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Agricultural management strategies to enhance family farming in Brazil

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Introduction

• Family farms in Brazil produce 70% of the food consumed nationwide and its production is primarily designed for urban populations => these farms play a major role for food security.

• It is necessary to improve agricultural management in this sector, in order to enhance food production, to ensure ecosystem service (ES) provision and to offer better life conditions for rural population.

• We present a framework to identify the weaknesses and potentialities of agroecosystems in three study areas, each one located in different biomes in Brazil: Atlantic Forest, Cerrado and Caatinga. The aim is to recommend more appropriate agricultural practices that are able to improve food production in a sustainable way.

Materials and methods

Brazil is a huge country, with differences in natural characteristics and cultural aspects. For this reason, it is not proper to recommend a unique model for family farm management (Figure 1).

Figure 1: Brazilian biomes and some aspects from the study area.

Results and Discussion

• The criteria for the agroecosystem development were based on existing knowledge of the area associated with gathered information through interviews with farmers and further stakeholders, and small field studies on social, economic, environmental and agricultural aspects.

•The results were organized in a framework, as presented in Figure 3.

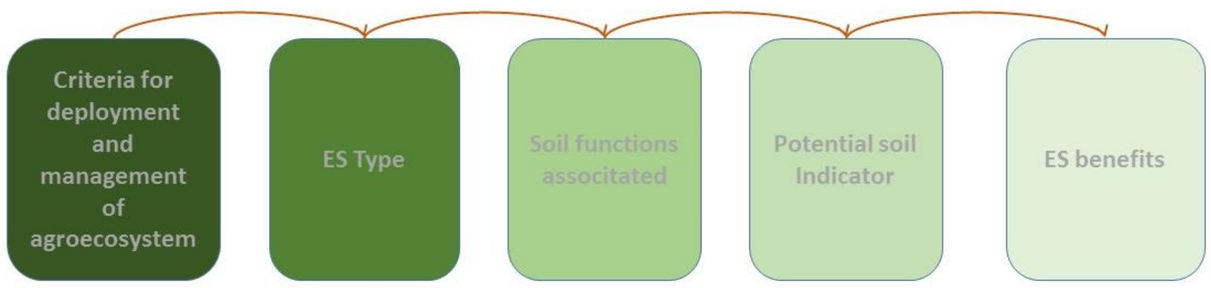

Figure 3: Relation among the criteria for deployment and management of agroecosystems proposed for the study areas with ES type, soil functions, potential soil indicator and ES benefits and policy relevance.

• Results showed that ES types more affected by deployment and management of agroecosystems were supporting and provisioning services, which demonstrated the potential of agriculture management to provide multiple services besides food, fiber and energy.

• "No fire use" and "agricultural consortium" were the criteria for deployment and management of agroecosystems with higher potential for increasing ES provision and biomass stock in soil and litter was the soil parameter (Figure 4).

Criteria for deployment and management of agroecosystem	ES Type			Soil functions associtated	Potential soil Indicator	ES benefits
	Provisioning	Supporting	Regulating			
No fire use	+++	+++	+++	Water infiltration / Habitat	Soil porosity Bulk density Hydraulic conductivity Retention curve Biomass carbon stock in soil and litter Microbial enzymatic activity (carbon cycle) Microbial enzymatic activity (phosphorus cycle) Microbial enzymatic activity (sulfur cycle) Soil macrofauna	Co_2 mitigation Stability in crop production Air purification Biodiversity protection Human health
Agricultural consortium	+	++	++	Nutrient cycling / Carbon sequestration and accumulation / Sediment retention / Habitat	Phosphorus (P2O5) content Potassium (K2O) content Calcium (CaO) content Magnesium (MgO) content Sum of bases = S = Ca + Mg + K + Na Biomass carbon stock in soil and litter Microbial enzymatic activity (carbon cycle) Microbial enzymatic activity (phosphorus cycle) Microbial enzymatic activity (sulfur cycle) Soil macrofauna	Higher food diversity Food security GEE mitigation Biodiversity protection Avoid land use change (LUC)

Figure 4: Relation among the criteria for deployment and management of agroecosystems proposed for the study areas with ES type, soil functions, potential soil indicator, ES benefits and policy relevance Qualitative estimates for each agricultural practice and their impacts on ES types are represents by low impacts (+) to high impacts (+++).

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