

# LBA-ECO LC-09 Land Cover Transitions Maps for Study Sites in Para, Brazil: 1970-2001

## Summary:

This data set includes classified land cover transition maps at 30-m resolution derived from Landsat TM, MSS, ETM+ imagery and aerial photos of Altamira, Santarem, and Ponta de Pedras, in the state of Para, Brazil. The Landsat images were classified into several types of land use (e.g., forest, secondary succession, pasture, annual crops, perennial crops, and water) and subjected to change detection analysis to create transition matrices of land cover change. Dates of acquired images represent the most cloud-free image retrievals from 1970-2001 for each site and are therefore not continuous. There are 3 GeoTIFF files (.tif) with this data set.

## Data Citation:

Cite this data set as follows:

Brondizio, E.S. and E.F. Moran. 2012. LBA-ECO LC-09 Land Cover Transitions Maps for Study Sites in Para, Brazil: 1970-2001. Data set. Available on-line [<http://daac.ornl.gov>] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A.  
<http://dx.doi.org/10.3334/ORNLDAAC/1098>

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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 Users who download LBA data in the five years after data have been archived must contact the investigators who collected the data, per provisions 6 and 7 in the Policy.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 June of 2012. Users who download the data between June 2012 and July 2017 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 website [<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](#)
- [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-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; Fudemma, 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](mailto:ebrondiz@indiana.edu))

**LBA Data Set Inventory ID:** LC09\_Transition\_Matrices

This data set includes classified land cover transition maps at 30-m resolution derived from Landsat TM, MSS, ETM+ imagery and aerial photos of Altamira, Santarem, and Ponta de Pedras, in the state of Para, Brazil. The Landsat images were classified into several types of land use (e.g., forest, secondary succession, pasture, annual crops, perennial crops, and water) and subjected to change detection analysis to create transition matrices of land cover change. Dates of acquired images represent the most cloud-free image retrievals from 1970-2001 for each site and are therefore not continuous.

### Related data sets

- LBA-ECO LC-09 Landsat ETM+ Data, Two Sites in Rondonia and Para, Brazil: 1999-2002 (Landsat ETM+ data at nearby sample sites)
- LBA-ECO LC-09 Landsat TM Data, Study Sites in Rondonia and Para, Brazil: 1985-2004

## 2. Data Characteristics:

This data set includes classified land cover transition maps at 30-m resolution derived from Landsat TM, MSS, ETM+ imagery and aerial photos of Altamira, Santarem, and Ponta de Pedras, in the state of Para, Brazil. The Landsat images were classified into several types of land use (e.g., forest, secondary succession, pasture, annual crops, perennial crops, and water).

There are 3 GeoTIFF files (.tif) with this data set, one for each of the three study areas. The images have the projection information listed below.

- Projected Coordinate System: Universal Transverse Mercator Zones 21S and 22S
- Projection: Transverse\_Mercator

- False\_Easting: 500000.000000
- False\_Northing: 10000000.000000
- Central\_Meridian: -75.000000
- Scale\_Factor: 0.999600
- Latitude\_of\_Origin: 0.000000
- Linear\_Unit: Meter
- Geographic Coordinate System: GCS\_South\_American\_1969
- Datum: D\_South\_American\_1969
- Prime Meridian: Greenwich
- Angular Unit: Degree

**Files/Land Use Classes:**

**s\_class\_altamira.tif.**

Value	Class
0	Unclassified
1-2	Forest
3-4	Deforestation before 1970
5	Deforestation before 1975
6	Deforestation before 1976
7-8	Deforestation before 1979
9-10	Deforestation before 1985
11-12	Deforestation before 1991
13-14	Deforestation before 1996
15	Forest
16	Deforestation before 1996
17-18	Water

**rs\_class\_pontadepedras.tif**

Value	Class
0	Unclassified
1	Water
2	Forest
3	Deforestation before 1991
4	Bare Soil
5	Secondary Succession
6	Fallow Use
7	Secondary Regrowth
8	Savanna

rs\_class\_santarem.tif

Value	Class
0	Unclassified
1	Water
2	Forest
3	Deforestation before 1972
4	Deforestation before 1979
5	Deforestation before 1986
6	Deforestation before 1991
7	Deforestation before 2001
8	Savanna
9	Other land cover (urban, roads, bare areas, etc)

**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) - Altamira (Para Western (Santarem))	-54.00000	-51.00000	-2.50000	-4.0000	South-American Datum, 1969 (SAD-69)
Para Western (Santarem) - Santarem-Cuiaba Road (Para Western (Santarem))	-55.61	-54.288055	-2.305	-4.5591666	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)

**Time period:**

- The data set covers the period 1970/01/01 to 2001/12/31
- Temporal Resolution: Annual

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

- LANDSAT-5 / (ETM+ (ENHANCED THEMATIC MAPPER PLUS) / DEFORESTATION
- LANDSAT-5 / MSS (MULTISPECTRAL SCANNER) / DEFORESTATION
- LANDSAT-5 / MSS (MULTISPECTRAL SCANNER) / LAND USE CLASSES

### 3. Data Application and Derivation:

Data to be used in spatial analysis of land use and land cover change.

