# Mapping the supply and demand of ecosystem services: a first step towards multifunctional land management in eastern Amazonia

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## Introduction

- Paragominas is one of the oldest forest frontiers in eastern Amazonia. Forest clearing is now banned in the region prompting a transition towards land-use intensification.
- It is not clear, what the landscape configurations are that can reconcile ecosystem services with agricultural production for commodities.

**Fig.1 Landscape in Paragominas: a mosaic of abandoned pastures, crops, riparian forest and degraded forest.**

## Objective & Method

- The aim of this study is to spatially assess the supply and demand of three soil-based ecosystem services (soil functions) to identify mismatches and trade-offs.
- We assessed the supply and demand for commodity production, habitat for biodiversity, and carbon cycling and storage based on the Functional Land Management framework.
- Supply was assessed based on a literature review for the various combinations of land use and pedo-morphological conditions.
- Indicators for supply included: i) carbon stocks (Mg C/ha), ii) species richness (α-biodiversity), and iii) export (US$ FOB, 2017) and local revenues (R$).
- Environmental policy targets were taken as proxy indicators of societal demands for the three soil functions in question.

## Results

Undisturbed forests have the highest C stocks in above ground biomass, dead wood, litter and soil (Fig 3a). An area-based estimate of the mitigation potential for Paragominas during the 2010-2020 period, is 1 million Mg $CO_2$eq, in order to reach the national target (Fig 3b).

Supply of habitat for biodiversity is higher in areas with less forest fragmentation and disturbance (Fig.3c). Demand framed by policy mandates maintaining 50-80% forest coverage in all rural properties including riparian forests (Fig. 3d).

Intensified production occurs mostly on clayey soils located in proximity to the road (Fig. 3e). Production targets are a 15-18% and 2-4% yearly increase for soybean and livestock production, respectively until 2030 (Fig. 3f).

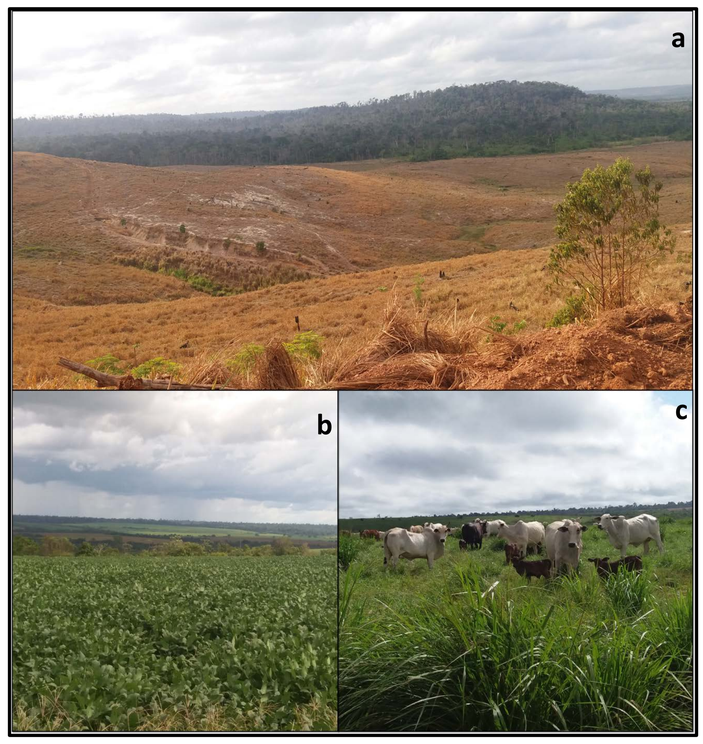


**Fig.2 Erosion and degraded forest (a) and intensified areas of soybean production on a plateau of clayey soils (b) and beef production on sandy soils (c).**

