What do we really know about the Brazilian Amazon forest carbon stocks?

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Introduction

Amazon forest is a huge carbon sink, fundamental for the provision of ecosystem services as water supply, climate regulation ensuring the existence of biodiversity and human populations. Forest biomass (≈ 50% of carbon) data is relevant for National Communications on Greenhouse Gases (NCGHGs) mitigation mechanisms as REDD (Reducing Emissions from Deforestation and forest Degradation) under the United Nations Framework Convention on Climate Change (UNFCCC).

Quantifying biomass is a challenging task. Available field plots do not cover the whole Brazilian Amazon; biomass maps have great differences among them in their quantity and spatial biomass distribution (Ometto et al. 2014). Remote sensing have advances in biomass estimations, but still have limitations on extrapolation methods and the lack of enough field data for validation (Saatchi et al. 2015). This may have relevant impacts in the deforestation-driven carbon emissions modeling (e.g. Aguiar et al., 2012; Bacinni et al., 2012; Harris et al., 2012), since forest biomass is the primary data.

This study aims to understand the different types and networks of biomass data in the Brazilian forest Amazon, to find the spatial data gaps.

About the biomass data

Biomass information for the Brazilian Amazon forest are constituted by different measuring plots which conform diverse networks dependent on various institutions. This networks differs one to another in scale, measurement data, distribution and number of plots, as is shown in Figures 1 and 2.

