NPP Boreal Forest: Schefferville, Canada, 1974, R1

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Revision date: July 15, 2013

Summary:

This data set contains two files (.txt format). One file provides above- and below-ground biomass, soil, and nutrient data for a mature boreal ecosystem (subarctic *Picea mariana*/lichen woodland) near Schefferville, Canada (54.72 N, -67.70) for the 1974 growing season. The second data file contains climate data (precipitation amount and maximum/minimum temperature) from a weather station located 22 km northeast of the study site for the 1948-1990 period.

The black spruce/lichen woodland is a vegetation type found in the transitional zone between boreal forest and tundra on well-drained, nutrient-poor podzolic soils. These spruce/lichen woodlands are generally not subject to attack by herbivory, but natural fires are common. The study forest was estimated to be 110 years old, based on annual tree ring data which showed the number of years since it was last burned. Biomass estimates were determined by harvesting trees, shrubs, and ground cover in the 0.2 ha study plot. To confirm the "typical" nature of the site, species composition and density were evaluated for the principal plot and compared to that of fifteen other plots. Organic and mineral soils were also extracted. The plant and soil samples were evaluated for nutrient and mineral content.

Living tree, shrub, and lichen components contributed a total biomass of 2,636, 833, and 939 g/m^2, respectively. NPP was estimated by the Terrestrial Ecosystem Model (TEM) to be about 340 g/m^2/yr.

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 2001.

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:

Rencz, A.N., and A.N.D. Auclair. 2013. NPP Boreal Forest: Schefferville, Canada, 1974, 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/573

This data set was originally published as:

Rencz, A.N., and A.N.D. Auclair. 2001. NPP Boreal Forest: Schefferville, Canada, 1974. 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 a boreal ecosystem (subarctic lichen woodland) was determined at Schefferville, Canada, during the 1974 growing season. The main objective was to describe a "typical" lichen woodland, a vegetation type found in the transitional zone between boreal forest and tundra on well-drained, nutrient-poor podzolic soils. Such areas are occupied sparsely by black spruce trees (*Picea mariana*) with low growth rates compared with closed boreal forest (typically 0.1-0.2 mm/year radial growth), together with some shrubs (e.g., *Betula glandulosa*) and a full ground cover of lichen (*Cladonia alpestris*). Lichen woodlands are generally not subject to attack by herbivory, but fires are common.

The 0.2-ha study plot (45.2 x 45.2 m) is located 22 km northeast of Schefferville (54.72 N, 67.70 W) in the province of Quebec. This area is characterized by short cool summers and long cold winters with mean monthly temperatures ranging from -23 C in January to 12 C in July. The mean annual precipitation is 770 mm with about half that amount in the form of rain.

Between June and July 1974, fifteen trees, all the shrubs, and all the ground lichen were harvested on the principal plot to estimate above- and below-ground biomass. The plant samples along with organic layer and soil samples, collected during this period, were evaluated for nutrient and mineral content. To confirm the "typical" nature of the site, species composition and density were evaluated for the principal plot and compared to that of fifteen other plots.

Living trees, shrubs, and lichen contributed a total biomass of 2,636, 833, and 939 g/m^2, respectively. NPP was estimated by the Terrestrial Ecosystem Model (TEM) to be about 340 g/m^2/yr (Olson et al., 2012a; b). Auclair and Rencz (1982) (as presented in McGuire et al., 1992) estimate NPP to be 323.8 g/m^2/yr.

2. Data Description:

This data set contains two files (.txt format). One file provides above- and below-ground biomass, soil, and nutrient data for a mature boreal ecosystem (subarctic *Picea mariana*/lichen woodland) near Schefferville, Canada (54.72 N, -67.70 W) for the 1974 growing season. The second data file contains climate data (precipitation amount and maximum/minimum temperature) from a weather station located 22 km northeast of the study site for the 1948-1990 period.

Spatial Coverage

Site: Schefferville, Canada

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Elevation (m)
Schefferville, Canada	-67.70	-67.70	54.72	54.72	500 ?

Site Information

Schefferville, Quebec (54.72 N, -67.70 W), is located in a transitional region between boreal forest and treeless tundra ecozones. Lichen woodlands in this area form a mosaic with treeless ridges, forested valleys, *Carex* meadows, and numerous lakes.

