NPP Grassland: Otradnoe, Russia 1969-1973, R1

Get Data

Revision date: April 29, 2015

Summary:

This data set provides three data files in text format (.txt). Two files contain biomass and above-ground net primary production (ANPP) estimates for two upland meadows with contrasting soil types at the Otradnoe research station of the V.L. Komarov Botanical Institute of the Russian Academy of Sciences located on the Karelian peninsula 100-km to the north of St. Petersburg, Russia. The third file contains monthly and annual climate data recorded at the study site for the period 1968-1973.

Measurements of above- and below-ground live and dead biomass were made at a sandy meadow (OTRS) from 1969 to 1972 and at a loamy meadow (OTRL) from 1969 to 1973. Additional biomass measurements were made at OTRS in June 1972 and at OTRL in May 1973. Monthly N, P, and S content of above-ground live biomass were measured 1969-1971 at OTRS. ANPP and below-ground net primary production (BNPP) estimates varied at the sites: 269 and 507 $g/m^2/yr$ at OTRL, respectively, and 342 and 794 $g/m^2/yr$ at OTRS, respectively.

The study sites are two of eight major grassland types of Eurasia which encompass an extremely wide climatic gradient in the direction of increasing maximum summer temperatures and continentality and decreasing precipitation in a north-west to the south-east band of steppes in the European and Asian parts of the former USSR (Commonwealth of Independent States). The Otradnoe sites represent upland meadow ecosystems in a moderate climate with annual mean maximum/minimum temperatures of 23.8/-15.5 degrees C and annual mean precipitation of 485.2 mm for the period 1968-1973.

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 1996.

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.shtml.

Data Citation:

Cite this data set as follows:

Gilmanov, T.G. 2015. NPP Grassland: Otradnoe, Russia, 1969-1973, R1. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA. http://dx.doi.org/10.3334/ORNLDAAC/152

This data set was originally published as:

Gilmanov, T.G. 1996. NPP Grassland: Otradnoe, Russia, 1969-1973. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A.

Table of Contents:

1. Data Set Overview:

Project: Net Primary Productivity (NPP)

Long-term ecological research at grasslands within the former USSR collected a large amount of data on phytomass, productivity and element cycling, together with climatic and soil regimes for various types of grassland ecosystems. These grasslands are found in different natural "continentality" climatic zones in the direction of increasing maximum summer temperatures, decreasing precipitation north-west to the south-east. The grassland types range from the luxuriant highly productive meadow-steppes of Central Russia to the ultracontinentalsteppes of Central Asia and the arid ephemeral grasslands in the Middle-Asian republics of the former USSR.

The results of the USSR studies are mostly reported in the Russian literature but were summarized and used more recently by Gilmanov et al. (1997) to assess grassland differences and CENTURY model robustness across this wide environmental gradient.

The Otradnoe site provides grassland data from two different soil textures: a loamy soil meadow (OTRL) and a sandy soil meadow (OTRS). The data set contains biomass and ANPP estimates for each growing season (April-October) between 1969-1973. Measurements of above-ground live phytomass, standing dead, and litter and below-ground live and dead biomass were made at biweekly to monthly intervals at OTRL (1969-1973). The same parameters were measured at OTRS (1969-1972). Monthly N, P and S content of above-ground live biomass at OTRS was also measured (1969-1971). ANPP was estimated for each year. Climate data for Otradnoe were recorded for the period 1968-1973.

Averaged over the time series, above-ground live phytomass, standing dead, and litter biomass at OTRL were estimated to be 244, 64, and 103 g/m^2 (dry matter weight), respectively, while below-ground phytomass and mortmass were estimated to be 508 and 255 g/m^2, respectively (Table 1, Gilmanov et al., 1997). Above-ground live phytomass, standing dead, and litter biomass at OTRS were estimated to be 277, 62, and 121 g/m^2 (dry matter weight), respectively, and below-ground phytomass and mortmass were estimated to be 627 and 323 g/m^2, respectively (Table 1, Gilmanov et al., 1997). ANPP and BNPP estimates varied similarly: 269 and 507 g/m^2/yr at the loamy meadow, respectively, and 342 and 794 g/m^2/yr at the sandy meadow, respectively (Table 1, Gilmanov et al., 1997). ANPP and BNPP estimates reported by Scurlock and Olson (2013) are averages for the two sites (ANPP = 306 g/m^2/yr and BNPP = 650 g/m^2/yr).

