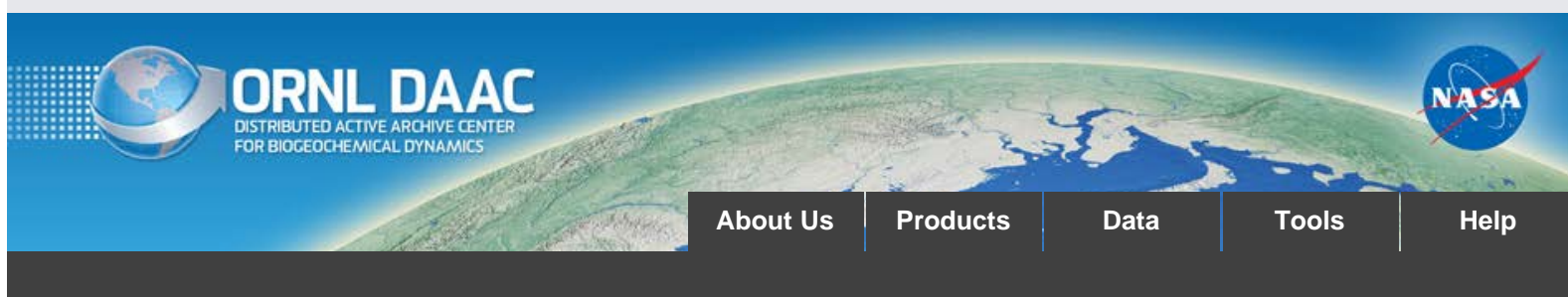


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NPP Boreal Forest: Jadrass , Sweden, 1973-1983, R1

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Revision Date: July 15, 2013

Summary:

This data set contains three files (.txt format). Two of the files contain stand characteristics, above- and below-ground biomass, and above- and below-ground production allocation data for Scots pine (*Pinus sylvestris*) forests near Jadrass, Sweden. One file is for a young regenerating forest (14-20 years old), and the other is for an old-growth forest (120-125 years old). The field measurements were made by destructive and non-destructive methods between 1973 and 1983. The third file contains climate data recorded at the Jadrass site from 1974 through 1990.

The research was conducted under the auspices of the SWECON (Swedish Coniferous Forest Biome) Project to enhance understanding of plant biomass dynamics and factors regulating plant growth. Most of the research concerned plant and vegetation processes, but particular interest was also given to soil processes, consumption processes, and energy and water exchange in the canopy and the soil.

Total net primary production (NPP) in the young forest was estimated at 860 g/m²/year (above-ground = 372 g/m²/year; below-ground = 488 g/m²/year). NPP for the old-growth forest was not calculated; however, the data set contains estimates of branch and trunk growth (43 g/m²/year and 106 g/m²/year, respectively), annual litterfall (135-162 g/m²/year), needle grazing loss (1.55 g/m²/year), fine tree root production (188 g/m²/year), and understory root production (30 g/m²/year).



Figure 1. General view of the "Ih II" experimental area of young (15-years-old) *Pinus sylvestris* at the Jdraas study site, Sweden. (The layout of treatment plots and wooden walkways can be seen. The experiment is surrounded by mature forest about 120 years old. Photograph taken summer 1975.)

Revision Notes: The NPP data file has been split into two files, one for the young regenerating forest and one for old-growth forest. The data files have been revised to correct previously reported data and information and to add new data from published sources. Please see the [Data Set Revisions](#) section of this document for detailed information.

Additional Documentation:

The 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:

Linder, S., and G. I. Agren. 2013. NPP Boreal Forest: Jdraas , Sweden, 1973-1990, 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/202](https://doi.org/10.3334/ORNLDAAC/202)

This data set was originally published as:

Linder, S., and G. I. Agren. 1998. NPP Boreal Forest: Jdraas , Sweden, 1973-1980. 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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1. Data Set Overview:

Project: Net Primary Productivity (NPP)

Productivity of a boreal coniferous forest was determined at the Jdraas research site under the SWECON (Swedish Coniferous Forest Biome) Project which started in 1972. In this intensive study, the dynamics of above- and below-ground biomass were monitored, together with energy and water budgets, and nutrient and soil processes, from 1973 through 1983. Some experimental treatments and measurements have continued beyond 1983 but are not included in this data set.

The 1.5 x 2.5 km Jdraas study site (60.82 N 16.50 E) is situated at Ivantjärnsheden near Jdraas in central Sweden, at the southern limit of the "northern coniferous" region, about 30 km northwest of the town of Gävle. The site experiences cool summers with long days, and long, cold winters. Summer droughts occur because of the sandy soils with low water storage capacity. Land use history in the region includes forest grazing, burning for crops and grazing, charcoal burning, tar burning, logging, and tree felling for paper pulp. Charcoal and tar burning probably dominated recent land use at Jdraas , and the site was probably completely treeless around 1850-1860 due to charcoal consumption for smelting.

The research plots at the site represent an age series of Scots pine (*Pinus sylvestris*) forest stands, ranging from those which were clear-felled in 1977 (Plot "Ih 0") to those which were 125 years old in 1979 (i.e., established about 1854; Plot "Ih V"). The studies of ecosystem productivity that are included in this data set were concentrated in Plot "Ih II" which was harvested in 1957 and thinned of seed trees in 1962 (and thus being between 14 and 20 years old when the productivity measurements were made), and in Plot "Ih V" which was 120-125 years old when productivity measurements were made. Although several fertilization and irrigation treatments were made in different areas within Plot "Ih II," the data presented herein are from untreated (control) plots. Similarly, the Plot "Ih V" was untreated.

Total net primary production of the 20-year-old untreated stand (Plot "Ih II") in 1979 was estimated at 860 g/m²/year (above-ground = 372 g/m²/year; below-ground = 488 g/m²/year) (Linder and Axelsson, 1982; Persson, 1980b; Scurlock and Olson, 2012). Estimates of TNPP for the 120-125 year-old stand are not reported in this data set; however, the data set contains estimates of branch and trunk growth (43 g/m²/year and 106 g/m²/year, respectively), annual litterfall (135-162 g/m²/year), needle grazing loss (1.55 g/m²/year), fine tree root production (188 g/m²/year), and understory root production (30 g/m²/year) from various studies (Bringmark, 1977 and Persson, 1980a).

As reported in the cited literature (but not presented herein), TPP was doubled in the irrigated and fertilized treatment areas in Plot "Ih II" to 1,680 g/m²/ year, with more carbon allocated to shoot than root growth (above-ground = 1,222 g/m²/year; below-ground = 724 g/m²/ year). Fertilization resulted in dramatic increases in productivity, persisting long after treatment was discontinued. Irrigation did not significantly increase productivity, with or without fertilizer.

ANPP, BNPP, and TNPP estimates for Jadrass untreated sites are also reported Gower et al. (2001; 2012) and Olson et al. (2012a; b) (Table 1).

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		
jdr1_npp_r1.txt	Agren et al. (1980) ^{1,2}	jdr Ih_II (14-yr-old stand)	54	91	145
	Linder and Axelsson (1982) and Persson (1980b) ^{1,3}	jdr Ih_II (20-yr-old stand)	177	232	409
jdr2_npp_r1.txt	Bringmark (1977) and Persson (1980a) ^{1,4}	jdr Ih_V (120-yr-old stand)	135	104	239
NPP_Multibiome_EnvReview_Table_A1_R1.xls	Scurlock and Olson (2012) based on Linder and Axelsson (1982) and Persson (1980a) ¹	jdr (20-yr-old stand)	177	232	409
GPPDI_ClassA_NPP_162_R2.csv	Olson et al. (2012a)	Class 137 (MI 133) (14-yr-old stand based on Agren et al. (1980) ⁵	56	NA	152
		Class 137 (MI 134) (20-yr-old stand based on ORNL estimates)	177	232	409
		Class 137 (MI 131) (20-yr-old stand based on Linder and Axelsson (1982))	176	285	462
		Class A 137 (MI 132) (120-yr-old stand based Bringmark (1977) and Persson (1980a) ¹	138	103	240
EMDI_ClassA_NPP_81_R2.csv	Olson et al. (2012b)	Class A 137 ⁶	137	207	316
borfornpp2.csv	Gower et al. (2001; 2012)	Class II Jadrass 14-yr ⁷	56	NA	NA
borfornpp1_r1.csv		Class I Jadrass 20-yr ⁸	177	285	462
		Class I Jadrass 120-yr ⁹	138	103	241

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.

