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the Eastern Amazon: Empirical Evidence and Policy
Perspectives for the Bragantina Region**

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Cuvillier Verlag Göttingen

<https://cuvillier.de/de/shop/publications/2573>

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1 Introduction

1.1 Research Background

Agriculture has been practiced in the Brazilian Amazon for centuries. Most of this agriculture is based on slash-and-burn practices, which is the primary means of sustenance for about 400,000 smallholders in the region (INCRA/FAO 2000). Since 1987, global concerns about tropical deforestation and alleged global warming have led researchers to investigate land use practices, with a particular focus on agriculture (Smith et al. 1996; Toniolo and Uhl 1995).

According to Scatena et al. (1996), most of this research into the dynamics of land use in Amazonia has examined development policies, indigenous groups, colonists, cattle ranchers or logging operations. While development policies and groups such as colonists and cattle ranchers have a major impact on Amazonian land use change, there is a growing awareness that the land use practices of smallholders have been overlooked. Some researchers believe this is a serious oversight since 80% of the total agricultural production in the Brazilian Amazon is derived from smallholders who are mainly dependent on the available natural resources and live in poor conditions (Serrão and Homma 1993). For example, Vosti et al. (2002, p.6) notes that, “agricultural productivity and poverty among smallholders is of particular importance in Amazonia because smallholdings have an important presence in demographic and economic terms.”

Although the part smallholders have played has received less attention than the roles played by other groups, smallholder agriculture in the Bragantina (Pará State) in the eastern Amazon region has been investigated by several researchers (Costa 1992; Fearnside 1994; Hurtienne 2002; Kitamura 1982; Serrão and Homma 1993). Unlike many other parts of Amazonia, Bragantina has a long settlement history, beginning in the mid-nineteenth century. Land use in the region dates back at least 100 years and has gone through several phases. It was the first area of extensive and planned settlement to have taken place in the Amazonian lowland (Baar et al. 2004). Occupation of the Bragantina region brought with it vast

deforestation¹ and today the region is an agricultural landscape comprised of a variety of secondary vegetation and fields with annual cropping, plantation crops and pastures (Burger 1991; Denich 1991; Sommer et al. 2000).

This long history of land use by non-indigenous groups makes the Bragantina region particularly interesting to many researchers because most studies investigating land use practices in the Brazilian Amazon have focused on the less established agricultural frontiers. Furthermore, experience from the Bragantina region is a good indicator of what is likely to happen in other areas of Amazonia as they become increasingly altered and populated. For example, Falesi et al. (1980), Rocha (1993), and Smith et al. (1995) have used the example of the Bragantina region to warn about the environmental dangers of agricultural development in Amazonia and how the corresponding problems might be dealt with in the future. These researchers believe that although ecological constraints have certainly played a role in undermining agricultural production, it is the socio-economic problems are of more importance. These include the failure of the government to provide adequate support, unfavourable crop markets and inappropriate managerial skills of the colonists, each of which significantly contributing to failures in smallholder farming.

Most farmers in the Bragantina region use slash-and-burn agricultural practices, which involves cutting down and burning vegetation in order to restore soil fertility. In the slash-and-burn system, short cropping periods produce maize, cowpea, and cassava alternate with long fallow periods. However, in the last three decades, many farmers have started to shorten the fallow periods as a result of a, high population density and market incentives aimed at intensifying land use. In the long run, this situation affects soil fertility and fallow regeneration capacity that, in turn, decreases agricultural productivity (Denich 1989; Hölscher et al. 1997). Furthermore, the use of fire in land preparation brings about additional (external) costs in the form of health effects, greenhouse gas emissions, and material damage resulting from accidental fires.

¹ Until 1955 most primary forest, apart from minor spots along rivers (bottomland forests, *igapós*) and on inaccessible terrain, was converted into agricultural land or fallow (Sousa Filho 2003, quoted in Hedden-Dunkhorst et al. 2003)

Researches conducted in the region have investigated the technical feasibility and productivity of alternative fire-free technologies for land preparation (the combination of mechanical mulch technologies and fallow improvement techniques). However, for such technological innovations to be sustainable, it is required that they foster economic development, reduce poverty and at the same time decrease pressure on the environment. The complex policy challenge is how to structure technology options (available particularly to smallholders) and market rules to provide the type of policy induced incentives and improve capabilities for smallholder farming to improve its productivity. Understanding these challenges at the smallholder production level requires obtaining comprehensive farm level insights and evaluating farmer's responses to price and non-price factors under alternative production technologies.

1.2 Problem Statement

Over the last four decades smallholder agriculture in the Bragantina region has constantly adapted to changing demographic, social, political, economic, and environmental conditions. The impact of these changing circumstances has been magnified by poverty associated with smallholder farming in this region (Flohrsuetz and Kitamura 1991). Over the last decade Bragantina, as elsewhere in Brazil, has had projects in poverty reduction implemented that have been linked with social indicators and social inclusion (Verner 2004). However, poverty in Pará State is still broad and deep, and as in 2000, Pará remains one of the poorest states in Brazil. Poverty is more prevalent in rural areas. Reducing poverty is one of the central challenges for the government in the region.

The extent of tradeoffs between developmental and environmental objectives has been acknowledged by the government but not yet fully addressed. These essentially structural problems are amplified by the presence of institutional rigidities and policy constraints. Yet, the government has undertaken reform measures that affect the incentive structure and productivity of the smallholder farming system. The most important direct (sector-specific) agricultural policy, has been the National Programme for the Strengthening of Family Agriculture (PRONAF) resulting from the agrarian reform programme in the second half of the 1990s

(Helfand 2003; Hurtienne 2002). This was further strengthened by another financial policy formed for Amazon regional development, called FNO-Especial². It is a credit program from the Ministry of Integration (Ministério da Integração Nacional), launched in 1993 that specifically addressed smallholders in the region.

