LBA-ECO ND-08 Soil Respiration, Soil Fractions, Carbon and Nitrogen, Para, Brazil

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Revision date: October 3, 2014

Summary:

This data set provides (1) carbon (C) and nitrogen (N) concentration measurements of two soil aggregate fractions (250-2000 micon, small macro-aggregates (SMAG)), and (53-250 micron (micro-aggregates (mico)) and (2) in situ soil respiration measurements (January-March 2003) on sand and clay soils from a Eucalyptus plantation and an adjacent primary forest. The soils for fractionation were sampled in July 2001 from 0-20 cm and 30-50 cm depths. The research site was on the property of Jari Celulose, Monte Dourado, Para, Brazil.

There are two files with this data set in comma-delimited (.csv) format.

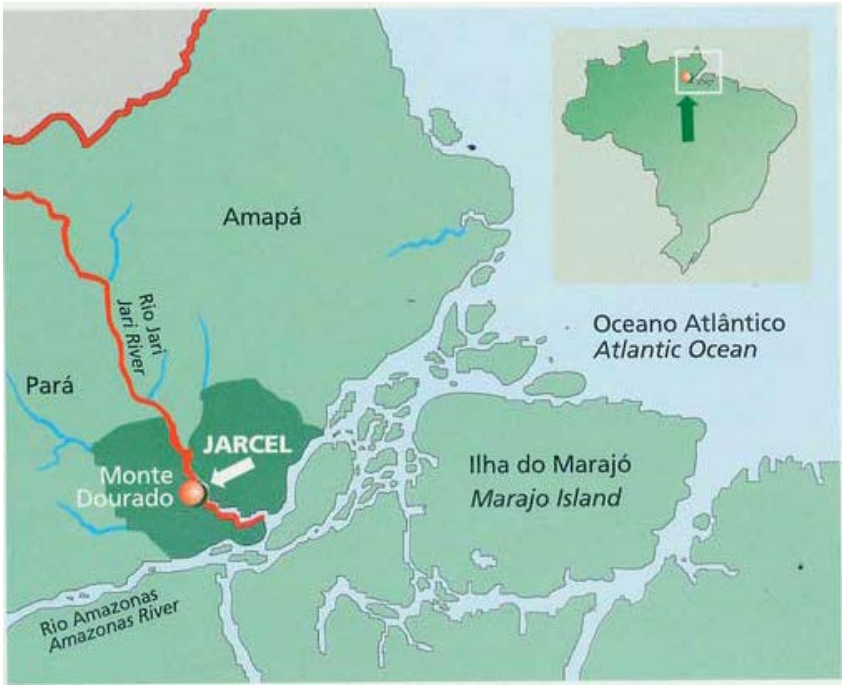

Figure 1. Map indicating the Jari Research site (Beldini et al., Manuscript).

Data Citation:

Cite this data set as follows:

Beldini, T.P., and K. McNabb. 2014. LBA-ECO ND-08 Soil Respiration, Soil Fractions, Carbon and Nitrogen, Para, Brazil. 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/1250

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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: Nutrient Dynamics

Team ID: ND-04 (McNabb /Costa)

The investigators were Ken Mcnabb and Troy Beldini. Contact: McNabb, Ken (mcnabb@auburn.edu).

LBA Data Set Inventory ID: ND08_Soil_Resp_Fractions

This data set provides (1) carbon (C) and nitrogen (N) concentration measurements of two soil aggregate fractions (250-2000 micon, small macro-aggregates (SMAG)), and (53-250 micron (micro-aggregates (mico)) and (2) in situ soil respiration measurements (January-March 2003) on sand and clay soils from a Eucalyptus plantation and an adjacent primary forest. The soils for fractionation were sampled in July 2001 from 0-20 cm and 30-50 cm depths. The research site was on the property of Jari Celulose, Monte Dourado, Para, Brazil.

2. Data Characteristics:

There are two data files with this data set in comma-delimited (.csv) format. The soils for the C and N measurements were sampled from 0-20 cm and 30-50 cm depth from a natural forest and plantation sites.

1. **ND08_Soil_particles.csv:** Soil aggregate class C and N concentrations, C content, and percent mass.

2. **ND08_Soil_respiration.csv:** Soil respiration as g CO2 per m2 per day.