2. Data Description:

Spatial Coverage

Site: Otradnoe, Russia

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Elevation (m)
Otradnoe, Russia	30.25	30.25	60.83	60.83	50

Spatial Resolution

Information not available

Temporal Coverage

1969-1972 for sandy meadow and 1969-1973 for loamy meadow; climate data are available for the period 1968/01/01-1973/12/31

Temporal Resolution

Biweekly to monthly harvests of biomass during the growing season (April-October) of each year

Data File Information

Table 1. Data file descriptions

FILE NAME	TEMPORAL COVERAGE	FILE CONTENTS
otr1_npp.txt	1969/04/25-1973/05/09	Above- and below-ground biomass and ANPP data for the loamy grassland at Otradnoe, Russia
otr2_npp.txt	1969/04/25-1972/06/28	Above- and below-ground biomass and ANPP data for the sandy grassland at Otradnoe, Russia
otr_cli.txt	1968/01/01-1973/12/31	Climate data from a weather station near Otradnoe, Russia

NPP Data. Biomass and ANPP estimatesfor the Otradnoe sites are provided in two text files (.txt format), one file for each study site (Table 2). The variable values are delimited by semicolons. The first 18 lines are metadata; data records begin on line 19. Missing data are denoted by -999.9. All biomass units are expressed in g/m^2 (dry matter weight). ANPP units are expressed as g/m^2 per sampling period (dry matter weight).

Table 2. Column headings in NPP file for loamy meadow (OTRL) <otr1_npp.txt>

COLUMN HEADING	DEFINITION	UNITS
Site	Site where data were gathered (code refers to site identification)	text
Treatmt	Long term management of site (code refers to treatment described in metadata in data file)	
Year	Year in which data were collected	yyyy
Mn	Month in which data were collected	mm
Dy	Day on which data were collected	dd
Tyear	Date in decimal year (year plus the Julian date divided by 365)	numeric
AGbiomass	Above-ground biomass	g/m^2
Stdead	Standing dead biomass	
Litter	Litter found above ground	
AGtotmatter	Total above-ground biomass (live + dead + litter)	
BGbiomass	Below-ground live biomass	
BGdead	Below-ground dead biomass	
BGtotmatter	Total below-ground biomass (live + dead)	g/m^2
ANPP	Above-ground net primary production [1]	g/m^2/sampling date
CUMANPP	Cumulative above-ground net primary production	

Sample NPP Data Record

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Site;Treatmt;Year;Mn;Dy;Tyear;AGbiomass;Stdead;litter;AGtotmatter;BGbiomass;BGdead;BGtotmatter;ANPP;CUMANPP
[units g/m2]


ot1;1_loamy ;1969;04;25;1969.320; 5.6; 0.0; 47.6; 53.2; 326.0; 164.0; 490.0; 0.0; 0.0
ot1;1_loamy ;1969;05;29;1969.410; 59.7; 0.0; 14.4; 74.1; 559.3; 279.7; 839.0; 0.0; 0.0
ot1;1_loamy ;1969;06;19;1969.470; 152.8; 2.8; 9.2; 164.8; 554.7; 277.3; 832.0; 96.0; 96.0
ot1;1_loamy ;1969;07;07;1969.520; 146.0; 3.3; 12.0; 161.3; 587.0; 293.0; 880.0; 0.1; 96.0
ot1;1_loamy ;1969;08;06;1969.600; 194.1; 49.4; 10.8; 254.3; 707.0; 353.0;1060.0; 94.3; 190.3
ot1;1_loamy ;1969;09;09;1969.690; 126.8; 89.2; 1.6; 217.6; 426.0; 213.0; 639.0; 0.1; 190.4
ot1;1_loamy ;1969;10;20;1969.800; 11.4; 110.4; 0.6; 122.4; 466.0; 233.0; 699.0; 0.1; 190.5 ...
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Table 3. Column headings in NPP file for sandy meadow (OTRS) <otr2_npp.txt>

COLUMN HEADING	DEFINITION	UNITS
Site	Site where data were gathered (code refers to site identification)	text
	Long term management of site (code refers to treatment	

Treatmt	described in metadata in data file)	
Year	Year in which data were collected	yyyy
Mn	Month in which data were collected	mm
Dy	Day on which data were collected	dd
Tyear	Date in decimal year (year plus the Julian date divided by 365)	numeric
AGbiomass	Above-ground biomass	g/m^2
Stdead	Standing dead biomass	
Litter	Litter found above ground	
AGtotmatter	Total above-ground biomass (live + dead + litter)	
BGbiomass	Below-ground live biomass	
BGdead	Below-ground dead biomass	
BGtotmatter	Total below-ground biomass (live + dead)	
ANPP	Above-ground net primary production [1]	g/m^2/sampling date
CUMANPP	Cumulative above-ground net primary production	
N-AGlive	Nitrogen content of above-ground live biomass	gN/m^2
P-AGlive	Phosphorous content of above-ground live biomass	gP/m^2
S-AGlive	Sulfur content of above-ground live biomass	gS/m^2

