219 - SOIL CARBON STOCKS AND DYNAMICS IN ACRE: CONTRASTS WITH THE REMAINING BRAZILIAN AMAZON

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INTRODUCTION

Soils are an important reservoir of carbon. It is considered that the first meter deep of the planet's soils stores from 1300 to 2000 Pg C (1 Pg = 10^{15} g). Tropical soils store 506 Pg C, of these, around 66 Pg C are in the soils of the Amazon and 47 Pg C in Brazilian legal Amazon. The State of Acre is located in the extreme west of Brazil, occupying an area that had great geological influence from the mountain chain of Andes. The soils present pedologic characteristics very different from the ones found in the remaining of Brazilian Amazon, prevailing Inceptisols, Alfisols, and Ultisols, generally eutrophic, young and little weathered, in some cases presents argilas 2:1. Not much is known about the impact of the use of the earth on the organic matter in these soil conditions.

OBJECTIVES

This work had as objectives:

- Estimate the stock of carbon of the main classes of soils of the State of Acre and to compare with studies carried out for the Amazon area.
- To evaluate the effect of the change in the use and covering of the earth on the stock of carbon and isotopic composition of the organic matter in two soil conditions in Acre.

METHODS

To reach the objectives the work was performed in two scales, regional and local. The first case estimated the stocks of carbon up to one meter deep, using a map of soils in the scale 1:1.000.000 and analytic data of pedologic profiles accomplished in the area (Figure 1). The second case determined the concentration of carbon, δ13C and density of the soil of samples collected at 12-15, 20 year-old pasture lands, and forest in the depths 0-5, 5-10, 10-20, 20-30, 30-40, 50-60, 70-80 and 90-100 cm, in Ultisols (well drained) and Alfisols (poorly drained) (Figure 2).

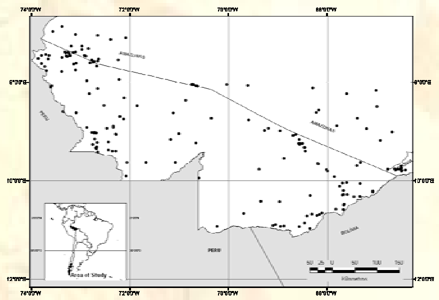

Figure 1 – Location of 182 profiles used to estimate soil carbon stock in the State of Acre.

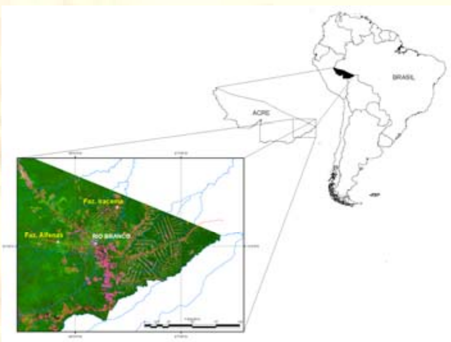

Figure 2 – Geographic location of studied areas where was the effect of changing land use/cover over the stock and the isotopic composition of soil carbon.

RESULTS

Figures 3 and 4, and table 1 show results from estimates of soil carbon stocks in the main soil s of the State of Acre.

Figures 5, 6 and 7 show the results of evaluations on the stocks of carbon isotopic composition in soils of pasture and primary forest in two farms in the East of the State of Acre.

Estimates of soil carbon stocks in the main soils of the Acre

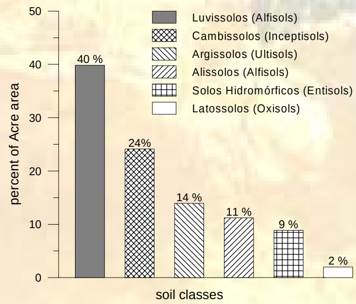

Figure 3 – Relative distribution of 6 main groups of soils based on the map of soils in the State of Acre – scale 1:1.000.000.

Table 1. Carbon stock (kg m-2) in the first 100 cm depth. Data cooperation.