Lichen woodlands develop on well-drained, nutrient-poor soils in this study area. Well-drained but fertile sites are dominated by *Picea*-moss forests. *Picea* or *Larix* bogs and *Carex* meadows occupy hydric sites. *Abies balsamea* is limited to well-drained Dolomitic soils. On ridges above 730 m, alpine tundra communities prevail.

Picea mariana is the normal dominant in the Labrador-Ungava region. On more productive sites, *P*. *glauca* may codominate but rarely dominates. Trees in lichen woodlands have slow annual radial growth (0.1-0.2 mm/yr), rarely exceed 10 m in height, and are typically 3 to 15 m apart. Ground between the trees is covered by thick lichen mats. *Cladonia alpestris* is the normal dominant lichen. With increasing shade, *C. igracilis* and the moss *Dicranum fuscescens* increase in importance. In most communities, there is a well developed layer of shrubs dominated by *Betula glandulosa* and *Ledum groenlandicum*. The remaining species are mainly ericads or cryptogams.

The woodlands are not subject to extensive herbivory but fires are common. Regeneration after fire is slow, taking 80 years to reproduce continuous lichen mat. The mature *P. mariana*/lichen woodland site studied herein was estimated to be 110 years old, based on tree ring evidence of the period of time following the last forest fire.

The study site is flat or gently sloping and the soils are generally thin (< 50 cm deep), gravelly (20 to 50% >2 mm diameter) sandy clay loams to sandy loams, and poorly developed pedogenetically. A 3- to 5-cm thick layer of decomposing lichen squamules (L horizon) passes into a 5 cm thick black H horizon and then into reddish brown Bm (cambic) horizons with some evidence of podzolization (a thin gray Ae horizon) at the base of the H and top of the Bm horizons.

Typically, plant growth is limited by a high percentage of hydrogen ions on the exchange complex. In Schefferville, conditions of low soil temperature and water saturation are important factors in lichen woodland development.

Climate data were recorded at the weather station in Schefferville, Canada (54.80 N -66.82 W elevation 518/522 m) which is located about 22 km northeast of the study site. This area is characterized by short cool summers and long cold winters with mean monthly temperatures ranging from -23 C in January to 12 C in July. The mean annual precipitation is 770 mm with about half that amount in the form of rain.

Spatial Resolution

A sample of trees was harvested from a uniform 0.2 ha (45.2 x 45.2 m) area of *P. mariana*/lichen woodland delineated in the form of a square plot. Ground cover and shrubs were sampled for frequency and biomass along three 45.2 m transect lines positioned at equal intervals across the plot. All plant tissue of ground-layer fractions (shrubs, moss, and lichens) were excavated from twenty-five 0.25 m^2 quadrats positioned at 5 m intervals along each of the three transect lines. Soil samples were collected from 100 cm^2 quadrats in a 10 m plot at same site.

Temporal Coverage

Fifteen trees were harvested between June 10 and 25, 1974. Shrubs and ground layer samples were collected from June 27 and July 4, 1974. Mineral soils were sampled on August 15, 1974. Organic soil samples are collected from June through August 1974.

Climate data are available from August 1948 through October 1990. There are some missing data.

Temporal Resolution

Biomass measurements were made during the 1974 growing season. Fifteen *P. mariana* trees were harvested over a 16-day period. Understory and ground cover was harvested over a 8-day period. Mineral soils were collected once. Organic soil samples were collected at twice weekly intervals.

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 maximum/minimum temperature (C). There are some missing data so monthly and annual climatic means are provided only for the 1949-1989 period.

Data File Information

Table 1. Data files in this data set archive

FILE NAME	TEMPORAL COVERAGE	FILE CONTENTS
sch_npp.txt	1974/06/01-1974/08/31	Biomass and nutrient content data for a boreal ecosystem (subarctic *Picea mariana*/lichen woodland) near Schefferville, Canada
sch_cli.txt	1948/08/01-1990/06/30	Monthly and annual average maximum/minimum temperature from a weather station at Schefferville, Canada, 22 km northeast of the study site
	1949/01/01-1990/10/31	Monthly and annual precipitation amount from a weather station at Schefferville, Canada, 22 km northeast of the study site

