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LBA-ECO ND-11 Soil Properties of Forested Headwater Catchments, Mato Grosso, Brazil

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Summary:

Revision Date: February 27, 2009

The results of the analysis of soil chemical parameters, texture, and color are reported for 185 georeferenced soil profile sample points over four forested headwater catchments near Juruena, Mato Grosso, Brazil (Novaes Filho et al., 2007a and Novaes Filho et al., 2007b). Samples were collected from an approximately 20 x 20-m grid over each watershed from 2004/05/01 to 2004/08/18. By sampling each location at depths of 0-20 and 40-60 cm it was possible to distinguish and map the principle soil classes found in the study area to the 2nd category level of the Brazilian System of Soil Classification (Cooper et al., 2005) associated with the topographic relief.

The data set contains one comma separated ASCII data file with spatially referenced soil nutrient and organic carbon data from 0-20 cm (A layer, topsoil) and 40-60 cm (B layer, subsoil) depths for the Juruena watersheds study area.

A satisfactory relationship between the redness index of the diagnostic horizons and the soil class colors was also found. In spite of the apparent homogeneity of the visible landscape characteristics such as slope, soil color, and vegetation, the carbon and soil clay attributes were found to vary greatly. This variability over small distances demonstrates that extrapolation of soil characteristics and soil carbon stocks to larger areas could produce erroneous results if the spatial variability of the soil attributes is not taken into consideration.

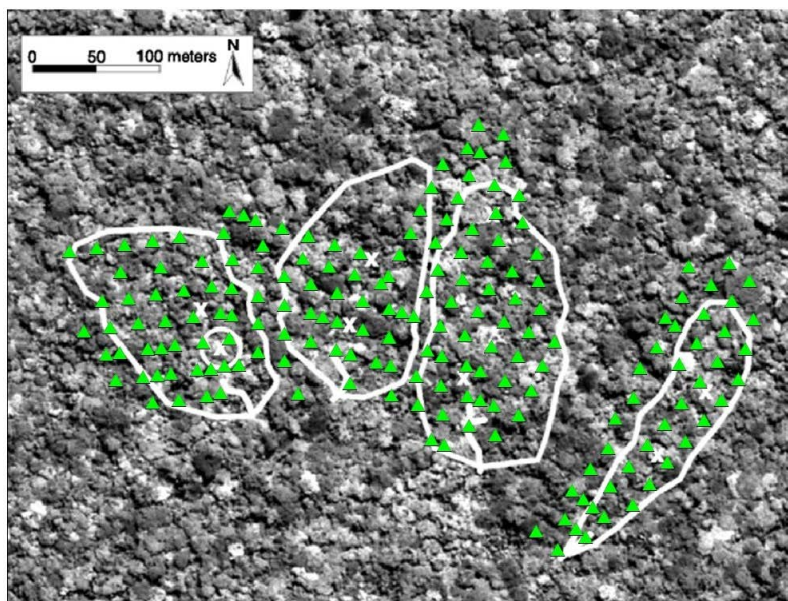


Figure 1. Soil sample locations (plotted by ORNL DAAC) are depicted with watershed delineation and streams overlain on a 2002 IKONOS panchromatic image of the forested study location (courtesy of EOS-Webster). Watersheds are identified as B1, B2, B3, and B4 from right to left.

Data Citation:

Cite this data set as follows:

Novaes Filho, J.P., E.C. Selva, E.G. Couto, J. Lehmann, M.S. Johnson, and S.J. Riha. 2009. LBA-ECO ND-11 Soil Properties of Forested Headwater Catchments, Mato Grosso, Brazil. Data set. Available on-line [<http://daac.ornl.gov>] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. [doi:10.3334/ORNLDAAC/914](https://doi.org/10.3334/ORNLDAAC/914)

Implementation of the LBA Data and Publication Policy by Data Users:

The LBA Data and Publication Policy [http://daac.ornl.gov/LBA/lba_data_policy.html] is in effect for a period of five (5) years from the date of archiving and should be followed by data users who have obtained LBA data sets from the ORNL DAAC. Users who download LBA data in the five years after data have been archived must contact the investigators who collected the data, per provisions 6 and 7 in the Policy.

