LBA-ECO CD-17 Secondary Forest Survey, Para and Rondonia, Brazil: 2002-2003

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Revision Date: October 13, 2014

Summary:

This data set provides measurements for diameter at breast height (DBH), tree height, distance from tree stems to the farthest canopy element, and a species survey of secondary forests in Para and Rondonia, Brazil, from 2002-2003. The forest areas were defined as Type A and Type B stands. Measurements were made in the overstory, understory, and midstory of each stand.

Type A stands were sampled intensively, with the goal of providing high-fidelity spatial information about the 3-dimensional structure of the stand. These stands were 60 x 60-m (0.36-ha) areas divided into 10 x 10-m grids of uniform clearing and abandonment history and were identifiable from Landsat images. Type B stands were sampled extensively, with the goal of providing unbiased estimates of biomass, along with some information about the vertical structure of the stand and of spatial variability. These stands were polygons of uniform clearing and afforestation history based on multitemporal Landsat imagery, and varied in size and shape.

These field measurements are part of a proposed four-step, incremental approach to combine in situ field measurements, fine resolution aircraft observations, and intermediate resolution space-based observations of regrowing forests to test and refine a model of regrowth potential for Amazonia and to characterize the optimal scale for mapping structure of regrowing forests with remote sensing.

The Landsat files provide classified land cover for each scene and can be used as a time series to evaluate land cover change over time. Each file is a geolocated land cover map based on 30-m Landsat data.

There are three comma-delimited data files with this data set (.csv) and 10 classified LANDSAT images provided in GeoTIFF (.tif) format.

Data Quality Statement: The Data Center has determined that this data set has missing or incomplete data, metadata, or other documentation resulting in diminished usability of this product.

Known Problems: Some unresolved issues remain where data values are inconsistent with the variable descriptions provided with the data set. The site identification and plot identification values are not consistently used in all three data files. The variables are not adequately described.

Data Citation:

Cite this data set as follows:

Salas, W.A., D.S. Alves, M.J. Ducey, D.J. Zarin and J. Qi. 2014. LBA-ECO CD-17 Secondary Forest Survey, Para and Rondonia, Brazil: 2002-2003. 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/1254

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 October 2014. Users who download the data between October 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:

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

Activity: LBA-ECO

LBA Science Component: Carbon Dynamics

Team ID: CD-17 (Ducey / Alves)

The investigators were Alves, Dr. Diogenes Salas; Ducey, Dr. Mark; Salas, Dr. William; Zarin, Dr. Daniel J. and Qi, Dr. Jiaguo. You may contact Zarin, Dr. Daniel J. (zarin@ufl.edu)

LBA Data Set Inventory ID: CD17_Forest_Survey

This data set provides measurements for diameter at breast height (DBH), tree height, distance from tree stems to the farthest canopy element, and a species survey of secondary forests in Para and Rondonia, Brazil, from 2002-2003. The forest areas were defined as Type A and Type B stands. Measurements were made in the overstory, understory, and midstory of each stand.

Type A stands were sampled intensively, with the goal of providing high-fidelity spatial information about the 3-dimensional structure of the stand. These stands were 60 x 60-m (0.36-ha) areas divided into 10 x 10-m grids of uniform clearing and abandonment history and were identifiable from Landsat images. Type B stands were sampled extensively, with the goal of providing unbiased estimates of biomass, along with some information about the vertical structure of the stand and of spatial variability. These stands were polygons of uniform clearing and afforestation history, based on multitemporal LANDSAT imagery, and varied in size and shape.

2. Data Characteristics:

There are three comma-delimited (.csv) and 10 classified Landsat images provided in GeoTIFF (.tif) format with this data set. All data were collected from three secondary forests in the Brazilian Amazon: (1) Sao Francisco do Para, Para, Belem, Brazil; (2) Alto Paraiso, Rondonia, Brazil; and (3) Ruropolis Para, Brazil.

Known problems: Some unresolved issues remain where data values are inconsistent with the variable descriptions provided with the data set. The site identification and plot identification values are not consistently used in all three data files. The variables are not adequately described.