However, these government efforts towards improving the welfare of smallholders concentrated mainly on capitalised farmers and cash cropping (Correa and Ortega 2003; Costa 2000b). If efforts for improving the welfare of smallholders focus only on capitalised farmers and cash cropping, there may be an unequal flow of benefits aimed at improving smallholder welfare. Nevertheless, significant productivity improvements in smallholder agriculture, and thus the economic well-being of rural households, hinge in large measure on those policies for rural and agricultural development (Hurtienne 2002). Yet, ambiguities abound about the precise role and impact of agricultural policies, especially towards outweighing social benefits versus social and environmental costs.

One of the greatest challenges for the government is to accomplish environmental objectives without hampering the region's essential development process. In this sense, many changes are taking place, like the initiative of a policy aimed at establishing a credit programme for family agricultural producers that creates incentives for the adoption of sustainable agricultural practices. PROAMBIENTE is an alternative programme of credit that was accepted in 2003 by the Ministry of Environment (Secretaria de Desenvolvimento Sustentável do Ministério do Meio Ambiente) under its governmental plan (Plano PluriAnual 2004/2007)³. This programme has been developed to build on environmental services in order to finance farmers practicing sustainable agriculture.

While policy success depends on the responsiveness of farmers to new incentives, the examination of the characteristics and choices of production technologies in the

² The 1988 Constitution established that 3% of funds collected from income tax by the federal government would go to Constitutional Funds to help diminish regional development gaps. The FNO is the Constitutional Fund of the North (Amazonia) and receives 0.6% of the total funds. For the fiscal year 2002/2003 the resources allocated to the FNO-Especial credit amounted approximately 28.5 million US\$ (BASA undated).

³ The Government of Brazil (2003c).

region has received little empirical attention in the literature⁴ (Costa 2000b). Furthermore, farmers are under increasingly pressure to search for fire-free land preparation techniques as legal and political initiatives, national and international bodies aim to at prohibit the use of fire in land management (Denich et al. 2004). Despite such pressure, farmers have demonstrated a willingness to adopt such technologies. During a collective action that took place in Pará State between 1990-1995, smallholders claimed that they were in fact not reluctant to adopt technological innovations; they argued that on the contrary, they have been playing an important role in adapting production techniques to new constraints and opportunities⁵. According to Ludewigs (2002, p.15), “many associations of rural smallholders are formed by farmers who are conscious about the long term effects of sustainable agriculture, and are thus open to the learn sustainable practices such as avoiding fires, and enhancing soil organic matter through mulching and agroforestry.”

Generally, increased interest by national and international agencies in the development of fire-free agricultural practices had taken place during the last decade. Those technologies are seen as promising agricultural production technologies that may contribute to the conservation of natural resources and to the sustainability of smallholder farming systems. However, realisation of the potential benefits of fire-free practices depends on the diffusion of the technologies and its adoption by the majority of potential users. Moreover, under the current evolving policy environment and given that the appropriate mechanisms are provided to compensate farmers to shift to fire-free agricultural practices, the potential social gains of reducing deforestation by avoiding the use of fire for land preparation are expected to outweigh the private profitability forgone⁶.

Yet, despite considerable interest in such technology and evidence from several studies showing the technical feasibility and productivity of fire-free practices, economic assessments that examine the impact of those technologies on farmer’s

⁴ Some examples of studies examining land use choice, comparing relative profits of alternative systems are: Almeida and Uhl (1995), Arima and Uhl (1997) and Toniolo and Uhl (1995).

⁵ Costa (2000b) and Tura (2000) provide details on the collective action that took the form of public protests mainly organized by farmers’ unions and supporting NGOs.

welfare are few. Furthermore, the participation of smallholder agriculture, as the main contributor of the economy in the region, has increased significantly in the last decades. Despite this, the welfare of farmers has not increased as fast as the increase in the welfare of non-farmers (Verner 2004). For this reason, the evaluation of the structure of agricultural production, as well as the welfare of the farmers, becomes an important issue that has to be addressed.

Indeed, given the lack of farm level data, micro-economic studies of supply and demand response are few in the region and decisions made by farmers as to the allocation of resources is guided by relative changes in input and output prices. In order to measure the impact of agricultural policies at farm level, it is necessary to determine a measure of farmer responsiveness to such price changes. Key non-price factors, such as differences in agro-ecological zones, infrastructure and technology, should also be considered in determining the responsiveness of farmers to changes in agricultural policies. Many questions largely remain unanswered. These are related to: the quantitative importance of various agricultural production factors likely to affect changes in smallholder income; the impact of fire-free practices on their welfare and the proportion of who will benefit from them, and; the main farm-level factors and household characteristics influencing the potential for adoption of these technologies.

1.3 Objectives and Research Questions

Given the relevance of an economic evaluation of the structure of agricultural production, as well as the welfare of smallholders, it is the aim of this study to provide a micro-level foundation for discussion of farmer's response to price and non-price factors within the smallholder sector, and to explore the implications of these findings for policy perspectives in the Bragantina region.

Moreover, since the adoption of fire-free agricultural practices and increased farm profitability are important objectives for agriculture in Bragantina, an analysis of agricultural production is of particular importance because fire-free agricultural

⁶ For evidence on this debate, see Vosti et al. (2002).