NPP Data. NPP estimates for the Schefferville site are provided in one text file (Table 1). The variable values are delimited by semi-colons. 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/Comments

sch; none; 1974; 06; -999.9; stand_age; 110; yr; Auclair_and_Rencz (1982)
sch; none; 1974; 06; -999.9; height_spruce; 3-15; m; Rencz_and_Auclair_(1978)
sch; none; 1974; 06; -999.9; numdensity_all; 525; trees/ha; Rencz_and_Auclair_(1978)
sch; none; 1974; 06; -999.9; numdensity_spruce; 510; trees/ha; Rencz_and_Auclair_(1978)
sch; none; 1974; 06; -999.9; cones_spruce; 72.6; g/m2; Rencz_and_Auclair_(1978)
sch; none; 1974; 06; -999.9; needles_spruce; 372; g/m2; Rencz_and_Auclair_(1978)
sch; none; 1974; 06; -999.9; deadneedles_spruce; 3.3; g/m2; Rencz_and_Auclair_(1978)
sch; none; 1974; 06; -999.9; branches_spruce; 376.9; g/m2; Rencz_and_Auclair_(1978)
sch; none; 1974; 06; -999.9; deadbranches_spruce; 183.4; g/m2; Rencz_and_Auclair_(1978)
sch; none; 1974; 06; -999.9; trunks_spruce; 851.9; g/m2; Rencz_and_Auclair_(1978)
sch; none; 1974; 06; -999.9; roots_spruce; 962.9; g/m2; Rencz_and_Auclair_(1978)
sch; none; 1974; 06; -999.9; Tot_live_tree_biomass; 2636.3; g/m2; Rencz_and_Auclair_(1978)
...
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Table 2. Column headings in NPP file

COLUMN HEADING	DEFINITION	Units
Site	Site where data were gathered (code refers to site identification)	Text
Treatmt	Site treatment as described in metadata in data file	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	Text

Table 3. Parameter definitions in NPP file

PARAMETER	DEFINITION	UNITS	SOURCE
stand-age	Maximum age of trees in stand (number of years following last burn), based on tree ring evidence	yr	p. 965, Auclair and Rencz (1982)
height-spruce	Range of tree heights in stand	m	p. 171, Rencz and Auclair (1978)
numdensity_all	Total density of all tree species in stand (*Larix laricina* + *Picea glauca* + *P. mariana*)	trees/ha	Table 1, Rencz and Auclair (1978)
numdensity_spruce	Density of *P. mariana*	trees/ha	
cones_spruce	Dry weight biomass of *P. mariana* cones, based on harvest samples of 15 trees	g/m^2	Table 3, Rencz and Auclair (1978)
needles_spruce	Dry weight biomass of living *P. mariana* needles, based on harvest samples of 15 trees		
deadneedles_spruce	Dry weight biomass of dead *P. mariana* needles (nonliving tissue), based on harvest samples of 15 trees		
branches_spruce	Dry weight biomass of living *P. mariana* branches, based on harvest samples of 15 trees		
deadbranches_spruce	Dry weight biomass of dead *P. mariana* branches (nonliving tissue), based on harvest samples of 15 trees		
trunks_spruce	Dry weight biomass of *P. mariana* tree trunks, based on harvest samples of 15 trees		
roots_spruce	Dry weight biomass of *P. mariana* roots, based on harvest samples of 15 trees. Root total includes sum of roots in 0-0.2, 0.2-1.0, 1-3, and >3 cm diameter classes plus root crowns		
Tot_live_tree_biomass	Total dry weight biomass of living *P. mariana* components (total tree biomass minus biomass of nonliving tissue), based on harvest samples of 15 trees		
Tot_tree_biomass	Total dry weight biomass of *P. mariana* components (living + nonliving tissue), based on harvest samples of 15 trees		
litter(L)_all	Dry weight biomass oflitter horizon of soil	g/m^2	Table 9, Auclair and Rencz (1982)
ferment+humus(F/H)_all	Dry weight biomass of fermentation and humus horizons of soil		
leaves_shrubs	Dry weight biomass of shrub leaves, based on harvest samples of twenty-five 0.25 m^2 quadrats		