Data files in .csv format:

1) CD17_Canopy_Data.csv: Canopy data
2) CD17_Regeneration_Data.csv: Understory data
3) CD17_Study_Area_Summary.csv: Study area descriptions

File 1. CD17_Canopy_Data.csv

Column	Column Heading	Units/format	Description
1	Key		Description not provided
2	Region		Region where study took place: (SF) Sao Francisco do Para, Para, Belem, Brazil; (AP) Alto Paraiso, Rondonia, Brazil; and (RU) Ruropolis Para, Brazil
3	Site_ID		Data collection site
4	Plant_ID		Unique identification number assigned to each plant in the field

5	Plot_ID		Plot identification number
6	Species_ID		Identification number assigned to individual plants in the field or OE. The description for "OE" was not provided with the documentation
7	Species_name		Species name (after confirmation) or OE. The description for "OE" was not provided with the documentation
8	Group		Species category: palm, vine, Vismia, Cecropia, and Sororoca, or OE. The description for "OE" was not provided with the documentation
9	Live_or_dead		Indicates whether the tree was alive (Live) or dead (Dead)
10	DBH	cm	Diameter at breast height (cm)
11	Height_total	m	Height in meters (m) to the tallest canopy element of selected individuals.
12	Height_to_crown	m	Height to the lowest live foliage of selected individuals (m)
13	Distance_N	m	Distance from the tree stem to the farthest canopy element to the north, projected into the horizontal plane
14	Distance_E	m	Distance from the tree stem to the farthest canopy element to the east, projected into the horizontal plane
15	Distance_S	m	Distance from the tree stem to the farthest canopy element to the south, projected into the horizontal plane
16	Distance_W	m	Distance from the tree stem to the farthest canopy element to the west, projected into the horizontal plane
17	Distance	m	Associated with Type A stands only (not Type B) and refers to distance in meters from a reference plot corner
18	Angle	degrees	Associated with Type A stands only (not Type B) and refers to angle in degrees from a reference plot corner
19	Double_tally		In Type B stands, whether or not the individual should be counted twice under the walkthrough protocol of Ducey et al. (2004) [Reference: Ducey, M.J., J.H. Gove, and H.T. Valentine. 2004. A walkthrough solution to the boundary overlap problem. Forest Science 50: 427-435.]
20	Comment		General observations about the plant or plot
21	Common_name		Common name of the species used in the region

NOTE: In the data file, -9999 indicates no value provided, no comment provided, or none.

File 2. CD17_Regeneration_Data.csv

Column	Column Heading	Description
1	Region	Region where study took place: AP= Alto Paraiso, Rondonia; RU=Ruropolis, Para; SF=Sao Francisco do Para, Para
2	Site name	Site where data were gathered
3	Stand_age	Stand age based on interviews (years)
4	Spacing	Spacing between circular plot centers for type B inventory method (see methods section for detail) (meters)
5	Date	Date when data were collected (YYYYMMDD)
6	Plot	Plot number: The reference location and initial plot is represented as 0E0N. Naming of the plots was done with reference to the initial plot. For example, if a plot was one column to the east of the initial plot, and one plot to the north, the plot was 1E1N. The plot that was one plot west of the initial plot, and three plots south, was 1W3S
7	Palms	No. individuals of all Palm species
8	Cecropia	No. individuals of all Cecropia species
9	Vismia	No. individuals of all Vismia species
10	Vine	No. individuals of all Vine species
11	Other_erect	No. individuals of all Other species
12	Sororoca	No. individuals of all Sororoca species
13	Herbaceous	Classification of the herbaceous cover (ABSENT, LIGHT, MEDIUM, HEAVY or Not recorded)
14	Vine_0_5	% of vine cover (0-5%)

15	Vine_5_25	% of vine cover (5-25%)
16	Vine_25_50	% of vine cover (25-50%)
17	Vine_50_75	% of vine cover (50-75%)
18	Vine_75_100	% of vine cover (75-100%)
19	Vines_canopy	Presence of vines in forest canopy: X if yes, -9999 if no
20	Vines_understory	Presence of vines in forest understory: X if yes, -9999 if no
21	Vines_both	Presence of vines in both forest canopy and forest understory: X if yes, -9999 if no
22	Vines_Cober_Herb	Variable description not provided
23-26	Fallen_logs_1-3	DBH in cm of the first (1), second (2) and third (3) fallen logs found (DBH/declination). Values are in the format OE/32,0/0 with the letters indicating orientation (OE- West-East, NS- North-South). the Value after the first slash is DBH in cm using the Portuguese convention of a comma for the decimal point and the number after the second slash is decomposition category (description provided by the Data Center)

NOTE: In the data file, -9999 indicates no value provided, no comment provided, or none.

