cm	Table 9
organic_horizon_weight	Mean organic horizon weight (excluding roots), based on 5 samples per plot	g/m^2	
litterfall	Annual average tree vegetation litterfall in 30-year-old stand (including needles, branches, bark, flower parts, and fruit) based on 3-year study	g/m^2/yr	p. 473 in Foster (1974)
leaves_N	Nitrogen content in tree foliage in 30-year-old stand		

leaves_P	Phosphorus content in tree foliage in 30-year-old stand	g/m^2	Table 3
leaves_K	Potassium content in tree foliage in 30-year-old stand		
leaves_Ca	Calcium content in tree foliage in 30-year-old stand		
leaves_Mg	Magnesium content in tree foliage in 30-year-old stand		
live_branches_N	Nitrogen content in living branches of trees in 30-year-old stand	g/m^2	Table 3
live_branches_P	Phosphorus content in living branches of trees in 30-year-old stand		
live_branches_K	Potassium content in living branches of trees in 30-year-old stand		
live_branches_Ca	Calcium content in living branches of trees in 30-year-old stand		
live_branches_Mg	Magnesium content in living branches of trees in 30-year-old stand		
dead_branches_N	Nitrogen content in dead branches of trees in 30-year-old stand	g/m^2	Table 3
dead_branches_P	Phosphorus content in dead branches of trees in 30-year-old stand		
dead_branches_K	Potassium content in dead branches of trees in 30-year-old stand		
dead_branches_Ca	Calcium content in dead branches of trees in 30-year-old stand		
dead_branches_Mg	Magnesium content in dead branches of trees in 30-year-old stand		
trunk_bark_N	Nitrogen content in trunk bark of trees in 30-year-old stand	g/m^2	Table 3
trunk_bark_P	Phosphorus content in trunkbark of trees in 30-year-old stand		
trunk_bark_K	Potassium content in trunk bark of trees in 30-year-old stand		
trunk_bark_Ca	Calcium content in trunk bark of trees in 30-year-old stand		
trunk_bark_Mg	Magnesium content in trunk bark of trees in 30-year-old stand		
trunk_wood_N	Nitrogen content in stem wood of trees in 30-year-old stand	g/m^2	Table 3
trunk_wood_P	Phosphorus content in stem wood of trees in 30-year-old stand		
trunk_wood_K	Potassium content in stem wood of trees in 30-year-old stand		
trunk_wood_Ca	Calcium content in stem wood of trees in 30-year-old stand		
trunk_wood_Mg	Magnesium content in stem wood of trees in 30-year-old stand		
cone_N	Nitrogen content in pine cones of trees in 30-year-old stand	g/m^2	Table 3
cone_P	Phosphorus content in pine cones of trees in 30-year-old stand		
cone_K	Potassium content in pine cones of trees in 30-year-old stand		
cone_Ca	Calcium content in pine cones of trees in 30-year-old stand		
cone_Mg	Magnesium content in pine cones of trees in 30-year-old stand		
root_N	Nitrogen content in tree roots in 30-year-old stand	g/m^2	Table 3
root_P	Phosphorus content in tree roots in 30-year-old stand		
root_K	Potassium content in tree roots in 30-year-old stand		
root_Ca	Calcium content in tree roots in 30-year-old stand		
root_Mg	Magnesium content in tree roots of trees in 30-year-old stand		
L_layer_N	Available nitrogen in L organic soil horizon (includes mosses) (in comparison with minimum soil fertility standards)	percent	Table 8
L_layer_C:N	Ratio of available carbon to nitrogen in L organic soil horizon	dimensionless	
L_layer_avail_N	Average amount of available nitrogen in L organic soil horizon	g/m^2	Table 7
L_layer_P	Available phosphorus in L organic soil horizon (in comparison with minimum soil fertility standards)	ppm	Table 8
	Average amount of available phosphorus in L organic soil		