branches_shrubs	Dry weight biomass of shrub branches, based on harvest samples of twenty-five 0.25 m^2 quadrats	g/m^2	Table 4, Rencz and Auclair (1978)
roots_shrubs	Dry weight biomass of shrub roots, based on harvest samples of twenty-five 0.25 m^2 quadrats		
Totshrub_biomass	Total dry weight biomass of shrub components (leaves + branches + roots), based on harvest samples of twenty-five 0.25 m^2 quadrats		
biomass_grass/moss	Dry weight biomass of grass, club moss, and other moss, based on harvest samples of twenty-five 0.25 m^2 quadrats. All moss and club moss biomass are leaf tissue	g/m^2	Table 4, Rencz and Auclair (1978)
biomass_ground_lichen	Dry weight biomass of ground lichen (leaf tissue), based on harvest samples of twenty-five 0.25 m^2 quadrats.		
cones_spruce_N	Nitrogen content in spruce cones	percent (of dry weight)	Table 4, Auclair and Rencz (1982)
cones_spruce_P	Phosphorus content in spruce cones		
cones_spruce_K	Potassium content in spruce cones		
cones_spruce_Ca	Calcium content in spruce cones		
cones_spruce_Mg	Magnesium content in spruce cones		
needles_spruce_N	Nitrogen content in spruce needles (living + dead)	percent (of dry weight)	Table 4, Auclair and Rencz (1982)
needles_spruce_P	Phosphorus content in spruce needles (living + dead)		
needles_spruce_K	Potassium content in spruce needles (living + dead)		
needles_spruce_Ca	Calcium content in spruce needles (living + dead)		
needles_spruce_Mg	Magnesium content in spruce needles (living + dead)		
branches_spruce_N	Nitrogen content in spruce branches (living + dead)	percent (of dry weight)	Table 4, Auclair and Rencz (1982)
branches_spruce_P	Phosphorus content in spruce branches (living + dead)		
branches_spruce_K	Potassium content in spruce branches (living + dead)		
branches_spruce_Ca	Calcium content in spruce branches (living + dead)		
branches_spruce_Mg	Magnesium content in spruce branches (living + dead)		
trunk_spruce_N	Nitrogen content in spruce boles (xylem + bark)	percent (of dry weight)	Table 4, Auclair and Rencz (1982)
trunk_spruce_P	Phosphorus content in spruce boles (xylem + bark)		
trunk_spruce_K	Potassium content in spruce boles (xylem + bark)		
trunk_spruce_Ca	Calcium content in spruce boles (xylem + bark)		
trunk_spruce_Mg	Magnesium content in spruce boles (xylem + bark)		
root_spruce_N	Nitrogen content in spruce roots (sum of roots in 0-0.2, 0.2-1.0 cm, 1-3, and >3 cm diameter classes plus root crowns)		
root_spruce_P	Phosphorus content in spruce roots (sum of roots in 0-0.2, 0.2-1.0 cm, 1-3, and >3 cm diameter classes plus root crowns)		

