LBA-ECO LC-07 Lake Sediment Nutrient Data, Lago Calado, Brazil: 1982-1984

Summary:

This data set reports lake sediment texture and porosity, carbon (C), nitrogen (N), and phosphorus (P) content of surficial sediments, 210Pb-derived nutrient accumulation rates in sediments, and burial rates of C, N, and P in sediments at eleven locations in Lake Calado, Amazonas, Brazil. Field samples were collected between February 1982 and August 1984. There are eight comma-delimited ASCII data files with this data set.

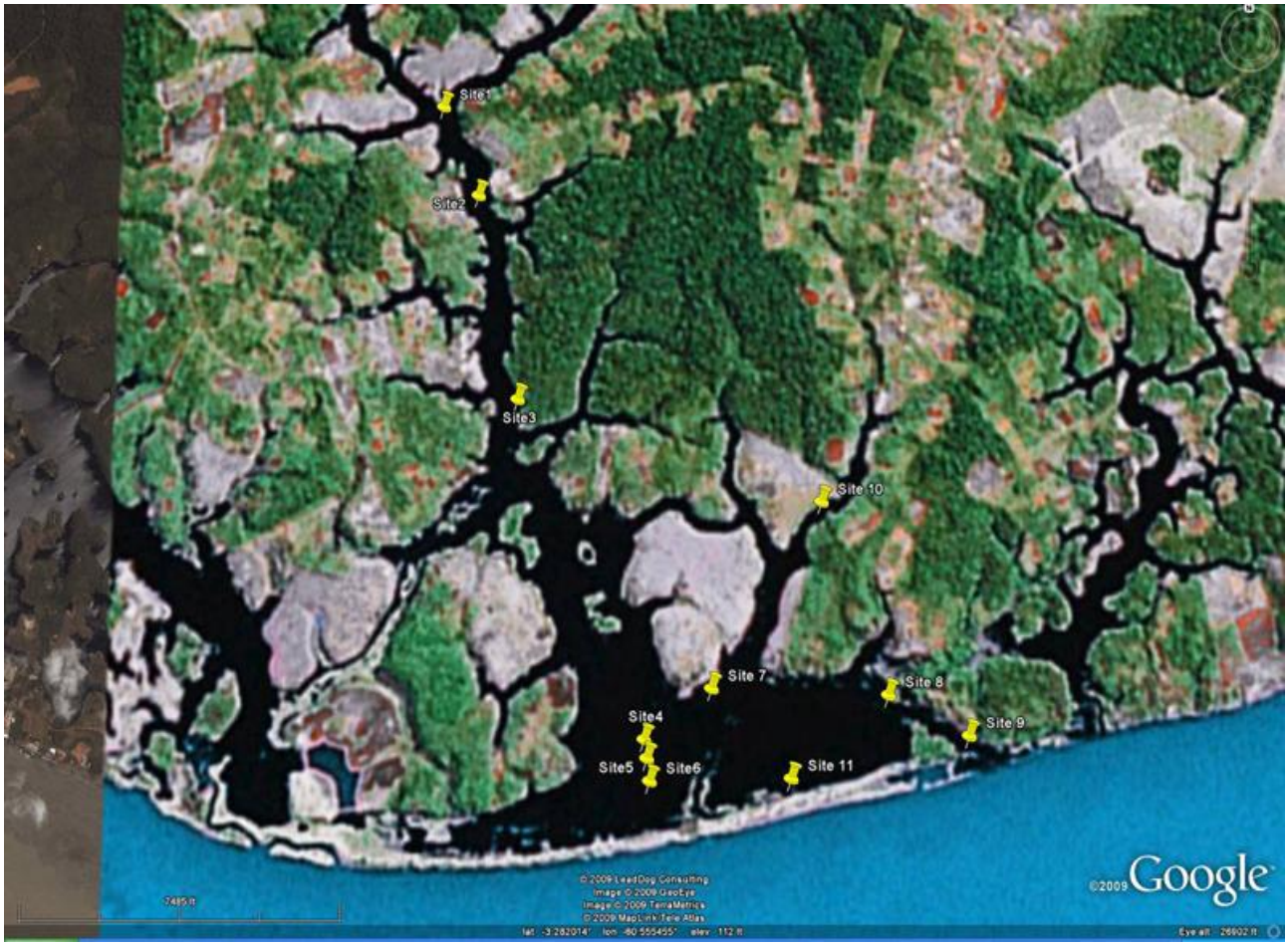

Figure 1. Map showing sampling site locations (yellow markers) in Lago Calado, Amazonas, Brazil. Site locations are derived from Figure 1 in Smith et al. (2003). Source: Google Earth.