This data set was archived in March of 2009. Users who download the data between March 2009 and February 2014 must comply with the LBA Data and Publication Policy.

Data users should use the Investigator contact information in this document to communicate with the data provider. Alternatively, the LBA Web Site [<http://lba.inpa.gov.br/lba/>] in Brazil have current contact information.

Data users should use the Data Set Citation and other applicable references provided in this document to acknowledge use of the data.

Table of Contents:

- [1 Data Set Overview](#)
- [2 Data Characteristics](#)
- [3 Applications and Derivation](#)
- [4 Quality Assessment](#)
- [5 Acquisition Materials and Methods](#)
- [6 Data Access](#)
- [7 References](#)

1. Data Set Overview:

Project: LBA (Large-Scale Biosphere-Atmosphere Experiment in the Amazon)

Activity: LBA-ECO

LBA Science Component: Nutrient Dynamics

Team ID: ND-11 (Lehmann/Passos/Couto)

The investigators were Novaes Filho Joao Paulo; Johnson, Mark Stephen; Couto, Eduardo Guimaraes and Lehmann, Johannes. You may contact Novaes Filho, Joao Paulo (jpnovaes@terra.com.br).

LBA Data Set Inventory ID: ND11_Soil_Spatial_Variability

The results of the analysis of soil chemical parameters, texture, and color are reported for 185 georeferenced soil profile sample points over four forested headwater catchments near Juruena, Mato Grosso, Brazil (Novaes Filho, et al., 2007a and Novaes Filho, et al., 2007b). Samples were collected from an approximately 20 x 20-m grid over each watershed from 2004/05/01 to 2004/08/18. By sampling each location at depths of 0-20 and 40-60 cm it was possible to distinguish and map the principle soil classes found in the study area to the 2nd category level of the Brazilian System of Soil Classification (Cooper et al., 2005) associated with the topographic relief.

The data set contains one comma separated ASCII data file with spatially referenced soil nutrient and organic carbon data from 0-20 cm (A layer, topsoil) and 40-60 cm (B layer, subsoil) depths for the Juruena watersheds study area.

A satisfactory relationship between the redness index of the diagnostic horizons and the soil class colors was also found. In spite of the apparent homogeneity of the visible landscape characteristics such as slope, soil color, and vegetation, the carbon and soil clay attributes were found to vary greatly. This variability over small distances demonstrates that extrapolation of soil characteristics and soil carbon stocks to larger areas could produce erroneous results if the spatial variability of the soil attributes is not taken into consideration.

Data set contains spatially referenced soil nutrient and carbon data for 0-20 cm and 40-60 cm depths for Juruena watersheds study area.

Related Data Sets:

LBA-ECO ND-11 Coarse Particulate Organic Carbon Watershed Exports, Jurena: 2003-2004

LBA-ECO ND-11 Stream Carbon and Nutrients, Mato Grosso, Brazil: 2003-2006

2. Data Characteristics:

One comma-delimited ASCII file is provided. Values of -9999 in the ASCII file indicate missing values.