root_spruce_K	Potassium content in spruce roots (sum of roots in 0-0.2, 0.2-1.0 cm, 1-3, and >3 cm diameter classes plus root crowns)	percent (of dry weight)	Table 4, Auclair and Rencz (1982)
root_spruce_Ca	Calcium content in spruce roots (sum of roots in 0-0.2, 0.2-1.0 cm, 1-3, and >3 cm diameter classes plus root crowns)		
root_spruce_Mg	Magnesium content in spruce roots (sum of roots in 0-0.2, 0.2-1.0 cm, 1-3, and >3 cm diameter classes plus root crowns)		
leaves_shrubs_N	Nitrogen content in shrub leaves	percent (of dry weight)	Table 5, Auclair and Rencz (1982)
leaves_shrubs_P	Phosphorus content in shrub leaves		
leaves_shrubs_K	Potassium content in shrub leaves		
leaves_shrubs_Ca	Calcium content in shrub leaves		
leaves_shrubs_Mg	Magnesium content in shrub leaves		
branches_shrubs_N	Nitrogen content in shrub branches	percent (of dry weight)	Table 5, Auclair and Rencz (1982)
branches_shrubs_P	Phosphorus content in shrub branches		
branches_shrubs_K	Potassium content in shrub branches		
branches_shrubs_Ca	Calcium content in shrub branches		
branches_shrubs_Mg	Magnesium content in shrub branches		
roots_shrubs_N	Nitrogen content in shrub roots	percent (of dry weight)	Table 5, Auclair and Rencz (1982)
roots_shrubs_P	Phosphorus content in shrub roots		
roots_shrubs_K	Potassium content in shrub roots		
roots_shrubs_Ca	Calcium content in shrub roots		
roots_shrubs_Mg	Magnesium content in shrub roots		
ground_lichen_N	Nitrogen content in ground lichen	percent (of dry weight)	Table 5, Auclair and Rencz (1982)
ground_lichen_P	Phosphorus content in ground lichen		
ground_lichen_K	Potassium content in ground lichen		
ground_lichen_Ca	Calcium content in ground lichen		
ground_lichen_Mg	Magnesium content in ground lichen		
organic_horizon_pH	pH of organic (L, F, H) horizon	[H+]	Table 3, Auclair and Rencz (1982) from Moore (1980)[1]
org._hor._C	Proportion of carbon in organic (L, F, H) horizon	percent	
org._hor._tot.N	Proportion of total nitrogen in organic (L, F, H) horizon		
org._hor._avail.N	Proportion of available nitrogen in organic (L, F, H) horizon		
org._hor._avail.P	Proportion of available phosphorus in organic (L, F, H) horizon		
org._hor._exch.K	Exchangeable potassium in organic (L, F, H) horizon	mequiv/100g	
org._hor._exch.Ca	Exchangeable calcium in organic (L, F, H) horizon		
org._hor._exch.Mg	Exchangeable calcium in organic (L, F, H) horizon		
org._hor._exch.Mg	Exchangeable magnesium in organic (L, F, H) horizon		
org._hor._CEC	Cation exchange capacity of organic (L, F, H) horizon		
soil_pH_(Bm_horizon)	pH of Bm (cambic) horizon	[H+]	Table 1, Moore (1980)[1], Table 3, Auclair and Rencz (1982)
soil_C_(Bm_hor.)	Proportion of carbon in Bm horizon	percent	
soil_tot.N_(Bm_hor.)	Proportion of total nitrogen in Bm horizon		
soil_avail.N_(Bm_hor.)	Proportion of available nitrogen in Bm horizon		
soil_avail.P_(Bm_hor.)	Proportion of available phosphorus in Bm horizon		
soil_exch.K_(Bm_hor.)	Exchangeable potassium in Bm horizon		

soil_exch.Ca_(Bm_hor.)	Exchangeable calcium in Bm horizon	mequiv/100g	
soil_exch.Mg_(Bm_hor.)	Exchangeable magnesium in Bm horizon		
soil_CEC_(Bm_hor.)	Cation exchange capacity of Bm horizon		

Note: [1]Moore (1980) measured soil parameters on the same site at Schefferville, Quebec, as described by Rencz and Auclair (1976) and Auclair and Rencz (1982). However, in Moore (1980) the age of the stand is estimated to be 138 years old.

Climate Data. The climate data for the Schefferville site are provided in one text file (Table 1). The variable values are delimited by semi-colons. The first 18 lines are metadata; data records begin on line 19. 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