## 4. Quality Assessment:

Data were georeferenced to previously rectified images with low RMS error (<1.0 m).

Classifications were produced with low errors of omission/commission (at time of metadata creation, these data were unavailable).

## 5. Data Acquisition Materials and Methods:

### Study Sites

Land cover types were identified in classified Landsat TM, MSS, ETM+ images and aerial photos of Altamira, Santarem, and Ponta de Pedras, in the state of Para, Brazil.

- Altamira was colonized in 1971 and has experienced high rates of deforestation and secondary succession. The soils are nutrient-rich and land cover includes dense forest and liana-dominated upland forest. Secondary succession includes liana forest, upland forest, and pasture.
- Ponta de Pedras is located in eastern Para, on the Marajó Island of Para, and represents a transitional environment composed of upland Oxisols and floodplain alluvial soils. Vegetative cover includes upland floodplain forests, palm-dominated forests, flooded forests, açai palm agroforestry, and different types of savannas.
- Santarem is located in western Para. The Tapajos National Forest lies southwest of Santarem. The Santarem-Cuiaba Road (BR-163) field site connects Santarem and Cuiaba (Cuiaba is located in the state of Mato Grosso, Brazil) and is located east of the Tapajos National Forest.

### Methods

Original imagery was acquired from the following:

- USGS EROS (<http://edc.usgs.gov/products/satellite/mss.html>)
- Landsat.org (<http://www.landsat.org>)
- INPE (<http://www.inpe.br/>)

Dates of acquired images represent the most cloud-free image retrievals from 1970-2001 and are therefore not continuous.

Bands were combined (layer-stack) and registered to UTM using ERDAS Imagine (Leica Geosystems, St. Gallen, Switzerland) (version unknown at the time of metadata creation). Images were georeferenced to previously rectified images using ERDAS Imagine. Radiometric and atmospheric corrections were done according to methods described by Green et al. (2005).

Data have been rectified and subset unless otherwise noted. Individual images were classified into several types of land use (e.g., forest, secondary succession, pasture, annual crops, perennial crops, and water).

These classified images were used in change detection analysis to create transition matrices of land cover change. Classified images were developed by first running an unsupervised ISODATA classification, and editing the class names based on image interpretation, AOIs, spectral signatures,

field notes and maps, and previous classification, using Erdas IMAGINE. Classified images were then used in a change detection analysis, using Erdas IMAGINE.

Data were originally in the Imagine file format (.img), but exported to TIF (.tif) using ERDAS Imagine 8.7.

## 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](mailto:uso@daac.ornl.gov)

Telephone: +1 (865) 241-3952

## 7. References:

Green, G.M., C.M. Schweik, and J.C. Randolph. 2005. Retrieving Land-Cover Change Information from Landsat Satellite Images by Minimizing Other Sources of Reflectance Variability. Pages 131-160 in E.F. Moran and E. Ostrom, editors. Seeing the Forest and the Trees: Human-Environment Interactions in Forest Ecosystems. MIT Press, Cambridge, MA.

### Related Publications

- McCracken, S.D., E.S. Brondizio, D. Nelson, E.F. Moran, A.D. Siqueira, and C. Rodriguez-Pedraza. 1999. Remote sensing and GIS at farm property level: Demography and deforestation in the Brazilian Amazon. *Photogrammetric Engineering and Remote Sensing* 65(11):1311-1320.
- Brondizio, E., S.D. McCracken, E.F. Moran, A.D. Siqueira, D.R. Nelson, and C. Rodriguez-Pedraza. 2002. The Colonist Footprint: Toward a conceptual framework of deforestation trajectories among small farmers in frontier Amazonia. Pages 133-161 in C.H. Wood and R. Porro, editors. *Deforestation and Land Use in the Amazon*. University of Florida Press, Gainesville, FL.
- Moran, E.F., A.S. Siqueira, and E.S. Brondizio. 2003. Household demographic structure and its relationship to the Amazon Basin. Pages 1-30 in J. Fox, R.R. Rindfuss, S.J. Walsh, and V. Mishra, editors. *People and the Environment: Approaches for Linking Household and Community Surveys to Remote Sensing and GIS*. Kluwer Academic Publishers, Boston, MA.
- Moran, E.F., and E. Brondizio. 1994. Integrating Amazonian vegetation, land-use, and satellite data. *BioScience* 44(5):329-339.
- Mausel, P., Y. Wu, Y. Li, E.F. Moran, and E.S. Brondizio. 1993. Spectral identification of successional stages following deforestation in the Amazon. *Geocarto International* 8(4):61-71.
- Lu, D., P. Mausel, E. Brondizio, and E. Moran. 2003. Classification of successional forest stages in the Brazilian Amazon basin. *Forest Ecology and Management* 181:301-312.