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Products

Data

Tools

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Data

[DAAC Home](#) > [Data](#) > [Field Campaigns](#) > [LBA \(Amazon\)](#) > [Data Set Documentation](#)

## LBA-ECO LC-21 Soil Characteristics, Logged Areas, Tapajos Forest, Para, Brazil: 2003

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Revision date: August 4, 2014

### Summary:

This data set provides measurements for soil nutrients from areas that were selectively logged and from control areas in the Tapajos National Forest, Para Western Santarem, Brazil. Data are included for calcium (Ca), phosphorus (P), magnesium (Mg), nitrogen (N), aluminum (Al), iron (Fe), silicon (Si), carbon 13, nitrogen 15, and potassium (K) concentrations. In addition, data are included for Phosphorus fractionation which was performed on a subset of the soils, and soil bulk density measurements. The samples were from clay-dominated (oxisols) soils.

Samples were collected in March 2003 from four blocks logged in areas that result after selective logging: forest, tree-fall gaps, skids, roads, deck edges and deck centers.

There are two data files with this data set.

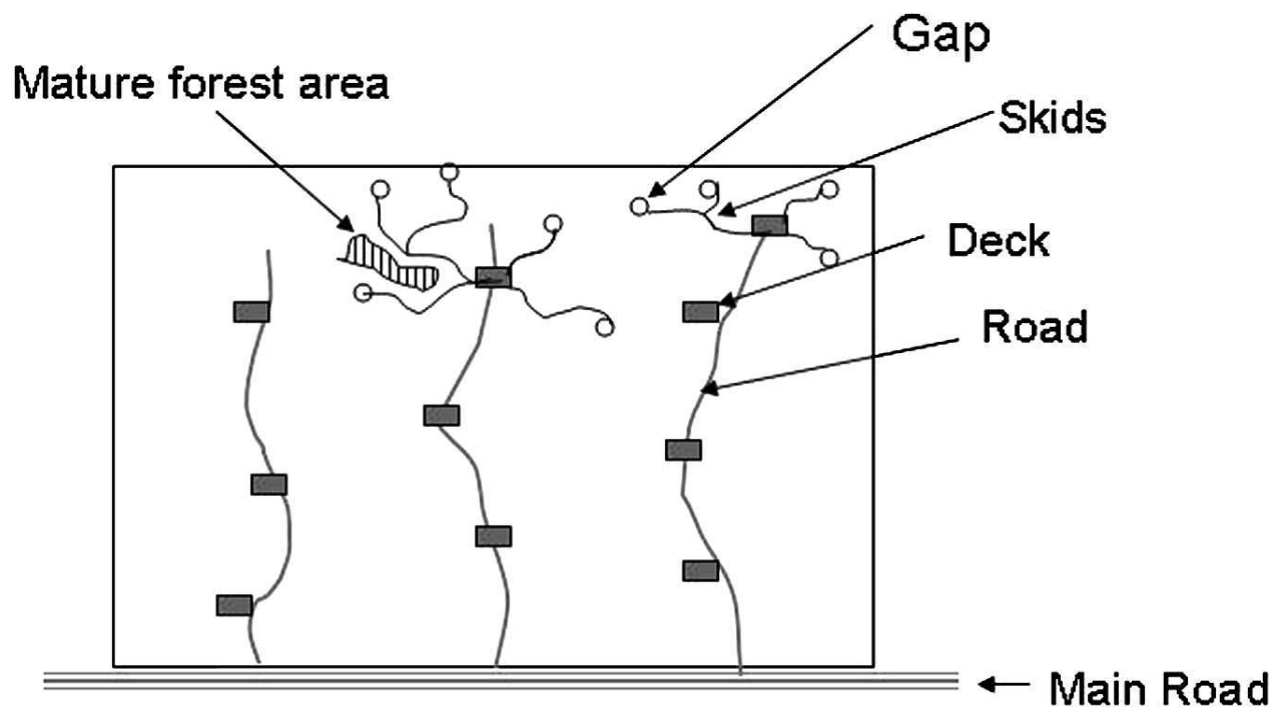


Figure 1. Diagram of a logging block. Image from Olander et al., 2005.

