CAN SHORT-TERM REFORESTATION PROVIDE SOIL CARBON SEQUESTRATION IN THE BRAZILIAN SEMIARID REGION?

Introduction

In the Brazilian semi-arid region, slash-and-burn agriculture is the primary driver of soil degradation, resulting in declining crop yields and the impoverishment of rural communities.

Nevertheless, smallholder farmers have adopted reforestation practices to sustain bee populations during the dry season, enhance carbon (C) stocks and improve soil health.

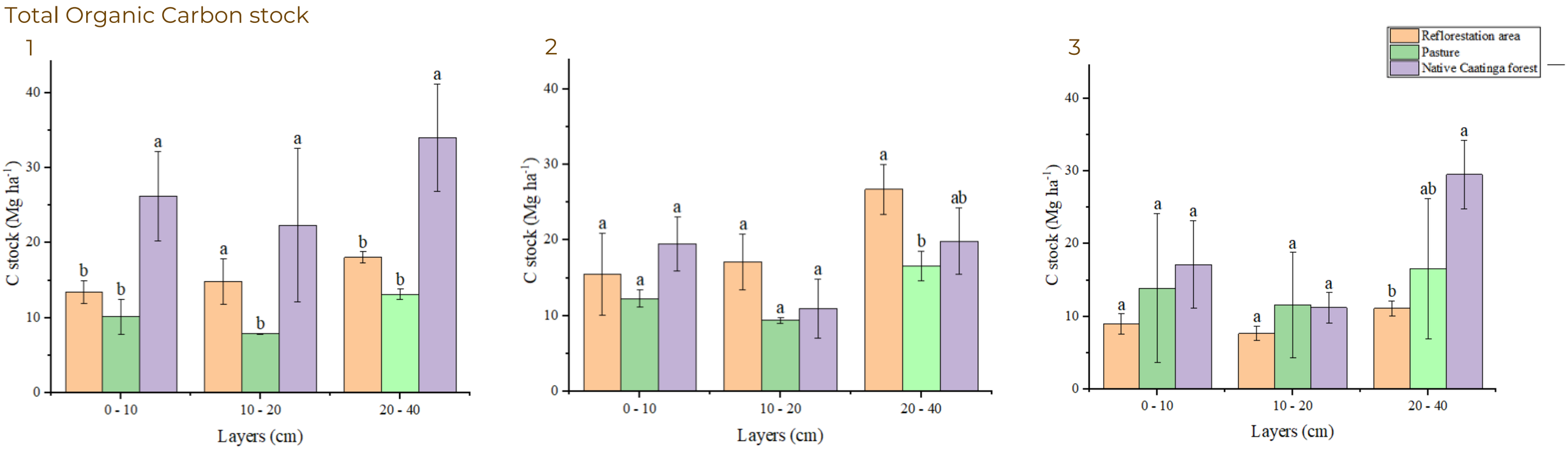
Therefore, this study aimed to evaluate the impact of reforestation on soil carbon sequestration potential in smallholder areas within the Brazilian semi-arid region.