sch ;mean;prec; 45.7; 40.0; 45.8; 49.0; 47.8; 75.9; 100.2; 91.6; 90.9; 76.9; 66.4; 49.8; 770.3
sch ;mean;tmax; -18.3; -16.0; -9.2; -1.5; 5.8; 13.8; 17.3; 15.3; 9.2; 1.8; -5.6; -14.7; -0.2
sch ;mean;tmin; -28.2; -27.2; -21.3; -12.5; -3.5; 3.3; 7.7; 6.5; 1.8; -4.3; -12.7; -23.6; -9.5
sch ;numb;prec; 41; 41; 42; 42; 42; 42; 42; 41; 42; 42; 41; 41; 39
sch ;numb;tmax; 42; 42; 42; 42; 42; 42; 41; 42; 42; 42; 42; 42; 41
sch ;numb;tmin; 42; 42; 42; 42; 42; 42; 41; 42; 42; 42; 42; 42; 41
sch ;stdv;prec; 25.7; 21.6; 24.4; 32.0; 22.9; 32.2; 36.9; 34.0; 33.6; 29.8; 29.2; 22.9; 131.5
sch ;stdv;tmax; 3.5; 3.8; 3.3; 2.4; 2.2; 2.2; 1.3; 1.5; 1.8; 1.9; 2.0; 3.2; 0.9
sch ;stdv;tmin; 4.2; 4.2; 4.2; 4.0; 2.2; 2.2; 0.9; 1.1; 1.3; 1.8; 2.7; 3.8; 1.2
sch ;1948;prec; -999.9; -999.9; -999.9; -999.9; -999.9; -999.9; -999.9; -999.9; -999.9; -999.9; -
999.9; -999.9; -999.9
sch ;1948;tmax; -999.9; -999.9; -999.9; -999.9; -999.9; -999.9; -999.9; 16.2; 12.0; 7.2; -2.5; -13.7; -
999.9
sch ;1948;tmin; -999.9; -999.9; -999.9; -999.9; -999.9; -999.9; -999.9; 6.7; 2.4; -2.7; -9.4; -21.8; -
999.9
sch ;1949;prec; 30.0; 12.0; 60.0; 45.0; 27.0; 83.0; 94.0; 79.0; 60.0; 69.0; 39.0; 64.0; 662.0
sch ;1949;tmax; -18.2; -20.9; -10.8; -1.5; 3.1; 16.5; 17.1; 15.0; 11.1; 3.6; -8.7; -12.4; -0.5
sch ;1949;tmin; -28.1; -31.5; -22.3; -13.2; -5.0; 3.6; 7.7; 5.1; 2.2; -3.4; -15.5; -22.8; -10.3
…
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)
  tmax = mean maximum temperature for month or year (C)
  tmin = mean minimum temperature for month or year (C)
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3. Data Application and Derivation:

The objectives of this study were to measure the distribution of biomass in different species and in different tissue and soil components of a mature lichen woodland and to describe a "typical" lichen woodland, a vegetation type found in the transitional zone between boreal forest and tundra ecoregions on well-drained, nutrient-poor podzolic soils. From these data, the investigators sought to interpret total biomass levels and the ecological significance of biomass structure, especially attributes such as biomass ratios of leaf-stem-root, herb-shrub-tree, and deciduous-evergreen tissue in comparison with other ecosystems.

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

4. Quality Assessment:

Auclair and Rencz (1982), Moore (1980), and Rencz and Auclair (1978) compared above- and below-ground biomass levels, tissue distribution, and nutrient content of vegetation and soils from the Schefferville site with that of similar lichen woodlands elsewhere in the world.

Comparison of biomass levels and tissue distribution (Rencz and Auclair, 1978) indicated the Schefferville woodland was similar to 15 other sites studied in the immediate area and to *Larix* woodlands in the (former) U.S.S.R. The total live biomass of the Schefferville lichen woodland in this study was at the low end of the range (2,000-20,000 g/m^2) reported for woodland vegetation worldwide. However, the Schefferville root-shoot ratios and shrub and ground layer biomass were high compared with boreal conifer and temperate deciduous forests.

A comparison of tree leaf macronutrient concentrations indicated that, in the majority of cases, levels were distinctly lower in the *P. mariana* woodland than in other taiga and forest ecosystems (Auclair and Rencz, 1982).

Moore (1980) found that the subarctic woodland soils had a lower nutrient status on an areal basis and lower plant productivity and biomass compared to their boreal forest counterparts. On the other hand, these subarctic soils were more acidic and had a lower base saturation than similar well-drained soils in the arctic tundra. Moore (1980) concluded that in many respects, in both a pedological and a nutritional sense, the subarctic woodland soils were transitional between the arctic and boreal soils.

Estimates of NPP derived from the TEM model (Olson et al., 2012a; b) agree very closely with the observations of Auclair and Rencz (1982) (as presented in McGuire et al., 1992).

Sources of Error

Information not available.

5. Data Acquisition Materials and Methods:

A uniform 0.2 ha (45.2 x 45.2 m) area of a 110-year-old *P. mariana*/lichen woodland was delineated in the form of a square plot.