Please see the [Data Set Revisions](#) section of this document for detailed information on the revised data sets (R1, R2, etc.).

¹For 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.

²NPP values are estimates for "average tree" summed to stand level

³ANPP estimates are based on measurements of branch + trunk + stump growth (90 gC/m²/yr) plus needle growth (87 gC/m²/yr).

BNPP estimates are based on measurements of fine root growth (190 gC/m²/yr) + coarse root growth (42 gC/m²/yr).

⁴ANPP estimates are based on measurements of branch + trunk growth (71 gC/m²/yr) plus litterfall (64 gC/m²/yr). BNPP estimates are based on measurements of fine root production (89.3 gC/m²/yr) + understory root production (14.3 gC/m²/yr).

⁵ANPP and TNPP estimates 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 0.5.

⁶ANPP is the average of 4 values reported in the GPPDI data file. BNPP is the average of 3 values reported in the GPPDI data file.

TNPP = ANPP + BNPP based on these averages.

⁷ANPP estimate from the original data source was 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 0.5.

⁸ANPP estimates are based on allometry calculations of branch + trunk + stump growth (102 gC/m²/yr) needle growth (75 gC/m²/yr). BNPP estimates are based on allometry calculations of fine root growth (230 gC/m²/yr) + coarse root growth (55 gC/m²/yr).

⁹ANPP estimates are based on allometry calculations of branch + trunk + stump growth (75 gC/m²/yr) plus needle growth (63 gC/m²/yr).

There is no estimate of fine root growth or coarse root growth in source although a total BNPP estimate based on allometry calculations is provided.



Figure 2. Destructive measurements on young *Pinus sylvestris* at the Jdraas study site, Sweden. (Bo Johansson, SWECON Project technician, is determining shoot length. Photograph taken June 1976 by Dr. S. Linder, Swedish University of Agricultural Sciences, Uppsala.).



Figure 3. Non-destructive measurements on young *Pinus sylvestris* at the Jdraas study site, Sweden. (Photograph taken 18th May 1978 by Dr. B. Axelsson, Swedish University of Agricultural Sciences, Uppsala).

2. Data Description:

This data set contains three text files. Two of the files contain stand characteristics, above- and below-ground biomass, and above- and below-ground production allocation data for Scots pine (*Pinus sylvestris*) forests near Jdraas , Sweden. One file is for a young regenerating forest (14-20 years old) and the other is for an old-growth forest (120-125 years old). The field measurements were made by destructive and non-destructive methods between 1973 and 1983. The third file contains climate data recorded at the Jdraas site from 1974 through 1990.

Spatial Coverage

Site: Jdraas , Sweden

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Elevation (m)
Jdraas , Sweden;	16.50	16.50	60.82	60.82	185

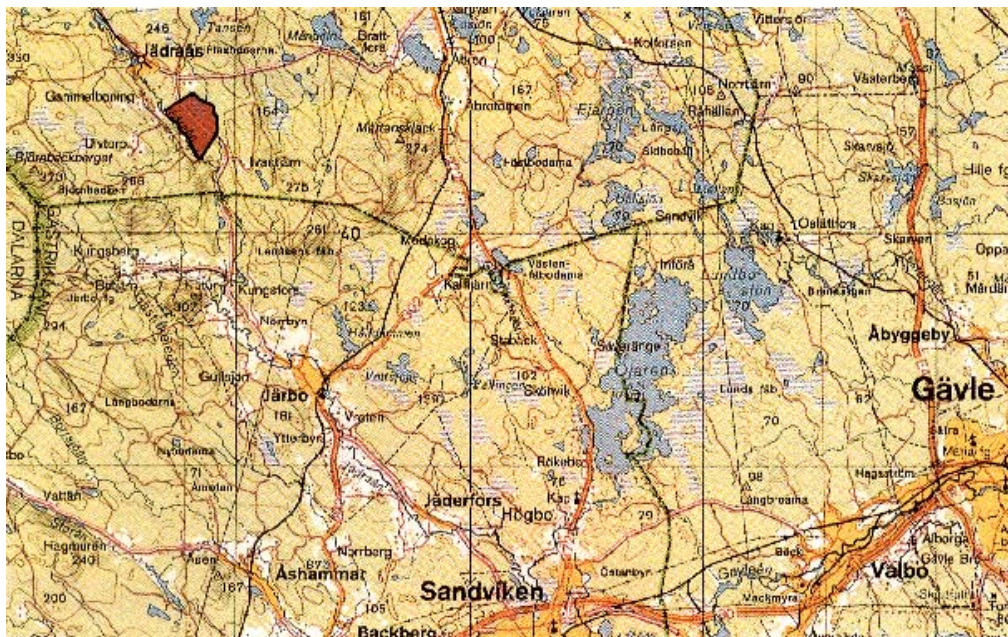


Figure 4. Location map for Jdraas Experimental Forest, which is administered by the Swedish University of Agricultural Sciences, Uppsala, Sweden. The Jdraas site is marked in red in the top left side of the map; it comprises 360 hectares, of which 275 hectares are fertile forest land. The land is owned by the forest company STORA. Map reproduced by kind permission of Dr. S. Linder and the Swedish University of Agricultural Sciences.

Site Information

Ivantjärnsheden is a Scots pine - heath - lichen stand on sand at Jdraas in central Sweden. It was chosen as the main research site for the SWECON because of the homogeneity of substrates, dry soils with fairly even percolation and without influence of water table close to the soil surface, and representative forest ecosystems that occur throughout Sweden. The research plots were selected so as to represent different stages in the rotation period of a pine stand.

Ivantjärnsheden is located just north of the border between the Boreal (northern coniferous or taiga) zone of northern Sweden and the Boreo-nemoral (southern coniferous) zone of southern Sweden. The transition is comparatively narrow with regard to topography, geography, climate, and biogeography. It contains both northern and southern plant and animal species. The research area is a level sedimentary sandy plain at 185 m above mean sea level (M.S.L.). The vegetation is mainly a dry pine - dwarf shrub - lichen heath of the *Cladonio-Pinetum (boreale)* association or the lichen and lichen-dwarf-shrub forest type growing on an ordinary podsol.

Within the research site, the dominant soil particle sizes at 15 cm depth are fine to medium sand (0.125-0.5 mm), much of which is aeolian in origin. At 70 cm depth, the textural composition varies between subareas with particles sizes ranging broadly from fine to coarse sand (0.125-1 mm).

The research plots represent an age-series of Scots pine forest stands from clear-felled in 1977 (Plot "Ih 0") to a 125-year-old stand in 1979 (i.e., established about 1854; Plot "Ih V"). This data set provides measurements from the control, untreated section of Plot "Ih II" and from Plot "Ih V" (also untreated).

Plot "Ih II" was harvested in 1957 and the seed trees thinned in 1962. Fertilization and irrigation treatments commenced in certain sections of the naturally-regenerated "Ih II" plot from about 1960. The control plot in "Ih II" did not receive any treatments and was about 14 years old when productivity measurements started in 1974. The study plots range in size (50 x 50 m or 30 x 30 m quadrats) with smaller subplots of 10 x 10 quadrats. The control Plot "Ih II" is a level, regenerating forest opening surrounded by a mature pine stand (see Figure 1). Dominant soil particles are medium sand at 15 cm and medium to coarse sand at 70 cm depth. The ground water table is 10 m depth at its upper level.

The topography of Plot "Ih V" is also level. It lies in the center of the dominant tree stand of the heath and is probably the most representative of the plots. Dominant soils are fine, medium, and coarse sand at 15 cm depth and medium and coarse sand at 70 cm depth. The ground water table is 10 m depth at its upper level. The vegetation belongs to the *Cladonio-Pinetum (boreale)* association. The ground vegetation is fairly stabilized from the successional view-point. Biomass estimates indicate somewhat smaller amounts of field layer (*Calluna vulgaris* and *Vaccinium vitis-idaea*) than of the bottom layer (*Pleurozium schreberi*, *Cladonia rangiferina*, and *C. silvatica*). The pine tree stand is fairly thin with suppressed spruce underneath. The stand originated in the 1850s and was lightly thinned in about 1962.

