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"Solidarity in a competing world - fair use of resources"

Agricultural Management Strategies to Enhance Family Farming in Brazil

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Abstract

Family farms in Brazil produce 70% of the food consumed nationwide and its production is primarily designated for urban populations. Therefore, these farms do play a major role in food security. However, it is necessary to improve agricultural management in this sector, in order to enhance the food production, to ensure ecosystem service (ES) provision and to offer better life conditions for rural population.

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. So, in this study, 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.

The proposed framework establishes the link between agroecosystems and ES provision, considering the criteria of management and agroecosystem establishment in each study area. A set of soil parameters that can be used as indicators to monitor the changes in the agroecosystems is also considered in this framework. The criteria for the agroecosystem development were based on existing knowledge of the biomes associated with gathered information through interviews with farmers and further stakeholders, and small field studies on social, economic, environmental and agricultural aspects. In each study area these criteria for deployment and management of agroecosystems were validated with representatives of agricultural entities and farmers. In a next step, the same group systematised the information and defined the agroecosystems priorities for their area. As a result, sustainable alternatives for agricultural management were identified in order to improve the output of the agroecosystems, considering the specific biome characteristics as well as the community necessities. For instance, "no fire use" and "agricultural consortium" were the main criteria for the deployment and management of agroecosystems with a higher potential for increasing ES provision, and biomass stock in soil and litter were the related soil parameters to be used as indicator to monitor the impact.

Keywords: Ecosystem services, multiple agricultural system, tropical farming

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Agricultural management strategies to enhance family farming in Brazil

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Keywords: multifunctional agriculture; agroecosystem; ecosystem services.

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.

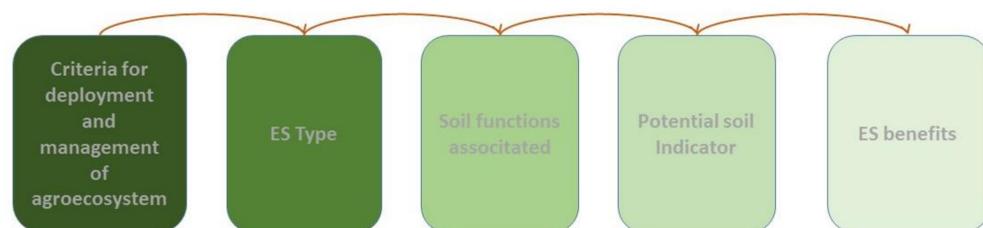


Figure 3: Relation among the criteria for deployment and management of agroecosystems proposed for the study areas with ES type, soil functions, potential soil indicator and ES benefits and policy relevance.

- 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 associated	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 represented by low impacts (+) to high impacts (+++).

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