L_layer_avail_P	horizon	g/m2	Table 7
L_layer_exch_K	Exchangeable potassium in L organic soil horizon (in comparison with minimum soil fertility standards)	meq/100g	Table 8
L_layer_exch_Ca	Exchangeable calcium in L organic soil horizon (in comparison with minimum soil fertility standards)		
L_layer_exch_Mg	Exchangeable magnesium in L organic soil horizon (in comparison with minimum soil fertility standards)		
L_layer_CEC	Cation exchange capacity (CEC) of L organic soil horizon		
F_layer_N	Available nitrogen in F organic soil horizon (includes mosses) (in comparison with minimum soil fertility standards)	percent	Table 8
F_layer_C:N	Ratio of available carbon to nitrogen in F organic soil horizon	dimensionless	
F_layer_avail_N	Average amount of available nitrogen in F organic soil horizon	g/m2	Table 7
F_layer_P	Available phosphorus in F organic soil horizon (in comparison with minimum soil fertility standards)	ppm	Table 8
F_layer_avail_P	Average amount of available phosphorus in F organic soil horizon	g/m2	Table 7
F_layer_exch_K	Exchangeable potassium in F organic soil horizon (in comparison with minimum soil fertility standards)	meq/100g	Table 8
F_layer_exch_Ca	Exchangeable calcium in F organic soil horizon (in comparison with minimum soil fertility standards)		
F_layer_exch_Mg	Exchangeable magnesium in F organic soil horizon (in comparison with minimum soil fertility standards)		
F_layer_CEC	Cation exchange capacity (CEC) of F organic soil horizon		
H_layer_N	Available nitrogen in H organic soil horizon (includes mosses) (in comparison with minimum soil fertility standards)	percent	Table 8
H_layer_C:N	Ratio of available carbon to nitrogen in H organic soil horizon	dimensionless	
H_layer_avail_N	Average amount of available nitrogen in H organic soil horizon	g/m2	Table 7
H_layer_P	Available phosphorus in H organic soil horizon (in comparison with minimum soil fertility standards)	ppm	Table 8
H_layer_avail_P	Average amount of available phosphorus in H organic soil horizon	g/m2	Table 7
H_layer_exch_K	Exchangeable potassium in H organic soil horizon (in comparison with minimum soil fertility standards)	meq/100g	Table 8
H_layer_exch_Ca	Exchangeable calcium in H organic soil horizon (in comparison with minimum soil fertility standards)		
H_layer_exch_Mg	Exchangeable magnesium in H organic soil horizon (in comparison with minimum soil fertility standards)		
H_layer_CEC	Cation exchange capacity (CEC) of H organic soil horizon		
Soil(Bf_horizon)_N	Available nitrogen in Bf soil horizon (includes mosses) (in comparison with minimum soil fertility standards)	percent	Table 8
Soil(Bf_horizon)_C:N	Ratio of available carbon to nitrogen in Bf soil horizon	dimensionless	
Soil(Bf_horizon)_avail_N	Average amount of available nitrogen in Bf soil horizon	g/m2	Table 7
Soil(Bf_horizon)_P	Available phosphorus in Bf soil horizon (in comparison with minimum soil fertility standards)	ppm	Table 8
Soil(Bf_horizon)_avail_P	Average amount of available phosphorus in Bf soil horizon	g/m2	Table 7
Soil(Bf_horizon)_exch_K	Exchangeable potassium in Bf soil horizon (in comparison with minimum soil fertility standards)	meq/100g	Table 8
Soil(Bf_horizon)_exch_Ca	Exchangeable calcium in Bf soil horizon (in comparison with minimum soil fertility standards)		
Soil(Bf_horizon)_exch_Mg	Exchangeable magnesium in Bf soil horizon (in comparison with minimum soil fertility standards)		
Soil(Bf_horizon)_CEC	Cation exchange capacity (CEC) of Bf soil horizon		
Undstrylitterfall	Annual ground vegetation litterfall in 30-year-old stand		
treelitter-fall	Annual tree vegetation litterfall in 30-year-old stand, including		