Data Citation:

Cite this data set as follows:

Smith, L.K., J.M. Melack, and D.E. Hammond. 2011. LBA-ECO LC-07 Lake Sediment Nutrient Data, Lago Calado, Brazil: 1982-1984. 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/1050

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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.

Table of Contents:

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-07 (Melack / Novo / Forsberg)

The investigators were Melack, John M.; Smith, Lesley K.; and Hammond, Douglas E. You may contact Gastil-Buhl, M. (contact re: data) (gastil@lifesci.ucsb.edu) and Melack, John (contact re: science) (melack@lifesci.ucsb.edu).

LBA Data Set Inventory ID: LC07_Lake_Nutrient_Sediments

Sediment samples were collected from eleven locations in Lake Calado, a dendritic lake located on the floodplain of the central Amazon basin, adjacent to the north shore of the Solimoes River, east of the city of Manacapuru, Brazil between February 1982 and August 1984. Samples were analyzed to determine composition of the sediment, including percentage of sand, silt and clay; surface sediment porosity; carbon (C), nitrogen (N), and phosphorus (P) content of surficial sediments; 210Pb-derived nutrient accumulation rates; and burial rates of C, N, and P in sediments.

2. Data Characteristics:

Data were collected from 11 sites in Lake Calado, Manazonsa, Brazil, and there are 8 ASCII data files.

File 1. LC07_Lake_Nutrients_Site_Info.csv

This data file contains the coordinates and habitat information for the 11 sites.

Column	Heading	Units/format	Description
1	Site_number	numeric	Study sample sites: 1-11
2	Latitude	decimal degrees	Latitude in decimal degrees of study site. Negative indicating south
3	Longitude	decimal degrees	Longitude in decimal degrees of study site. Negative indicating west
4	Habitat	open water, streambed, or macrophyte	Habitat type. There are nine open water sites (=open) (sites 1-9), one stream bed site (=stream) (site 10), and one site where emergent floating aquatic macrophytes occur during the high water period (=macro) (site 11)
Fig. 1 is a map of Lake Calado located in Amazonas, Brazil. The numbers on the map indicate the sampling sites of the sediment survey.			
The site locations in this table were approximated using Figure 1 in Smith et al. (2003) and Google Earth, for the purpose of this archive, to describe the sites listed in the results tables. Approximate uncertainty is about 0.005 to 0.01 degrees.			
Lago Calado is located on the north shore of the Solimoes River, east of the city of Manacapuru, in Brazil. Site 1 is farthest from the Solimoes River.			

Example Data Record:

```
Site_number,Latitude,Longitude, Habitat
1,-3.269,-60.583,open water
2,-3.275,-60.58,open water
10,-3.295,-60.558,streambed
11,-3.312,-60.56,macrophyte
```

File 2. **Sediment_Texture.csv**

This file contains data on the percentage of sand, silt, and clay in 0-2 and 10-12 cm intervals of extruded soil cores, and surface porosity of samples collected in Lake Calado.

Column	Heading	Units/format	Description
1	Site	numeric	Study Site: 1,3,4 from Smith et al. (2003). See Figure 1 and Table 1 for site locations
2	Year	yyyy	Year sampled (1982, 1984). Month and day are not given
3	Soil_sample_interval	cm	Soil sample intervals sectioned from extruded cores: 0-2 centimeter interval, 10-12 centimeter interval
4	Pct_sand	%	The percentage of sand in the soil sample
5	Pct_sand_SD	%	Standard deviation of Pct_sand value
6	Pct_silt	%	The percentage of silt in the soil sample
7	Pct_silt_SD	%	Standard deviation of Pct_silt value
8	Pct_clay	%	The percentage of clay in the soil sample
9	Pct_clay_SD	%	Standard deviation of Pct_clay value
10	Porosity	%	Surface porosity in percent
11	Porosity_SD	%	Standard deviation of the porosity value
Standard deviations are based on the mean (n=2). Missing values are represented as -999. If no standard deviation is provided, only one measurement was made.			

