Assessment of soil ecosystem service-climate regulation in an agricultural municipality in the Cerrado

Introduction

Soil ecosystem service climate regulation (SES CR) refers to soil capacity to sequester and store carbon, contributing to the mitigation of climate change.

The aim of this work is to present a methodology for assessment of SES CR, based on the selection of indicators and information obtained from soil surveys. The methodology was tested in the municipality of Campo Grande, state of Mato Grosso do Sul (MS), Brazil. It is an intense agricultural activity municipality, mainly occupied by pastures, located in the Cerrado biome.

Methods

The assessment of SES CR was carried out considering the soil carbon stock (SCS) segmented by different soil classes, textural classes (Mothci and Amaral, 1979; Motta et al., 2013), and land use and cover classes (Map Biomas Project, 2023), as an approximation of the soil carbon sequestration process. The organic carbon content of the soil and soil density were the manageable soil properties used as indicators for calculating SCS. These results were applied to develop a scenario for the recovery of degraded pastures in Campo Grande, MS.

Results and discussion

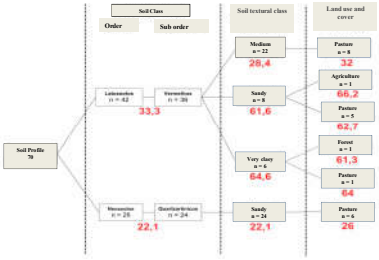

Fig 1. The medians of soil carbon stock (SCS) (in red) in the arable layer up to 30 cm deep, in Mgha^{-1}, and the number of soil profiles (n) by soil class, textural class, and land use and cover in Campo Grande, Mato Grosso do Sul, Brazil

The results are in line with research that analyzes the relationship between soil carbon stock and its texture (Fig.1). Bayer et al. (2006) indicate a greater physical stability of organic matter linked to clay, predominant in Latossolos. Sandy soils exhibit greater carbon losses due to the intense depletion in coarse-textured soils, which have excessive drainage, low-activity clays, and inadequate aggregation.

In 2022, Campo Grande had around 530,000 hectares of pastures, of which 54% were severely degraded and 38% moderately degraded (LAPIG, 2022). The recovery of pastures with severe and moderate levels of degradation in the Cerrado, with the adoption of sustainable management practices, such as no-tillage and integrated systems, increased the SCS by 0.34 Mg C ha^{-1} year^{-1} up to 30 cm depth after 20 years of recovery (Oliveira, et al., 2022). This could result in approximately 166,600 Mg C in the 0-30 cm layers, reducing emissions associated with pasture degradation in Campo Grande, MS.

Conclusion

- ✓ The Soil carbon stock in Campo Grande, MS was:
  - Higher in Latossolos than in Neossolos;
  - Higher in soils with higher clay content than in medium and sandy texture;
  - Hight under pastures, when compared to other land uses.
- ✓ Sustainable management practices in pastures can increase the carbon storage capacity in these soils, contributing to the mitigation of climate change.
- ✓ The use of data and information from soil surveys to measure and monitor SCS change is promising and can support climate change policies, contributing directly to SDG 13.

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