	needles, branches, bark, flower parts, and fruit		
Undstrylitterfall_N	Annual nitrogen content in ground vegetation litterfall in 30-year-old stand		
treelitterfall_N	Annual nitrogen content in tree vegetation litterfall in 30-year-old stand, including needles, branches, bark, flower parts, and fruit	g/m^2/yr	Table 4[3]
Undstrylitterfall_P	Annual phosphorus content in ground vegetation litterfall in 30-year-old stand		
treelitterfall_P	Annual phosphorus content in tree vegetation litterfall in 30-year-old stand, including needles, branches, bark, flower parts, and fruit		

Notes: [1]All data from Foster and Morrison (1976) except where stated otherwise.

[2]Above- and below-ground biomass and biomass element content data are the average of regression-stand table estimates from Hegyi (1972) and Morrison (1973, 1974).

[3]Litterfall amount and element concentration data are from Foster (1974).

Climate Data. The climate data for Mississagi sites are provided in one file (Table 3) although the data are derived from two weather stations, one for precipitation and the other for air temperature.

The data set is a text file (.txt format). The first 18 lines are metadata; data records begin on line 19. The variable values are delimited by semi-colons. The value -999.9 is used to denote missing values.

Sample Climate Data Record

```
Site;Temp;Parm; Jan; Feb; Mar; Apr; May; Jun; Jul; Aug; Sep; Oct; Nov; Dec; Year
ssm ;mean;tavg; -10.4; -10.6; -4.7; 3.2; 9.7; 14.2; 17.7; 17.0; 12.8; 7.3; 0.7; -6.7; 4.1
ssm ;numb;tavg; 29; 29; 29; 29; 29; 28; 28; 29; 29; 29; 28; 28; 27
ssm ;stdv;tavg; 2.6; 3.0; 2.1; 1.6; 1.8; 1.4; 1.3; 1.4; 1.1; 1.9; 1.3; 2.8; 0.6
ssm ;1962;tavg; -12.4; -14.6; -3.4; 3.0; 11.6; 14.6; 16.7; 17.0; 11.9; 8.4; 1.1; -7.4; 3.9
ssm ;1963;tavg; -14.3; -15.8; -5.8; 3.7; 8.2; 16.2; 18.6; 15.9; 12.1; 12.0; 3.6; -8.7; 3.8
ssm ;1964;tavg; -6.7; -9.3; -6.3; 3.1; 11.7; 13.9; 19.2; 15.3; 12.5; 6.9; 1.8; -8.5; 4.5
…
ssm ;mean;prec; 53.3; 38.6; 48.5; 56.3; 69.2; 76.5; 68.2; 77.5; 91.6; 77.2; 80.3; 61.6; 798.0
ssm ;numb;prec; 102; 102; 102; 102; 102; 102; 102; 102; 102; 102; 101; 101; 101
ssm ;stdv;prec; 24.2; 19.0; 26.0; 25.7; 33.8; 37.9; 34.4; 36.2; 42.0; 35.0; 34.0; 24.2; 121.7
ssm ;1889;prec; 63.5; 67.8; 7.9; 60.2; 64.5; 148.1; 85.3; 78.0; 142.2; 47.2; 46.7; 87.4; 898.8
ssm ;1890;prec; 102.4; 73.9; 41.9; 67.1; 98.3; 126.0; 131.1; 104.4; 101.1; 51.8; 54.9; 64.8; 1017.7
ssm ;1891;prec; 52.3; 80.3; 63.2; 53.6; 12.7; 24.1; 56.4; 87.4; 24.9; 70.1; 148.6; 77.5; 751.1
ssm ;1892;prec; 61.2; 36.3; 38.6; 58.9; 79.2; 88.9; 59.2; 52.1; 45.5; 75.7; 82.0; 86.6; 764.2
...
Where,
Temp (temporal) - specific year or long-term statistic:
  mean = mean based on all years
  numb = number of years
  stdv = standard deviation based on all years
Parm (parameter):
  prec = precipitation for month or year (mm)
  tavg = mean average temperature for month or year (C)
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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 above-ground annual tree growth and annual litter production, including litter production in the understory layer. These are considered the major components of NPP.

The aim of this study was to assess the importance of nutrient accumulation in both trees and ground vegetation and nutrient transfers between vegetation and soil, to the reserves of plant nutrients in the soil.

The biomass dynamics data for the Mississagi sites are provided for comparison with models and estimation of NPP. Climate data are provided for use in driving ecosystem/NPP models.

4. Quality Assessment:

Foster (1974) compares litterfall accumulation in the 30-year-old stand to that in other similar aged boreal pine stands. Litter produced in the Mississagi stand ranged from 340.5 to 419.9 g/m^2/yr year over a 3-year period. This annual variation was less than that reported for other conifers by Bray and Gorham (1964). The quantity was higher than the values for jack pine in the north central United States, although studies did not include material >3-5 mm in their study. Annual litter production of lodgepole pine (*Pinus contorta*), a species in many respects similar to jack pine, was higher than that reported from this study (460.0 g/m^2/yr over a 4-year period). Published data assembled by Bray and Gorham (1964) indicated an average of about 300.0 g/m^2/yr of litterfall each year in cool, temperate conifer forests.

The concentrations of nutrients in litter found by Foster (1974) were lower than those reported for jack pine in the north central United States and conifers in other areas. The low concentrations may reflect the low soil fertility of the outwash sand and gravel soil on the Mississagi site. The combination of high amounts of litter and low nutrient concentrations produced quantities of nutrients in the litter which were in the same order of magnitude as those for other conifers in cool, temperate regions. See Foster (1974) for additional comparative analyses.

Foster and Morrison (1976) compare biomass and nutrient content of *Pinus banksiana* from this study with that of *P*. spp. trees of comparable age in different parts of the world. Dry matter and element contents are comparable to those of cool temperate *Pinus sylvestris* and *Pinus nigra* var. *calabrica* on dry, nutrient-poor sand dunes in Scotland. Nutrient concentrations at Mississagi were also comparable to values found in an old field stand of *Pinus virginiana* in the United States. Dry matter and element concentrations at Mississagi, however, are considerably lower than those of *P*. *sylvestris* and *P*. *nigra* var. *calabrica* on clay soils in Scotland and of warm temperate *Pinus taeda* on a clay loam soil in the United States, and very much lower than those of *Pinus radiata* stands in New Zealand.

Sources of Error

Information not available.

5. Data Acquisition Materials and Methods:

Forest Stand Characteristics

The basic mensurational data are from Hegyi (1972 and personal communication) for *Pinus banksiana* stands based on trees with dbh of 1.52 cm or above.

Biomass and Nutrient Concentrations in Tree Components

Above-ground biomass (dry matter) weights and N, P, K, Ca, and Mg concentrations in biomass components are from Hegyi (1972) and Morrison (1973). The values presented in the present study are the average of regression-stand table estimates from four 0.08 ha plots in each age class. Below-ground root dry matter and element content figures were similarly derived (Morrison 1974).

Biomass and Nutrient Concentrations in Ground Vegetation and Soil

Ground vegetation was sampled in the month of August from five randomly located 0.25 m^2 subplots in each of the four 0.08 ha plots in the 30-yr-old stand. Macroelement concentrations were determined by standard laboratory methods. See Foster and Morrison (1976).

Soil Horizons Nutrient concentrations

Mean soil horizon thickness was estimated from 20 random measurements per 0.08 ha plot, and mean organic horizon weight (excluding roots) from five 0.09 ha randomly located subplots per 0.08 ha plot. For each horizon in each of the four plots a composite soil sample representing 25 points was taken for chemical analysis. The weight of elements in each mineral soil horizon is the product of the weight of soil material < 2 mm in diameter, as determined from bulk density, horizon thickness and coarse fragment content, times element percentage concentration. See Foster and Morrison (1976) for description of laboratory chemical analysis methods.

Litterfall and Nutrient Concentrations

