LBA-ECO CD-08 Radiocarbon Dates for Large Trees from a Forest near Manaus, Brazil

Revision date: February 28, 2011

Summary

This data set reports the ages and growth rates of trees as determined by radiocarbon dating (14C), selected from a logging operation near the city of Itacoatiara, about 250 km east of Manaus, Brazil in 1997. Samples were collected from forty-four trees from 15 species with a basal diameter greater than 100 cm and prepared for radiocarbon dating by Accelerator Mass Spectrometry (AMS) at Lawrence Livermore National Laboratory. There is one comma-separated ASCII data file with this data set.

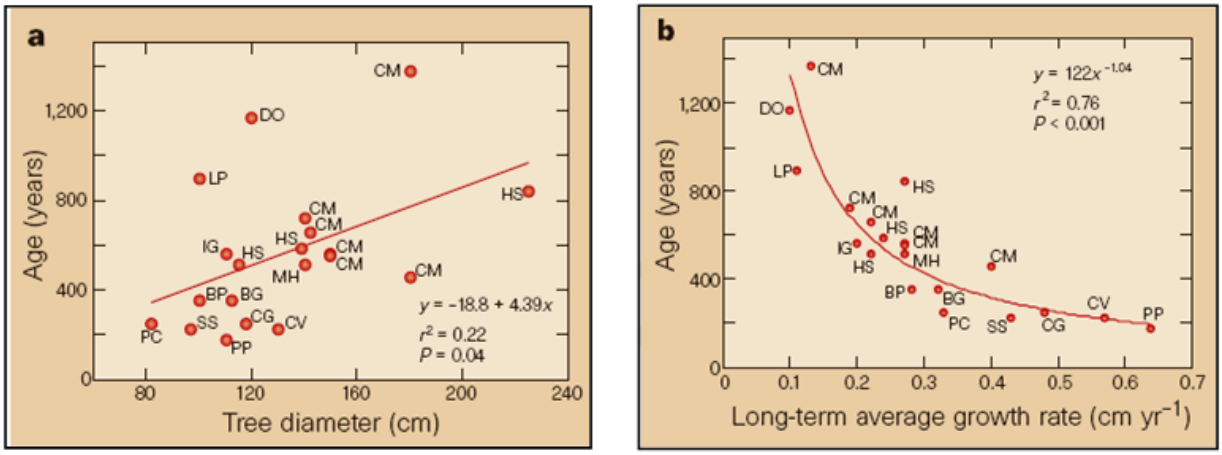

Figure 1. Radiocarbon dates for 20 central Amazon trees. (This is a subset of the 44 trees reported in this data set.) Long-term average growth rates were calculated as diameter divided by age. Although significant, size is not a reliable predictor of age (a). For large trees, growth rate is probably a much better predictor of age (b). Species are: BG, Bagassa guianansis; BP, Brosimum parinarioides; CM, Cariniana micrantha; CG, Caryocar glabrum; CV, Caryocar villosum; DO, Dipteryx odorata; HS, Hymenolobium spp.; IG, Iryanthera grandis; LP, Lecythis poiteaui; MH, Manilkara huberi; PP, Parkia pendula; PC, Peltogyne catingae; SS, Sclerolobium spp. From Chambers et al., 1998.

Data Citation:

Cite this data set as follows:

Chambers, J.Q., N. Higuchi, and J.P. Schimel. 2011. LBA-ECO CD-08 Radiocarbon Dates for Large Trees from a Forest near Manaus, Brazil. 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/996

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 Users who download LBA data in the five years after data have been archived must contact the investigators who collected the data, per provisions 6 and 7 in the Policy.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 March of 2011. Users who download the data between March 2011 and February 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-08 (Trumbore / Camargo)

The investigators were Chambers, Jeffrey Q.; Trumbore, Susan E. and Higuchi, Niro . You may contact Chambers, Jeffrey Q. (chambers@tulane.edu)

LBA Data Set Inventory ID: CD08_Radiocarbon_Dates_Manaus

Forty-four trees from 15 species were radiocarbon dated by Accelerator Mass Spectrometry (AMS) at Lawrence Livermore National Laboratory. Trees were selected from a logging operation near the city of Itacoatiara, about 250 km east of Manaus, Brazil. Trees were chosen according to size with approximately 100 cm the minimum base diameter.

Related Data Set

- LBA-ECO CD-08 Radiocarbon Dating of Tree Ages in Amazonas, Acre, and Para in Brazil

2. Data Characteristics:

Data are presented in one comma-delimited ASCII file: **CD08_Manaus_forest_tree_age_data.cvs**

Column Number	Column Heading	Units	Description
1	species		Species or genus (when species unknown) name of sampled tree
2	common_name		Common name for this species/genus in the Central Amazon
3	family		Biological family name
4	radiocarbon_date		Age determined from radiocarbon dating given as calendar age with 1997 as the tree harvest date. Radiocarbon dating was performed at Lawrence Livermore National Laboratory using standard protocols
5	standard_error		Radiocarbon date standard error
6	calibrated_date		Radiocarbon age adjusted for atmospheric variability
7	1997_age		Measured age of tree at harvest date, uncalibrated
8	base_diameter	cm	The diameter of the tree stump where sample was taken
9	average_growth_rate	cm/yr	Base diameter (from column 8) divided by age (from column 7) = average growth rate