## Data Citation:

### Cite this data set as follows:

Asner, G.P., and L.P. Olander. 2014. LBA-ECO LC-21 Soil Characteristics, Logged Areas, Tapajos Forest, Para, Brazil: 2003. Available on-line [<http://daac.ornl.gov>] from the Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA. <http://dx.doi.org/10.3334/ORNLDAAC/1236>

## 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](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 Users who download LBA data in the five years after data have been archived must contact the investigators who collected the data, per provisions 6 and 7 in the Policy.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 2014. Users who download the data between August 2014 and September 2019 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.

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:** Land Use and Land Cover

**Team ID:** LC-21 (Asner / Bustamante / Silva)

The investigators were Asner, Gregory Paul; Bustamante, Mercedes M.C.; Silva, Jose Natalino Macedo; Broadbent, Eben North; Carlson, Kim; Carvalho, Ana Paula Ferreira; Hare, Anna Quinn; Knapp, David E.; Oliveira, Paulo Jose Silva Costa; Prado, Zayra Azeredo; Silva, Jose Salomao Oliveira and Villagomez, April Marie. You may contact Asner, Gregory P. ([gpa@stanford.edu](mailto:gpa@stanford.edu)) and Knapp, David E. ([deknapp@stanford.edu](mailto:deknapp@stanford.edu))

### LBA Data Set Inventory ID: LC21\_Soil\_Characteristics

This data set provides measurements for soil nutrients from areas that were selectively logged and from control areas in the Tapajos National Forest, Para Western Santarem, Brazil. Data are included for calcium (Ca), phosphorus (P), magnesium (Mg), nitrogen (N), aluminum (Al), iron (Fe), silicon (Si), carbon 13, nitrogen 15, and potassium (K) concentrations. In addition, data are included for Phosphorus fractionation which was performed on a subset of the soils, and soil bulk density measurements. The samples were from clay-dominated (oxisols) soils.

Samples were collected in March 2003 from four blocks logged in areas that result after selective logging: forest, tree-fall gaps, skids, roads, deck edges and deck centers.

Related data sets:

[LBA-ECO LC-13 GIS Coverages of Logged Areas, Tapajos Forest, Para, Brazil : 1996, 1998.](#)

## 2. Data Characteristics:

There are two comma-delimited data files with this data set. The data are for soil nutrient analysis from areas that were selectively logged and from control areas in the Tapajos National Forest, Para Western Santarem, Brazil.

\*The block and area descriptions were taken from the data set "[LBA-ECO LC-13 GIS Coverages of Logged Areas, Tapajos Forest, Para, Brazil: 1996, 1998](#)", available from the ORNL DAAC.

### File #1. LC21\_all\_soil\_nutrients.csv

Column	Column Heading	Units/format	Description
1	Block		Logging block

2	use		Area ID number: 0=control, 1=forest, 2=treefall, 3=skid trail, 4=road, 5= deck.
3	Damage		R=road, P=patio, F=forest, S=skid trail, T=treefall
4	Road		Road ID within each block
5	Patio		Landing ID along each road
6	Skid		Skid trail ID associated with each landing
7	Treefall		Treefall gaps where the canopy falls and remains after being cut from the tree bole
8	Forest		Unlogged forest at least 10 m from any deck (patio), skid, road, or gap
9	Rep		Replicate samples in a Damage sampling area
10	pH		Soil pH in water
11	Ca	ug/g	Calcium concentration in soil
12	Mg	ug/g	Magnesium concentration in soil
13	K	ug/g	Potassium concentration in soil
14	P	ug/g	Phosphorus concentration in soil
15	Fe	ug/g	Iron concentration in soil
16	Al	ug/g	Aluminum concentration in soil
17	Si	ug/g	Silicon concentration in soil
18	C	mg/g	Carbon concentration in soil
19	15N	per mil	Nitrogen 15 concentration in soil
20	13C	per mil	Carbon 13 concentration in soil, with respect to Pee Dee Belemnite (PDB) standard
21	C	%	Percent Carbon in soil
22	N	%	Percent Nitrogen in soil
23	C_N		Ratio of Carbon-Nitrogen in soil
24	C	mg/g	Percent Carbon (from #20 ) as mg/g
25	N	mg/g	Percent Nitrogen (from #21) as mg/g
26	bulk density	mg/m3	Soil bulk density

File 2. LC21\_Logging\_soil\_P\_fractions.csv

\*Sample ID: B=block #, R=road number, P=patio #, F, S,T, and R=location paired to the number of sample.