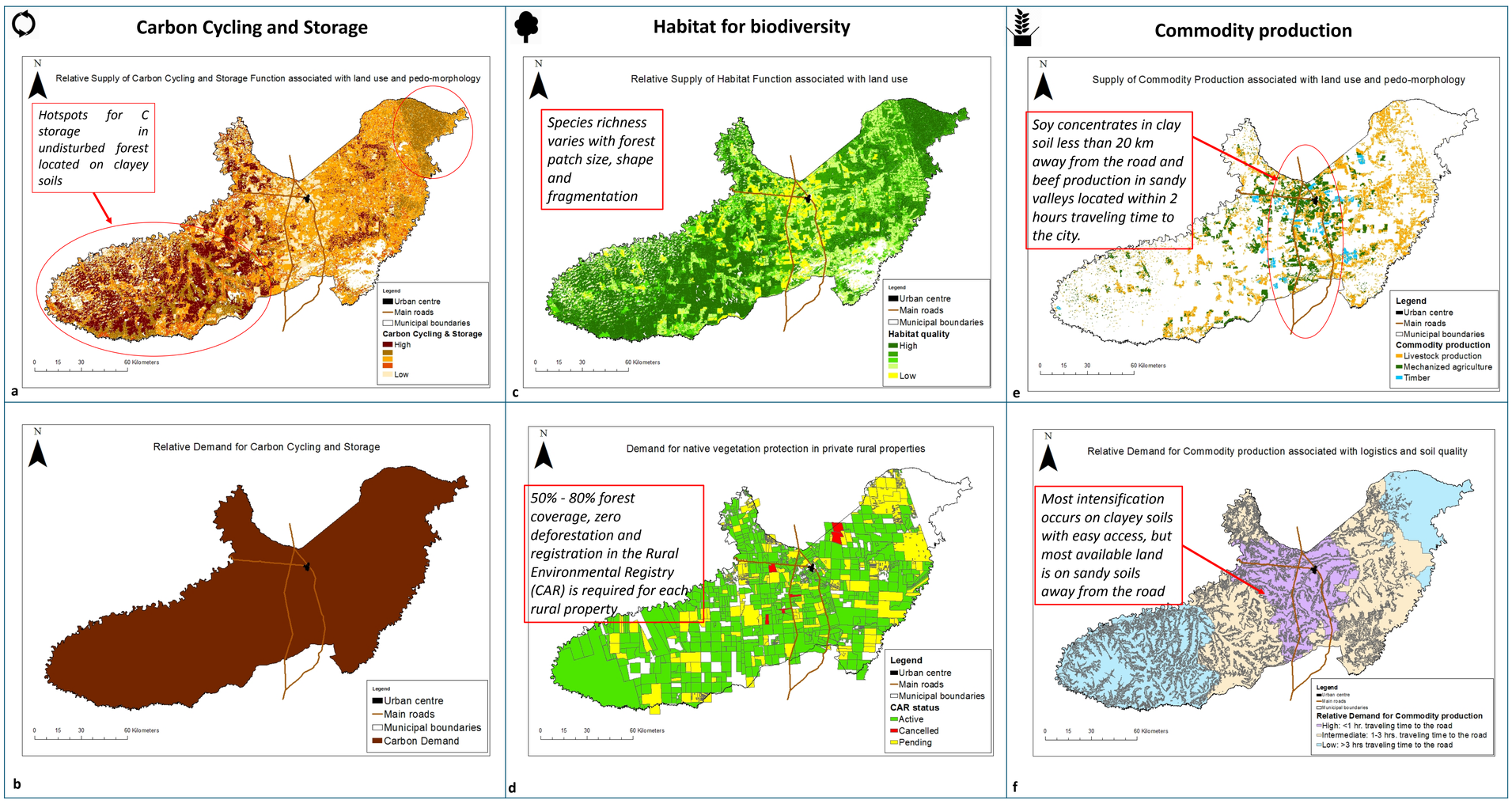


**Fig.3 Indicative maps of the Supply (top row) and Demand (bottom row) for Carbon Cycling and Storage, Habitat for biodiversity and Commodity production**

## Conclusions

Undisturbed forests fulfil the demand for C storage while pastures and secondary forests have the potential to meet the demand for C sequestration under the proper management.

Assessing supply of habitat for biodiversity shows that even when complying with legislation, biodiversity can still decrease due to forest degradation and fragmentation.

Most cleared areas available for production are located in sandy soils where intensification is more difficult and costly. Trade-offs could emerge in clayey soils covered by undisturbed forests if these are degraded and eventually converted to arable land.

✓A bottom-up approach is needed to establish whether or not policies are representative of local demands to set concrete municipal targets for each soil function. This requires further research at the farm level that could inform a zoning process aiming at multi-functional landscapes that optimize soil functions in Paragominas.

## Acknowledgements

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