Revision date: August 28, 2009

LBA-ECO LC-09 Soil Composition and Structure in the Brazilian Amazon: 1992-1995

Summary:

This data set reports basic soil structure and composition information for five Amazonian research sites: Altamira, Bragantina, Tome-Acu, and Ponta de Pedras, all four in the state of Para, Brazil; and one site in Yapu, Colombia. Soil characteristics reported for all five study sites include cation information (e.g., H, Al, Mg, K, Na, S), percent of soil C, N, and organic matter, soil texture/composition and color, pH, and land use history. Soil bulk density and tons of carbon/ha are reported for only three of the study sites: Altamira, Bragantina, and Tome-Acu. All of the data are provided in one comma-separated data file.

The five study areas represent characteristic differences in soil fertility and a range of land uses typical of the Amazon region. One of these areas, Altamira, is characterized by above average pH and nutrients and excellent texture. The other four areas are more typical of the 75 percent of the Amazon that is characterized by Oxisols and Ultisols, with well-drained but low pH and low levels of nutrients (Cochrane and Sanchez 1981, Nicholaides et al. 1985). Ponta de Pedras in Marajo Island, located in the estuary, is composed of upland Oxisols and floodplain alluvial soils. Igarape-Acu in the Bragantina region is characterized by both nutrient-poor Spodosols and Oxisols. Tome-Acu, south of Igarape-Acu, represents a mosaic of Oxisols and Ultisols. Yapu, in the Colombian Vaupes, is composed of patches of Spodosols and Oxisols. Three of the areas area colonization regions at various degrees of development: Altamira is a colonization front that opened up in 1971, whereas Tome-Acu was settled by a Japanese population in the 1930s, and Bragantina was settled in the early part of the twentieth century. Marajo (Ponta de Pedras) is the home of caboclos, whereas Yapu is home to Tukanoan Native American populations. In these study areas we find slash-and-burn cultivation as well as plantation agriculture and mechanized agriculture. Length of fallows vary in these communities. The two indigenous areas leave their land in longer fallow than do the three colonization areas, and the proportion of land prepared from secondary forests increases with length of settlement as the stock of mature forest declines over time.

Data Citation:

Cite this data set as follows:

Brondizio, E.S. and E.F. Moran. 2009. LBA-ECO LC-09 Soil Composition and Structure in the Brazilian Amazon: 1992-1995. 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/938

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 August of 2009. Users who download the data between August 2009 and July 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 will 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:

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

Activity: LBA-ECO

LBA Science Component: Land Use and Land Cover

Team ID: LC-09 (Moran / Batistella)

The investigators were Moran, Emilio Federico; Batistella, Mateus; Adams, Ryan Thomas; Boucek, Bruce William; Brondizio, Eduardo S.; D'Antona, Alvaro; Demming, Kristin Rooke; Fiorini, Stefano; Futemma, Celia Regina Tomiko; Hedin, Lars; Hetrick, Scott S.; Jensen, Ryan R.; Lu, Dengsheng; Ludewigs, Thomas; Mausel, Paul; McGroddy, Megan; Menzies, John Iral; Navarro, Doris Graziela; Ponzoni, Flavio Jorge; Randolph, J.C.; Schmid, Hans Peter E.; Siqueira, Andrea Dalledone; Toniolo, Maria Angelica; Valeriano, Dalton De Morisson; Valladares, Gustavo Souza; VanWey, Leah and Yu, Genong . You may contact Brondizio, Dr Eduardo, S. (ebrondiz@indiana.edu)

LBA Data Set Inventory ID: LC09_Soil_Composition

This data set reports basic soil structure and composition information for five Amazonian research sites: Altamira, Bragantina, Tome-Acu, and Ponta de Pedras, all four in the state of Para, Brazil; and one site in Yapu, Colombia. Soil characteristics reported for all five study sites include cation information (e.g., H, Al, Mg, K, Na, S), percent of soil C, N, and organic matter, soil texture/composition and color, pH, and land use history. Soil bulk density and tons of carbon/ha are reported for only three of the study sites: Altamira, Bragantina, and Tome-Acu. All of the data are provided in one comma-separated data file.