In the study plots, elevated walking bridges of untreated wood were placed along the most frequent pathways to prevent damage to vegetation and compaction of soil in both plots. Plot "Ih II" is surrounded by a high fence and Plot "Ih V" by a low one to prevent browsing by moose.

Climate data in this data set are available for the period 1974-1990 from a weather station at the boreal forest site. Mean maximum temperature during the study period was 7.6 degrees C and mean minimum temperature was -0.7 degrees C. Mean annual precipitation during the same time period was 731 mm, with mean annual amounts ranging between 431 and 901 mm. The growing season in the Jdraas area, defined as daily mean air temperature exceeding 6 C, lasts for 161 days on average (May 4-October 12). Occurrence of frost during the growing season is frequent.

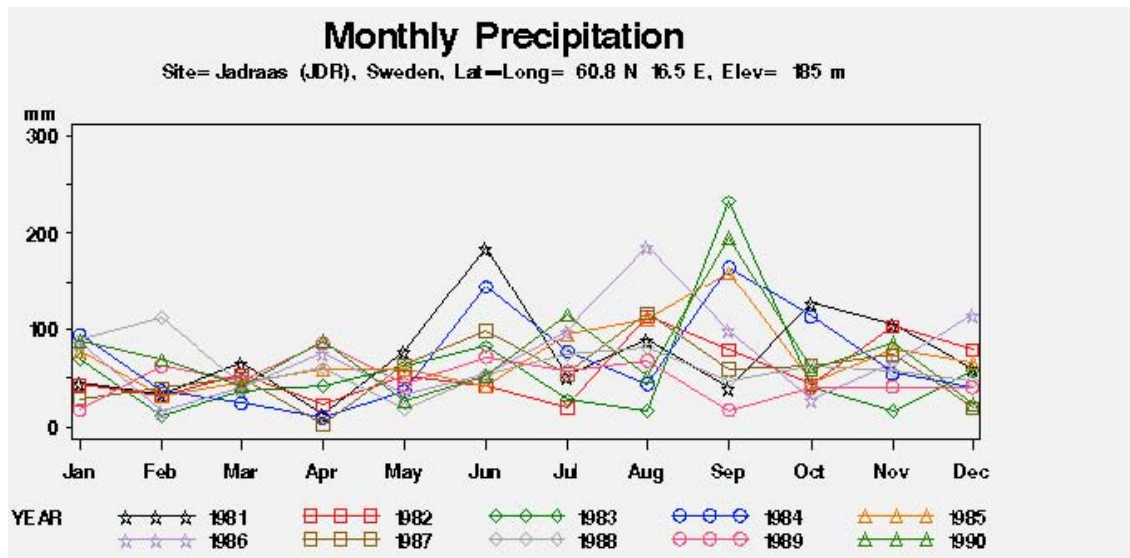


Figure 5. Monthly precipitation 1981-1990 at the Jdraas boreal forest site, Sweden.

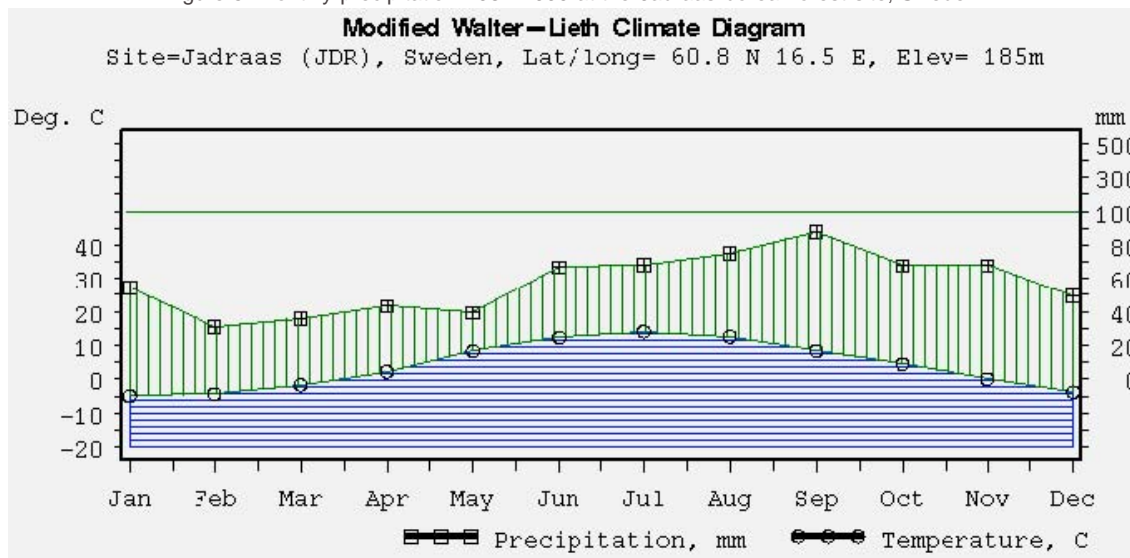


Figure 6. Modified Walter-Lieth climate diagram based upon mean temperature and precipitation data for the Jdraas boreal forest site, Sweden. (criss-cross red shading, where present - period of relative drought; vertical green shading - period of relative humid season).

Spatial Resolution

The Jdraas study site was 1.5 x 2.5 km in total size. The research plots were divided into regular grids of 50 x 50 or 30 x 30 m quadrats which were further subdivided into 10 x 10 m quadrats. Permanent 0.5 x 0.5 m quadrats were randomly distributed inside the larger 10 x 10 m quadrats for non-destructive cover estimates of the field and bottom layers. Soil sampling sites were 1 x 1 m plots within 5-20 randomly placed 10 x 10 m quadrats. Root biomass cores had an area of 36.26 cm².

Temporal Coverage

Stand structure, biomass, and productivity measurements were made on different occasions during the growing seasons (May-November) between 1973 and 1983. Climate data are available from 1974 through 1990.

Temporal Resolution

Above- and below- ground tree layer stand characteristics, biomass, and productivity measurements were made at Plot "Ih II" when the stand was 14 years old and again when it was 15-20 years old. Tree biomass and production measurements were made at Plot "Ih V" when the stand was 120 and 125 years old. Stand characteristics and vegetation and soil nutrient content were measured in Plot "Ih V" when the stand was 117-118 years old. Cover analyses of the field and bottom layers at Plots "Ih II" and "Ih V" were carried out each year during August-October. Root sampling took place at intervals of 2-3 weeks during the growing season.

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). Monthly and annual climatic means are provided for the 1974-1990 period.

Data File Information

Table 2. Data files in this data set archive

FILE NAME	TEMPORAL COVERAGE	FILE CONTENTS
jdr1_npp_r1.txt	1973/05/01-1980/11/31	Stand characteristics, above- and below-ground biomass, and above- and below-ground production allocation data for a young regenerating (untreated) boreal forest near Jdraas , Sweden
jdr2_npp_r1.txt	1973/05/01-1983/11/30	Stand characteristics, above- and below-ground biomass, and above- and below-ground production allocation data for an old-growth (untreated) boreal forest near Jdraas , Sweden
jdr_cli.txt	1974/01/01-1990/12/31	Monthly and annual precipitation amount and maximum/minimum temperature data from a weather station at the boreal forest site near Jdraas , Sweden

NPP Data. NPP estimates for the Jdraas , Sweden sites are provided in two text files (.txt format, Table 2), one for each site. 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 (jdr1_npp_r1.txt)

Site; Treatmt; Year; Month; Day; parameter; amount; units; Reference/ Comments
jdr; lh_II; 1974; -999.9; -999.9; stand_age; 14; years; Agren et al. (1980) "average tree"
jdr; lh_II; 1974; -999.9; -999.9; height; 278; cm; Agren et al. (1980) "average tree"
jdr; lh_II; 1974; -999.9; -999.9; needles; 123.0; g/m^2 ; Agren et al. (1980) "average tree"
jdr; lh_II; 1974; -999.9; -999.9; branches; 62.4; g/m^2 ; Agren et al. (1980) "average tree"
jdr; lh_II; 1974; -999.9; -999.9; trunks; 125.6; g/m^2 ; Agren et al. (1980) "average tree"
jdr; lh_II; 1974; -999.9; -999.9; ANPP; 113; $\text{g/m}^2/\text{year}$; Agren et al. (1980) "average tree"
jdr; lh_II; 1974; -999.9; -999.9; BNPP; 192; $\text{g/m}^2/\text{year}$; Agren et al. (1980) "average tree"
jdr; lh_II; 1974; -999.9; -999.9; TNPP; 305; $\text{g/m}^2/\text{year}$; Agren et al. (1980) "average tree"
...