Example data records

```
species,common_name,family,radiocarbon_date,standard_error,calibrated_date,1997_age,base_diameter,average_growth_rate
Bagassa guiananensis,Tatajuba,Moraceae,300,50,310,350,110,0.31
Brosimum parinarioides,Amap ,Moraceae,280,50,310,350,100,0.29
Cariniana micrantha,Tauari vermelha,Lecythidaceae,1440,50,1330,1370,180,0.13
Cariniana micrantha,Tauari vermelha,Lecythidaceae,780,50,680,720,140,0.19
Cariniana micrantha,Tauari vermelha,Lecythidaceae,650,50,615,660,140,0.21
Cariniana micrantha,Tauari vermelha,Lecythidaceae,470,50,520,560,150,0.27
Cariniana micrantha,Tauari vermelha,Lecythidaceae,440,50,510,550,150,0.27
Cariniana micrantha,Tauari vermelha,Lecythidaceae,360,50,413,460,180,0.39
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There are no missing values.

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Geodetic Datum
Amazonas (Manaus) - ZF3 Biological Dynamics of Forest Fragments Project (BDFFP) (Amazonas (Manaus))	-60.06400	-60.06400	-2.33300	-2.33300	World Geodetic System, 1984 (WGS-84)
Amazonas (Manaus) - ZF2 km 25 - INPA Forest Management Site (Amazonas (Manaus))	-61.00000	-61.00000	-2.00000	-2.00000	World Geodetic System, 1984 (WGS-84)

Time period:

- The data set covers the period 1997/01/01 to 1997/12/31.
- Temporal Resolution: single measurements

Platform/Sensor/Parameters measured include:

- LABORATORY/AMS (ACCELERATOR MASS SPECTROMETER /AGE DETERMINATIONS
- FIELD INVESTIGATION/HUMAN OBSERVER/FOREST COMPOSITION/STRUCTURE
- LABORATORY/AMS (ACCELERATOR MASS SPECTROMETER/RADIOCARBON

3. Data Application and Derivation:

The ages of tropical rain forest trees provide critical information for understanding the dynamics of tree populations, determining historical patterns of disturbance, developing sustainable forestry practices and calculating carbon cycling rates (Chambers et al., 1998). These data provide an estimate of the age of these trees when they were harvested in a logging operation.

4. Quality Assessment:

The main source of error is for trees less than about 350 years old, where errors can be as large as plus/minus 150 years. For trees older than 350 years, error in calendar age estimates are about 50 years.

5. Data Acquisition Materials and Methods:

Forty-four trees from 15 species were selected for radiocarbon dating from a logging operation (Mil Madeireira) near the city of Itacoatiara, about 250 km east of Manaus, Brazil. The logging operation is on 80,000 hectares of primary forest where they have identified sixty- five species as commercially

valuable. Our samples were either selected at the log yard where boles were stacked prior to processing or through use of a geographic information system that precisely located stumps from all harvested trees in 2.000 ha blocks. Trees were chosen according to size with approximately 100 cm the minimum base diameter. The centermost wood (first ring) from the base of the tree provides a date commensurate with the sapling stage of a tree. In all species samples, a ring structure was evident. Data were collected from the center-most region of the stumps. However, if a bole was hollow, samples were taken from either the upper end of the base section or if the hollow was continuous along the stem, from the periphery of the hollow at the base.

The samples were radiocarbon dated (14C) by Accelerator Mass Spectrometry (AMS) at Lawrence Livermore National Laboratory (for a review of AMS techniques, see Taylor et al, 1992). Age determined from radiocarbon dating is given as calendar age with 1997 as the tree harvest date. The accuracy of radiocarbon dating varies with the age of the organic material because atmospheric 14C concentrations respond to production rate changes caused by natural variation in cosmic radiation. There are fluctuations in the calibration curve of radiocarbon age versus true (calendar) age (Stuiver and Becker 1986). Because of these fluctuations, radiocarbon analysis can only unambiguously date organic material that is more than 350 years old. Radiocarbon dates on younger material typically correspond to several possible calibrated age ranges between 1650 and 1950 A.D., unless other evidence allows discrimination between these possibilities.

6. Data Access:

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:

Chambers, J. Q., N. Higuchi, and J. P. Schimel. 1998. Ancient trees in Amazonia. Nature 391:135-136. doi:10.1038/34325

Chambers, J. Q., T. Van Eldik, J. Southon, and N. Higuchi. 2001. Tree age structure in tropical forests of Central Amazonia. Pages 68-78 in R. O. J. Bierregaard, C. Gascon, T. E. Lovejoy, and R. C. G. Mesquita, editors. Lessons from Amazonia. Yale University Press, New Haven.

Stuiver, M.,Becker,B.,1986. High-Precision decadal calibration of the radiocarbon timescale, AD1950–2500BC. Radiocarbon 28(2B): 863–910.

Taylor, R.E., A. Long and R.S. Kra (eds.), Radiocarbon After Four Decades An Interdisciplinary Perspective (New York: Springer Verlag, 1992).