For additional information, please see the following web site:

- ACT, Indiana University (http://www.indiana.edu/~act/)
- Instituto Nacional de Meteorologia (http://www.inmet.gov.br/)

Related Data Sets:

- LBA-ECO LC-09 Vegetation Composition and Structure in the Brazilian Amazon: 1992-1995 (Vegetation composition and structure data at same sample sites)
- LBA-ECO LC-09 Daily Precipitation for Altamira and Santarem, Para, Brazil: 1961-1998 (Precipitation data at several similar sample sites)

2. Data Characteristics:

Filename: LC09_Soil_Composition_Structure.csv. Missing values are represented as -9999. The data are provided in one comma-separated ASCII file.

Column Number	Column Heading	Units/format	Description
1	Sample_year	YYYY	Sampling year: 1992, 1993
2	Latitude	UTM	Sampling location latitude
3	Longitude	UTM	Sampling location longitude
4	Location		Sampling location name (Altamira, Bragantina, Ponta de Pedras, Tome-Acu, Yapu)
5	Sample_ID		Soil sample ID: Site code + Year (e.g. A001-92, B001-92, P001-92, T001-02, Y002-92)
6	Sample_depth	cm	Soil sample depth, segment of soil core (0-20, 20-40, 40-60, 60-80, 80-100)
7	Bulk_dens_rep1	g/cc	Soil bulk density, Rep #1
8	Bulk_dens_rep2	g/cc	Soil bulk density, Rep #2
9	Bulk_dens_rep3	g/cc	Soil bulk density, Rep #3
10	C_ton_ha	ton/ha	Tons of Carbon per hectare, calculated from bulk density and carbon concentration
11	pH		pH
12	Ca_MEQ_100g	meq/100g	Measuring cation exchange capacity - calcium
13	Mg_MEQ_100g	meq/100g	Measuring cation exchange capacity - magnesium
14	K_MEQ_100g	meq/100g	Measuring cation exchange capacity - potassium
15	Na_MEQ_100g	meq/100g	Measuring cation exchange capacity - sodium
16	S_MEQ_100g	meq/100g	Measuring cation exchange capacity - sulfur
17	H_MEQ_100g	meq/100g	Measuring cation exchange capacity - hydrogen
18	Al_MEQ_100g	meq/100g	Measuring cation exchange capacity - aluminum
19	C_perc	%	Concentration of carbon (C) in soil sample
20	N_perc	%	Concentration of nitrogen (N) in soil sample
21	OM_perc	%	Concentration of organic matter in soil sample
22	P_ppm	ppm	Concentration of phosphorus in soil sample
23	K_ppm	ppm	Concentration of potassium in soil sample
24	Na_ppm	ppm	Concentration of sodium in soil sample
25	Sand_CoarsePart	%	Percentage of coarse sand particles in soil sample
26	Sand_FinePart	%	Percentage of fine sand particles in soil sample
27	Silt	%	Percentage of silt in soil sample
28	Tot_clay	%	Percentage of clay in soil sample
29	SoilColor		Munsell soil color
30	SoilColorObs		Observation of soil color
31	LC_type		Land cover type sampled (Liana forest, upland forest, SS1, SS2, SS3)

32	LC_age	years	Land cover age (years)
33	LU_type	years	Land use type reported (years of use)
34	LULC_hist		Land use/land cover history with dates where available
35	Man_mec_ag		Agriculture methods (manual, mechanized, manual/mechanized)
36	Num_burn		Number of burnings
37	Fert_use		Fertilizer use (no, yes or yes/no which indicates previous but no current

Example Data Records:

Header records omitted.