Sample NPP Data Record (jdr2_npp_r1.txt)

Site; Treatmt; Year; Month; Day; parameter; amount; units; Reference/ Comments
jdr; lh_V; 1977; -999.9; -999.9; stand_age; 120; years; Bringmark (1977)
...
jdr; lh_V; 1977; -999.9; -999.9; needles; 393.7; g/m^2 ; Bringmark (1977)
jdr; lh_V; 1977; -999.9; -999.9; shoots; 81.7; g/m^2 ; Bringmark (1977)
jdr; lh_V; 1977; -999.9; -999.9; branches; 810.5; g/m^2 ; Bringmark (1977)
jdr; lh_V; 1977; -999.9; -999.9; trunks; 4824.3; g/m^2 ; Bringmark (1977)
...
jdr; lh_V; 1979; -999.9; -999.9; stand_age; 125; years; Axelsson and Brakenhielm (1980)
...
jdr; lh_V; -999.9; -999.9; -999.9; Totlittfall; 162; $\text{g/m}^2/\text{year}$; Berg et al. (1995)
...
jdr; lh_V; 1979; -999.9; -999.9; branch_growth; 43.4; $\text{g/m}^2/\text{year}$; Bringmark (1977)
jdr; lh_V; 1979; -999.9; -999.9; trunk_growth; 106.1; $\text{g/m}^2/\text{year}$; Bringmark (1977)
jdr; lh_V; 1977; -999.9; -999.9; Totlittfall; 135.2; $\text{g/m}^2/\text{year}$; Bringmark (1977) ...

Table 3. Column headings in NPP file

COLUMN HEADING	Defintion	Units
Site	Site where data were gathered (code refers to site identification)	Text
Treatmt	Sub-plot where data were collected	Text

Year	Year in which data were collected	Numeric
Month	Month in which data were collected	Numeric
Day	Day on which data were collected	Numeric
parameter	Parameters measured (see definitions in Table 3)	Text
amount	Data values	Numeric
units	Unit of measure	Text
References / comments	Primary sources of data plus explanatory comments	Text

Table 4. Parameter definitions in NPP file (jdr1_npp_r1.txt)

PARAMETER	DEFINITION	UNITS	SOURCE
stand_age	Average age of trees in Plot "Ih II" when measurements were made	years	Table 1, Agren et al. (1980)
height	Average tree height in Plot "Ih II" when measurements were made	cm	
needles	Leaf biomass for the untreated stand in Plot "Ih II" when measurements were made ¹	g/m ²	
branches	Leaf biomass for the untreated stand in Plot "Ih II" when measurements were made ¹		
trunks	Leaf biomass for the untreated stand in Plot "Ih II" when measurements were made ¹		
ANPP	Above-ground net primary production for the untreated stand in Plot "Ih II" ²	g/m ² /year	Table 4, Agren et al. (1980)
BNPP	Below-ground net primary production of <i>P. sylvestris</i> (fine + coarse roots) in the untreated stand of Plot "Ih II" ³		p. 514, Persson (1978); p. 311, Agren et al. (1980)
TNPP	Total net primary production for the untreated stand in Plot "Ih II"		by addition
stand-age	Age range of canopy and understory trees in Plot "Ih II" when measurements were made ⁴	years	various sources
height	Mean height of trees in Plot "Ih II" when measurements were made	cm	Table 2, Axelsson and Brakenhielm (1980)
numdensity	Tree density in Plot "Ih II" when measurements were made	trees/ha	
finerootprodn	Annual average fine root and necromass (< 2 mm dia.) production of <i>P. sylvestris</i> in Plot "Ih II" when measurements were made ⁵	g/m ² /year	p. 514, Persson (1978)
largerootprodn	Minimum annual coarse root (2 - < 10 mm dia.) production of <i>P. sylvestris</i> in Plot "Ih II" when measurements were made ⁵		
litter	Litter biomass (attached dead plant debris not included)	g/m ²	Table 5, Persson (1980b)
finerootprodn	Annual turnover of fine (dead and living) roots of <i>P. sylvestris</i> in the F/H layer plus fine roots in the mineral soil in the control stand of Plot "Ih II" based on pooled seasonal averages	g/m ² /year	p. 82, Persson (1980b)
Undstry_rootprodn	Annual turnover of fine (dead and living) roots of dominant understory species (<i>Calluna vulgaris</i> and <i>Vaccinium vitis-idaea</i>) in the F/H layer plus fine roots in the mineral soil in the control stand of Plot "Ih II" based on pooled seasonal averages		
pineroots	Total root biomass (< 10 mm) of <i>P. sylvestris</i> in control Plot "Ih II" in the 0-30 cm soil layers ⁶		
	Total root biomass (< 10 mm) of other plants (<i>Betula</i> spp. + <i>Empetrum nigrum</i> + <i>Calluna vulgaris</i> + <i>Vaccinium vitis-idaea</i> + <i>V. myrtillus</i> +		

otherroots	<i>Deschampsia fluxuosa</i> in control Plot "Ih II" in the 0-30 cm soil layers ⁶	g/m ²	Table 2, Persson (1980b)	
pinedeadroots	Total root necromass (< 10 mm) of <i>P. sylvestris</i> in control Plot "Ih II" in the 0-30 cm soil layers ⁶			
otherdeadroots	Total root necromass (< 10 mm) of other plants (<i>Betula</i> spp. + <i>Empetrum nigrum</i> + <i>Calluna vulgaris</i> + <i>Vaccinium vitis-idaea</i> + <i>V. myrtillus</i> + <i>Deschampsia fluxuosa</i>) in control Plot "Ih II" in the 0-30 cm soil layers ⁶			
stand_age	Age of control stand (Plot "Ih II") during 1979 sampling period	years	Linder and Axelsson (1982)	
LAI	Average leaf area index for April-May 1979 sampling period for control site in Plot "Ih II"	m ² /m ²		
LAI	Average leaf area index for July-August 1979 sampling period for control site in Plot "Ih II"			
needles	Biomass of current + older needles in control site of Plot "Ih II"	g/m ²		
branches	Biomass of branches in control site of Plot "Ih II"			
trunks	Biomass of stems in control site of Plot "Ih II"			
stumps	Biomass of stumps in control site of Plot "Ih II"			
AGbiomass	Total above-ground biomass in control site of Plot "Ih II" (sum of above)			by addition
coarseroots	Biomass of coarse roots (> 1 mm in diameter) in control site of Plot "Ih II"			Linder and Axelsson (1982)
needle_growth	Annual needle growth (current needles growth + shoot axis growth) in control site of Plot "Ih II"	g/m ² /year		Table 4, Linder and Axelsson (1982)
branch_growth	Annual branch growth in control site of Plot "Ih II"			
trunk_growth	Annual stem growth in control site of Plot "Ih II"			
stump_growth	Annual stump growth in control site of Plot "Ih II"			
ANPP	Total annual above-ground net primary production in control site of Plot "Ih II" (sum of above)		by addition	
finerootprodn	Estimated annual fine root production in control site of Plot "Ih II" based on the amount of carbon needed to balance the carbon budget for the stand		Table 4, Linder and Axelsson (1982)	
largerootprodn	Annual coarse root production in control site of Plot "Ih II"		by addition	
BNPP	Total annual below-ground net primary production in control site of Plot "Ih II" (sum of above)			
TNPP	Total net primary production in control site of Plot "Ih II" (ANPP + BNPP)			
N_fixation	Mean annual N ₂ -fixation in Plot "Ih II"	gN/m ² /year	p. 339, Granhall and Lindberg (1980)	
soilpH (0-10cm)	Soil pH, 0-10 cm depth in Plot "Ih II"	dimensionless	Table 2, Axelsson and Brakenhielm (1980)	
soilpH (10-20cm)	Soil pH, 10-20 cm depth in Plot "Ih II"			

Notes: ¹Calculations of above-ground biomass estimates for stand components were made by replacing needle, branch, and trunk biomass for an average tree (in gC dw) with values in g/m² for each stand component (assuming 50% carbon content).

