



# Poverty dynamics, ecological endowments, and land use among smallholders in the Brazilian Amazon



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## ABSTRACT

Rural settlement in previously sparsely occupied areas of the Brazilian Amazon has been associated with high levels of forest loss and unclear long-term social outcomes. We focus here on the micro-level processes in one settlement area to answer the question of how settler and farm endowments affect household poverty. We analyze the extent to which poverty is sensitive to changes in natural capital, land use strategies, and biophysical characteristics of properties (particularly soil quality). Cumulative time spent in poverty is simulated using Markovian processes, which show that accessibility to markets and land use system are especially important for decreasing poverty among households in our sample. Wealthier households are selected into commercial production of perennials before our initial observation, and are therefore in poverty a lower proportion of the time. Land in pasture, in contrast, has an independent effect on reducing the proportion of time spent in poverty. Taken together, these results show that investments in roads and the institutional structures needed to make commercial agriculture or ranching viable in existing and new settlement areas can improve human well-being in frontiers.

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## 1. Introduction

In recent decades, poverty and inequality appear to have declined across the Amazon, in tandem with rapid, increased deforestation (Guedes et al., 2012; Ludewigs et al., 2009). Because deforestation is an immediate and highly public impact of human activities on the tropical rainforest, environmental and social scientists have expressed concern about its pace across the region. These concerns are focused especially on the conversion of primary forest to land uses such as slash-and-burn agriculture or extensive pasture for cattle (Walker et al., 2000). The environmental impacts of these land-use decisions have pushed some policy makers to propose public and state interventions aimed at curbing deforestation, notably, the reduction of investments in road-building with the aim of reducing accessibility to farms in the Amazon, increasing transportation costs, and decreasing urban–rural interaction (Fearnside, 2005). Despite these efforts, continued recent road network expansion projects have increased market accessibility throughout the Amazon (IIRSA, 2009; Pfaff et al., 2009). The

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expansion of infrastructure projects and agribusiness in the face of political resistance suggests a lack of consensus regarding how to create opportunities for sustainable development (Lima et al., 2011).

In frontier settings, rural poverty and well-being are closely linked to these questions of how human occupation interacts with the natural and built environments, and how these interactions are in turn influenced by contextual factors.<sup>1</sup> If human well-being depends primarily on the natural environment, policies that aim to reduce human impacts on the landscape by making it more difficult for settlers to prosper in environmentally sensitive regions could lead to increased out-migration from frontier regions and effectively discourage further settlement (Carr, 2009). Policies that do so by decreasing accessibility may also create barriers to financial and technical assistance, or decrease the opportunity cost of rural wage labor, with the perverse effect of keeping more frontier households trapped for longer spells in cycles of investment poverty and resource exploitation (Chomitz, 2007; Young, 1998). Slowed in the process of converting natural capital into other, higher return capitals (e.g. human capital through education and physical capital through investments in technology), these households may well be barred from transitioning to more sustainable livelihoods. If incomes depend on use of natural capital, households will have few options other than continued deforestation of new parcels to the extent that frontiers with weak environmental enforcement still exist (Barbier, 2007; Millikan, 1988; Schmink and Wood, 1984).

Reardon and Vosti (1995) label this cycle of poverty a “poverty trap”, in which the poor are obliged to forego technology and inputs that could preserve or restore natural capital, instead retaining or adopting ecologically threatening land uses and further depleting already low levels of natural capital (Chomitz, 2007; Reardon and Vosti, 1995). Policies rooted in this perspective would promote land use regulation to prevent further occupation of virgin areas and to discourage unsustainable practices in settled regions (Vosti et al., 2003). An emerging, but complementary, view is that the overexploitation of natural capital by poor Amazonian households in already-settled regions or in new small-scale agricultural frontiers is neither irrational nor permanent, but rather a rational and temporary strategy (when successful) directed at obtaining other forms of capital (e.g. human capital, financial capital or physical capital) that are vital to escaping the investment poverty trap that Reardon and Vosti describe (Lima et al., 2011; De Vreyer et al., 2009; Barbier, 2007).

In this formulation, the unsustainable natural capital depletion observed in many regions of the Amazon may offer poor households a viable strategy for transitioning out of poverty, but only if the households engaged in this pursuit are able to effectively convert natural capital into financial, physical, and other capitals with higher returns (VanWey et al., 2012b; de Sherbinin et al., 2008). This long-term investment strategy may be an intergenerational commitment, with human capital formation being less important for the first generation, but highly valuable for the second generation (Barbieri et al., 2009). Continued reliance on natural capital alone signals ongoing hardship and leads to ongoing degradation of environmental services. Whether aggregate well-being can be increased and natural resource dependence decreased is contingent upon large numbers of households successfully obtaining the high-return capitals that generate upward mobility. In this scenario, the critical policy and scientific question shifts from how to prevent households from deforesting altogether, and focuses instead on identifying those elements of the local context that make it possible for people in the Brazilian Amazon to successfully move out of poverty.

Because the link between rural well-being and the environment is both context and time dependent, a first step towards more coherent and place-adjusted policy making is the examination of what case studies can tell us (Hull and Guedes, 2013; Rindfuss et al., 2007). Understanding how some capitals, such as biophysical or natural capital, affect poverty is an important step toward constructing better policies for the promotion of rural well-being and ultimately rural development. This paper addresses poverty in the Amazon from a multi-capital perspective (Bebbington, 1999) that views capital as more than productive assets and investments, including other assets, entities, and attributes of actors that enhance capabilities (Sen, 1997) and livelihoods. The impact on rural poverty of two types of capital (natural and biophysical) is considered in conjunction with land use, household income, prior wealth, and human capital (education of household head) in one region of the Amazon. We estimate the empirical relationship between these capitals and poverty status as well as the time spent as poor, among rural households deriving their livelihoods from small-scale agropastoral activities. We take advantage of a representative longitudinal sample of rural smallholders in the colonization area of Altamira, Pará State, Brazil. Observing households at two time points allows us to examine the time spent in poverty for households having different endowments of natural capital, market accessibility, biophysical characteristics and land use by using a Markovian approach to estimating the time in poverty. Our estimates of time in poverty are first based on raw transition probabilities followed by conditional probabilities, predicted by a multivariate probit model of poverty status, controlling for socio-demographic characteristics (education and income). The comparison of cross-tabulation and regression-based Markovian estimates of time spent as poor allows us to understand how the association between natural and biophysical capitals and time in poverty is altered when other socio-economic characteristics are included.

The remainder of this paper is organized as follows. In Section 2, we discuss past research linking poverty and the natural as well as built environment in the Amazon, and further elaborate the theoretical framework in which the present analysis is situated. We then describe the study area in the Brazilian state of Pará in Section 3. Section 4 introduces the methodology used to describe, estimate, and simulate poverty transitions among settler households. Results are presented in Section 5, followed by a discussion in Section 6.

<sup>1</sup> Poverty decline in the Amazon has very complex causes, but studies suggest that in recent years government and private transfers have played an important role (Guedes et al., 2012; Marinho and Araujo, 2010; Barbieri and Bilsborrow, 2009; Brondizio and Moran, 2008; Schwarzer, 2000).

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