Sample NPP Data Record

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Site;Treatmt;Year;Mn;Dy;Tyear;AGbiomass;Stdead;litter;AGtotmatter;BGbiomass;BGdead;BGtotmatter;ANPP;CUMANPP;
N-AGlive;P-AGlive;S-AGlive [units g/m2]

ot2;2_sandy ;1969;04;25;1969.320; 7.3; 0.0; 63.2; 70.5; 460.0; 230.0; 690.0; 0.0; 0.0; 0.123; 0.010; 0.01
ot2;2_sandy ;1969;05;29;1969.410; 89.0; 0.0; 16.8; 105.8; 657.3; 328.7; 986.0; 81.7; 81.7; 1.308; 0.142; 0.169
ot2;2_sandy ;1969;06;19;1969.470; 189.4; 3.6; 15.2; 208.2; 590.7; 295.3; 886.0; 104.0; 185.7; 2.136; 0.284; 0.340
ot2;2_sandy ;1969;07;07;1969.520; 292.8; 6.0; 19.2; 318.0; 718.3; 359.7;1078.0; 109.8; 295.5; 2.137; 0.439; 0.439
ot2;2_sandy ;1969;08;06;1969.600; 213.2; 76.8; 6.0; 296.0; 793.0; 397.0;1190.0; 0.0; 295.5; 1.806; 0.260; 0.320
ot2;2_sandy ;1969;09;09;1969.690; 108.7; 112.2; 0.4; 221.3; 542.0; 271.0; 813.0; 0.0; 295.5; 1.065; 0.098; 0.163
ot2;2_sandy ;1969;10;20;1969.800; 17.3; 148.8; 0.4; 166.5; 821.3; 410.7;1232.0; 0.0; 295.5; 0.130; 0.021; 0.040
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Climate Data. Climate data are provided in one text file (.txt format). 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

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Site;Temp;Parm; Jan; Feb; Mar; Apr; May; Jun; Jul; Aug; Sep; Oct; Nov; Dec; Year

otr;mean;prec; 24.4; 22.9; 25.3; 31.4; 27.0; 22.3; 73.5; 41.6; 85.0; 55.5; 45.1; 31.3; 485.2
otr;mean;tmax; -7.3; -5.1; 0.6; 7.0; 14.6; 21.5; 23.4; 21.0; 14.2; 6.6; 1.1; -1.4; 23.
otr;mean;tmin;-13.3;-12.5; -7.6; -1.8; 4.0; 11.1; 13.4; 12.0; 6.4; 1.2; -3.5; -6.6; -15.5
otr;numb;prec; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0
otr;numb;tmax; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0
otr;numb;tmin; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0; 6.0
otr;stdv;prec; 14.3; 9.8; 16.3; 19.5; 15.0; 14.0; 47.9; 18.6; 41.8; 14.3; 9.3; 9.1; 91.0
otr;stdv;tmax; 5.8; 3.6; 2.3; 0.5; 1.1; 1.5; 2.7; 1.1; 0.7; 1.2; 1.1; 2.8; 2.1
otr;stdv;tmin; 5.8; 3.6; 2.3; 0.5; 1.1; 1.5; 2.7; 1.1; 0.7; 1.2; 1.1; 2.8; 4.2
otr;1968;prec; 24.8; 30.6; 32.7; 42.2; 41.3; 45.5; 82.5; 41.2;110.1; 60.4; 31.5; 26.8; 569.6
otr;1968;tmax;-16.1; -3.1; 2.9; 7.7; 13.9; 22.1; 19.7; 20.8; 13.7; 5.1; 0.7; -1.2; 22.1
otr;1968;tmin;-22.1;-10.5; -5.3; -1.1; 3.3; 11.7; 9.7; 11.8; 5.9; -0.3; -3.9; -6.4; -22.1
…

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)

3. Data Application and Derivation:

Data on biomass dynamics and productivity were recently assembled and checked as part of a series of grassland data sets covering a wide range of climate and "continentality" (increasing maximum summer temperatures, decreasing precipitation) from the north-west to the south-east in the Commonwealth of Independent States (former USSR) (Gilmanov et al., 1997). These grasslands represent a wide environmental gradient from the luxuriant highly productive meadow-steppes of Central Russia to the ultracontinentalsteppes of Central Asia and the arid ephemeral grasslands in the Middle-Asian republics of the former USSR. The field data from these study sites were used by Gilmanov et al. (1997) to assess grassland differences and CENTURY model robustness.