Example Data Record:

Site,Year,Soil_sample_interval,Pct_sand,Pct_sand_SD,Pct_silt,Pct_silt_SD,Pct_clay,Pct_clay_SD,
Porosity,Porosity_SD
1,1982,0 to 2,-999,-999,-999,-999,-999,-999,0.952,-999
1,1982,10 to 12,-999,-999,-999,-999,-999,-999,0.952,-999
...
1,1984,0 to 2,9,-999,10,-999,81,-999,0.941,0.001... 4,1982,0 to 2,-999,-999,-999,-999,-999,-999,0.868,-999
4,1982,10 to 12,-999,-999,-999,-999,-999,-999,0.868,-999
4,1984,0 to 2,1,0,35,7,64,7,0.871,0.005
...

File 3. **Surface_Core_Nutrients.csv**

This file contains data on the surficial particulate carbon, nitrogen, and phosphorus content (mol/mg dry weight) in sediment cores collected in Lake Calado.

Column	Heading	Units/format	Description
1	Site	numeric	Study Site: 1,3,4 from Smith et al. (2003). See Figure 1 and Table 1 for site locations
2	Year	yyyy	Year sampled (1982, 1984). Month and day are not given
3	Carbon	mol/mg dry weight	Surficial particulate carbon content in sediment cores
4	Carbon_SD	mol/mg dry weight	Standard deviation of carbon value
5	Nitrogen	mol/mg dry weight	Surficial particulate nitrogen content in sediment cores
6	Nitrogen_SD	mol/mg dry weight	Standard deviation of nitrogen value
7	Phosphorus	mol/mg dry weight	Surficial particulate phosphorus content in sediment cores
8	Phosphorus_SD	mol/mg dry weight	Standard deviation of phosphorus value
Standard deviations are based on the mean (n=2). Missing values are represented as -999. If no standard deviation is provided, only one measurement was made.			

Example Data Record:

```
Site,Year,Carbon,Carbon_SD,Nitrogen,Nitrogen_SD,Phosphorus,Phosphorus_SD
1,1982,12.6,-999,0.84,-999,0.027,-999
1,1984,12.5,0.1,0.8,0.02,0.035,0.0003
3,1982,6.8,-999,0.59,-999,-0.03,-999
3,1984,6.7,0.2,0.57,0,0.034,0.0001 ...
```

File 4. **Surface_Nutrients.csv**

This file contains data on the carbon, nitrogen and phosphorus content (mol/mg dry weight) and molar C:N and N:P ratios of surficial sediments collected throughout L. Calado.

Column	Heading	Units/format	Description
1	Site	numeric	Study Site: 1-11 from Smith et al. (2003). See Figure 1 and Table 1 for site locations
2	Type	text	Habitat type where an EKMAN dredge was used to collect sediment samples. There are nine open water sites (=open) (sites 1-9), one stream bed site (=stream) (site 10), and one site where emergent floating aquatic macrophytes occur during the high water period (=macro) (site 11)
3	C	mol/mg dry weight	Carbon content in mol/mg dry weight
4	C_SD	mol/mg dry weight	Standard deviation of carbon value
5	N	mol/mg dry	Nitrogen content in mol/mg dry weight

		weight	
6	N_SD	mol/mg dry weight	Standard deviation of nitrogen value
7	P	mol/mg dry weight	Phosphorus content in mol/mg dry weight
8	P_SD	mol/mg dry weight	Standard deviation of phosphorus value
9	C_to_N_ratio	numeric	Ratio of carbon to nitrogen
10	C_to_N_ratio_SD	numeric	Standard deviation of carbon to nitrogen ratio
11	N_to_P_ratio	numeric	Ratio of nitrogen to phosphorus
12	N_to_P_ratio_SD	numeric	Standard deviation of nitrogen to phosphorus ratio
Standard deviations are based on the mean (n=2). Missing values are represented as -999. If no standard deviation is provided, only one measurement was made.			

Example Data Record:

```
Site,Type,C,C_SD,N,N_SD,P,P_SD,C_to_N_ratio,C_to_N_ratio_SD,N_to_P_ratio,N_to_P_ratio_S
D
1,open,13.40,0.69,0.743,0.057,0.0244,0.0160,18.0,0.9,30.4,2.3
2,open,13.00,0.28,0.879,0.007,0.0305,0.0011,14.8,0.3,28.8,0.2
3,open,6.68,0.11,0.571,0.030,0.0269,0.0007,11.7,0.2,21.2,1.1
...

10,stream,17.70,1.8,0.957,0.037,0.0304,0.0016,18.5,1.9,31.5,1.2
11,macro,9.68,0.12,0.557,0.107,0.0232,0.0008,17.4,0.2,24.0,4.6
```

File 5. **Seston_Nutrients.csv**

This file contains data on the epilimnetic seston composition (microM) during the stratified period in Lake Calado. The values represent the mean of two samples collected at the sub-surface and above the hypolimnion. See Data File #8 LC07_Lake_Nutrients_Site_Info.csv for coordinates of study site locations.