²Calculations of above-ground NPP estimates for the untreated stand were made by summing average tree growth of needles, branches, and trunks (in gC/yr), then converting this estimate to gC/ha/yr for the stand, and then converting the result to g/m²/yr (again, assuming 50% carbon content).

³Calculations of below-ground NPP estimates for the untreated stand were made by adding cumulative annual total in the fine-root necromass to a minimum estimate of the production of coarse roots and stumps for *P. sylvestris* in the stand. See p. 514, Persson (1978) for details.

⁴In 1979, Plot "Ih II" had a 20-year-old tree population with an understory of younger pine, thus the age range.

⁵The value for fine root production is the average from two strata in each 10 x 10 m plot (i.e., *P. sylvestris* growing above clusters of heather, *Calluna vulgaris*,

and *P. sylvestris* growing in non-*Calluna* mosaics of reindeer lichens, cup lichens, etc.).⁶Estimates are pooled averages from 13 samples taken during 1974-1975.

Table 5. Parameter definitions in NPP file (jdr2_npp_r1.txt)

PARAMETER	DEFINITION	UNITS	SOURCE		
stand_age	Average age of trees in Plot "Ih V" when measurements were made (1977)	years	Bringmark (1977)		
stand_age	Average age of trees in Plot "Ih V" when measurements were made (1979)	years			
height	Average tree height in Plot "Ih V" when measurements were made (1973)	cm	Table 2, Axelsson and Brakenhielm (1980)		
numdensity	Tree density in Plot "Ih V" when measurements were made (1973)	trees/ha			
basal_area	Basal area of tree stand in Plot "Ih V" when measurements were made (1973)	m ² /ha	Bringmark (1977)		
basal_area	Basal area of tree stand in Plot "Ih V" when measurements were made (1974); from a randomized sample of trees, used for branch sampling in an insect laval abundance study		Table 1, Larsson and Tenow (1980)		
needles	Total needle biomass of <i>P. sylvestris</i> in Plot "Ih V" based on samples taken in June and October of 1974	g/m ²	Table 3, Larsson and Tenow (1980)		
needles_S.E.	Standard error for total needle biomass in Plot "Ih V" based on samples taken in June and October of 1974				
needles	Needle biomass of current needles plus older needles of <i>P. sylvestris</i> in Plot "Ih V" in 1977	g/m ²	Table 1, Bringmark (1977)		
shoots	Shoot biomass of current shoots plus older shoots of <i>P. sylvestris</i> in Plot "Ih V" in 1977				
branches	Branch biomass of <i>P. sylvestris</i> in Plot "Ih V" in 1977				
trunks	Trunk + bark biomass of <i>P. sylvestris</i> in Plot "Ih V" in 1977				
AGbiomass	Total above-ground biomass of <i>P. sylvestris</i> in Plot "Ih V" in 1977		by addition		
stumps+bigroots	Biomass of stumps + large roots of <i>P. sylvestris</i> in Plot "Ih V" in 1977	g/m ²	Table 1, Bringmark (1977)		
coarse+fine roots	Biomass of coarse + fine roots of <i>P. sylvestris</i> in Plot "Ih V" in 1977				
Undstry_AGbiomass	Above-ground biomass of heather + cowberry in Plot "Ih V" in 1977				
Undstry_BGbiomas	Below-ground biomass of heather roots + cowberry rhizomes in Plot "Ih V" in 1977				
mosses+lichens	Biomass of mosses + lichens in Plot "Ih V" in 1977				
Stdead	Biomass of standing dead tree branches, heather, and cowberry in Plot "Ih V" in 1977				
litter	Total surface litter in Plot "Ih V" in 1977				
deadroots	Total root litter in Plot "Ih V" in 1977				
stand_age	Estimated age of Scots pine in Plot "Ih V" in 1973			years	p. 110, Berg et al. (1995)
needles	Needle biomass of Scots pine in Plot "Ih V" in 1979-80			g/m ²	Figure 1, Berg et al. (1995) based on data from Andersson et al.
cones	Cone biomass of Scots pine in Plot "Ih V" in 1979-80				
shoots+branches	Shoot and branch biomass of Scots pine in Plot "Ih V" in 1979-80				
trunks	Stemwood and stembark biomass of Scots pine in Plot "Ih V" in 1979-80				
AGbiomass	Total above-ground biomass of Scots pine in Plot "Ih V" in 1979-80				
stumps+Totroots	Stump and root biomass of Scots pine in Plot "Ih V" in				

	1979-80		(1980)
Undstry_AGbiomass	Above-ground biomass of ground vegetation in Plot "Ih V" in 1979-80		
Undstry_BGbiomass	Below-ground biomass of ground vegetation in Plot "Ih V" in 1979-80		
litter	Surface litter biomass in Plot "Ih V" in 1979-80		
humus	Humus biomass in Plot "Ih V" in 1979-80		
Totlittfall	Average total litterfall from Scots pine canopy (needles + twigs + cones + attached dead) during a 10-year study (1973-1983)	g/m ² /year	p. 111, Berg et al. (1995)
branch_growth	Annual growth increment of branches and shoots in Plot "Ih V" in 1977		
trunk_growth	Annual growth increment of stemwood in Plot "Ih V" in 1977	g/m ² /year	Table 2, Bringmark (1977)
Totlittfall	Total annual litterfall (needles + cones + twigs + other matter) in Plot "Ih V" in 1977		
branch_growth_N	Nitrogen increment in branches and shoots in Plot "Ih V" in 1977		
trunk_growth_N	Nitrogen increment in stemwood in Plot "Ih V" in 1977	g/m ² /year	Table 2, Bringmark (1977)
Totlittfall_N	Nitrogen increment in litterfall (needles + cones + twigs + other matter) in Plot "Ih V" in 1977		
branch_growth_P	Phosphorus increment in branches and shoots in Plot "Ih V" in 1977		
trunk_growth_P	Phosphorus increment in stemwood in Plot "Ih V" in 1977	g/m ² /year	Table 2, Bringmark (1977)
Totlittfall_P	Phosphorus increment in total litterfall (needles + cones + twigs + other matter) in Plot "Ih V" in 1977		
needles-N	Nitrogen concentration in Scots pine current and older needles in Plot "Ih V" in 1977		
shoots-N	Nitrogen concentrations in Scots pine current and older shoots in Plot "Ih V" in 1977		
branches-N	Nitrogen concentrations in Scots pine branches in Plot "Ih V" in 1977		
trunks-N	Nitrogen concentrations in Scots pine stemwood and stembark in Plot "Ih V" in 1977		
AGbiomass-N	Nitrogen concentrations in above-ground Scots pine biomass in Plot "Ih V" in 1977		
stumps+bigroots-N	Nitrogen concentrations in Scots pine stumps and big roots in Plot "Ih V" in 1977		
coarse+fine_roots-N	Nitrogen concentrations in Scots pine fine (< 10 mm) and coarse roots (10-50 mm) in Plot "Ih V" in 1977		
Undstry_AGbiomass-N	Nitrogen concentrations in heather and cowberry above-ground biomass (capsules, current shoots, C + 1 shoots C + 2 shoots, and older stems) in Plot "Ih V" in 1977	g/m ²	Table 1, Bringmark (1977)
Undstry_BGbiomass-N	Nitrogen concentrations in heather and cowberry below-ground biomass (fine roots < 2 mm, large roots > 2 mm, and rhizomes) in Plot "Ih V" in 1977		
mosses+lichen-N	Nitrogen concentrations in mosses and lichens in Plot "Ih V" in 1977		
Stdead-N	Nitrogen concentrations in standing dead (Scots pine, heather, and cowberry) in Plot "Ih V" in 1977		
litter-N	Nitrogen concentrations in total surface litter in Plot "Ih V" in 1977		
deadroots-N	Nitrogen concentrations in total root litter in Plot "Ih V" in 1977		
needles-P	Phosphorus concentration in Scots pine current and older needles in Plot "Ih V" in 1977		
shoots-P	Phosphorus concentrations in Scots pine current and		