Juruena_basins_soils.csv



COLUMN	COLUMN HEADING	DESCRIPTION
1	UTMX	sample location, latitude coordinate for Universal Transverse Mercator (UTM) zone 21S (easting)
2	UTMY	sample location, longitude coordinate for UTM zone 21S (northing)
3	pH_H2O_0_20	soil pH in water, 1: 2.5 w/v slurry, 0-20 cm depth
4	pH_CaCl2_0_20	soil pH in 0.01 M CaCl2 solution, 1;2.5 w/v slurry, 0-20 cm depth
5	P_0_20	soil phosphorus (mg/dm3), 0-20 cm depth
6	K_0_20	soil potassium (mg/dm3), 0-20 cm depth
7	Ca_0_20	soil calcium (cmolc/dm3), 0-20 cm depth
8	Mg_0_20	soil magnesium (cmolc/dm3), 0-20 cm depth
9	Al_0_20	soil aluminum (cmolc/dm3), 0-20 cm depth
10	H_0_20	soil hydronium (cmolc/dm3), 0-20 cm depth
11	Clay_pct_0_20	soil clay content (%), 0-20 cm depth
12	Silt_pct_0_20	soil silt content (%), 0-20 cm depth
13	Sand_pct_0_20	soil sand content (%), 0-20 cm depth
14	SumCat_0_20	sum of base cations (cmolc/dm3), 0-20 cm depth
15	CEC_0_20	cation exchange capacity (cmolc/dm3), 0-20 cm depth
16	Sat_Bas_0_20	base saturation of cation exchange capacity (%), 0-20 cm depth
17	Al_Sat_0_20	aluminum saturation (%), 0-20 cm depth
18	C_Tot_0_20	soil total carbon (g/kg), 0-20 cm depth
19	Color_0_20	soil color, Munsell color notation, 0-20 cm depth
20	pH_H2O_40_60	soil pH in water, 1: 2.5 w/v slurry, 40-60 cm depth
21	pH_CaCl2_40_60	soil pH in 0.01 M CaCl2 solution, 1;2.5 w/v slurry, 40-60 cm depth
22	P_40_60	soil phosphorus (mg/dm3), 40-60 cm depth
23	K_40_60	soil potassium (mg/dm3), 40-60 cm depth
24	Ca_plus_Mg_40_60	sum of soil calcium and magnesium (cmolc/dm3), 40-60 cm depth
25	Al_40_60	soil aluminum (cmolc/dm3), 40-60 cm depth
26	H_40_60	soil hydronium (cmolc/dm3), 40-60 cm depth
27	Clay_pct_40_60	soil clay content (%), 40-60 cm depth
28	Silt_pct_40_60	soil silt content (%), 40-60 cm depth
29	Sand_pct_40_60	soil sand content (%), 40-60 cm depth
30	SumCat_40_60	sum of base cations (cmolc/dm3), 40-60 cm depth
31	CEC_40_60	cation exchange capacity (cmolc/dm3), 40-60 cm depth
32	Sat_Bas_40_60	base saturation of cation exchange capacity (%), 40-60 cm depth
33	Al_Sat_40_60	aluminum saturation (%), 40-60 cm depth
34	C_Tot_40_60	soil total carbon (g/kg), 40-60 cm depth
35	Color_40_60	soil color, Munsell color notation, 40-60 cm depth

Example Data Records:

```
UTMX,UTMY,pH_H2O_0_20,pH_CaCl2_0_20,P_0_20,K_0_20,Ca_0_20,Mg_0_20,Al_0_20,H_0_20,Clay_pct_0_20,
Silt_pct_0_20,Sand_pct_0_20,SumCat_0_20,CEC_0_20,Sat_Bas_0_20,Al_Sat_0_20,C_Tot_0_20,Color_0_20,
pH_H2O_40_60,pH_CaCl2_40_60,P_40_60,K_40_60,Ca_plus_Mg_40_60,Al_40_60,H_40_60,Clay_pct_40_60,Silt_pct_40_60,
Sand_pct_40_60,SumCat_40_60,CEC_40_60,Sat_Bas_40_60,Al_Sat_40_60,C_Tot_40_60,Color_40_60,,,,,
```

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339525,8841537,4.5,4.0,1.1,38,0.6,0.3,0.8,2.9,18.2,
6.1,75.7,1.0,4.7,21.2,44.5,8.92,5YR 4/6,
4.4,4.1,0.3,4,0.3,0.4,2.3,33.3,0.9, 65.7,0.3,3.0,10.3,56.3,5.72,"2,5YR 4/6" ,,,,,,
```

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339510,8841550,4.2,3.7,0.6,52,0.3,0.2,1.3,2.4,27.5,
2.1,70.4,0.6,4.3,14.6,66.7,8.62,5YR 4/6,
4.2,3.9,0.4,10,0.3,0.4,2.7,30.2,1.0, 68.9,0.3,3.4,9.6,55.1,6.10,"2,5YR 4/6" ,,,,,,
```