Column	Column Heading	Units/format	Description
1	Batch		Batch number
2	sample number		Sample number
3	sample id		*Sample ID. For example, B16 R2 P1 F3=block 16, road 2, patio 1, and forest 3.
4	Block		Logging block
5	Road		Road ID within each block
6	Patio		Patio ID within each block
7	Skid		Skid trail ID within each block
8	Damage		R=road, P=patio, F=forest, S=skid trail, T=treefall
9	use		Area ID number: 0=control, 1=forest, 2=treefall, 3=skid trail, 4=road, 5=patio or deck
10	rep		Sample number within collection site
11	Resin extractable P	ug kg-1 soil	Resin strips (in KCl to flocculate soils) used to extract P
12	Bicarbonate extractable inorganic P	ug kg-1 soil	Bicarbonate (0.5M NaHCO <sub>3</sub> ) to extract inorganic P
13	Bicarbonate extractable organic P	ug kg-1 soil	Bicarbonate (0.5M NaHCO <sub>3</sub> ) to extract organic P
14	Sodium hydroxide extractable inorganic P	ug kg-1 soil	Sodium hydroxide (0.1M NaOH) to extract inorganic P

15	Sodium hydroxide extractable organic P	ug kg-1 soil	Sodium hydroxide (0.1M NaOH) to extract organic P
16	HCL extractable inorganic P	ug kg-1 soil	Hot concentrated acid (3.6M HCl) to extract inorganic P
17	HCL extractable organic P	ug kg-1 soil	Hot concentrated acid (3.6M HCl) to extract organic P
18	residual P	ug kg-1 soil	Residual P
19	sum of P fractions	ug kg-1 soil	Sum of all fractions from #s 10-16 above
20	total P digest	ug kg-1 soil	An independent measure of total soil P determined using the peroxide/sulfuric digest on a replicate soil sample

The value -9999 represents values not provided with this data set

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Geodetic Datum
Para Western - FLONA Tapajos (Para Western (Santarém))	-55.25	-54.83333	-2.75	-3.58333	World Geodetic System, 1984 (WGS-84)

**Time period:**

- The data set covers the period 2003/03/01 to 2003/03/01.
- Temporal Resolution: Single data collection

**Platform/Sensor/Parameters measured include:**

- LABORATORY / ICP-AES (INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION / CALCIUM
- LABORATORY / ICP-AES (INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION / POTASSIUM
- LABORATORY / ICP-AES (INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION / MAGNESIUM
- LABORATORY / ICP-AES (INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION / PHOSPHORUS
- LABORATORY / ICP-AES (INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION / NUTRIENTS
- LABORATORY / MASS SPECTROMETERS / NITROGEN
- LABORATORY / MASS SPECTROMETERS / CARBON
- LABORATORY / ANALYSIS / ORGANIC MATTER
- LABORATORY / ANALYSIS / INORGANIC MATTER

### 3. Data Application and Derivation:

These data were collected to demonstrate how soil characteristics differ after a selective logging event.

### 4. Quality Assessment:

These data were reviewed and found to be reasonable and accurate.

### 5. Data Acquisition Materials and Methods:

#### Site description

The selective logging site is located in the northern part of the Tapajós National Forest (TNF) in Pará, Brazil, about 50 km south of Santarém, on a plateau that runs along the east side of the Tapajós River. The logging area is minimally transected by drainages. The soils are 70% clay dominated (ultisols and oxisols) and 30% sand dominated (ultisols; Silver et al. 2000). Mean annual temperature is 25 degrees C and rainfall averages 2,000 mm yr-1 with most inputs falling during the wet season from January through June (Nepstad et al. 2004).

Selective logging was carried out in blocks of approximately 100 ha, and had four spatially explicit impacts:

- logging roads;
- logging decks, where logs are temporarily stacked for movement off site;
- skids trails along which mechanical skidders pull logs from the forest to the decks;
- tree-fall gaps, where the canopy falls and remains after being cut from the tree bole.

