

LBA-ECO CD-02 Forest Canopy Structure, Tapajos National Forest, Brazil: 1999-2003

Revision date: May 10, 2011

Summary:

This data set reports on Leaf Area Index (LAI) and Specific Leaf Area (SLA) measurements collected from forest and pasture sites in or near the Tapajos National Forest (TNF), 80 km south of the city of Santarem, Para, Brazil. The collections were between October 1999 and June 2003 from tower sites accessed via the km 67 forest entrance. There are 2 comma-delimited ASCII data files with this data set, and 1 companion data file which provides site descriptions.

Data Citation:

Cite this data set as follows:

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This data set was archived in May of 2011. Users who download the data between May 2011 and April 2016 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.

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1. Data Set Overview:

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

Activity: LBA-ECO

LBA Science Component: Carbon Dynamics

Team ID: CD-02 (Ehleringer / Martinelli)

The investigators were Cook, Craig; Domingues, Tomas Ferreira; Ehleringer, James; Flanagan, Lawrence; Martinelli, Luiz Antonio; Ometto, Jean Pierre H.B. and Berry, Joseph. You may contact Ehleringer, Jim (ehleringer@biology.utah.edu)

LBA Data Set Inventory ID: CD02_Forest_Canopy_Structure

This data set reports Specific Leaf Area (SLA) of samples collected from 1999-2003 and Leaf Area Index (LAI) measured in 2003 on forest towers and pasture sites in or near the Tapajos National Forest (TNF), 80 km south of the city of Santarem, Para, Brazil. The collections were from sites accessed via the km 67 forest entrance. Specific sites are identified in the data files.

Related data sets:

- [LBA-ECO CD-02 Leaf Level Gas Exchange, Amazonia, Brazil: 1999-2003](#) (leaf level gas fluxes measured throughout the canopy includes measurements from the same sites and same campaigns)
- [LBA-ECO CD-04 Leaf Area Index, km 83 Tower Site, Tapajos National Forest, Brazil](#) (LAI determination from same site)

2. Data Characteristics:

Data are presented in two comma-delimited ASCII files. File #1: **CD02_LAI_measurements_TNF.csv**, and File #2: **CD02_SLA_measurements_TNF.csv**.

Site location information is also provided in one companion, comma-delimited ASCII file:

CD02_LAI_Forest_Site_Descriptions.csv.

File #1: **CD02_LAI_measurements_TNF.csv**

Column	Heading	Units/format	Description
1	Sample_date	yyyy/mm/dd	Sampling date (yyyy/mm/dd)
2	Site_ID		Sampling site (see accompanying Study Site Description file)
3	File_ID		LAI 2000 file identification
4	Height	m	Height at which the measurements were taken, reported in

			meters (m) above the ground
5	Orientation		The direction the sensor was pointing during measurement 1 = north 2 = northwest 3 = west 4 = south 5 = southeast 6 = east
6	LAI	m ² /m ²	Leaf area index measured using a LAI 2000
7	DIFN		Diffuse non-interceptance, or visible fraction of the sky
8	MTA	degrees	Mean foliage tilt angle in degrees
Note: there are no missing values in this data file			

Example data records

```

Sample_date,Site_ID,File_ID,Height,Orientation,LAI,DIFN,MTA
2003/03/27,km 67 - Primary Forest Tower,1,36,1,0.45,0.694,0
2003/03/27,km 67 - Primary Forest Tower,2,36,2,0.41,0.701,45
2003/03/27,km 67 - Primary Forest Tower,3,36,3,0,1.001,57
...
2003/06/09,km 67 - Seca-Floresta, T4 (Treatment),14,4,3.25,0.069,45
2003/06/09,km 67 - Seca-Floresta, T4 (Treatment),15,2,3.51,0.059,50
2003/06/09,km 67 - Seca-Floresta, T4 (Treatment),16,0,4.48,0.023,43
...

```

File #2: **CD02_SLA_measurements_TNF.csv**

Column	Heading	Units/format	Description
1	Sample_ID		Sample identification number used for linking field measurements to lab analyses; sample IDs in some cases were repeated across sites
2	Sample_date	yyyy/mm/dd	Sampling date (yyyy/mm/dd)
3	Site_ID		Site identification code
4	Latitude	degrees	Latitude in decimal degrees; negative values indicate south
5	Longitude	degrees	Longitude in decimal degrees; negative values indicate west
6	Season		Season: Wet or Dry
7	Species		Scientific name in the format Genus species, where determined, otherwise not provided
8	Common_name		Local name, if recorded, otherwise not provided
9	Height	m	The distance in meters from the ground to the canopy where the leaf was collected
10	Functional_group		Vegetation type (Liana, Tree, Sapling or Grass) Note sapling refers to any non-grass life form in the pasture and can include shrubs, young trees and/or young lianas
11	Position		Canopy position (for forest sites only): Understory, Mid-canopy, Upper-canopy (top canopy layer), or not provided; for pasture site, canopy position is indicated as not applicable
12	Leaf_area	m ²	Leaf area measured by tracing leaf contour on paper sheet while in the field. In the lab, areas were determined using NIH 1.63 software after scanning drawings

13	Leaf_weight	g	Leaf dry weight (in grams) after leaves were dried in 65C ovens for 48 hours
14	SLA	m ² g ⁻¹	Specific leaf area: the ratio of leaf area to its dry weight, reported as m ² g ⁻¹
Missing numeric data values are indicated by -9999; missing character values are indicated as not provided.			