Column	Heading	Units/format	Description
1	Site	numeric	Study Site: 1,3,4 from Smith et al. (2003). See Figure 1 and Table 1 for site locations
2	Month	text	Month of year (mmm); year not specified
3	Carbon	micro Molar	Epilimnetic seston composition: Carbon
4	Nitrogen	micro Molar	Epilimnetic seston composition: Nitrogen
5	C_to_N_ratio	numeric	Ratio of carbon to nitrogen
No missing values			

Example Data Record:

```
Site,Month,Carbon,Nitrogen,C_to_N_ratio
1,Feb,44.6,5.4,8.3
1,Mar,61.6,8.7,7.2
...
4,Jul,73.8,8.3,9
4,Aug,61.6,7.6,7.6
```

File 6. **Sediment_210Pb.csv**

This file contains a summary of 210Pb data for cores collected at Lake Calado.

Column	Heading	Units/format	Description
1	Site	numeric	Study Site: 1,3,4 from Smith et al. (2003). See Figure 1 and Table 1 for site locations
2	Year	yyyy	Year sampled. Month and day are not specified
3	Interval	cm	Interval of the sediment core; Where marked with "a" = used for isotope 226 Ra composite; Where marked with "b" or not marked = not used for isotope 226 Ra composite
4	Cumulative_density	g/square_cm (g/cm^2)	Cumulative_density of 210 lead isotope
5	Total_210Pb	dpm/g	Total 210 isotope lead, as measured by disintegrations per minute (dpm)/gram
6	Uncertainty	dpm/g	Uncertainty (plus or minus)
Notes: Sediment interval samples with "a" were used for isotope 226Ra composite. Where marked with "b" or not marked, the sample was not used for isotope 226Ra composite. 226Ra analysis was used to indicate the background level of radium and estimate supported 210Pb (See description of File 6 in guide document).			

Example Data Record:

```
Site,Year,Interval,Cumulative_density,Total_210Pb,Uncertainty
1,1982,2-3b,0.25,32.8,1.4
1,1982,3-4a,0.36,29.0,1.0
...
3,1982,1-2a,0.13,30.6,1.2
3,1982,2-3a,0.24,33.3,1.0
...
4,1984,14-16,5.84,7.8,0.4
4,1984,18-20a,8.16,5.7,0.3
```

File 7. **Sediment_Accumulation.csv**

This file contains measurements of 210Pb from cores collected in Lake Calado.

Definitions
210Pb: lead isotope 210
226Ra: radium isotope 226; the background level of radium used to estimate supported 210Pb
Excess 210Pb: The quantity of unsupported 210Pb within the surficial sediments is called the excess 210Pb
Pb_Flux: The flux of 210Pb at the sediment-water interface (dpm/square_cm/year)
CIC: A model to derive accumulation rates of total dry weight (Appleby and Oldfield, 1983)
CRS: A model to derive accumulation rates of total dry weight (Appleby and Oldfield, 1983)
dpm: disintegrations per minute, the decay rate of the radio isotope

Column	Heading	Units/format	Description
1	Site	numeric	Study Site: 1,3,4 from Smith et al. (2003). See Figure 1 and Table 1 for site locations
2	Year	yyyy	Year sampled. Month and day are not specified
3	Ra_bkg_rate	dpm/g	Background level of radium used to estimate supported ^{210}Pb (Radon background rate)
4	Excess_Pb_rate	dpm/g	Excess 210Pb is the quantity of unsupported 210Pb within the surficial sediments (Radon-unsupported lead rate)
5	Excess_Pb_rate_SD	dpm/g	Excess 210Pb uncertainty in plus or minus standard deviation
6	Acc_rate_CIC	mg/square_cm/yr	Accumulation rate of total dry weight, derived from CIS model
7	Acc_rate_CIC_SD	mg/square_cm/yr	Uncertainty of value in column 6, in plus or minus standard deviation
8	Acc_rate_CRS	mg/square_cm/yr	Accumulation rate of total dry weight, derived from CRS model
9	Acc_rate_CRS_SD	mg/square_cm/yr	Uncertainty of value in column 8. Fitting uncertainties were all <10%; an uncertainty of 20% is assigned for each profile and 14% for the mean. (Means are omitted from archive)
10	Pb_Flux_CIC	dpm/square_cm/yr	Flux of 210Pb at the sediment-water interface, from CIC model
11	Pb_Flux_CIC_SD	dpm/square_cm/yr	Uncertainty of value in column 10
12	Pb_Flux_CRS	dpm/square_cm/yr	Flux of 210Pb at the sediment-water interface, from CRS model (no uncertainty provided). The uncertainty of integrating an individual profile was estimated to be 15%.

