

Soil carbon stocks in Gleysols in Brazil

Introduction

Gleysols are typical mineral hydromorphic soils, characterized by a gley horizon near the surface due to prolonged saturation. These soils originate from a range of unconsolidated fluvial, marine, and lacustrine sediments of Pleistocene or Holocene age. Their texture varies from sandy to clayey, and they exhibit diverse mineralogical assemblages.



Figure 1. Profile of a Gleysol from the Soil Correlation and Classification Meeting of the Amazon (RCC AM) (A); Overview of a mangrove forests in the Amazon region (Marapanin, Pará State) (B).

(RCC AM) (A); Overview of a mangrove forests in the Amazon region (Marapanin, Pará State) (B).

Methods

In Brazil, Gleysols comprise approximately 4% of the territory and are predominantly found in the Amazonian floodplains and mangrove along the Atlantic coast.

We selected 20 soil profiles, comprising 88 soil horizons (layers). We calculated the carbon stock to a depth of 0 to 30 cm. The states where the profiles were selected were Amazonas, Bahia, Espírito Santo, Minas Gerais and Rio de Janeiro. Measured soil carbon, bulk density, and layer thickness was used to estimate the soil carbon stocks.

Table 1. Descriptive statistics of soil properties (sand, silt, clay (g/kg), bulk density (Bd; Mg/m³), and carbon content (C; g/kg). N = 88 soil results

Parameter	mean	sd	median	min	max
Sand	206	231	109	0	920
Silt	427	235	365	20	810
Clay	367	224	294	10	880
Bd	1.08	0.37	1.17	0.09	1.73
C	60.59	192.51	12.90	0.18	1385.00

Results and discussion

Gleysols exhibited a wide distribution of particle sizes, with sand fractions ranging from 6 to 840 g kg⁻¹, silt fractions from 10 to 810 g kg⁻¹, and clay fractions from 10 to 880 g kg⁻¹. Organic carbon values ranged from 0.02 to 138.50 g kg⁻¹, with a median of 1.09 g kg⁻¹. Bulk densities values ranged from 0.09 to 1.73, and this variation not correlated with sand and organic matter content, suggesting a complex soil structure.

No significant linear correlation between clay content and organic (R = 0.02) was found.

The average carbon stock was 179 Mg C ha⁻¹. The largest soil carbon stock was found in Linhares, ES, with 1437 Mg C ha⁻¹, while the smallest was 18 Mg C ha⁻¹ in Benjamim Constant, AM. The median carbon stock was also 49 Mg C ha⁻¹.

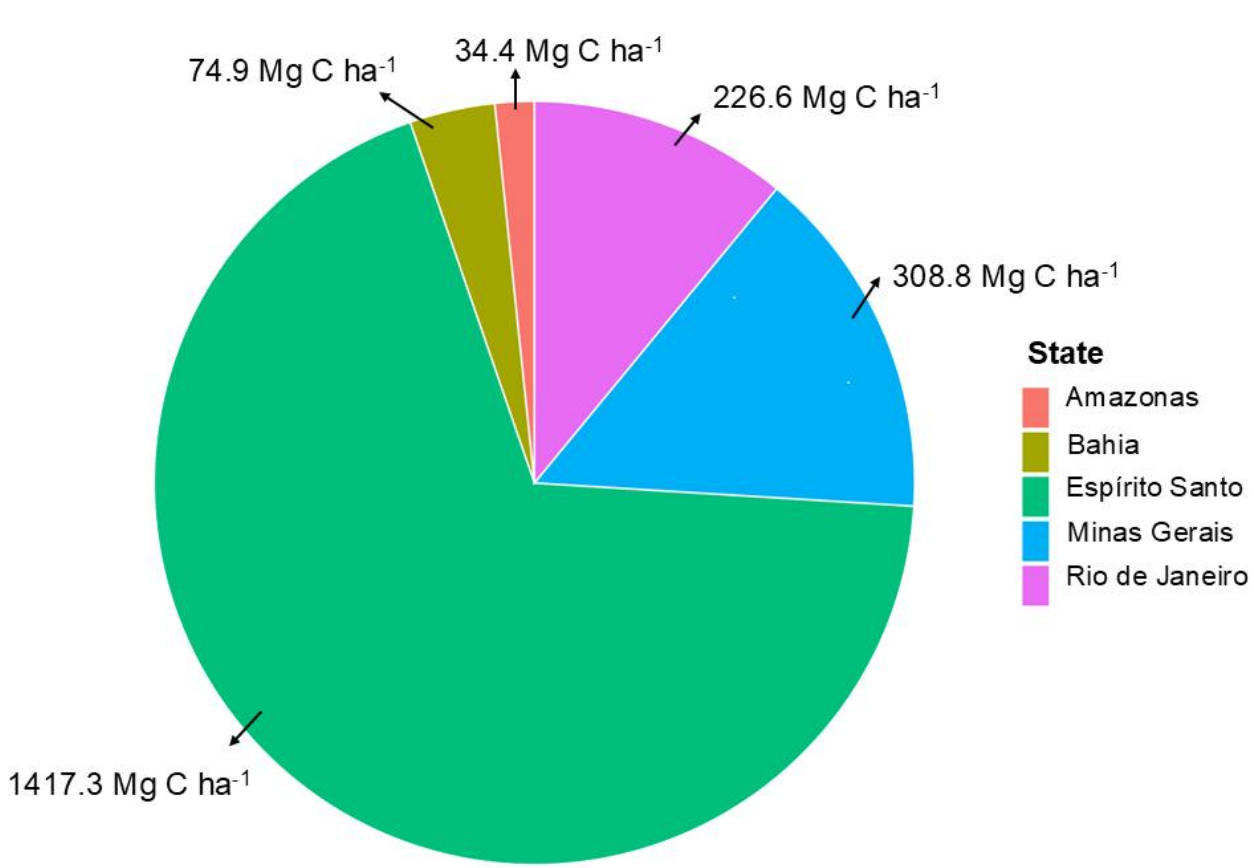


Figure 3. Mean average carbon stocks (Mg C ha⁻¹) from 0-30 epth in Brazilian Gleysols by state

Table 1. Descriptive statistics of soil carbon stocks ()from 20 Gleysols profiles in Brazil (0-30 cm).

	Mean	SD	Median	Min	max
Carbon stock (Mg C ha ⁻¹)	179	329	49	18	1417

Conclusion

Gleysols stocks are highly variable, with high carbon stocks in BA (Bahia) and low stocks in the Amazon. However, sampling and study locations are limited. Drained Gleysols may release high carbon concentrations and become highly acidic if they possess thionic characteristics. Enhanced research on these soil type and a better understanding of the drivers influencing carbon storage are crucial. The preservation of these soils and their associated vegetation (mangroves, riparian forests, igapó forests, and grasslands) is essential to maintain a large stocks of carbon. Enhanced research on these soil type and a better understanding of the drivers influencing carbon storage are crucial.

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REFERENCES

The Gleysols Data Bank is ongoing project. Data are available on request to the corresponding author. Indication of publications and available data to be inserted in the Gleysols Data Bank are welcome and will be added and the source cited. .

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