	older shoots in Plot "Ih V" in 1977		
branches-P	Phosphorus concentrations in Scots pine branches in Plot "Ih V" in 1977		
trunks-P	Phosphorus concentrations in Scots pine stemwood and stembark in Plot "Ih V" in 1977		
AGbiomass-P	Phosphorus concentrations in above-ground Scots pine biomass in Plot "Ih V" in 1977		
stumps+bigroots-P	Phosphorus concentrations in Scots pine stumps and big roots in Plot "Ih V" in 1977		
coarse+fine_roots-P	Phosphorus concentrations in Scots pine fine (< 10 mm) and coarse roots (10-50 mm) in Plot "Ih V" in 1977		
Undstry_AGbiomass-P	Phosphorus concentrations in heather and cowberry above-ground biomass (capsules, current shoots, C + 1 shoots C + 2 shoots, and older stems) in Plot "Ih V" in 1977		
Undstry_BGbiomass-P	Phosphorus concentrations in heather and cowberry below-ground biomass (fine roots < 2 mm, large roots > 2 mm, and rhizomes) in Plot "Ih V" in 1977		
mosses+lichen-P	Phosphorus concentrations in mosses and lichens in Plot "Ih V" in 1977		
Stdead-P	Phosphorus concentrations in standing dead (Scots pine, heather, and cowberry) in Plot "Ih V" in 1977		
litter-P	Phosphorus concentrations in total surface litter in Plot "Ih V" in 1977		
deadroots-P	Phosphorus concentrations in total root litter in Plot "Ih V" in 1977		
needles-C	Concentration of carbon in live needles, green litter		
needles-N	Concentration of nitrogen in live needles, green litter		
needles-P	Concentration of phosphorus in live needles, green litter	percent	Table 2, Larsson and Tenow (1980)
grazing_loss	Grazing loss in Plot "Ih V" defined as the removal of leaf material from the foliage by leaf-eating insect larvae over the full feeding period in 1974	g/m ² /year	p. 292, Larsson and Tenow (1980)
fineroots	Fine root biomass (< 2 mm in diameter) of <i>P. sylvestris</i> (0-30 cm depth) in Plot "Ih V" in 1974-1975 ¹		
Totroots	Total root biomass (< 10 mm in diameter) of <i>P. sylvestris</i> (0-30 cm depth) in Plot "Ih V" from in 1974-1975 ¹		
deadroots	Dead root biomass (< 2 mm in diameter) of <i>P. sylvestris</i> (0-30 cm depth) in Plot "Ih V" in 1974-1975 ¹		
Undstry_fineroots	Fine root biomass (< 2 mm in diameter) of understory vegetation (<i>Empetrum nigrum</i> + <i>Calluna vulgaris</i> + <i>Vaccinium vitis-idaea</i>) (0-30 cm depth) in Plot "Ih V" in 1974-1975 ¹		
Undstry_Totroots	Total root biomass (< 10 mm in diameter) of understory vegetation (<i>Empetrum nigrum</i> + <i>Calluna vulgaris</i> + <i>Vaccinium vitis-idaea</i>) (0-30 cm depth) in Plot "Ih V" from in 1974-1975 ¹		
Undstry_deadroots	Dead root biomass (< 2 mm in diameter) of understory vegetation (<i>Empetrum nigrum</i> + <i>Calluna vulgaris</i> + <i>Vaccinium vitis-idaea</i>) (0-30 cm depth) in Plot "Ih V" in 1974-1975 ¹		
finerootprodn	Annual turnover of fine roots of <i>P. sylvestris</i> from whole core (0-30 cm depth)		
Undstry_rootprodn	Annual turnover of fine roots of <i>Calluna vulgaris</i> from whole core (0-30 cm depth)	g/m ² /year	p. 255, Persson (1980a) in Persson, T. (ed.). (1980)
needlitt_decomp	Weight losses of needle litter in litter bags sampled six times over a 1,099 day period in Plot "Ih V"	percent	Table 1, Berg and Staaf (1980)
needlitt_lignin	Needle (Klason) lignin composition in needle litter after incubation periods (initial composition to 1,009 days) in		

	Plot "Ih V"	percent of actual weight	Table 2, Berg and Staaf (1980)
needlitt_N	Total nitrogen composition in needle litter after incubation periods (initial composition to 1,009 days) in Plot "Ih V"		
N_fixation	Mean annual N ₂ -fixation in Plot "Ih II"	gN/m ² /year	p. 339, Granhall and Lindberg (1980)
soilpH (0-10cm)	Soil pH, 0-10 cm depth in Plot "Ih II"	dimensionless	Table 2, Axelsson and Brakenhielm (1980)
soilpH (10-20cm)	Soil pH, 10-20 cm depth in Plot "Ih II"		
soil_C (0-10cm)	Carbon content in iron podsol in Plot "Ih V" at 0-10 cm depth	percent of dry weight	Table 1, Bringmark (1980)
soil_C (10-20cm)	Carbon content in iron podsol in Plot "Ih V" at 10-20 cm depth		
soil_C (20-30cm)	Carbon content in iron podsol in Plot "Ih V" at 20-30 cm depth		
soil_C (0-30cm)	Organic material in mineral soil (0-30 cm depth)	g/m ²	Figure 1, Berg et al. (1995)
soil_N (0-10cm)	Nitrogen content in iron podsol in Plot "Ih V" at 0-10 cm depth	percent of dry weight	Table 1, Bringmark (1980)
soil_N (10-20cm)	Nitrogen content in iron podsol in Plot "Ih V" at 10-20 cm depth		
soil_N (20-30cm)	Nitrogen content in iron podsol in Plot "Ih V" at 20-30 cm depth		
soil_B.D. (0-10cm)	Bulk density of iron podsol in Plot "Ih V" at 0-10 cm depth	percent	Table 1, Bringmark (1980)
soil_B.D. (10-20cm)	Bulk density of iron podsol in Plot "Ih V" at 10-20 cm depth		
soil_B.D. (20-30cm)	Bulk density of iron podsol in Plot "Ih V" at 20-30 cm depth		

Notes: ¹Estimates are pooled averages from 8 samples taken during 1974-1975.

Climate Data. The climate data for the Jdraas site are provided in one file (.txt format) (Table 2). The first 18 lines are metadata; data records begin on line 19. The variable values are delimited by semicolons. There are no missing values.