Example data records

```

Sample_ID,Sample_date,Site_ID,Latitude,Longitude,Season,Species,Common_name,
Height,Functional_group,Position,Leaf_area,Leaf_weight,SLA
178,2000/02/28,km 67 - Primary Forest Tower,-2.85611,-54.95806,Wet,Not provided,Murta,
1,Tree,Understory,0.0036,0.2383,0.0149
177,2000/02/28,km 67 - Primary Forest Tower,-2.85611,-54.95806,Wet,Not provided,Murta,
1,Tree,Understory,0.0053,0.3735,0.0142
176,2000/02/28,km 67 - Primary Forest Tower,-2.85611,-54.95806,Wet,Not provided,Not provided,
1,Tree,Understory,0.0099,0.5206,0.0191
...
5,1999/10/28,km 67 - Seca-Floresta T1 (Control), -2.89833,-54.95583,Dry,Tachigalia
myrmecophila,Not provided,
27,Tree,Upper-canopy,0.0089,-9999, -9999
4,1999/10/28,km 67 - Seca-Floresta T1 (Control),-2.89833,-54.95583,Dry,Tachigalia
myrmecophila, Not provided,
27, Tree,Upper-canopy, 0.0068,-9999, -9999
3,1999/10/28,km 67 - Seca-Floresta T1 (Control),-2.89833,-54.95583, Dry,Tachigalia
myrmecophila,Not provided,
27, Tree,Upper-canopy, 0.007, -9999, -9999
...

```

Companion file: **CD02_LAI_Forest_Site_Descriptions.csv**

Column	Heading	Units/format	Description
1	Site_ID		Site Identification code
2	Site_description		Study site description
3	Tower_height	m	Tower height in meters, if applicable; pasture site samples were not collected from the tower
4	Latitude	degrees	Site location latitude in decimal degrees; negative values indicate south
5	Longitude	degrees	Site location longitude in decimal degrees; negative values indicate west
6	In_LAI		Indicates whether LAI was measured at this site
7	In_SLA		Indicates whether SLA was measured at this site

Example data records

```

Site_ID,Site_description,
Tower_height, Latitude, Longitude, In_LAI, In_SLA
km 67 - Primary Forest Tower,km 67 - Primary Forest - Tower Site; collections were done from

```

the walk-up tower adjacent to the eddy flux tower,
40, -2.85611,-54.95806,Yes,Yes
...
km 83 - Forest Tower (before logging),km 83 - Forest Tower Site - collections were done from
the walk up tower adjacent to the eddy flux tower at the km 83 forest entrance; collections of the
area surrounding the tower were conducted both prior to and after reduced-impact logging that
occurred between March-October 2001
40, -3.01806,-54.96889,No,Yes
...
km 67 - Seca-Floresta T4 (Treatment),Seca-Floresta - Tower 4 (Rainfall Exclusion Experiment
Treatment Plot),
25, -2.89833,-54.95583,Yes,No

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Geodetic Datum
Para Western (Santarem) - km 67 Primary Forest Tower Site (Para Western (Santarem))	-54.95900	-54.95900	-2.85700	-2.85700	World Geodetic System, 1984 (WGS-84)
Para Western (Santarem) - km 67 Seca-Floresta Tower (Para Western (Santarem))	-55.00000	-55.00000	-2.75000	-2.75000	World Geodetic System, 1984 (WGS-84)
Para Western (Santarem) - km 83 Logged Forest Tower (Para Western (Santarem))	-54.97070	-54.97070	- 3.01700	- 3.01700	World Geodetic System, 1984 (WGS-84)
Para Western (Santarem) - km 77 Pasture Tower Tower (Para Western (Santarem))	-54.88850	-54.88850	-3.02020	-3.02020	World Geodetic System, 1984 (WGS-84)

Time period:

- The data set covers the period 1999/10/28 to 2003/12/01.
- Temporal Resolution: monthly

Platform/Sensor/Parameters measured include:

- FIELD INVESTIGATION / LEAF AREA METER / LEAF AREA INDEX
- FIELD INVESTIGATION / LEAF AREA METER / SPECIFIC LEAF AREA
- FIELD INVESTIGATION / WEIGHING BALANCE / CANOPY CHARACTERISTICS
- FIELD INVESTIGATION / LEAF AREA METER / CANOPY CHARACTERISTICS

3. Data Application and Derivation:

These data can be used for the computation of gross primary productivity (GPP) and for the evaluation of the biological control exerted by local vegetation over carbon and water fluxes.