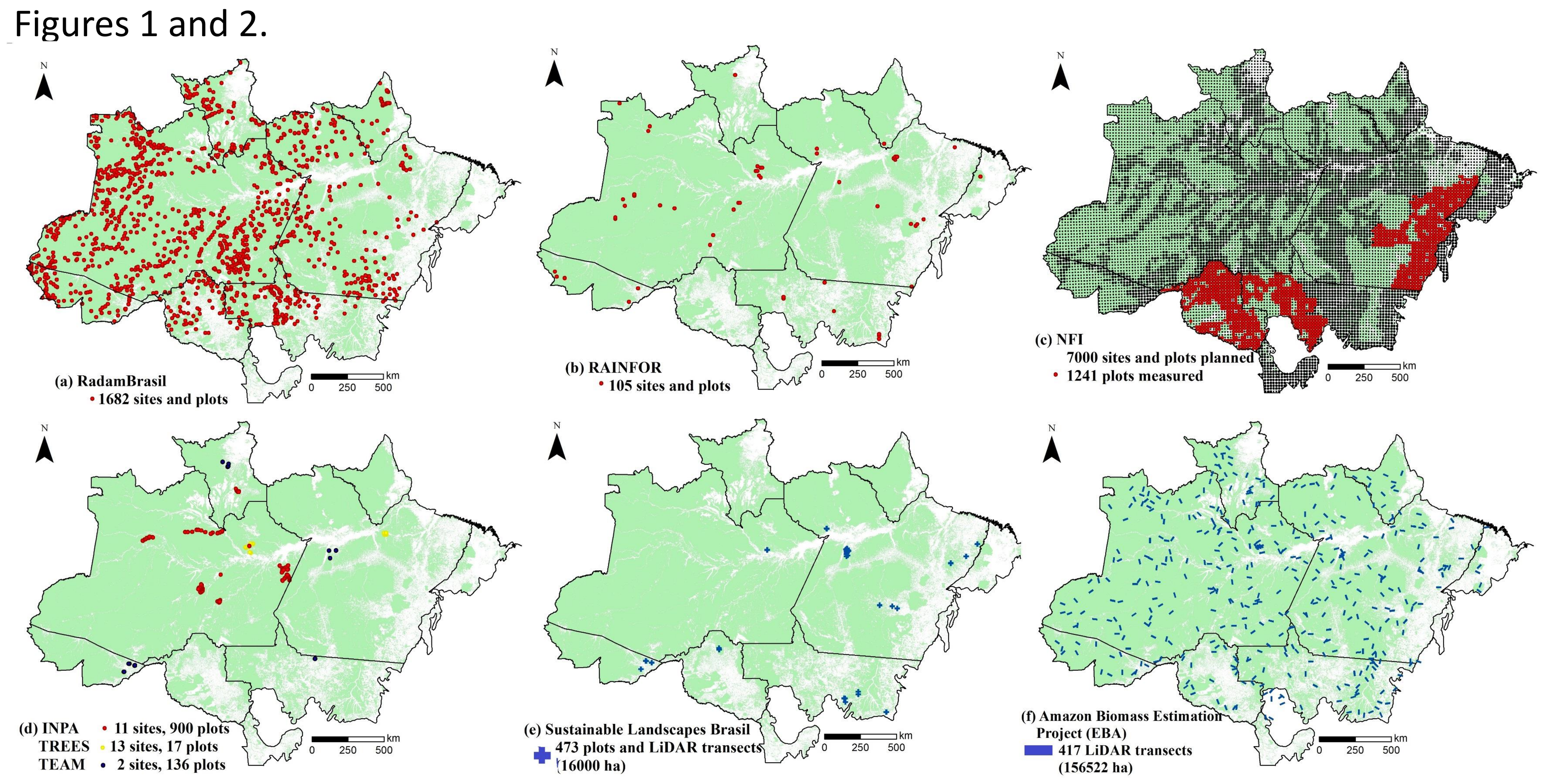

Figure 1. Forest biomass plots distribution, a) RadamBrasil (RadamBrasil 1983), b) RAINFOR (Malhi et al. 2002), c) National Forest Inventory (NFI 2016), d) INPA, TREES and TEAM networks and plots(TEAM Network 2016), e)Sustainable Landscapes Brazil, LiDAR trasects (Sustainable-Landscapes 2015), f) Amazon Biomass Estimation Project CCS-INPE (EBA, 2016)

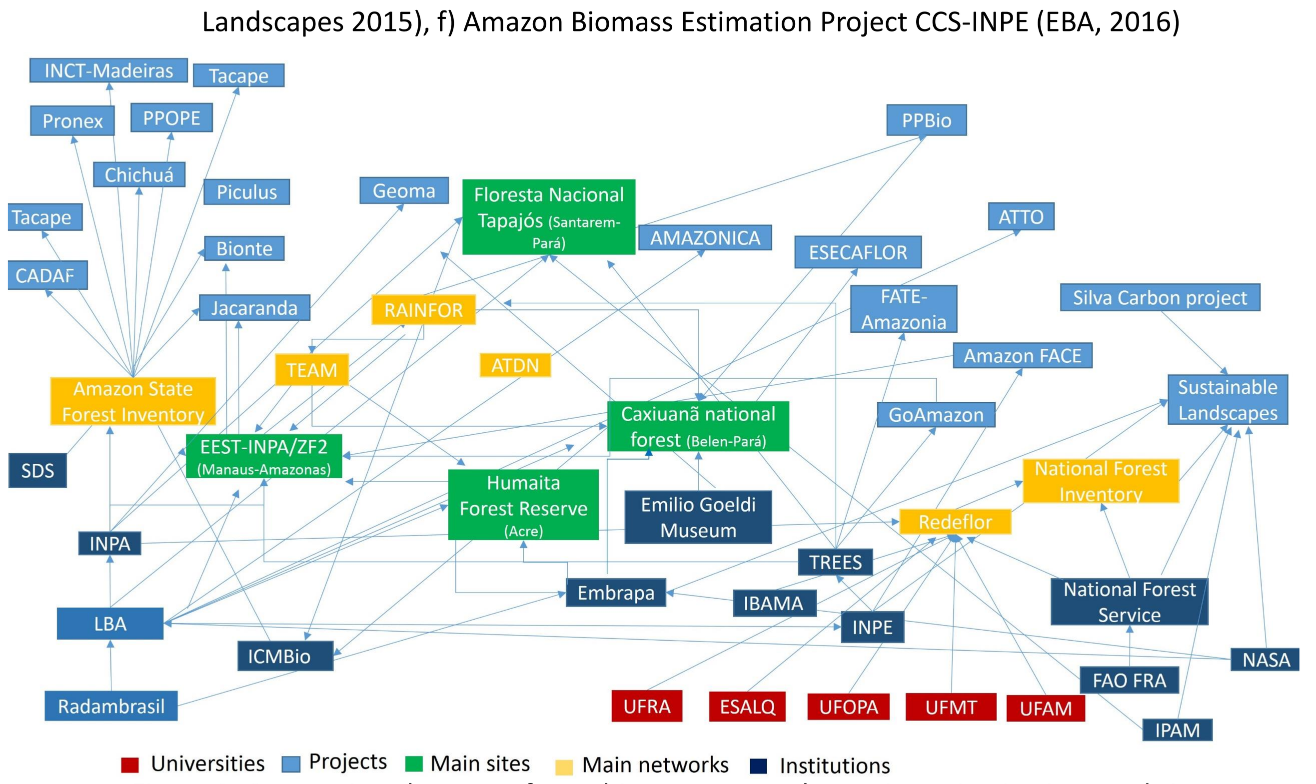

Figure 2. Connections between forest biomass networks, projects, institutions and sites

Biomass carbon density maps

Biomass quantity and distribution on the resulting maps have great differences between them (Fig.3). This can be explained since they are a result of different kinds of combinations of field data, allometry, remote sensing data and modeling results at different scales.