Soil Classification	C (kg m-2) Acre[ψ]	Brazilian Amazonia[¥]	Amazon Basin[#]	South America[£]
Luvissolos Crômicos	7,5 ± 1,1		8,9 ± 34	4,0
Luvissolos Hipocrômicos	7,1 ± 1,4	7,6 ± 0,4		
Vertissolos Ebanicos	11,3	11,3		14,0
Cambissolos Háplicos Ta Eut.	5,9 ± 1,6	6,8 ± 1,1		
Cambissolos Háplicos Ta Dist.	6,9 ± 1,5	7,7 ± 0,5	9,5 ± 46	60,0
Cambissolos Háplicos Tb Dist.	6,4 ± 2,1			
Chernossolos Háplicos	8,9 ± 1,4			15,0
Argissolos Vermelhos Distófico	6,8 ± 1,4			
Argissolos Amarelos Distróficos	5,8 ± 1,3		8,5 ± 42	8,0
Argissolos Vermelho Amarelos Distróficos	6,1 ± 1,9	9,5 ± 0,3		
Nitossolos Háplicos Distróficos	5,9 ± 2.5		11.1 ± 34	
Nitossolos Vermelhos Distróficos	5,8 ± 1,0	15,0 ± 1,9		
Alissolos Crômicos	6,8 ± 1,3		15,2 ± 45	
Alissolos Hipocrômicos	7,8 ± 1,6			
Gleissolos Háplicos Ta Eutróficos	6,3 ± 2,1	7,2 ± 0,8	12,7 ± 59	
Gleissolos Háplicos Ta Distróficos	7,4 ± 3,7	12,2 ± 1,4		
Neossolos Fúvicos Ta Eutróficos	5,2 ± 1,0	6,8 ± 0,8	7,5 ± 46	
Plintossolos Háplicos Ta Distróficos	7,7 ± 1,4			
Plintossolos Argilúvicos Ta Distróficos	6,6 ± 0,8	9,4 ± 0,9	6,1 ± 45	
Latossolos Vermelhos Distróficos	5,9 ± 1,7	9,3 ± 0,8	10,2 ± 40	12,0
Latossolos Amarelos Distróficos	6,3 ± 2,1	8,5 ± 0,4		

[ψ]Data of this work. [£]Bohn, 1976. [¥]Moraes et al, 1995. [#]Batjes & Dijkshoorn, 1999.

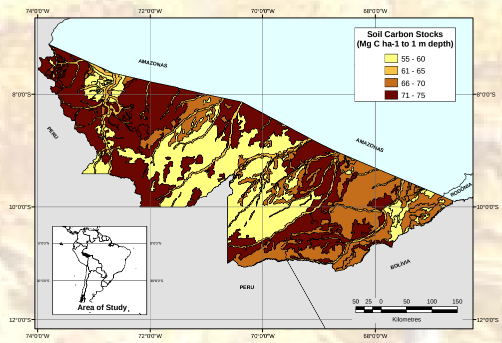

Figure 4 – Map of carbon stock in the soils in the State of Acre (Mg ha-1 to 100 cm depth).

Evaluations on the stocks of carbon isotopic composition in soils of pasture and primary forest

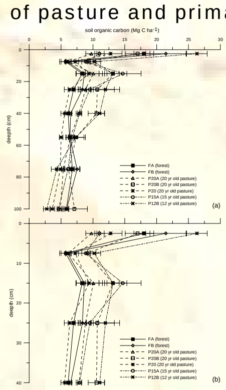

Figure 5 – Mean values and standard deviation of carbon stocks (kg m-2). Graphic (a) concentration of C up to 100 cm depth. Graphic (b) concentration of C up to 10 cm depth.

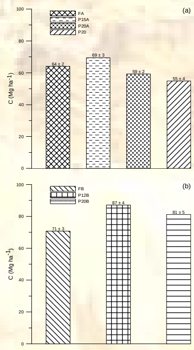

Figure 6 – Carbon stock (Mg h-1) in the first 100 cm depth soil in studied areas. Graphic (a) areas over Ultisol, and Graphic (b) areas over Alfisol.

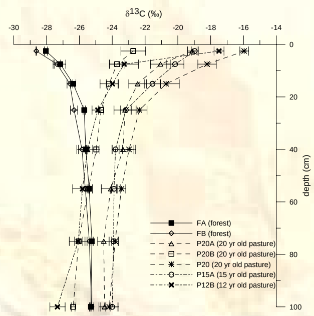

Figure 7 – Variation of δ13C (‰) in soil with depth in the studied areas.

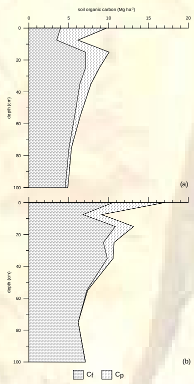

Figure 8 – Carbon stock (Mg h-1) corresponding to Cf (forest derived carbon) and Cp (pasture derived carbon) in soil profile. Graphic (a) refers to data in the 20 yr old pasture over Ultisol, and Graphic (b) refers to data in the 20 yr old pasture over Alfisol.

CONCLUSIONS

- Soils in Acre store about 1 Pg C to 1m depth. Eutrophic soils contain smaller C stocks than dystrophic soils within the same soil order.
- The rate of decomposition of carbon in Alfisols is lower than in Ultisols, but the mean residence time of organic matter is longer.
- The Ultisols tend to lose more carbon with land-use change.
- Based on soil carbon data, the productivity of Brachiaria brizantha cv. Marandu pastures is probably lower on Alfisols, indicating that, in addition to soil fertility, other characteristics such as soil drainage affect pasture productivity and arbon dynamics.