Sample Climate Data Record

```

Site;Temp;Parm; Jan; Feb; Mar; Apr; May; Jun; Jul; Aug; Sep; Oct; Nov; Dec; Year
JDR;mean;prec; 58.4; 31.9; 38.5; 45.4; 42.0; 71.3; 72.8; 80.5; 93.3; 71.4; 72.7; 52.6; 730.8
JDR;mean;tmax; -3.5; -2.5; 1.6; 6.4; 14.8; 18.0; 20.3; 18.8; 12.3; 7.0; 1.3; -3.0; 7.6
JDR;mean;tmin; -9.7; -9.1; -7.2; -3.2; 2.0; 7.5; 9.1; 7.3; 4.7; 1.1; -3.1; -7.4; -0.7
JDR;numb;prec; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 12.0
JDR;numb;tmax; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 12.0
JDR;numb;tmin; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 17.0; 12.0
JDR;stdv;prec; 24.4; 27.8; 14.4; 30.8; 19.0; 41.9; 39.6; 44.1; 62.2; 55.0; 28.4; 26.7; 34.5
JDR;stdv;tmax; 4.4; 4.0; 2.6; 1.3; 1.1; 1.4; 1.6; 1.4; 1.7; 1.3; 2.0; 3.0; 2.1
JDR;stdv;tmin; 4.1; 4.1; 2.5; 1.5; 1.4; 1.4; 1.4; 1.4; 1.7; 1.3; 1.8; 3.0; 2.1
JDR;1974;prec; 52.9; 8.0; 19.2; 31.6; 42.0; 49.5;118.2; 28.4; 89.2;234.7;104.5; 51.6; 829.8
JDR;1974;tmax; 0.8; 1.5; 3.4; 6.8; 15.6; 17.8; 22.6; 21.5; 15.5; 7.9; 3.5; 0.9; 22.6
JDR;1974;tmin; -6.1; -5.4; -4.9; -3.2; 0.1; 6.8; 6.8; 8.6; 5.2; 0.1; -2.1; -4.9; -6.1
JDR;1975;prec; 52.9; 8.0; 19.2; 31.6; 59.4; 28.6; 19.5; 54.6; 78.9; 23.3; 26.9; 28.7; 431.6
JDR;1975;tmax; 0.8; 1.5; 3.4; 6.8; 15.6; 17.8; 22.6; 21.5; 15.1; 7.9; 3.5; 0.9; 22.6
JDR;1975;tmin; -6.1; -5.4; -4.9; -3.2; 1.9; 7.2; 11.5; 9.5; 7.4; 1.6; -1.2; -3.6; -6.1
...
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)
    
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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 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- and below-ground production in the young forest and branch and trunk growth, litterfall, needle grazing loss, and root production in the old-growth forest. These are considered the major components of NPP.

The central aim of the long-term ecosystem studies conducted within the Swedish Coniferous Forest Project was to enhance understanding of plant biomass dynamics and factors regulating plant growth. Most of the research concerned plant and vegetation processes, but particular interest was also given to soil processes, consumption processes, and energy and water exchange in the canopy and the soil.

The biomass dynamics data for the Jdraas 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:

Measurements were made using methods adopted by the International Biological Program (IBP). The data provided are of generally good quality based on the site locations and time frame. Data were examined for general consistency and clarity.

Sources of Error

See individual studies.

5. Data Acquisition Materials and Methods:

Tree and Stand Structure in the Young Scots Pine Stand (14 years) (Flower-Ellis et al., 1976 as in Agren et al., 1980). In the late winter of 1972/73, the stand was subjected to a cleaning-thinning. Eighteen sample trees were collected for measurements of basal diameter, tree height, component numbers and lengths, and annual increments. In 1974, a 10 x 10 m grid of small quadrats already laid out was extended to cover the whole stand and 25 were chosen at random for inventory of tree height, DBH, girth, length of leading, previous year's and three-year-old shoots, number of live and dead whorls, number of live branches, and height to lowest live branch. All trees 100 cm and more in height on the sample plots were measured. The total number of trees measured was 319. Limited destructive sampling was conducted to estimate dry weight distribution.

Biomass Distribution in the Young Scots Pine Stand (20 years) Linder and Axelsson (1982). Distribution of biomass was determined by methods adopted by IBP. In the autumn of 1979 the heights and diameters at breast height of all trees on the control plot were measured. The tree population on the plot was thereafter divided into three classes, each representing a third of the total basal area and one tree per class was taken for detailed biomass studies. The coarse root systems of the harvested trees were excavated in May of the following year. The trees were analyzed whorl by whorl and the dry weight of needles and branches was determined and separated into age-classes. The growth of stems, branches, and coarse roots was determined from measurements of ring width and density. By assuming that the plot consisted of representative trees, the amounts of biomass per hectare were estimated by multiplying the tree structures by the number of trees per hectare.

Root Production in the Young Scots Pine Stand (15-20 years) (Persson, 1980b). The spatial distribution of fine-root production of *P. sylvestris* and other species (*Betula* spp., *Empetrum nigrum*, *Calluna vulgaris*, *Vaccinium vitis-idaea*, *V. myrtillus*, and *Deschampsia flexuosa*) was investigated by core sampling during an entire growth period, 1974-1975. The samples were removed with a long steel corer with an internal diameter at the hardened steel cutting edge of 6.7 cm (area 35.26 cm²). Random samples of 16 cores were made in both strata giving a total number of 416 cores. Sampling took place at intervals of 2-3 weeks during the growing season. Cores were sliced into three 10 cm sections, starting at the soil surface - from the L horizon, the uppermost being divided into F/H and mineral soil horizons. Living and dead root fragments (biomass and necromass, respectively) were sorted into different species and diameter fractions. Dead root fragments < 1 mm in diameter were ascribed to necromass in cases where they were longer than 2 cm; otherwise they were included in the soil organic matter. Dead root fragments > 1 mm in diameter were ascribed to necromass in cases where they were longer than 1 cm. The majority of necromass was longer than 2 cm and 1 cm, respectively. Litter biomass in the L horizon was also estimated, but sampling methods are not described in Persson (1980b).

Annual Carbon Budget for the Young Scots Pine Stand (15-20 years) (Agren et al., 1980; Persson, 1978). The annual carbon budget for a "mean" tree was estimated by incorporating independent estimates of all the major carbon inflows and outflows (i.e., net photosynthesis, respiration, growth, and mortality). To obtain a complete budget it was necessary to combine data from different years (1974-1976) measured at the control Plot "Ih II" at the Jdraas study site. The carbon budget for the stand was obtained by replacing gC/year with kgC/ha/year. This value was then converted to g/m²/year by assuming 50% carbon content.

N Fixation in the Young Scots Pine Stand (15-20 years) (Granhall and Lindberg, 1978, 1980). Randomized sampling sites (1 x 1 m plots) within 5-20 randomly placed 10 x 10 m quadrats were used for consecutive sampling. See Granhall and Lindberg (1978) for description of sampling procedures.

Needle Biomass, Grazing Loss, and Bioelement Concentrations in Live Needles from the 120-year-old Scots Pine Stand (Larsson and Tenow, 1980). The biomass of different needle age-classes was estimated by sampling vertical columns of foliage from the forest canopy using a skylift. Grazed needles were searched and partly eaten needles picked off and pooled in a pile (a). Their intact twin needles or nearest intact needle pair (in cases where both needles in a pair were eaten) were pooled in another pile (b) and remaining intact needles in a third (c). After counting the needle pairs in each pile, the piles were dried at +85 C for 48 hours and weighed to the nearest 0.001 g. The difference, b - a, approximated the grazed amount of needle biomass, and the sum, a + b + c +

(b - a), equaled the total needle biomass. Concentrations of bioelements in the live needle samples were determined by standard laboratory methods. Larsson and Tenow (1980) provide a detailed description of sampling and analysis procedures.

Biomass Distribution in the 120-year-old Scots Pine Stand (Bringmark, 1977). Bioelement fluxes of all the investigated compartments of the ecosystem, as well as increments of branches and stemwood, are derived from dry weights and concentrations. Dry weights were provided by J. Flower-Ellis (pers. comm.) and H. Persson (pers. comm.). Information on measurement procedures not available.