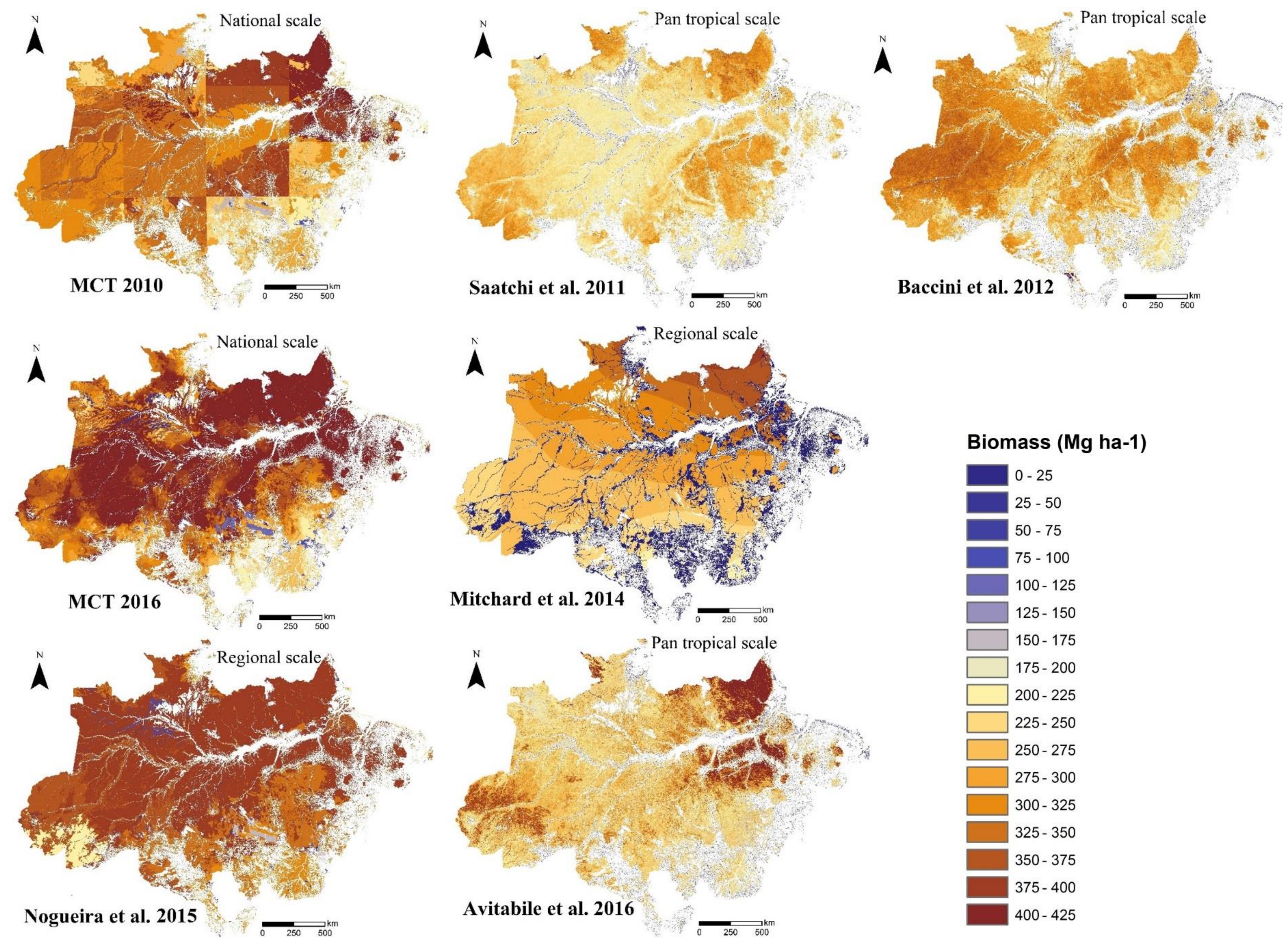

Figure 3. Biomass carbon density maps of the Brazilian Amazon at different scales using the same visual scale

