NPP Grassland: NPP Grassland: Towoomba, South Africa, 1949-1990, R1

Get Data

Revision date: May 29, 2015

Summary:

This data set provides seven data files in text format (.txt). The files provide biomass estimates, soil carbon (C), nitrogen (N), and phosphorus (P) measurements made at an artificially-established grassland savanna study site in Towoomba, South Africa. The study site was part of a long-term experiment to test the effect of fertilizer application. Biomass data are available for the years 1950-1981 (data are not available for 1976 or 1977); soil C, N, and P data are available for the years 1949, 1962, 1980, and 1990. The 1949 estimates were inferred in 1990 from undisturbed savanna adjacent to the experiment.

The savanna-fertilizer experiment was several hectares in extent, with five levels of nitrogen and three levels of phosphorus laid out in a randomized block design on an area from which all trees were removed. The ammonium sulphate and superphosphate fertilizers were added during November (50% of total), January (25%) and February (25%). The response to N fertilizer saturated at higher levels, so data from only six (3 x 2) of the 15 possible treatment combinations are provided.

Above-ground biomass was sampled by mowing to 5-cm height. It was assumed that 50 g/m2 was left in the field, plus an additional 5% of the mowed dry weight.

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.

Figure 1. Towoomba, South Africa, artificially-established grassland savanna experimental site.

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:

Scholes, R.J. 2015. NPP Grassland: NPP Grassland: Towoomba, South Africa, 1949-1990, 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/213

This data set was originally published as:

Scholes, R. J. 1996. NPP Grassland: NPP Grassland: Towoomba, South Africa, 1949-1990. 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)

The study site was part of a long-term experiment to test the effect of fertilizer application. The experiment was several hectares in extent in a randomized block design on an area from which all trees were removed. Five levels of nitrogen and three levels of phosphorus were applied to the site. The ammonium sulphate and superphosphate fertilizers were added during November (50% of total), January (25%) and February (25%) .

Above-ground biomass was sampled by mowing to 5-cm height. It was assumed that 50 g/m2 was left in the field, plus an additional 5% of the mowed dry weight. Biomass data are available for the years 1950-1981 (data are not available for 1976 or 1977); soil C, N, and P data are available for the years 1949, 1962, 1980, and 1990. The 1949 estimates were inferred in 1990 from undisturbed savanna adjacent to the experiment.

2. Data Description:

Spatial Coverage

Site: Towoomba, South Africa

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Towoomba, South Africa	28.35	28.35	24.90	24.90

Spatial Resolution

This fertilization experiment at the Towoomba agricultural research station was several hectares in extent in a randomized block design.

Temporal Coverage

Soil C, N, and P data are available for the years 1949, 1962, 1980, and 1990; biomass data are available for the years 1950-1981 (data are not available for 1976 or 1977).

Temporal Resolution

Measurements were made one time per year.

Data File Information

There are seven data files in text format (.txt) with this data set. Six NPP files provide biomass and soil C, N, and P measurements. The first file provides measurements taken without the addition of P or N to the soil. The other files provide measurements taken after one of five fertilization applications of varying nitrogen and phosphorus levels. There is also one climate file that provides precipitation and temperature measurements.

Table 1. Data file descriptions

FILE NAME	TEMPORAL COVERAGE	Description
twm1_npp.txt	1949/06-1990/03	This file provides measurements when soil treatments =0; no added P or N; treatment code = P0N0
twm2_npp.txt		This file provides measurements when soil treatments = no added P and N=2; treatment code = P0N2.
twm3_npp.txt		This file provides measurements when soil treatments = no added P and N=3; treatment code = P0N3.
twm4_npp.txt		This file provides measurements when soil treatments = P2 and no added N; treatment code = P2N0
twm5_npp.txt		This file provides measurements when soil treatments = P2 and N2; treatment code = P2N2
twm6_npp.txt		This file provides measurements when soil treatments = P2 and N3; treatment code = P2N3
npp_cli.txt	1910/01/01-1983/12/31	Temperature and precipitation data from a weather station 500-m from the grassland study site

NPP Data. The data are provided in six text files (.txt format). The variable values are delimited by semicolons. The first lines are metadata. Missing data are denoted by the value -999.9. All biomass units are expressed in g/m^2.