Biomass Distribution in the 120-year-old Scots Pine Stand Berg et al. (1995) based on data from Andersson et al. (1980). Information on measurement procedures not available.

Root Biomass and Production in the 120-year-old Scots Pine Stand (Persson, 1980a). Samples (area 36.26 cm²) were removed by coring. Random samples of 30 cores were made on each sampling occasion giving a total number of 240 cores (with 210 of these cores being sorted). The cores were sliced into 10 cm sections starting at the litter (L) horizon, the uppermost section being divided into F/H and mineral soil horizons. The root fragments were then classified into different diameter fractions as described above for the young Scots pine stand (15-20 years). Fine root production was calculated according to the methods described in Persson (1978, 1980b).

Litter Decomposition in the 120-year-old Scots Pine Stand (Berg and Staaf, 1980). About 2 g of needle litter was enclosed in 8 x 8 cm litter bags made terylene net with a mesh size of 1 mm. Litter bags were placed on the litter (L) layer in a measurement plot (1 x 1 m) in each of 20 blocks in a randomized block design. The experiment commenced on October 23, 1974, and ran for three years (1,009 days) to October 27, 1977. One sample was collected from each of the 20 plots on six occasions. The contents of the litter bags were cleaned of moss, lichen and dwarf shrub remnants, dried at 85 degrees C, weighed individually, and then pooled. Chemical composition of needle litter after different incubation periods (initial composition, after 370 days, after 554 days, and after 1,099 days) was analyzed using standard laboratory methods.

Chemical Properties of Soils in the 120-year-old Scots Pine Stand Bringmark (1980, 1995). Information on measurement procedures not available.

Climate Data. Climate was monitored at the Jdraas forest site. Measurements included precipitation and maximum/minimum temperature. Monthly and annual means are reported in the climate file from 1974 through 1990.



Figure 7. Needle litter traps in the irrigated and fertilized (IF) treatment at the Jdraas study site, Sweden. (After 7 years of treatment, tree girth and height have both increased significantly compared with control plots, and the understory is considerably more dense. Photograph taken July 1982 by Dr. S. Linder, Swedish University of Agricultural Sciences, Uppsala).

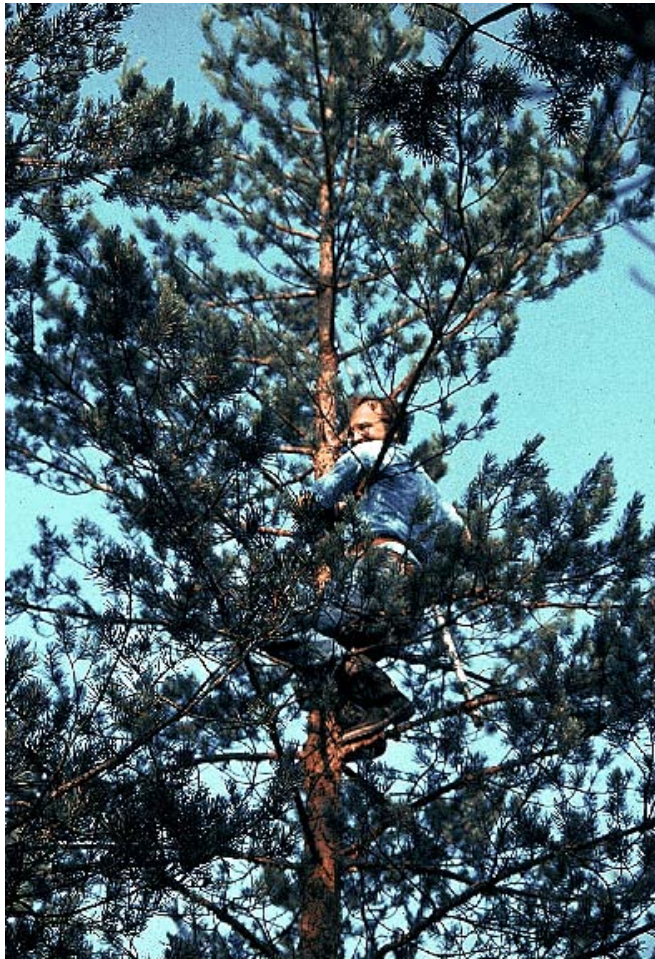


Figure 8. Sampling for current-year shoots at the Jdraas study site, Sweden. (Dr. S. Kellomäki is climbing a pine tree, now 30 years old, in the irrigated and fertilized plot. Photograph taken July 1990 by Dr. S. Linder, Swedish University of Agricultural Sciences, Uppsala).



Figure 9. Sprinkler system on one of the irrigated and fertilized (IF) plots at the beginning of the SWECON study at the Jdraas study site, Sweden. (A dilute solution of complete fertilizer was applied daily at 0500 during the growing season. The understory is dominated by heather [*Calluna vulgaris*] and reindeer lichen [*Cladonia* sp.]). Photograph taken June 1974 by Dr. S. Linder, Swedish University of Agricultural Sciences, Uppsala).



Figure 10. Temperature-controlled shoot cuvette for continuous measurement of gas exchange in young *Pinus sylvestris* at the Jdraas study site, Sweden. (Cooling air passes between the double walls of the chamber, and air from the center of the cuvette is circulated to an infra-red gas analyzer for analysis of CO₂ assimilation and respiration. Photograph taken summer 1975 by Dr. S. Linder, Swedish University of Agricultural Sciences, Uppsala).

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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8. Data Set Revisions:

Revision Summary:

The NPP data file, **jdr_npp.txt**, has been split into two files, one for the young regenerating Scots pine forest (**jdr1_npp_r1.txt**) and one for the old-growth Scots pine forest (**jdr2_npp_r1.txt**). The data files have been revised to correct temporal coverage, to correct some previously reported data and information, and to add new data from published sources.

In the NPP data file, **jdr1_npp_r1.txt** (young pine), root biomass data have been corrected to agree with values in Table 2 of Persson (1980b). The date when coarse roots were harvested has been corrected to agree with Linder and Axelsson (1982). Needle growth from Linder and Axelsson (1982) has been added.

In the NPP data file, **jdr2_npp_r1.txt** (old-growth pine), the date when tree height was measured and the date when needles were harvested in the autumn of 1974 have been corrected to agree with Axelsson and Brakenhielm (1980) and Larsson and Tenow (1980), respectively. The dates when stand age was estimated, above- and below-ground biomass was measured, and litterfall was collected were corrected to agree with those dates reported by Berg et al. (1995). The dates when soil bioelements were measured was corrected to agree with Bringmark (1980).

All other values in the data files are consistent with published sources.

Data File Changes:

Below-ground biomass data for Plot "Ih II" (young regenerating stand) in **jdr1_npp_r1.txt** have been corrected to agree with values in Table 2 of Persson (1980b).

Parameter Field*	Uncorrected in jdr_npp.txt	Corrected in jdr1_npp_r1.txt
	g/m ²	
pineroots	75.9	49.8
otherroots	252.9	153.1
pindeadroots	232.3	164.7
otherdeadroots	152.1	94.5

The date (year and month) when coarse roots (> 1 mm in diameter) were sampled in Plot "Ih II" (young regenerating stand) in **jdr1_npp_r1.txt** has been corrected to agree with Linder and Axelson (1982).

Parameter Field*	Uncorrected in jdr_npp.txt		Corrected in jdr1_npp_r1.txt	
	Year	Month	Year	Month
coarseroots	1979	10	1980	05

Needle growth in Plot "Ih II" (young regenerating stand) from Table 4 in Linder and Axelson (1982) has been added to **jdr1_npp_r1.txt**.

Parameter Field*	Uncorrected in jdr_npp.txt	Corrected in jdr1_npp_r1.txt
	g/m ² /year	
needle_growth	NR	182

Note: NR: Not reported.

The temporal coverage of the data file, **jdr2_npp_r1.txt**, for Plot "Ih V" (old-growth forest) has been corrected.

Uncorrected in jdr_npp.txt	Corrected in jdr1_npp_r1.txt
1973-1980	1973-1983

The date (year) when tree height was measured in Plot "Ih V" (old-growth forest) has been corrected in **jdr2_npp_r1.txt** to agree with the date in Table 2 of Axelsson and Brakenhielm (1980).

Parameter Field*	Uncorrected in jdr_npp.txt	Corrected in jdr2_npp_r1.txt
	Year	
height	1974	1973

The date (month/day) when needles were harvested for biomass estimates in Plot "Ih V" (old-growth forest) in the autumn of 1974 has been corrected in **jdr2_npp_r1.txt** to agree with the date in Table 3 of Larsson and Tenow (1980).

Parameter Field*	Uncorrected in jdr_npp.txt		Corrected in jdr2_npp_r1.txt	
	Month	Day	Month	Day
needles	06	11	10	24
needles_S.E.	06	11	10	24

The dates (year) when stand age was estimated, above-and below-ground biomass was measured, and litterfall was collected in Plot "Ih V" (old-growth forest) have been corrected in **jdr2_npp_r1.txt** to agree with the dates reported by Berg et al. (1995).

Parameter Field*	Uncorrected in jdr_npp.txt	Corrected in jdr2_npp_r1.txt
	Year	
stand_age		1973
needles		
cones		
shoots+branches		
trunks		

AGbiomass	-999.9	1979-80
stumps+Totroots		
Undstry_AGbiomass		
Undstry_BGbiomass		
litter		
humus		
Totlittfall		

Note: The total litterfall value is the annual average over the 10-year study (1973-1983).

The date (year) when soil bioelements and bulk density were measured in samples from Plot "Ih V" (old-growth forest) have been corrected in **jdr2_npp_r1.txt** to agree with the dates reported by Bringmark (1980).

Parameter Field*	Uncorrected in jdr_npp.txt	Corrected in jdr2_npp_r1.txt
	Year	
soil_C(0-10cm)	1980	1975-76
soil_C(10-20cm)		
soil_C(20-30cm)		
soil_C(0-30cm)		
soil_N(0-10cm)		
soil_N(10-20cm)		
soil_N(20-30cm)		
soil_B.D. (0-10cm)		
soil_B.D. (10-20cm)		
soil_B.D. (20-30cm)		

*See data set Guide document for parameter definitions.

The data values in **flk1_npp_r1.txt** and **flk2_npp_r1.txt** are now correct.

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

Revision History:

Original Citation

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