File 3. CD17_Study_Area_Summary.csv

Column	Column Heading	Description
1	Region	Region where study took place: AP= Alto Paraiso, Rondonia; RU=Ruropolis, Para; SF=Sao Francisco do Para, Para
2	Site_ID	Site identification code
3	Method	Method used: A=intensive and B=extensive. See methods section for details.
4	Plot_ID	Plot code: unique code given to each plot (estimated age followed by Y, M or O for Young, Medium and Old stand age)
5	Age	Age of the plot (years) based on interviews with the owner
6	Age_class	Age class: Young, Medium, Old
7	Number_of_plots	Number of plots sampled within each area of a certain age
8	Area_total	Total sampled area in m2

Landsat images (GeoTIFF (.tif) format)

There are 10 .tif files-three for Rondonia, three for Ruropolis, and four for Saofrancisco. The files are named as **place_YYYYMMDDr_classified.tif**.

File names:

rondonia_20010802r_classified.tif
rondonia_20020805r_classified.tif
rondonia_20030520r_classified.tif
ruropolis_19990810r_classified.tif
ruropolis_20000828r_classified.tif
ruropolis_20010730r_classified.tif
saofrancisco_20000731r_classified.tif
saofrancisco_20010803r_classified.tif
saofrancisco_20020907r_classified.tif
saofrancisco_19990713r_classified.tif

The files provide classified land cover for each scene and can be used as a time series to evaluate land cover change over time. Each file is a geolocated land cover map based on 30-m Landsat data. **NOTE: There were additional files which could not be archived due to file problems.**

The classes are as follows:

1. Forest
2. Cleared
3. Secondary Vegetation

4. Water
5. Cloud
6. Cloud Shadow

All files are formatted as discrete unsigned 8 bit integer values with 30-m x 30-m pixel resolution. Each file has a color map assigned to the six land cover values. Number of rows and columns varies by file.

Projection System by file:

rondonia_20010802r_classified.tif, rondonia_20020805r_classified.tif

```
PROJCS["UTM Zone 20, Southern Hemisphere",
   GEOGCS["Clarke 1866",
     DATUM["Clarke_1866",
       SPHEROID["Clarke 1866",6378206.4,294.9786982138982],
       TOWGS84[0,0,0,0,0,0,0]],
   PRIMEM["Greenwich",0],
   UNIT["degree",0.0174532925199433]],
PROJECTION["Transverse_Mercator"],
PARAMETER["latitude_of_origin",0], PARAMETER["central_meridian",-63],
PARAMETER["scale_factor",0.9996],
PARAMETER["false_easting",500000],
PARAMETER["false_northing",10000000],
UNIT["metre",1,
 AUTHORITY["EPSG","9001"]]]
```

rondonia_20030520r_classified.tif

```
PROJCS["UTM Zone 20, Southern Hemisphere",
  GEOGCS["Clarke 1866",
     DATUM["Clarke_1866",
       SPHEROID["Clarke 1866",6378206.4,294.9786982138982],
       TOWGS84[0,0,0,0,0,0,0]],
     PRIMEM["Greenwich",0],
     UNIT["degree",0.0174532925199433]],
PROJECTION["Transverse_Mercator"],
PARAMETER["latitude_of_origin",0],
PARAMETER["central_meridian",-63],
PARAMETER["scale_factor",0.9996],
PARAMETER["false_easting",500000],
PARAMETER["false_northing",10000000],
UNIT["metre",1,
   AUTHORITY["EPSG","9001"]]]
```

ruropolis_19990810r_classified.tif, ruropolis_20000828r_classified.tif, ruropolis_20010730r_classified.tif

```
PROJCS["WGS 84 / UTM zone 21S",
    GEOGCS["WGS 84",
       DATUM["WGS_1984",
         SPHEROID["WGS 84",6378137,298.257223563,
           AUTHORITY["EPSG","7030"]],
       AUTHORITY["EPSG","6326"]],
     PRIMEM["Greenwich",0],
    UNIT["degree",0.0174532925199433],
   AUTHORITY["EPSG","4326"]],
PROJECTION["Transverse_Mercator"],
PARAMETER["latitude_of_origin",0],
PARAMETER["central_meridian",-57],
PARAMETER["scale_factor",0.9996],
PARAMETER["false_easting",500000],
PARAMETER["false_northing",10000000],
UNIT["metre",1,
   AUTHORITY["EPSG","9001"]],
AUTHORITY["EPSG","32721"]]
```

saofrancisco_19990713r_classified.tif, saofrancisco_20000731r_classified.tif, saofrancisco_20010803r_classified.tif, saofrancisco_20020907r_classified.tif

```
PROJCS["WGS 84 / UTM zone 23S",
    GEOGCS["WGS 84",
```

```
      DATUM["WGS_1984",
        SPHEROID["WGS 84",6378137,298.257223563,
          AUTHORITY["EPSG","7030"]],
        AUTHORITY["EPSG","6326"]],
      PRIMEM["Greenwich",0],
      UNIT["degree",0.0174532925199433],
      AUTHORITY["EPSG","4326"]],
    PROJECTION["Transverse_Mercator"],
    PARAMETER["latitude_of_origin",0],
    PARAMETER["central_meridian",-45],
    PARAMETER["scale_factor",0.9996],
    PARAMETER["false_easting",500000],
    PARAMETER["false_northing",10000000],
    UNIT["metre",1,
      AUTHORITY["EPSG","9001"]],
    AUTHORITY["EPSG","32723"]]
```