Table 2. Column headings in the six NPP files

COLUMN HEADING	DEFINITION	UNITS
Site	Site where data were gathered (code refers to site identification)	text
Treatmt	Fertilization with varying nitrogen and phosphorus levels (code refers to the levels of N and P added to the soils (described in table	

	1 above and in the metadata in the data file headers)	
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/m2/yr
soilC	Soil carbon content	g/m2
soilN	Soil nitrogen content	
soilP	Soil phosphorus content	

Sample NPP Data Record for <**twm1_npp.txt**>

```
Site;Treatmt;Year;Mn;Dy   ;Tyear;AGbiomass; soilC; soilN; soilP [units g/m2]

twm ;P0N0   ;1949;6;-999.9;1949.500;-999.9; 5329 ;  327 ;  140
twm ;P0N0   ;1950;6;-999.9;1950.500; 102  ;-999.9;-999.9;-999.9
twm ;P0N0   ;1951;3;-999.9;1951.250;  31  ;-999.9;-999.9;-999.9

...
twm ;P0N0   ;1961;4;-999.9;1961.333; 164  ;-999.9;-999.9;-999.9
twm ;P0N0   ;1962;1;-999.9;1962.083;  49  ; 4029 ;  335 ;  164
twm ;P0N0   ;1963;3;-999.9;1963.250;  36  ;-999.9;-999.9;-999.9
twm ;P0N0   ;1964;3;-999.9;1964.250;  38  ;-999.9;-999.9;-999.9



...
twm ;P0N0   ;1980;3;-999.9;1980.250; 167  ; 3010 ;  322 ;-999.9
twm ;P0N0   ;1981;3;-999.9;1981.250; 118  ;-999.9;-999.9;-999.9
twm ;P0N0   ;1990;3;-999.9;1990.250;-999.9; 4637 ;  327 ;  131
```

Sample NPP Data Record for <**twn2_npp.txt**>

```
Site;Treatmt;Year;Mn;Dy ;Tyear;AGbiomass; soilC; soilN; soilP [units g/m2]
twm ;P0N2 ;1949;6;-999.9;1949.500;-999.9; 5329 ; 327 ; 140
twm ;P0N2 ;1950;6;-999.9;1950.500; 160 ;-999.9;-999.9;-999.9
twm ;P0N2 ;1951;3;-999.9;1951.250; 33 ;-999.9;-999.9;-999.9
...
twm ;P0N2   ;1961;4;-999.9;1961.333;  229 ;-999.9;-999.9;-999.9
twm ;P0N2   ;1962;1;-999.9;1962.083;   58 ; 4184 ;  341 ;  162
twm ;P0N2   ;1963;3;-999.9;1963.250;   16 ;-999.9;-999.9;-999.9

...
twm ;P0N2   ;1980;3;-999.9;1980.250;  369 ; 2969 ;  316 ;-999.9
twm ;P0N2   ;1981;3;-999.9;1981.250;  353 ;-999.9;-999.9;-999.9
twm ;P0N2   ;1990;3;-999.9;1990.250;-999.9; 4299 ;  392 ;  135
```

Sample NPP Data Record for <**twn3_npp.txt**>

```
Site;Treatmt;Year;Mn;Dy   ;Tyear;AGbiomass; soilC; soilN; soilP [units g/m2]

twm ;P0N3   ;1949;6;-999.9;1949.500;-999.9; 5329 ;  327 ;  140
twm ;P0N3   ;1950;6;-999.9;1950.500; 193  ;-999.9;-999.9;-999.9
twm ;P0N3   ;1951;3;-999.9;1951.250;  33  ;-999.9;-999.9;-999.9

...
twm ;P0N3   ;1963;3;-999.9;1963.250;  27  ;-999.9;-999.9;-999.9
twm ;P0N3   ;1964;3;-999.9;1964.250;  29  ;-999.9;-999.9;-999.9
twm ;P0N3   ;1965;3;-999.9;1965.250; 198  ;-999.9;-999.9;-999.9



...
twm ;P0N3   ;1980;3;-999.9;1980.250; 353  ; 2808 ;  267 ;-999.9
twm ;P0N3   ;1981;3;-999.9;1981.250; 282  ;-999.9;-999.9;-999.9
twm ;P0N3   ;1990;3;-999.9;1990.250;-999.9; 3695 ;  356 ;  129
```