Notes: 226Ra indicates the background level of radium used to estimate supported 210Pb. Excess 210Pb is the quantity of unsupported 210Pb within the surficial sediments.
Accumulation rates of total dry weight (mg/square_cm/yr), which were derived from two models (CIC and CRS; Appleby and Oldfield, 1983), are also compared.
Uncertainties were calculated as mean standard error for each profile/sample size (n) and are provided as plus-or-minus 1 standard deviation, unless otherwise indicated (Smith et al., 2003, Table 5).

Example Data Record:

```
Site,Year,Ra_bkg_rate,Excess_Pb_rate,Excess_Pb_rate_SD,Acc_rate_CIC,Acc_rate_CIC_SD,Acc
_rate_CRS,
Acc_rate_CRS_SD,Pb_Flux_CIC,Pb_Flux_CIC_SD,Pb_Flux_CRS
1,1982,10.9,24,1,40,3,45,9,
0.97,0.08,1
1,1984,13.6,19.4,1.7,62,15,37,8,
1.21,0.3,0.69
3,1982,9.4,21.7,1.6,211,54,75,15,
4.58,1.22,2.64
3,1984,15.2,24.6,0.8,97,9,92,18,
2.39,0.24,2.3
...
```

File 8. **Nutrient_Burial_Rates.csv**

This file contains data on the burial rates of carbon, nitrogen, and phosphorus (mmol/square_cm/yr) for Lake Calado from Table 6 (Smith et al., 2003). Burial rates of carbon, nitrogen, and phosphorus across the 25 cm horizon were calculated as the product of the elemental content in the sediments between 20 and 30 cm and the sediment accumulation rate derived from the CRS model.

Column	Heading	Units/format	Description
1	Site	numeric	Study Site: 1,3,4 from Smith et al. (2003). See Figure 1 and Table 1 for site locations
2	Year	yyyy	Year sampled. Month and day are not specified
3	Carbon	mmol/square_cm/yr	Burial rate of carbon
4	Carbon_SD	mmol/square_cm/yr	Standard deviation of carbon value
5	Nitrogen	mmol/square_cm/yr	Burial rate of nitrogen
6	Nitrogen_SD	mmol/square_cm/yr	Standard deviation of nitrogen value
7	Phosphorus	mmol/square_cm/yr	Burial rate of phosphorus
8	Phosphorus_SD	mmol/square_cm/yr	Standard deviation of phosphorus value
Notes: Errors for individual cores were calculated as: SD = (AX)0.5 (Bevington, 1969), where A = (SQ)2 and X = [(sds)2 /S2] + [(sdq)2 /Q2]; SD is the standard deviation of the burial rates; S is the sediment accumulation rate (CRS model, Table 5);			

Q is the quantity of C, N, or P in the surficial sediments, sds is the standard deviation of the sediment accumulation rate (S), and sdq is the standard deviation of the quantity of C, N, or P in the surficial sediments (Q).
Notes: Table 6 in Smith et al. (2003) also provides 2-yr mean values for each site.

Example Data Record:

```
Site,Year,Carbon,Carbon_SD,Nitrogen,Nitrogen_SD,Phosphorus,Phosphorus_SD
1,1982,0.58,0.12,0.036,0.008,0.0011,0.0006
..
3,1982,0.41,0.09,0.035,0.009,0.0012,0.0006
...
4,1984,0.09,0.02,0.009,0.002,0.0021,0.0004
```

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Geodetic Datum
Lago Calado (Amazonas (Manaus)	-60.593	-60.554	-3.254	-3.319	World Geodetic System, 1984 (WGS-84)

Table 1. Coordinates and habitat information for the sample sites.

This table contains the coordinates and habitat information for the 11 sample sites. See data file 1.

Latitude and Longitude are given in decimal degrees with negative meaning these are south and west. Approximate uncertainty is about 0.005 to 0.01 degrees.