4. Quality Assessment:

The data have been reviewed and there are no known problems at this time.

The LAI-2000 assumes a random distribution of leaves and cannot distinguish leaf area from non-leaf area (stems and branches); therefore it measures plant area index (Weiss et al. 2004)

5. Data Acquisition Materials and Methods:

Field sites

All measurements were done in or near the Tapajos National Forest (TNF), 80 km south of the city of Santarem in the state of Para.

LAI measurement sites:

Leaf area indices were measured throughout the canopy profile from four walk-up towers.

The accumulation of leaf area index (LAI) through the forest canopy profile was determined in June 2003. LAI estimates were derived from the differences between simultaneous readings from two LAI-2000 sensors (Licor). One of the sensors was fixed at the top of the canopy, while the other was carried through the canopy. Measurements were taken every 1.5 meter at the rainfall exclusion towers and every 2 meters at the km 67 tower.

1. The first tower was 40 m tall, located adjacent to the eddy flux tower and is identified as km 67 tower; Site_ID: km 67 - Primary Forest Tower.
2. The second and third towers were located approximately 10 km southeast of the first tower in the rainfall exclusion experiment control plots (Control plot at Seca-Floresta site towers 1 and 2; Nepstad et al. 2002) and were 25 meters tall; Site_IDs: km 67 - Seca-Floresta T1 (Control) km 67 - Seca-Floresta T2 (Control).
3. The fourth tower was located in the rainfall exclusion experiment dry-down treatment plot at Seca-Floresta site (tower 4) and was also 25 meters tall; Site_ID: km 67 - Seca-Floresta T4 (Treatment).

SLA measurements:

For the leaf mass and specific leaf area measurements collections were taken from walk-up towers to allow access to the full canopy in the forest sites.

Leaves from all branches within reach of the towers were sampled for leaf mass per unit area (LMA) determination. For LMA determination contours of individual leaves were traced on paper sheets immediately upon collection. Paper sheets with leaf tracings were scanned in the laboratory and the area of individual leaves was determined with National Institute of Health (NIH)-Image software version 1.6. The actual leaves collected were taken to the laboratory for weight determination after being dried for 24 hours at 65 degrees C in convection ovens.

Eight locations within or near the TNF were included:

1. Towers 1 and 3 in the rainfall exclusion experiment control plot; Site_IDs: km 67 - Seca-Floresta T1 (Control) and km 67 - Seca-Floresta T3 (Control).
2. Towers 1, 2 and 3 in the rainfall exclusion experiment dry-down treatment plot at km 67; Site_IDs: km

67 - Seca-Floresta T1 (Treatment), km 67 - Seca-Floresta T2 (Treatment), and km 67 - Seca-Floresta T3 (Treatment).

3. The walk-up tower adjacent to the eddy flux tower at km 67; Site_ID: km 67 - Primary Forest Tower.

4. The walk-up tower adjacent to the eddy flux tower at the km 83 forest entrance. Collections were done both prior to and after reduced impact logging that occurred between March-October 2001 in the area surrounding the tower; Site_IDs: km 83 - Forest Tower (before logging) and km 83 - Forest Tower (after logging).

5. Location in a pasture adjacent to the eddy flux tower at km 77 and did not require a tower for canopy access; Site_ID: km 77

Pasture Measurements

For the leaf mass and specific leaf area measurement samples, grasses and sapling leaves were collected and taken to the laboratory for weight determination after being dried for 24 hours at 65 degrees C in convection ovens. There were no pasture LAI measurements.

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:

Nepstad D.C. et al. 2002. The effects of partial throughfall exclusion on canopy processes, aboveground production and biogeochemistry of an Amazon forest. *J. Geophys. Res.* 107, 8085, [doi:10.1029/2001JD000360](https://doi.org/10.1029/2001JD000360)

Weiss, M., F. Baret, G.J. Smith, I. Jonckheere and P. Copin. 2004. Review of methods for in situ leaf area index (LAI) determination. Part II. Estimation of LAI, errors and sampling. *Agric. For. Meteorol.* 121 37-53. [doi:10.1016/j.agrformet.2003.08.001](https://doi.org/10.1016/j.agrformet.2003.08.001)

Related Publications

- Domingues, T.F., J.A. Berry, L.A. Martinelli, J.P.H.B. Ometto, and J.R. Ehleringer. 2005. Parameterization of Canopy Structure and Leaf-Level Gas Exchange for an Eastern Amazonian Tropical Rain Forest (Tapajos National Forest, Para, Brazil). *Earth Interactions* 9(17):1-23. [doi:10.1175/EI149.1](https://doi.org/10.1175/EI149.1)