File 1. **ND08_Soil_particles.csv**

Column	Column Heading	Units/format	Description
1	Soil_type		Samples were collected from two soil types: a clayey Oxisol indicated by CLAY and a sandy Ultisol indicated by SAND
2	Forest_type		Samples were collected from plots in both plantations and native forest indicated by Plantation and Natural respectively.
3	Depth		Two sampling depths were studied: surface represents the 0 to 20-cm soil layer and depth the 30 to 50-cm soil

			layer
4	Aggregate_class		Aggregates were classified by size. The two size classes presented are small macroaggregates (SMAG) defined as between 250 and 2,000 microns in diameter and microaggregates (micro) defined as between 53 and 250 microns in diameter
5	Particle_class		Aggregates were broken up by sonication and then the SMAG component particles were sonicated, seived and separated into classes
6	Soil_mass_percent	percent	Percent of the original SMAG or micro fraction total mass in each particle class (resulting from an initial 100 g dry weight soil sample)
7	Conc_C	percent	Calculated concentration of carbon reported in percent based on the oven-dry mass of that fraction and its carbon concentration
8	Conc_N	percent	Calculated concentration of nitrogen reported in percent based on the oven-dry mass of that fraction and its nitrogen concentration
9	C_content	mg	Carbon content in SMAG and microaggregates derived by summing the carbon content in the particle size fractions from SMAG and microaggregates, reported in milligrams C per 100 g soils.
10	N_content	mg	Calculated nitrogen pool in the particle class reported in milligrams. Method used was the same as for carbon in the previous column

Example data records

```
Soil_type,Forest_type,Depth,Aggregate_class,Particle_class,Soil_mass_percent,Conc_C,Conc_N,C_content,N_content
CLAY,Natural,surface,small macro,Sand,80.24,2.49,0.15,0.4751,0.0286
CLAY,Natural,surface,small macro,Silt,11.86,2.5,0.24,0.0705,0.0069
...
CLAY,Plantation,depth,micro,Clay,4.95,1.19,0.17,0.0067,0.0007
CLAY,Plantation,surface,small macro,Sand,92.52,3.36,0.34,1.0765,0.1103
...
Sand,Plantation,micro,Silt,depth,4.82,6.36,1.00E-02,0.0265,0
Sand,Plantation,micro,Clay,depth,2.12,5.13,0,0.0094,0
```

File 2. **ND08_Soil_respiration.csv**

Column	Column Heading	Description
1	Texture	Soil texture: Clay or Sand
2	Forest	Forest: D=within the lines of trees on the Eucalyptus plantation, E=between the lines of trees on the Eucalyptus plantation, and N=natural forest
3	Respiration	Soil respiration as g CO2 per m2 per day

Example data records

```
Texture,Forest,Respiration
Clay,D,13.31,
Clay,D,17.39,
Clay,D,14.64,
...
sand,E,18.36,
sand,E,19.63
...
sand,N,23.26
sand,N,14.97
```

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Para Eastern ((Belem) (Jari Celulose))	-52.550000	-52.550000	-0.86000	-0.86000

Time period:

- The data set covers the period 2001/07/01 to 2003/03/31.
- Temporal Resolution: one time

Platform/Sensor/Parameters measured include:

- LABORATORY / CHN ANALYZER / NITROGEN
- LABORATORY / CHN ANALYZER / CARBON
- LABORATORY / WEIGHING BALANCE / SOIL RESPIRATION

3. Data Application and Derivation:

The data could be used to assess the effects of soil disturbance on tropical tree plantations.

4. Quality Assessment:

None provided.

5. Data Acquisition Materials and Methods:

Site Description:

This project was conducted on the property of Jari Celulose, Monte Dourado, Para, Brazil where 55,000 ha of Eucalyptus spp. (Jari, 2009) are harvested on approximately 6 year rotations to produce bleached kraft pulp for international and domestic sales (McNabb and Wadauski, 1999). The regions climate is classified as hot and humid in the Koppen system. The annual rainfall average is 2,115 mm, with a dry season from September to November. The natural vegetation is tropical ombrophilous lowland forest (UNESCO, 1973).

The initial clearing of native forest for plantations began in 1968. Soils from a plantation (E. grandis x E. urophylla) and an adjacent (< 5 m) primary forest area were investigated. Each site was converted from native forest using slash-and-burn methods, in 1971 for the sandy site and 1988 for the clay one. Within each site, relief, slope, soil parent material and texture were uniform. Soil consisted of macro aggregates (> 250 um diameter) and micro-aggregates (<250 u, diameter).

Soil mass and moisture

Eight sample plots of 100-m2 (10-m by 10-m) were established, four in the plantation and four in the natural forest. Soil samples were taken from four randomly selected locations within each plot during July 2001. Sampling was done using a bucket auger. Soil samples were collected at 0-20 and 30-50 cm depths and bulked across samples within a plot. A 2-kg composite sample was taken from each depth after thorough mixing in the field. After sampling, soil samples for all analyses were immediately transported to the laboratory and sub-samples of all soils were dried at 105 degrees C (Beldini et al., 2009).