Site number	Latitude	Longitude	Habitat
1	-3.269	-60.583	open water
2	-3.275	-60.58	open water
3	-3.288	-60.578	open water
4	-3.309	-60.57	open water
5	-3.31	-60.57	open water
6	-3.312	-60.569	open water
7	-3.303	-60.565	open water
8	-3.307	-60.554	open water
9	-3.31	-60.548	open water
11	-3.312	-60.56	macrophyte

Time period:

- The data set covers the period 1982/02/01 to 1984/08/31
- Temporal Resolution: monthly

Platform/Sensor/Parameters measured include:

- LABORATORY / CHN ANALYZER / NUTRIENTS
- LABORATORY / SPECTROMETER / ISOTOPES
- FIELD INVESTIGATION / SEDIMENT CORERS / SEDIMENT COMPOSITION
- FIELD INVESTIGATION / DREDGING DEVICES / SEDIMENTS

3. Data Application and Derivation:

The results were derived from sediment cores collected from Lake Calado in 1982 and 1984. A significant positive, linear relationship was found between the distance from the river and the C, N and P content of the sediments ($r^2 = 0.93$, $r^2 = 0.92$, $p<0.001$ for C and N, respectively, and $r^2 = 0.64$, $p<0.05$ for P), indicative of high organic matter content on the floodplain and a greater proportion of clay near the river. Average sediment accumulation rates derived from two cores collected from each of three stations ranged from 41 to 117 mg/cm^2/yr. Lake-wide, annual burial rates are estimated to be 3.5 mol C/m^2, 0.28 mol N/m^2, and 0.016 mol P/m^2.

Sampling program included major habitats within the lake which are representative of the central Amazon floodplain. The findings are a necessary component of mass balance analyses of carbon and nutrients for the Amazon floodplain and to evaluations of how land use changes may influence sedimentation rates on the floodplains. Results from this work have been used by others (e.g., Engle et al., 2008).

4. Quality Assessment:

Quality assessment for all reported values are shown in the data files.

File 1. LC07_Lake_Nutrients_Site_Info.csv: Latitude and Longitude are given in decimal degrees. Approximate uncertainty is about 0.005 to 0.01 degrees.

File 2. Sediment_Texture.csv: The percentage of sand, silt, and clay in the 0-2 and 10-12 cm intervals, and surface porosity in sediment cores collected in Lake Calado. Standard deviations are based on the mean (n=2). If no standard deviation is provided, only one measurement was made.

File 3. Surface_Core_Nutrients.csv: Surficial particulate carbon, nitrogen, and phosphorus content (mol mg-1dry weight) in sediment cores collected in Lake Calado. Standard deviations are based on the mean (n=2). If no standard deviation is provided, only one measurement was made.

File 4. Surface_Nutrients.csv: Carbon, nitrogen and phosphorus content (mol mg-1dry weight) and molar C:N and N:P ratios of surficial sediments collected throughout L. Calado. Standard deviations are based on the mean (n=2). If no standard deviation is provided, only one measurement was made.

File 5. Seston_Nutrients.csv: Epilimnetic seston composition (microM) during the stratified period in Lake Calado. The values represent the mean of two samples collected at the sub-surface and above the hypolimnion. No uncertainty values are given.

File 6. Sediment_210Pb.csv: Summary of 210Pb data for cores collected at Lake Calado. The + or - uncertainty values are given in column six.

File 7. Sediment_Accumulation.csv: Measurements of 210Pb from cores collected in Lake Calado. Uncertainties were calculated as mean standard error for each profile/sample size (n) and are provided as plus-or-minus 1 standard deviation, unless otherwise indicated.

File 8. Nutrient_Burial_Rates.csv: Burial rates of carbon, nitrogen and phosphorus for Lake Calado. Errors for individual cores were calculated as: SD = (AX)0.5 (Bevington, 1969), where A = (SQ)2 and X = [(sds)2 /S2] + [(sdq)2 /Q2]; SD is the standard deviation of the burial rates; S is the sediment accumulation rate (CRS model, Table 5); Q is the quantity of C, N, or P in the surficial sediments, sds is the standard deviation of the sediment accumulation rate (S), and sdq is the standard deviation of the quantity of C, N, or P in the surficial sediments (Q).

5. Data Acquisition Materials and Methods:

Site Information

Samples were collected from Lake Calado, situated on the north bank of the Solimoes River about 80 km west of the confluence of the Solimoes and Negro Rivers at -3.08333 S, -60.56667 W. Lake Calado is a narrow, dendritic lake, and its shape is suggestive of a drowned-river valley. Its main axis runs in a north to south orientation perpendicular to the Solimoes River. The lake's maximum depth and surface area fluctuate between 1-12 m and 2-8 km^2 and are controlled by the annual rise and fall of the Solimoes River. Once the lake reaches a depth of 3-5 m, its water-column thermally stratifies, but stratification does not persist until the lake reaches a depth of 6 m. At depths of 7 m or greater, the hypolimnion remains anoxic for extended periods of time.