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339142,8841453,4.9,4.3,1.7,142,1.1,1.0,0.1,4.2,50.5,
18.6,30.9,2.5,6.8,36.4,4.8,14.81,5YR 5/6,
4.9,4.3,0.5,24,0.6,0.3,1.3,46.1,13.2, 40.8,0.7,2.2,29.6,31.2,7.39,5YR 6/6,,,,,,
Blank lines added to improve readability.
```

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Geodetic Datum
Mato Grosso - Juruena (Mato Grosso)	-58.470796	-58.466252	-10.475392	-10.478216	World Geodetic System, 1984 (WGS-84)

Time period:

- The data set covers the period 2004/05/01 to 2004/08/18.

Platform/Sensor/Parameters measured include:

- LABORATORY / ANALYSIS / SOIL CHEMISTRY
- FIELD INVESTIGATION / HUMAN OBSERVER / SOIL CLASSIFICATION
- FIELD INVESTIGATION / HUMAN OBSERVER / SOIL COLOR
- LABORATORY / ANALYSIS / CATION EXCHANGE CAPACITY
- LABORATORY / CARBON ANALYZER / CARBON

3. Data Application and Derivation:

Data set contains results from field study of spatial variability of soil properties.

4. Quality Assessment:

No known problems with data.

5. Data Acquisition Materials and Methods:

Soil samples collected using dutch auger and analyzed using EMBRAPA standard methods (Brazilian Agricultural Research Corporation) for analysis of soil chemical and physical properties (Silva et al., 1998). The units of cmolc (centimoles of charge) and dm³ (cubic decimeters) are common in Brazilian soil analyses employing EMBRAPA standards.

Soil texture was determined using the pipette method with 16 hours of slow shaking (30 rpm) and dispersion of organic matter with NaOH and sodium hexametaphosphate.

Soil color was determined on fresh, moist soils in the field using a Munsell color chart.

Exchangeable calcium, magnesium and aluminum were all determined on dry soils extracted with 1 M KCl. Aluminum concentrations were measured via titration with NaOH. Calcium and magnesium concentrations were determined by titration with EDTA (provides a value for the concentration of Ca + Mg). Concentration of exchangeable Ca alone was determined by titrating the 1M KCl extract with 0.0125M EDTA after addition of calcon carbonic acid. Exchangeable Mg concentrations are then determined as the difference between Ca + Mg and Ca concentrations.

Available phosphorus, exchangeable potassium and sodium were all extracted from air dry soils using a Melich I extraction solution (0.05 M HCl + 0.0125 M H₂SO₄). The ratio of soil to extraction solution was 1:10 w/v. Phosphorus in the extractant solution was measured on a spectrophotometer using the ascorbic acid- molybdate blue reaction. Potassium and sodium were measured by flame photometry (atomic absorption).

Potential acidity, the sum of aluminum and hydrogen ion concentrations extracted with 0.5M calcium acetate solution was measured by titration with 0.025M NaOH phenolphthalein as an indicator.

The analysis of carbon was done using the combustion method at high temperatures (Eltra oven at 1350 degrees C) and an elemental analyzer (Multi NC 3000) in which all forms of carbon in the soil are converted to CO₂ followed by measurement of the CO₂ (total carbon), following the method described by the Soil Survey Staff (1996).

Equations for calculated values:

Total exchangeable bases (S) = (Ca²⁺) + (Mg²⁺) + (K⁺) + (Na⁺)

Cation exchange capacity (T) = S + (H⁺) + (Al³⁺)

Base saturation (V) = 100*(S/T)

Exchangeable Al saturation (m) = 100*((Al³⁺)/(S + Al³⁺))

6. Data Access:

This data set 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:

Cooper M, Mendes LMS, Silva WLC, Sparovek G. 2005. A national soil profile database for Brazil available to international scientists. Soil Science Society of America Journal 69: 649-652. The database is available for free download at <http://www.esalq.usp.br/gerd/> (verified 04 Feb 2008).

Novaes Filho J.P., Couto E.G., de Oliveira V.A., Johnson M.S., Lehmann J., Riha J. (2007a). Spatial variability of soil physical attributes used in soil classification of microbasins in southern Amazonia. Revista Brasileira de Ciencia do Solo (Brazilian Journal of Soil Science), 31, 91-100. doi:10.1590/S0100-06832007000100010.

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Silva, F.C. da, P.A. da Eira, W. De Oliveira Barreto, D. Vidal Perez and C.A. Silva. 1998. Analises químicas para avaliacao da fertilidade do solo: Metodos usados na Embrapa Solos. Doc. No. 3

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