Sample NPP Data Record for <**twn4_npp.txt**>

```
Site;Treatmt;Year;Mn;Dy   ;Tyear;AGbiomass; soilC; soilN; soilP [units g/m2]

twm ;P2N0   ;1949;6;-999.9;1949.500;-999.9; 5329 ;  327 ;  140
twm ;P2N0   ;1950;6;-999.9;1950.500;  129 ;-999.9;-999.9;-999.9
twm ;P2N0   ;1951;3;-999.9;1951.250;   31 ;-999.9;-999.9;-999.9
...
twm ;P2N0   ;1962;1;-999.9;1962.083;   64 ; 3107 ;  331 ;  239
twm ;P2N0   ;1963;3;-999.9;1963.250;   44 ;-999.9;-999.9;-999.9
twm ;P2N0   ;1964;3;-999.9;1964.250;   60 ;-999.9;-999.9;-999.9
...
ttwm ;P2N0   ;1980;3;-999.9;1980.250;  240 ; 3107 ;  306 ;-999.9
twm ;P2N0   ;1981;3;-999.9;1981.250;  176 ;-999.9;-999.9;-999.9
twm ;P2N0   ;1990;3;-999.9;1990.250;-999.9; 4226 ;  307 ;  253
```

Sample NPP Data Record for <**twn5_npp.txt**>

```
Site;Treatmt;Year;Mn;Dy   ;Tyear;AGbiomass; soilC; soilN; soilP [units g/m2]

twm ;P2N2   ;1949;6;-999.9;1949.500;-999.9; 5329 ;  327 ;  140
twm ;P2N2   ;1950;6;-999.9;1950.500;  224 ;-999.9;-999.9;-999.9
twm ;P2N2   ;1951;3;-999.9;1951.250;   71 ;-999.9;-999.9;-999.9
...
twm ;P2N2   ;1963;3;-999.9;1963.250;   98 ; 4334 ;  352 ;  232
twm ;P2N2   ;1964;3;-999.9;1964.250;   91 ;-999.9;-999.9;-999.9
twm ;P2N2   ;1965;3;-999.9;1965.250;  400 ;-999.9;-999.9;-999.9
...
twm ;P2N2   ;1980;3;-999.9;1980.250;  536 ; 3214 ;  306 ;-999.9
twm ;P2N2   ;1981;3;-999.9;1981.250;  533 ;-999.9;-999.9;-999.9
twm ;P2N2   ;1990;3;-999.9;1990.250;-999.9; 5047 ;  399 ;  310
```

Sample NPP Data Record for <**twn6_npp.txt**>

```
Site;Treatmt;Year;Mn;Dy   ;Tyear;AGbiomass; soilC; soilN; soilP [units g/m2]

twm ;P2N3   ;1949;6;-999.9;1949.500;-999.9; 5329 ;  327 ;  140
twm ;P2N3   ;1950;6;-999.9;1950.500;  380 ;-999.9;-999.9;-999.9
twm ;P2N3   ;1951;3;-999.9;1951.250;  131 ;-999.9;-999.9;-999.9
...
twm ;P2N3   ;1964;3;-999.9;1964.250;   91 ;-999.9;-999.9;-999.9
twm ;P2N3   ;1965;3;-999.9;1965.250;  440 ;-999.9;-999.9;-999.9
twm ;P2N3   ;1966;3;-999.9;1966.250;  184 ;-999.9;-999.9;-999.9
...
twm ;P2N3   ;1980;3;-999.9;1980.250;  482 ; 3219 ;  354 ;-999.9
twm ;P2N3   ;1981;3;-999.9;1981.250;  618 ;-999.9;-999.9;-999.9
twm ;P2N3   ;1990;3;-999.9;1990.250;-999.9; 3139 ;  302 ;  270
```