Biomass data gaps

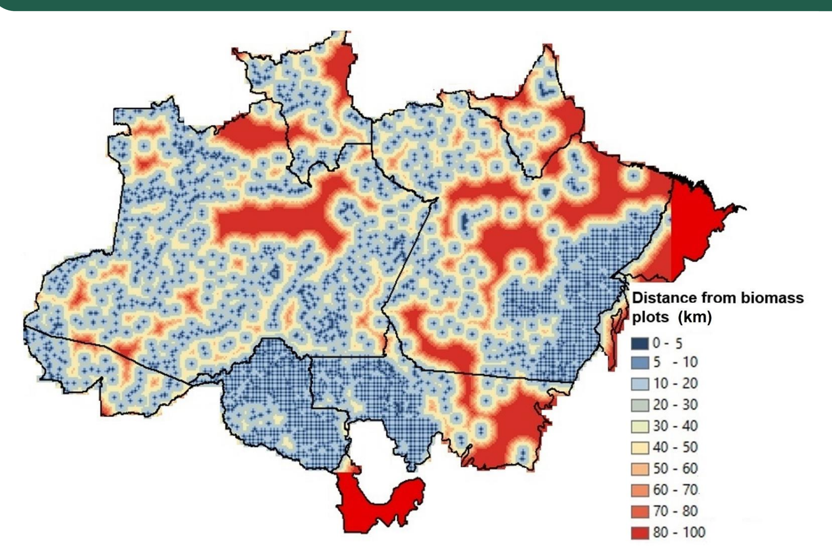

Figure 4. Distance from forest biomass plots networks

By plotting the spatial distribution of all the existing plots and calculating distance map from them, it is possible to visualize the gaps (Fig. 4). It is expected a noticeable reduction of these gaps since, under the National Forest Inventory framework (IFN), systematic measurements in a grid scheme are being made. Southeast of Pará, west of Mato Grosso and almost all Rondônia are already measured.

Is interesting to see the number of biomass plots per environmental factors as soil, vegetation, topography and climate, since only few classes are well represented (Fig. 5).

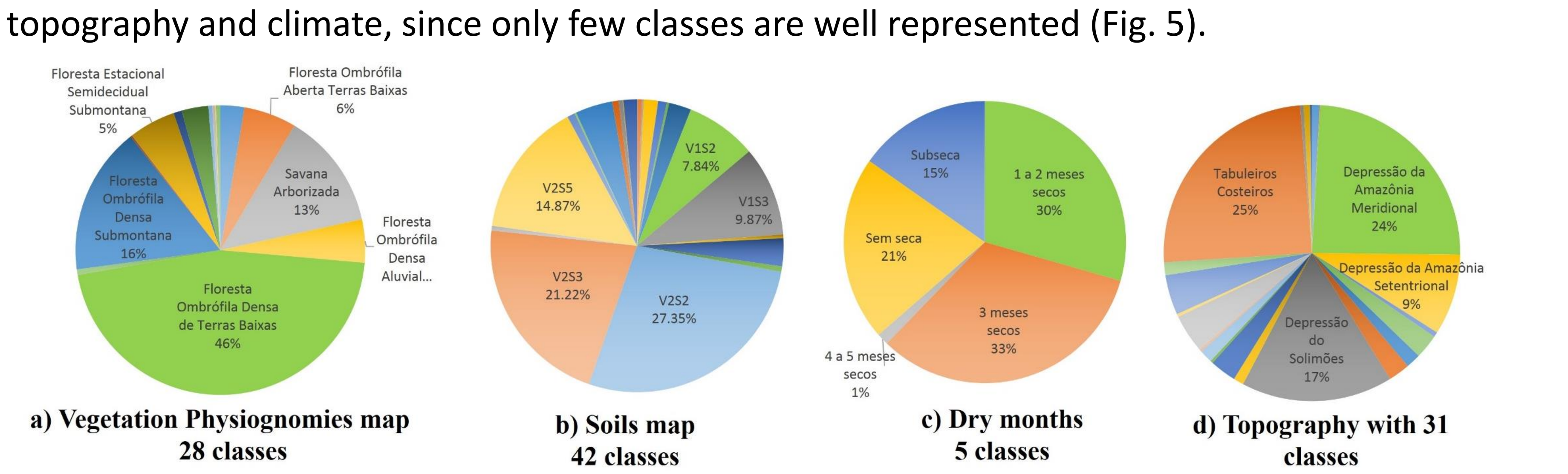

Figure 5. Biomass plots per Environmental factors in the Brazilian Amazon forest Biome. a) Vegetation Physiognomies (MCT 2010); b) Soils (Bernoux et al. 1997); c) Dry months (IBGE 2002); d) Topography (MMA 2002).

Conclusions

We found noticeable spatial gaps of biomass field data and lack representativeness of relevant environmental factors, which must be addressed. Initiatives like The IFN plots, the LiDAR surveys of Amazon Biomass Estimation Project (EBA) will highly improve the biomass data quality and distribution. Until then the analysis and systematization of previous efforts will provide valuable lessons and key elements like the areas with the biomass similarities and differences or the correlation between field data and environmental factors that influence biomass distribution. The data availability of forest biomass and communications between stakeholders are fundamental for this task.

Acknowledgements

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