#### Sample Collections

In March 2003, four blocks logged between August and October 2002 were sampled. These blocks were located on clay-dominated (oxisols) soils. Samples

were randomly selected from two logging decks for sampling from each block. Samples were collected along the roads leading to the decks every 10 m along a 40-m transect (n= 5), and in the decks every 5 m along a central transect (25-m x 25-m) with three additional samples taken in the center spaced at least 2 m apart (n=7). Out from the decks, one skid was sampled every 10 m along a 40-m transect (n=5). At the first tree crown found, five samples were taken in and around the fallen crown (n =5). In the matrix of unlogged forest at least 10 m from any deck, skid, road, or gap, three to five control samples were taken at 10-m intervals along transects (n=3 or 5) (Olander et al., 2005).

In March 2003, we sampled four blocks logged between August and October 2002. These blocks were located on clay-dominated (oxisols) soils.

We randomly selected two logging decks for sampling from each block. We sampled the roads leading to the decks every 10 m along a 40-m transect (n=5), and in the decks every 5 m along a central transect (25-m x 25-m) with three additional samples taken in the center spaced at least 2 m apart (n=7). Out from the decks, one skid was sampled every 10 m along a 40-m transect (n=5). At the first tree crown found, five samples were taken in and around the fallen crown (n=5). In the matrix of unlogged forest at least 10 m from any deck, skid, road, or gap, three to five samples were taken at 10-m intervals along transects (n= 3 or 5).

### Soil Nutrient Analysis

Soil samples were dried at 70 degrees C for 10 days and subsamples were ground and sieved (2-mm) with charcoal and large roots removed. Total C, N, 13C, and 15N were measured on an elemental analyzer mass spectrometer (Delta Plus, Finnigan Mat, San Jose, CA, USA) at CENA (University of Sao Paulo). Exchangeable P, Ca, K, and Mg were measured on 5g subsamples of soil extracted with Mehlich III (Tran and Simard 1993) and analyzed on the ICP-AES (SpectroFMV-3). pH was measured in water. Two analytical replicates per sample were analyzed using reference material (2710 Montana Soil, NIST) for total soil nutrients.

### Phosphorus fractionations

The P fractionations were conducted on a subset of samples using a modified Hedley fractionation (Tiessen and Moir 1993; Townsend et al. 2002). Three analytical replicates were used for each sample. The soils were subjected to the following series of extractions:

- Resin strips (in KCl to flocculate soils)
- bicarbonate (0.5M NaHCO<sub>3</sub>)
- hydroxide (0.1M NaOH)
- hot concentrated acid (3.6M HCl)
- a final peroxide/sulfuric acid digest

This same digest was used on a portion of the bicarbonate, hydroxide, and acid extractions, so that the organic P content could be determined from the total minus the inorganic.

All samples were analyzed using the Murphy–Riley method (Murphy and Riley 1962) using a spectrophotometer (Shimadzu UV-1203). An independent measure of total soil P was determined using the peroxide/sulfuric digest on a replicate soil sample. The sum of all fractions was compared to this independent measure to provide a measure of confidence in the fractionation scheme.

## 6. Data Access:

These data are 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](mailto:uso@daac.ornl.gov)

Telephone: +1 (865) 241-3952

## 7. References:

- Asner, G.P., M. Keller, R. Pereira, and J.C. Zweede. 2008. LBA-ECO LC-13 GIS Coverages of Logged Areas, Tapajos Forest, Para, Brazil : 1996, 1998. 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/893.
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  - [User Working Group](#)
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  - [Data Citation Policy](#)
  - [News](#)
  - [Newsletters](#)
  - [Workshops](#)
- Products**
  - [Product Overview](#)
  - [Field Campaigns](#)
  - [Validation](#)
  - [Regional/Global](#)
  - [Model Archive](#)
- Data**
  - [Complete Data Set List](#)
  - [Search for Data](#)
  - [Field Campaigns](#)
  - [Validation](#)
  - [Regional/Global](#)
  - [Model Archive](#)
- Tools**
  - [Data Search](#)
  - [Site Search](#)
  - [Search by DOI](#)
  - [WebGIS](#)
  - [SDAT](#)
  - [MODIS Land Subsets](#)
  - [THREDDS](#)
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  - [FAQs](#)
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