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

4. Quality Assessment:

NPP of grasslands is subject to a number of different methods of estimation from biomass data, some of which may be inappropriate for particular biome types. Methodology of estimation/calculation needs to be taken into account, as well as methodology of measurement, when making comparisons between different regions. Errors in biomass measurement may also occur between different study sites. For short time series of data it may be assumed that measurement methodology remains consistent; however, over very long time series changes in staff, tools, etc. may lead to "calibration" errors.

The CENTURY model simulation behavior corresponds well to observed data for the two Otradnoe study sites.

5. Data Acquisition Materials and Methods:

Site Information

The Otradnoe site provides grassland data for two upland meadows with different soil textures: a loamy soil (OTRL) and a sandy soil (OTRS). The loamy meadow OTRL is an upland plant community on heavy-loamy soddy-podzolic soil. The plant community comprises 61 vascular species dominated by the grasses *Agrostis tenius*, *Anthoxanthum odoratum*, *Festurca rubra*, the forbs *Alchemilla monticola*, *Centaurea jacea*, *Achillea millefolium*, *Lathyrus pratensis*, and the legume *Trifolium pratense*. The sandy meadow site, OTRS, is located on a sandy soddy-podzolic soil. The species richness is 47 vascular species with the grasses *Alopecurus pratensis*, *Agrostis tenius*, *Anthoxanthum odoraturn*, the forbs *Alchemilla monticola*, *Achillea millefolium*, *Centaurea jaccea*, and the legumes *Trifolium repens* and *Vicia cracca* dominating among them. These kind of meadows represent man-made pastures in the southern taiga sub-zone of the forest zone, and are typically mowed annually. They were established during the International Biological Programme (IBP) period at the Otradnoe research station of the V.L. Komarov Botanical Institute of the Russian Academy of Sciences.

The study site has been described by Guricheva et al. (1975); an account also appears in Ponyatovskaya (1978) [in Russian].

Table 4. Site characteristics

Description	Values
mean annual precipitation	485.2 mm
mean monthly minimum temperature	-12.5/-9.2 C (sandy/loamy) (Feb)
mean monthly maximum temperature	23.4/26.3 C (sandy/loamy) (July)
vegetation type	sandy meadow / loamy meadow
dominant species	Alopecurus pratensis (sandy); Alchemilla monticola (loamy) (both C3)
historical long-term management regime	annual mowing (both sub-sites)
max above-ground live biomass (typical month)	277 g/m^2 (sandy); 244 g/m2 (loamy) (both June)
soil type	soddy-pozolic, sandy; soddy-pozolic, loamy
soil pH	5.0 (sandy); 5.2 (loamy)
soil texture (sand/ silt/ clay)	0.80 / 0.12 / 0.08 (sandy);

	0.425 / 0.40 / 0.175 (loamy)
soil carbon content	3,780 g/m^2 (sandy); 5780 g/m^2 (loamy) (0-20 cm)
soil nitrogen content	280 g/m^2 (sandy); 460 g/m^2 (loamy) (0-20 cm)

Methods

Methodological aspects of field experimental studies of biomass and production of grassland ecosystems in the Commonwealth of Independent States (former USSR) were summarized by Titlyanova (1988) [in Russian]. The methods of field measurements of above-ground and below-ground biomass in Russian grasslands are based on the harvest technique and with respect to sampling area, replication, etc., are very close to the methods used by western ecologists during the International Biological Programme (IBP) studies (e.g., Milner and Hughes, 1968; Sims and Coupland, 1979). The Russian approach to estimation of the annual production of grassland plant communities (with subdivision on above- and below-ground components) is based on a calculation procedure utilizing data of repeated sampling (usually biweekly) during the season of live, standing dead and litter fractions of phytomass. This method of calculation gives the estimates of production which are 1.6 to 2.0 times higher than the seasonal maximum of the standing crop of the corresponding phytomass fraction (Titlyanova, 1988).

This data set is part of a series of grassland data sets assembled and checked by Dr. Tagir Gilmanov (Gilmanov et al., 1997) from primary sources originally reported [in Russian] in Guricheva et al. (1975). Accounts of the productivity of the two Otradnoe sites also appear in Ponyatovskaya (1978) [in Russian].

6. Data Access:

This data set is available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

Data Archive:

Web Site: http://daac.ornl.gov

Contact for Data Center Access Information:

E-mail: uso@daac.ornl.gov
Telephone: +1 (865) 241-3952

7. References:

Gilmanov, T.G., W.J. Parton and D.S. Ojima. 1997. Testing the CENTURY ecosystem level model on data sets from eight grassland sites in the former USSR representing a wide climatic/soil gradient. Ecological Modelling 96: 191-210. doi: 10.1016/S0304-3800(96)00067-1

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