Climate Data. Climate data are provided in one text file (.txt format). 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

twm ;mean;prec; 122.5;  92.0;  70.5;  36.8;  12.4;   4.6;   4.4;   5.7;  14.6;  49.9; 101.7; 114.2;  629.4
twm ;mean;tmax;  29.5;  29.1;  28.1;  26.5;  23.6;  21.1;  21.4;  24.2;  27.6;  29.3;  29.4;  28.9;   26.3
twm ;mean;tmin;  16.7;  16.8;  15.2;  12.1;   7.4;   4.4;   3.7;   5.5;  10.3;  14.1;  15.6;  16.3;   11.1
...
twm ;1926;prec;  69.5; 116.1;  32.1;   1.8;  32.6;   8.5;  21.4;   0.7;  13.5;  11.8; 125.3; 151.0;  584.3
twm ;1927;prec; 103.5; 111.2;  61.4;  28.5;   0.0;   0.2;  16.9;   2.5;   2.7;  82.2;  25.6;  65.0;  499.7
twm ;1928;prec; 126.6; 100.3;  27.3;  90.0;   0.0;   0.2;   0.0;  28.3;   4.8;  11.8; 101.8; 126.5;  617.6
...
twm ;1981;prec; 179.0;  31.4;  80.5;  16.5;   4.6;   4.5;   0.0;   0.5;  16.7; 173.9;  68.4; 127.4;  703.4
```

```
twm ;1982;prec; 191.5;  19.1;  39.6;  30.9;   0.0;   2.2;   9.6;   0.5;   1.2;  46.2;  31.4;  88.6;  460.8
twm ;1983;prec; 145.5;  38.3; 117.1;  21.9;   6.5;  14.3;   4.8;  20.1;   2.6;  41.4; 168.2; 173.9;  754.6


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)
  tmin = mean minimum temperature for month or year (C) (mean value based on 1949-1962 only)
  tmax = mean maximum temperature for month or year (C) (mean value based on 1949-1962 only)
```

3. Data Application and Derivation:

Grassland biomass dynamics data for Towoomba, South Afric 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.

Since above-ground biomass was sampled by mowing to 5-cm height, it was assumed that 50 g/m2 is left in the field, plus an additional 5% of the mowed dry weight. Soil nutrients were measured in 1962, 1980 and 1990, and 1949 estimates were inferred in 1990 from undisturbed savanna adjacent to the experiment.

Some uncertainty exists over the precise fertiliser application rates according to the plot sizes assumed.

5. Data Acquisition Materials and Methods:

Site description

The Towoomba agricultural research station is situated 100-km north of Pretoria, near the town of Warmbaths. The savanna-fertilizer experiment was several hectares in extent.

Table 3. Site characteristics (before fertilization treatments)

Description	Values
mean annual precipitation	629 mm
vegetation type	Fine-leaved savanna
dominant species	Cymbopogon plurinodes (C4)
soil type	Rhodic vertisol
soil pH	6.1
soil texture (sand/ silt/ clay)	0.50/0.14/0.36
soil carbon content	5,329 g/m2 (0-20 cm)
soil nitrogen content	327 g/m2 (0-20 cm)
soil phosphorus content	140 g/m2 (0-20 cm)

Methods

The savanna-fertilizer experiment was several hectares in extent, with five levels of nitrogen and three levels of phosphorus laid out in a randomized block design on an area from which all trees were removed. The ammonium sulphate and superphosphate fertilisers were added during November (50% of total), January (25%) and February (25%). The response to N fertiliser saturated at higher levels, so data from only six (3 x 2) of the 15 possible treatment combinations are presented here. Biomass data are available for every year from 1950 to 1980, except 1976 and 1977. Since above-ground biomass was sampled by mowing to 5-cm height, it was assumed that 50 g/m2 was left in the field, plus an additional 5% of the mowed dry weight. Soil nutrients were measured in 1962, 1980 and 1990, and 1949 estimates were inferred in 1990 from undisturbed savanna adjacent to the experiment.

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

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