All trees in the 0.2 ha plot were counted to calculate density. Tree biomass was determined by a destructive harvest of 15 trees. The trees were arbitrarily selected from 1-cm diameter classes to represent the range of tree diameters on the site. Field samples of the trees were collected between June 10 and 25, 1974. (l) Each tree was manually felled on polyethylene sheets. All branches were removed and stem length was measured from the tip to the stem base. (2) Trees less than 3.6 m height were cut into 0.5-m lengths. Taller trees were cut into 1.0 m lengths. Age was determined from the lowermost section of the bole by counting annual rings. Wet weights were obtained for each section. A single 25 cm section was then removed from the midsection of the bole and dried at 70 C for 48 h to determine wet-dry weight ratios. (3) Using bud-scale scar locations, branches were cut into seven age classes. This was done to enable an estimate of needle retention and yearly changes in nutrient concentration. Classes included 1-year intervals for each first 5 years, a class of all branch parts older than 5 years, and another of all dead branches. Wet weights were obtained on branches older than 5 years. To estimate dry weight of these older branches, a 25-cm branch section was obtained from each upper, middle, and lower crown position, and treated as described for bole wood. Dead and younger branch classes were dried and total weights were determined in each case. (4) Needles from each of the branch classes were separated, dried, and weighed. (5) Roots were excavated manually from each sample tree and washed to remove any adherent soil. Removal of the total root system was greatly facilitated by the tendency of small roots and large lateral roots to occur directly below the lichen mat and penetrate the soil humus (H) layer only slightly. Maximum depth of penetration by large vertical roots was 30 cm. Roots were divided into diameter classes 0.0-0.2 cm, 0.2-1.0 cm, 1.0-3.0 cm, and > 3.0 cm and root crown, dried, and weighed. The purpose of this separation was to provide an estimate of root mass and nutrient concentrations of fine roots and to compare these with larger root classes. (6) Cones from each tree were removed, dried, and weighed. (7) Epiphytic lichen of *Alectoria* spp. were removed from all stem and branch sections, dried, and weighed collectively.

All plant tissue of ground-layer L and soil F + H fractions were excavated from twenty-five 0.25 m^2 quadrats positioned at 5-m intervals along each of three transect lines located at equal intervals across the plot. Each quadrat was returned intact to the laboratory where each species was then segregated into leaf, stem, and root tissue. Live lichen podetia were classified as "leaf" tissue. *P. mariana* roots were distinguished by their large size and absence of red pigmentation. Roots of the shrubs *Betula glandulosa* and *Ledum groenlandicum* were distinguished by following above-ground tissue. Roots of *Empetrum* and *Vaccinium* species were grouped into "ericaceous species." Soil F + H horizons were separated. All soil and plant tissue samples were then dried to constant weight at 70 C and stored for subsequent nutrient analysis.

Dry weights for each tissue component were summarized by species and transformed to an area basis (g/m^2). Since shrub and ground layer species were sampled in their entirety from 0.25 m^2 quadrats, their conversion to an area basis presented no problem. Because only partial sampling of *P. mariana* trees on the 0.2 ha plot was possible, transformation to an area basis required an intermediary step. Linear regression equations were first computed relating diameter to total tree biomass and to the biomass of leaf, branch, bole, and root tissue for the 15 trees harvested (Rencz, 1976). These equations were then used to determine biomass levels for all trees measured on the 0.2 ha plot.

Plant-tissue nutrient concentrations in vegetative components of the 110-year-old stand were determined by standard laboratory procedures to assess total levels. See Auclair and Rencz (1982) for details. Concentrations of nitrogen and other elements in tree, shrub, moss, and lichen components of the stand were based on a composite of several tissue samples on which a single chemical determination was made.

For soil samples, a quadrat of 5 x 2 m was established on an area of relatively uniform microtopography and lichen cover in the same *P. mariana*/lichen woodland (Moore, 1980). At twice weekly intervals from June to September 1974, soil samples of the L, H, L + H, and Bm horizons were collected from ten 100 cm^2 subquadrats, one located within each 1 m^2 section of the main quadrat. Each horizon was carefully excavated and volume measurements were recorded for the computation of bulk density. At two sampling dates, the samples were kept separate to obtain an estimate of the spatial variability in soil properties within each plot. At other sampling dates, the 10 subsamples were bulked and mixed, and duplicate measurements made. Fresh, moist samples were mixed by hand and the <2-mm diameter material was analyzed for the subsoil horizons. Bulked samples were dried at 70 C, weighed, and analyzed by standard laboratory procedures.

Climate data were recorded at the weather station in Schefferville, Canada (54.80 N -66.82 W elevation 518/522 m) which is located about 22 km northeast of the study site. Parameters include precipitation amount, minimum temperature, and maximum temperature. Monthly and annual means are reported in the climate file from 1949 through 1989.

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

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