The soil samples were stored in sealed plastic bags at 4 degrees C and analyzed within two weeks of field sampling. Aggregate size classes were isolated according to the protocol described by Cambardella and Elliot (1994). The entire field-moist soil sample was passed through a 2.8-mm sieve and then a sub-sample was taken to determine the gravimetric moisture content. The soil moisture content of each soil sample used in the fractionation procedure was adjusted to a common level following Elliott & Cambardella (1991).

The initial 100-g oven-dry equivalent sample used in the wet-sieving procedure was capillary-wetted overnight at 4 degrees C while resting on pre-rinsed Whatman filter paper to bring the sample to field capacity. Following capillary wetting, the sample was gently immersed in 500 mL of deionized water and placed on the sieving apparatus. The sample was then wet-sieved through a series of three nested sieves to obtain two aggregate fractions: (1) 250-2000 micons (small macro-aggregates (SMAG)), and (2) 53-250 microns (micro-aggregates (mico)). The sieving apparatus was a RoTap model RX-29 (W.S Tyler, Salisbury, NC, USA) without the tapping action of the hammer arm. The sieving cycle was 2 min, with a water flow rate of 1,750 mL per min. Each of the fractions was dried overnight at 50 degrees C and weighed.

Soil C and N

C and N in aggregates were determined through dry combustion analysis on a Perkin-Elmer 2400 series II CHNS/O analyser (Perkin-Elmer, Norwalk, CT, USA). The mass of the aggregate fraction is the percent of dry soil from an oven-dry equivalent of 100 g of field-moist soil. C and N contents were calculated based on the oven-dry equivalent mass of the aggregate fraction and its C or N concentration, and aggregate masses were corrected for sand content as described by Elliott et al. (1991).

Soil respiration

The inverted-bucket procedure as outlined in Anderson and Ingram (1992) was used for field sampling. Sample chambers were plastic buckets with diameters of 27 cm and heights of 21.5 cm covering a 572 cm2 area of the forest floor. Soil tins with a 7 cm inside diameter were used to hold the soda lime. As recommended by Edwards (1982), 34.35 g of 6-12 mesh soda lime was used. In order to test the effect of different amounts of soda lime on the

quantity of CO2 adsorbed, soil tins with 1.5 and 2 times the 34.35 g were placed in the field each day along with tins with just 34.35g of soda lime. Subsequent analysis yielded no significant difference for CO2 adsorption between the different amounts of soda lime (Beldini et al., Manuscript).

Sampling points were chosen randomly using the center of the plot as the beginning point of reference. The litter layer and any growing vegetation were gently scraped away from the sample point leaving the bare mineral soil surface in which the cut bucket top (hereafter referred to as the bucket collar) was embedded. The bucket collar was placed 2-3 cm into the soil about two weeks before sampling with soda lime began. These sampling points were used throughout the duration of the study (Beldini et al., Manuscript).

A small, 3-legged plastic stand was placed in the center of the sampling area inside the bucket collar to act as a support on which to place the soil tin with the soda lime. All buckets were covered with aluminum foil to prevent any bias introduced by differing amounts of incident solar radiation upon the buckets associated with variable bucket colors. Each forest type within a soil texture had two sampling points in each block for a total of 8 sampling points. Thus there were 16 sampling points on the sandy soil and 16 on the clay soil. About 100 samples were taken in each forest type x soil texture combination at irregular intervals between January 22, 2003 and March 11, 2003, for a total of 406 samples. At the laboratory of Jari Celulose, soda lime samples were taken from a 100 degrees C oven, allowed to cool in a desiccator, then weighed on a scale accurate to four decimal places. The soil tins were tightly closed and Teflon tape or Parafilm was affixed around the lid to further secure the sample from extraneous CO2 absorption. Pre-sampling experimentation with and without the extra covering on the soil tins showed that without the covering an average of 0.7 g of CO2 was absorbed during a 24-hour period, but with the extra covering absorption was negligible, i.e., ≤10-4 gram increase in mass. The soil tins with dried soda lime were taken to the field, placed under the buckets and left for 24 hours. A control sample was placed in its own bucket (one per day in each forest type/texture combination) to account for the exposure time of the samples to the open air during sample placement and retrieval. At the end of 24 hours the samples were retrieved and fresh samples were left in their place. After carefully capping upon retrieval in the field, the soil tins were brought back to the laboratory and oven-dried in a 100 degrees C oven for 24 hours after which samples were removed, cooled, and weighed. Sample weight gain was taken to be CO2 absorbed, after subtraction of the control (Beldini et al., Manuscript). The correction factor used to compensate for the water formed during the chemical absorption of CO2 by soda lime was 1.69 (Grogan 1998). Weight gain of the samples over the course of the sampling period was monitored and soda lime was discarded and replaced accordingly, as recommended in Anderson and and Edwards (1982).

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:

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