Lake Calado's geomorphology and local catchment influence the depositional environments and particulate inputs. To the north, L. Calado is narrow and is fed by small streams. Inputs are dominated by the flooded forest growing along the shores and clearwater streams draining upland forest. To the south, the lake widens and forms a basin parallel to the levee separating the lake from the river. Inputs are dominated by the suspended load of the Solimoes River, which annually spills into the lake through the connecting channel or occasionally over the levee (about once every 10 years. In this portion of the lake, approximately 25 to 50 % of the area is covered by floating emergent macrophytes during the rising and high water periods. The middle section of the lake is intermediate along the continuum from stream to floodplain geomorphology. A number of streams enter this portion of the lake, and the influence of the Solimoes River is sometimes detected. Floating emergent macrophytes and flooded forests occur. During the high water period, the waters of a neighboring lake (L. Miriti) drain into this middle reach from the west through a macrophyte and shrub filled channel.

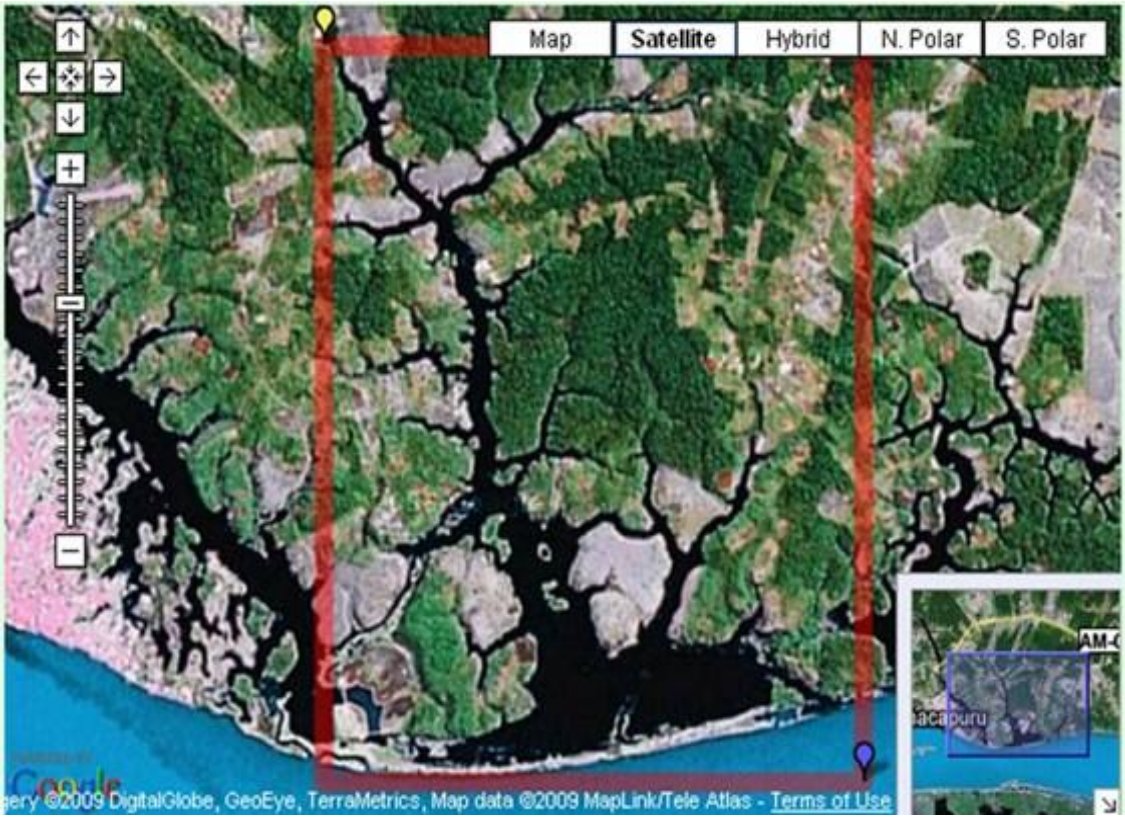

Figure 2. Lago Calado Google Map Bounding Box showing study area. Source: Google Earth.