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Para Eastern (Belem) - Sao Francisco do Para (Para Eastern (Belem))	-47.75	-47.75	-1.16667	-1.16667
Rondonia - Alto Paraiso (Rondonia)	-63.328	-63.328	-9.69	-9.69
Para - Ruropolis (Para)	-54.90917	-54.90917	-4.09583	-4.09583

Time period:

- The data set covers the period 2002/10/05 to 2003/11/01.
- Temporal Resolution: Single measurement.

Platform/Sensor/Parameters measured include:

- FIELD SURVEY / HUMAN OBSERVER / FOREST COMPOSITION/VEGETATION STRUCTURE
- FIELD SURVEY / HUMAN OBSERVER / VEGETATION SPECIES
- FIELD SURVEY / STEEL MEASURING TAPE / BIOMASS

3. Data Application and Derivation:

These field measurements are part of a proposed four-step, incremental approach to combine in situ field measurements, fine resolution aircraft observations, and intermediate resolution space-based observations of regrowing forests to test and refine a model of regrowth potential for Amazonia, and to characterize the optimal scale for mapping structure of regrowing forests with remote sensing.

4. Quality Assessment:

Known Problems: Some unresolved issues remain where data values are inconsistent with the variable descriptions provided with the data set. The site identification and plot identification values are not consistently used in all three data files. The LANDSAT data were not provided with the data set.

5. Data Acquisition Materials and Methods:

The data were collected from secondary forests in Para (eastern (Belem)) and Rondonia, Brazil, from 2002-2003. The eastern region of Para is made up of the area in the state of Para east of the Xingu River. This area lies in eastern Amazonia. Rondonia is located in the western part of the Amazon where the greatest amount of deforestation in the Amazon region has taken place. Most deforestation is a result of the intense colonization of the state that has occurred since the mid 1970s. The total area that has been deforested is approximately 276,315 hectares, about 1.2% of the state's area.

FIELD SAMPLING

The forest areas were defined as Type A and Type B stands. Measurements were made in the overstory, understory, and midstory of each stand. Type A stands were sampled intensively, with the goal of providing high-fidelity spatial information about the 3-dimensional structure of the stand. These stands were 60 x 60-m (0.36-ha) areas of uniform clearing and abandonment history and identifiable from Landsat images. Type B stands were sampled extensively, with the goal of providing unbiased estimates of biomass, along with some information about the vertical structure of the stand and of spatial variability. These stands were polygons of uniform clearing and afforestation history, based on multitemporal Landsat imagery. Their size and shape varied and did not correspond exactly to any aggregation of Landsat pixels.

TYPE A

In the Type A stands it was assumed that the grids were approximately aligned with the cardinal directions. A corner of the stand was located, and coordinates recorded using a GPS unit. Layout of the stand began with locating any cell corner. There was no special need to begin with A1NW, for example. Within each cell, measurements described below were made in the understory, midstory, overstory (downed logs (if any) were also measured). When an extreme corner of the stand (A1NW, A6SW, F1NE, or F6SE) was reached, the coordinates of that corner were recorded using the GPS, and a digital photo was taken facing toward the center of the stand. When a new cell was established, the cell corners were flagged and labelled with a Suunto compass and either the Vertex hypsometer or the distance tape, whichever was more convenient for establishing distances in the stand. Each cell was 10 m2.

Understory Measurement

Understory measurements were taken in the SW corner of every cell, using a 1-m radius, quarter-circle plot tucked into the corner. All woody stems less than breast height were tallied according to the same functional groups used for overstory trees: palms, Cecropia, Vismia, other erect, and vines. No dimensions (heights or diameters) were taken for these seedlings. The herbaceous understory was characterized subjectively as: absent: no herbaceous cover, light: scattered herbaceous individuals, medium: some patches of cover, contained in a matrix of bare areas, heavy: some bare patches, contained in a matrix of contiguous herbaceous cover, complete: thick herbaceous cover without bare patches.