Sample_year,Latitude,Longitude,Location,Sample_ID,Sample_depth,Bulk_dens_rep1,Bulk_dens_rep2,Bulk_dens_rep3,C_ton_ha,pH,
Ca_MEQ_100g,Mg_MEQ_100g,K_MEQ_100g,Na_MEQ_100g,S_MEQ_100g,H_MEQ_100g,Al_MEQ_100g,C_perc,N_perc,
OM_perc,P_ppm,K_ppm,Na_ppm,Sand_CoarsePart,Sand_FinePart,Silt,Tot_clay,SoilColor,SoilColorObs,LC_type,LC_age,LU_type,
LULC_hist,Man_mec_ag,Num_burn,Fert_use

1992,9637017,344603,Altamira,A001-92,0-20,0.94,-9999,-9999,33.65,5.0,
4.1,1.1,0.08,0.02,5.3,4.9,0.2,1.79,0.29,
3.06,2,-9999,-9999,6,6,32,56,2.5YR 3/4,DARK REDDISH BROWN,SS 3,16,Experiment,
1975-forest; 1976-cleared,Manual,-9999,-9999
1992,9637017,344603,Altamira,A001-92,20-40,1.13,-9999,-9999,22.14,5.2,
1.7,1.2,0.03,0.02,2.95,2.9,0.1,0.98,0.22
,1.69,1,-9999,-9999,6,6,25,63,2.5YR 3/4,DARK REDDISH BROWN,SS 3,16,Experiment,
1975-forest; 1976-cleared,Manual,-9999,-9999
1992,9637017,344603,Altamira,A001-92,40-60,1.13,-9999,-9999,18.53,5.2,
1.5,0.6,0.02,0.01,2.13,2.7,0,0.82,0.15
,1.4,1,-9999,-9999,4,6,28,62,2.5YR 4/8,REDDISH BROWN,SS 3,16,Experiment,
1975-forest; 1976-cleared,Manual,-9999,-9999
...
1995,-9999,-9999,Yapu,YA08-95,40-60,-9999,-9999,-9999,-9999,4.7
,0.2,0,-9999,-9999,-9999,-9999,0.6,0.55,0.04,
0.94,<1,-9999,-9999,46,35,7,12,10YR 5/6,"Yellowish brown,Areias Quartzosa
Distrofico",SS,3,Swidden agriculture,
Before 1990-forest or old growth; 1991-crop; 1992-fallow ,-9999,-9999,-9999
1995,-9999,-9999,Yapu,YA08-95,60-80,-9999,-9999,-9999,-9999,4.9
,0.3,0.1,-9999,-9999,-9999,-9999,0.4,0.35,0.02,
0.6,<1,-9999,-9999,48,33,9,10,10YR 6/6,"Bright yellowish brown,Areias Quartzosa
Distrofico",SS,3,Swidden agriculture,
Before 1990-forest or old growth; 1991-crop; 1992-fallow ,-9999,-9999,-9999
1995,-9999,-9999,Yapu,YA08-95,80-100,-9999,-9999,-9999,-9999,5.0

,0.2,0.1,-9999,-9999,-9999,-9999,0.3,0.26,0.02
,0.44,<1,-9999,-9999,48,34,8,10,10YR 6/6,"Bright yellowish brown,Areias Quartzosa Distrofico",SS,3,Swidden agriculture,
Before 1990-forest or old growth; 1991-crop; 1992-fallow ,-9999,-9999,-9999

Line breaks added to improve readability.

Site boundaries: (All latitude and longitude given in degrees and fractions)

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Geodetic Datum
Para Western (Santarem) - Altamira (Para Western (Santarem))	-54.00000	-51.00000	-2.50000	-4.00000	South-American Datum, 1969 (SAD-69)
Para Eastern (Belem) - Bragantina (Para Eastern (Belem))	-53.80000	-53.52000	-1.00000	-1.40000	South-American Datum, 1969 (SAD-69)
Para Eastern (Belem) - Ponta de Pedras (Para Eastern (Belem))	-48.86000	-48.86000	-1.36000	-1.36000	South-American Datum, 1969 (SAD-69)
Para Eastern (Belem) - Tome Acu (Para Eastern (Belem))	-48.18000	-48.18000	-2.40000	-2.40000	South-American Datum, 1969 (SAD-69)
Colombia - Yapu (Colombia)	-72.00000	-69.00000	-1.50000	-2.50000	South-American Datum, 1969 (SAD-69)