Methods

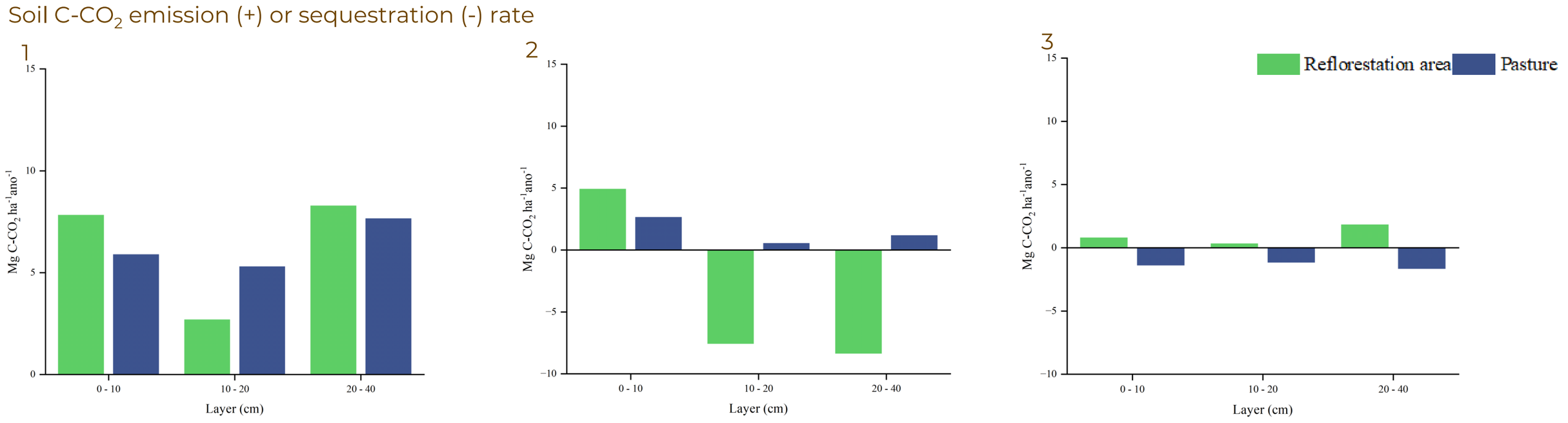
- Three rural properties with different soil clay content (1: Oxisol, 15 dag kg^{-1}; 2: Ultisol, 10 dag kg^{-1}; 3: Oxisol, 6 dag kg^{-1});
- Management systems: (1) Reflorestation – RF (Mimosa caesalpiniaefolia Leucaena leucocephala and Moringa oleifera, with 2, 3 and 5 years of adoption); (2) pasture; (3) native caatinga forest;
- Soil sampling (0-10, 10-20 and 20-40 cm) and analysis: Total organic C (TOC) stocks, particulate organic carbon – POC; mineral-associated organic carbon – MAOC and soil C sequestration or emission rate;
- Data analysis: ANOVA, assuming data normality (Shapiro–Wilk test) and Tukey's for mean comparison ($P < 0.05$).

Results

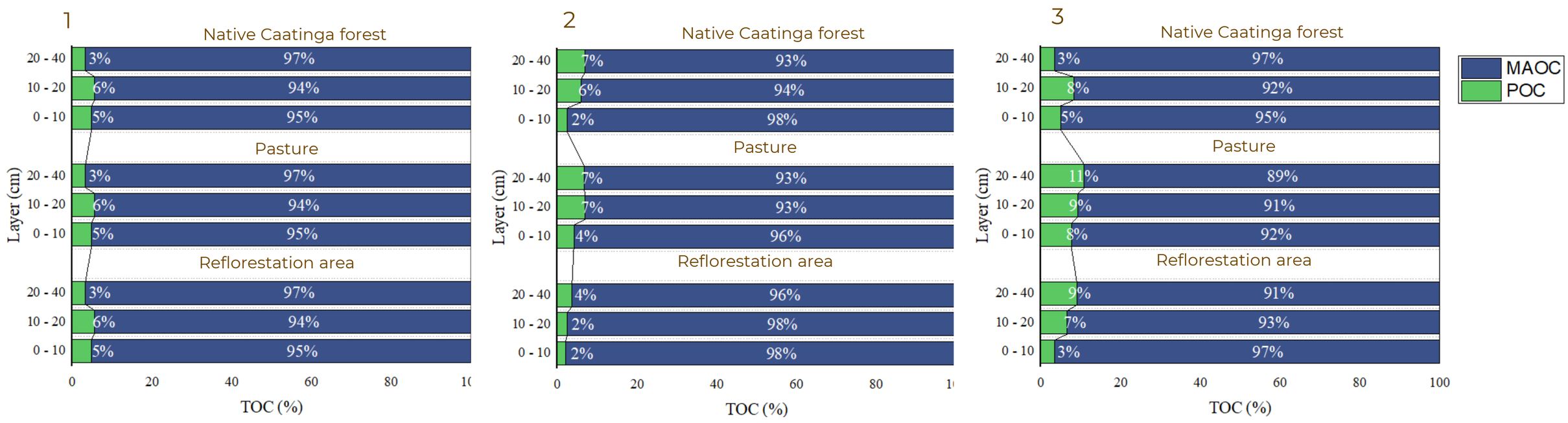
Total Organic Carbon stock



Soil C-CO_2 emission (+) or sequestration (-) rate



Particulate organic carbon – POC; mineral-associated organic carbon – MAOC.



Conclusion

The predominantly sandy soils, which have a long history of degradation, along with the still limited contribution of residues from the tree species used, make it challenging to rebuild organic matter. Increasing species diversity—particularly with species that produce more biomass—could be the key to boosting soil carbon stocks and improving beekeeping activities.

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