Tree litterfall was measured from July 1969 to June 1972 in the 30-year stand. Litterfall from the forest canopy was removed monthly from 15 10-cm high, 0.25 m^2 traps placed on the forest floor. Litterfall included needles, branches, bark, flower parts, and fruit. Tree litterfall values are year-end totals (reported for the month of June of each year). The contribution of understory vegetation to litterfall was estimated by determining dry weight of above-ground vegetative material in five 0.25 m^2 areas in the plot in August 1969, then reducing this weight by the estimated weight loss at senescence (25%). All plant material was oven-dried at 70 degrees C, weighed, and ground for chemical analysis. Litter from the forest canopy was chemically analyzed each month. See Foster (1974) for description of laboratory chemical analysis methods.

Climate Data

Precipitation data are available from a weather station at Saulte Sainte Marie, Michigan, USA (46.5 N -84.4 W elevation 218 m) and average temperature data are available from a weather station at Saulte Sainte Marie, Ontario, Canada (46.5 N 84.5 W elevation 188 m).

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:

Foster, N.W. 1974. Annual macroelement transfer from Pinus banksiana Lamb. forest to soil. Canadian J. Forest Research 4: 470-476.

Foster, N.W., and I.K. Morrison. 1976. Distribution and cycling of nutrients in a natural Pinus banksiana ecosystem. Ecology 87: 110-120.

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Olson, R.J., K.R. 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

Additional Sources of Information:

Bray, J. R., and E. Gorham. 1964. Litter production in forests of the world. Adv. Ecol. Res. 2: 101-157.

Olson, R.J., J.M.O. Scurlock, S.D. Prince, D.L. Zheng, and K.R. Johnson (eds.). 2012a. NPP Multi-Biome: Global Primary Production Data Initiative Products, R2. Data set. Available on-line [http://daac.ornl.gov] from the Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA doi:10.3334/ORNLDAAC/617

Olson, R.J., J.M.O. Scurlock, S.D. Prince, D.L. Zheng, and K.R. Johnson (eds.). 2012b. NPP Multi-Biome: NPP and Driver Data for Ecosystem Model-Data Intercomparison, R2. Data set. Available on-line [http://daac.ornl.gov] from the Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA doi:10.3334/ORNLDAAC/615

8. Data Set Revisions:

Revision Summary:

TheNPP data file (**mss_npp_r1.txt**) in this data set has been revised to correct previously reported temporal coverage values and litterfall data. The temporal coverage of climate data file (**mss_cli_r1.txt**) has also been corrected.

Data File Changes:

The temporal coverage of the npp data in this data set has been corrected to agree with that reported in Foster (1974). Annual average litterfall for the 30-year jack pine stand has been corrected to agree with the value reported on page 473 of Foster (1974). The data values in **mss_npp_r1.txt** are now correct.

Parameter Field	**Uncorrected in mss_npp.txt**	**Corrected in mss_npp_r1.txt**
Temporal coverage (years)	1970-1973	1969-1973
Litterfall (amount)	400 $g/m^2/yr$	372.9 $g/m^2/yr$
Undstrylitterfall (month of data collection in 1969)	-999.9	8

The temporal coverage and metadata in the climate file in this data set have been corrected.

Weather station (Saulte Sainte Marie, Ontario, Canada)	**Uncorrected in mss_cli.txt**	**Corrected in mss_cli_r1.txt**
Temporal coverage	1948-1990	1962-1990

Data User Action: If you downloaded this data set from the ORNL DAAC on-line archive before July 15, 2013, you should download it again from the ORNL DAAC.

Revision History:

Original Citation

Morrison, I.K., and N.W. Foster. 2001. NPP Boreal Forest: Mississagi, Canada, 1970-1973. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA

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