Time period:

- The data set covers the period 1992/01/01 to 1993/12/31.
- Temporal Resolution: each site was sampled once

Platform/Sensor/Parameters measured include:

- LABORATORY/ANALYSIS/SOIL CHEMISTRY
- FIELD INVESTIGATION/WEIGHING BALANCE/SOIL BULK DENSITY
- FIELD INVESTIGATION/HUMAN OBSERVER/SOIL COLOR
- FIELD INVESTIGATION/HUMAN OBSERVER/SOIL CLASSIFICATION
- FIELD SURVEY/ HUMAN OBSERVER/LAND COVER
- LABORATORY/ANALYSIS/CATIO EXCHANGE CAPACITY
- LABORATORY/CARBON ANALYZER/CARBON
- LABORATORY/KJELDAHL DIGESTION/NITROGEN

3. Data Application and Derivation:

This data set provides soil nutrients and physical characteristics as well as length and type of dominant land use. These types of data are useful for the development of models to predict productivity and structure of secondary forests after pasture or agricultural areas are abandoned.

4. Quality Assessment:

Soil analyses were carried out by experienced researchers in the field and analyzed at the Embrapa Amazonia Oriental research lab in Belem, Brazil, and at the CEPLAC research facility in Belem. There are no known problems with the data.

5. Data Acquisition Materials and Methods:

At each site, soil samples were collected with a dutch bipartite soil auger at 20-cm intervals down to a depth of 1 meter. Soil color was determined by use of Munsell color charts. Chemical and textural analyzes were carried out by the soil laboratories of the Cocoa Research Center (CEPLAC) and the Brazilian Agropastoral Research Center for the Humid Tropics (EMBRAPA/CPATU) in Belem, Para.

Organic material was analyzed using the modified Walkley-Black method: a volumetric method through aqueous dichromatic oxidation with potassium (0.4 N) and titration with ammonia iron sulfate (0.1 N).

Exchangeable Al was analyzed using the KCl method: soil extraction with a solution of 1M KCl in a proportion of 1:10 and volumetric determination with a dilute solution of NaOH.

Exchangeable Ca and Mg also were analyzed using the KCl method: soil in a solution of 1M KCl (in a proportion of 1:10) and analyzed (in Portuguese, 'complexometrica') with EDTA and spectral interference from atomic absorption measured in the visible, infrared, and ultraviolet ranges through spectrophotometry.

Available P was measured using the Mehlich-1 method, also called the double-acid or North Carolina method: an extractive solution comprised of HCl (0.05M) and H2SO4 (0.0125M) mixed with soil in a solution (proportion: 1:10) and determined colorimetrically.

Available K and Na also were measured using the Mehlich-1 method: an extractive solution comprised of a mixture of HCl (0.05M) and H2SO4 (0.0125M) mixed with soil in a solution (proportion: 1:10) and determined directly using flame photometry.

H and Al were measured using the calcium acetate method: soil extraction was made using a solution of calcium acetate (0.5M) buffered to a pH of 7. The soil solution proportion varied, but was most efficient at 1:20. Determination was made using a dilute solution of NaOH.

Total organic N was measured using the Kjeldahl method: burning to oxidation was made using a digestive solution containing H2SO4 and catalysts (CuSO4 and Na2SO4) distilled to a vapor, and with the Kjeldahl condenser, quantified by titration with HCl (0.02N).

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:

Cochrane, T.T. and L.F. Sanchez. 1981. Climates, Landscapes and Soils of the Tropical Savannas of South-America. Interciencia 6: 239-244.

Nicholaides, J.J. D.E. Bandy, P.A. Sanchez et al. 1985. Agricultural Alternatives for the Amazon Basin. BioScience 35: 279-285.

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