Sediment Collection

An EKMAN dredge was used to collect sediments from eleven stations throughout Lake Calado (Figure 1): nine open water sites (sites 1-9), one stream site (site 10), and one site where emergent floating aquatic macrophytes occur during the high water period (site 11). Two separate casts were made per site, and a sub-sample of the top (approximately 2 cm) of material was collected in screw-top, glass bottles. These samples were returned to the University of California, Santa Barbara, and analyzed for carbon, nitrogen and phosphorus as described below.

One sediment core per site was collected in March 1982, and in February 1984, from three stations (1, 3, 4) located along the north to south axis of the lake (Figure 1). The 1982 cores were collected with a piston corer (inside diameter of 3.8 cm) inserted into the sediments with rods from the surface. The 1984 cores were collected with a coring device consisting of polyvinylchloride plastic pipe (inside diameter of 10 cm) and a one-way valve. The overlying water within both corers was clear, indicating that the cores collected were undisturbed. After collection, the cores were processed immediately at a floating laboratory anchored in the middle of the southern portion of the lake. The 1982 cores were extruded and sectioned at 1 cm intervals, and the 1984 cores were extruded and sectioned at 1 cm intervals near the top and at 2 cm intervals elsewhere. The samples were analyzed for percentage of sand, silt, and clay in 0-2 and 10-12 cm intervals, surface porosity, and surficial particulate carbon, nitrogen, and phosphorus content in sediment cores.

Analyses

The water and solid masses were determined by weighing aliquots of wet sediment before and after drying at 80 degrees C. Only the central portion of each section was used for analyses. The sediment porosity (Ø) values were obtained using the relationship:

$$Ø = M_w[M_w + (M_s/S)]^{-1}$$

where Mw and Ms are the masses of water and solids (g), respectively; and S is the specific gravity of dry solids (2.2).

The carbon and nitrogen content in the dried sediment samples was determined with a PERKIN-ELMER CHN analyzer. Phosphorus was measured by digestion in 1 N HCl after ignition for 1 hour at 550 degrees C, followed by spectrophotometric determination of orthophosphate. The method of Folk (1969) was used to determine the sand, silt and clay fractions of the 0-2 cm and 10-12 cm intervals. The sediment samples were dispersed with a 5 grams per liter solution of Calgon and sieved through a 64 micron sieve. The proportion remaining in the sieve was considered the sand fraction. The silt (5-63 micron) and clay (<5 micron) fractions were determined by pipette analysis based on settling time.

The determination of 210Po was based on the measurement of 210Po, the 210Pb granddaughter that is assumed to be in secular equilibrium with its grandparent. This assumption should be satisfactory because both isotopes should have low solubility in these low salinity waters, and because several months elapsed between sample collection and analysis. The analysis followed procedures outlined in Fuller (1982). Dried sediment (0.2-1.0 g) and a spike of 5-20 dpm of 208Po were placed in a Teflon beaker. Solid phases were totally dissolved by sequential leaching with concentrated hydrochloric, nitric plus perchloric, and hydrofluoric acids. After the sample was dissolved, it was dried, and the residue was dissolved in 1 N HCl. Ascorbic acid was added to complex iron, and polonium isotopes were spontaneously electroplated onto a silver disk. Activity on the disk was counted in an alpha spectrometer to measure the ratio of 210Po to 208Po. Solutions remaining after plating were stored, and selected samples were combined for analysis of 226Ra, measured by in-growth of 222Rn and alpha scintillation procedures.

Mass accumulation rates were calculated from excess 210Pb and cumulative density data; the latter was calculated as the integral of dry density versus depth. Two methods were used to calculate accumulation rates (CIC, the constant initial concentration model, and CRS, the constant rate of supply model; Appleby and Oldfield, 1983). At least one composite sample from sites 1, 3, and 4 consisting of 3 or more depth intervals was analyzed for 226Ra in each core to estimate the supported 210Pb activity (i.e., the quantity of 210Pb activity derived from the disintegration of the 226Ra within the sediments). Excess 210Pb was calculated as the difference between measured 210Pb (total 210Pb) and average 226Ra.

Burial rates of carbon, nitrogen and phosphorus across the 25 cm horizon were calculated as the product of the elemental content in the sediments between 20 and 30 cm and the sediment accumulation rate derived from the CRS model.

The elemental composition of seston located within the epilimnion was determined on a monthly basis during the period of thermal stratification (February-August 1984). One-liter water samples were collected with a VAN DORN sampler at the sub-surface and above the hypolimnion, filtered in duplicate onto tarred pre-combusted 45 mm GELMAN AE glass-fiber filters and dried at 80 degrees C.

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

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