Midstory Measurement

Midstory stems were defined as stems taller than breast height but less than 5-cm DBH. All midstory stems were tallied within a 3-m radius, quarter-circle plot tucked into the SW corner of the cell. The following variables were recorded for all midstory stems: Functional group: palms, Cecropia, Vismia, other erect, vine, lve or dead, DBH, taken with calipers facing the SW corner, in cm. In addition, for the two stems of each functional type that were closest to the SW corner, the following variables were measured: Height, taken with the Vertex hypsometer, in m., Height to the lowest live foliage, taken with the Vertex hypsometer, in m., Crown width, taken with the Vertex or with a tape, in the four cardinal directions.

Overstory Measurement

Overstory stems were defined as all stems greater than 5-cm DBH. All overstory stems on the plot were tallied, measured, and mapped. The following variables were recorded for every overstory stem: Distance from the SW corner, m, Bearing from the SW corner, degrees (0-90), Functional group: palms, Cecropia, Vismia, other erect, vine, live or dead, DBH, taken with a DBH tape, in cm. In addition, for the two stems of each functional type that are closest to the SW corner, the following variables were measured: Height, taken with the Vertex hypsometer, in m., Height to the lowest live foliage, taken with the Vertex hypsometer, in m., Crown width, taken with the Vertex or with a tape, in the four cardinal directions.

TYPE B

Type B stands were sampled on a grid and the spacing of the grid depended on the size of the stand. The position of the polygon was established based on a good GPS position fix and some were outside the stand (for example, in an adjacent road or clearing). The distance and bearing from this position fix to the center of the first plot was recorded. This plot served as the reference location for the position of the stand, and is denoted as plot 0E 0N. Additional plots were laid out on a square grid aligned with the Landsat grid for the area. Naming of the plots was done with reference to the initial plot. For example, if a plot was one column to the east of the initial plot, and one plot to the north, the plot was 1E 1N. The plot that was one plot west of the initial plot, and three plots south, was 1W 3S. The spacing of the grid was variable, so that sampling effort and relative accuracy would be similar regardless of stand size.

The following table provides the grid spacing:

Number of 900-m2 Landsat Pixels in Stand	Grid Spacing (m)
1 to 2	6 x 6
3 to 6	10 x 10
7 to 12	15 x 15
13 to 20	20 x 20
21 to 30	25 x 25
31 or more	30 x 30

Plot Locations

The initial plot was located and measured, then all plot locations on the grid falling within the stand were measured. Valid plot locations within the stand were not skipped or omitted and the locations of plots were not shifted or moved because they were in unusual areas within the stand, such as gaps, or if they were close to the edge of the stand.

Understory Measurements

Understory measurements were made using an 0.5-m radius, full-circle subplot centered on the plot center. All woody stems less than breast height were tallied according to the same functional groups used for overstory trees: palms, Cecropia, Vismia, other erect, and vines. No dimensions (heights or diameters) were taken for these seedlings. The herbaceous understory was characterized subjectively as: absent: no herbaceous cover, light: scattered herbaceous individuals, medium: some patches of cover, contained in a matrix of bare areas, heavy: some bare patches, contained in a matrix of contiguous herbaceous cover, complete: thick herbaceous cover without bare patches.

Midstory Measurements

Midstory stems were defined as stems taller than breast height but less than 5-cm DBH. All midstory stems were tallied within a 1-m radius, full-circle subplot

centered on the plot center. The following variables were recorded for all midstory stems: Functional group: palms, Cecropia, Vismia, other erect, vine,live or dead, DBH taken with calipers facing the plot center, in cm. In addition, for the stem of each functional type that was closest to the plot center, the following variables were measured: height, taken with the Vertex hypsometer, height to the lowest live foliage, taken with the Vertex hypsometer, crown width, taken with the Vertex or with a tape, in the four cardinal directions.

Overstory Measurements

Overstory stems were defined as all stems greater than 5-cm DBH. Overstory stems were tallied using a 4-m radius circular plot, centered on the plot center. The following variables were recorded for every overstory stem: Functional group: palms, Cecropia, Vismia, other erect, vine, Live or dead, DBH taken with a DBH tape, in cm. In addition, for the one stem of each functional type that was closest to the plot center, the following variables were measured: height, taken with the Vertex hypsometer, height to the lowest live foliage, taken with the Vertex hypsometer, crown width, taken with the Vertex or with a tape, in the four cardinal directions.

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
Telephone: +1 (865) 241-3952

7. References

Ducey, M.J., J.H. Gove, and H.T. Valentine, 2004. A Walkthrough Solution to the Boundary Overlap Problem. Forest Science 50(4):427-435.