The Multi-Scalar Determinants of Rural Out-Migration in Colonization Areas of Roraima State, Brazil: an assessment of the displacement forces of frontier development upon the rural poor.

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Introduction

The Brazilian society is undergoing profound demographic, economic and structural changes. The stabilization of the economy after decades of hyper-inflation; the increasing role played by Brazil in the global economy, through trade and capital flows; the broad wealth redistribution policies implemented by Lula's government; along with major investments on infra-structure represent some of the transformations underway. Concomitantly, the Brazilian population has become increasingly urban; while, most internal migration is urban-to-urban in nature, taking place within metropolitan regions and toward dynamic mid-sized cities spread throughout the country. Despite the structural changes and the redirection of migration flows, Brazil still holds dynamic agricultural frontiers, which still allure a sizable number of migrants. These movements, however, have been largely neglected by the current literature.

Frontier-bound movements are integral part of Brazilian history, dating back to colonial times; however, the last great Brazilian frontier is the Amazon region. Over the last decades, the region has been subjected to a series of centrally planned investments in roads, railroad, industries, mineral resources exploration, agriculture, ranching, and colonization projects. Consequently, the regional economy and population increased many-fold, as thousands of migrants flooded the region in response to State investments and incentives (Becker, 1985).

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Nonetheless, policies have been highly inconsistent, favoring peasants at times and national and multinational corporations at others (Becker, 1990).

The myriad of studies on the Brazilian Amazon displays a bias for environmentally related investigations. As a result we know more about the ecological impact of settlements than we know about the evolution of settlements and human mobility (Browder and Godfrey, 1990; 1997). The literature on Amazonian mobility is essentially descriptive and focuses primarily on the characteristics of movers and migration patterns; whereas, the few theoretical works pose sweeping generalizations about the displacement power of development. Similarly, the literature on frontier evolution is impregnated with constructs that postulate that frontier development follows a set of hierarchical stages, moving from pre-capitalist to capitalist forms of production. These scholars suggest that as a given frontier settlement evolves through time, in-migration wanes and earlier settlers are displaced by incoming firms and large scale farmers to more backward parts of the frontier or into nearby cities. These studies, however, fail to account for the fact that not every settler moves out. Some remain and prosper amidst the several structural changes underway.

This paper focuses on those who remain in the frontier attempting to understand the multi-scalar factors that control their sojourns. In other words, what are some of the personal, household and community characteristics that entice longer versus shorter stays among the frontier settlers of the Brazilian Amazon? To answer this question, we explore the reality of the colonization areas of central Roraima, one of the nine States located within the Brazilian Amazon (Figure 1).

Population mobility is one of the most important catalysts of regional change and development (Carr, 2004). It brings significant demographic and economic consequences for movers and their farm households, as well as changes in communities of origin and destination. However, while very significant in its effects on deforestation, urbanization and regional development, population mobility within

the Amazon has scarcely been studied (Barbieri and Carr, 2005). On the other hand, the relationship between migration and poverty is a complex one. Migration can help to reduce poverty, while poverty itself is also a cause of migration. Although not all migrants are from among the poorest segments of their societies, the process of migration itself does affect the poorest, both directly and indirectly, and there remains significant potential to harness the benefits of migration to improve the livelihood of the poor. This paper gleans some insights into the migration-poverty-development nexus within the Brazilian Amazon.

This is a relevant endeavor for various reasons. From a regional perspective, this work will reveal various aspects of one of the least studied areas of the Brazilian Amazon, namely the State of Roraima. From a thematic perspective, it contributes to the literature on human mobility, by exploring the determinants of emigration from colonization areas, a theme scantly studied. Results also illuminate theory on frontier development by qualifying out-migrants and stayers placed in rural contexts marked by profound structural changes. From an epistemological and methodological perspective, the study of the multi-scalar determinants of emigration in colonization areas is connected to a growing trend among migration scholars, and will subsidize the formation of public policy directed to more stable and environmentally sound settlements within the Amazon region.

Theoretical approach

The theoretical literature on determinants and impacts of rural out-migration is vast and spans a broad range of disciplines, touching different aspects of the mobility system. Nonetheless, there has been growing awareness among scholars devoted to the study of human mobility, especially within volatile environments such as the Amazon region, that given the intrinsic complexity of the phenomenon at hand, unilateral and monolithic interpretations fail to take into account the full picture. Therefore, one needs to tackle the issue from a multi-level and multi-approach perspective. The present study is affiliated with this view (Barbieri et al. 2008;

Browder et al. 2008 i.e.) and will test the degree to which some of the embedded hypotheses present in various theoretical approaches operating at the individual, household and community level impact out-migration.

At the individual level

The Migration Selectivity and Human Capital approaches conceive the decision to migrate as an individual process (microeconomic), fruit of a rational evaluation of profit maximization, based on comparisons between utilities or personal satisfactions associated with the idea of migrating (Sjaastad, 1962; Todaro, 1969). Thus, when perceived returns of migration are greater than the costs involved in the migratory experience, one generally moves. The propensity of reaping profits with migration is determined largely by personal characteristics, such as age, sex, education, professional experience, etc. Previous experience and/or training in economic activities, and knowledge of social and environmental milieus may also prompt individuals to migrate, facilitating their survival and adaptation at future destinations. The underlying idea is that migrants do not represent a random sample of the overall population, as they tend to be disproportionately young, better educated, less risk- averse, and more achievement oriented and to have better personal contacts in destination areas than the general population in the region of out-migration.

At the household level

Originally the Life Cycle approach emphasizes the impact that changes in social status one undergoes throughout different stages of life (becoming an adult, marriage, birth of children, divorce, etc.) have upon mobility (Walker and Homma, 1996; Perz, 2002; Carr, 2004; Caldas et al. 2007). The application of these ideas in frontier areas, however, is based on Chayanov´s peasant cycle. The basic argument is that changes in household size and composition ultimately determine the form of land use. Consequently, households experience demographic and land

use processes that affect mobility decisions and therefore the supply of household labor. During periods of low labor availability, households usually adopt agricultural practices more suitable to the availability of labor, such as annual crops to keep a regular cash flow.

After the accumulation of some capital, and in periods of higher availability of labor, households can shift from annual crops to pasture and cash crops. At this stage, household members can also out-migrate due to labor opportunities elsewhere and, through remittances, to invest in the original farmland, often in cattle or perennials. Alternatively, they may out-migrate in order to constitute a new household in the event of a marriage, or following farmland degradation. In latter lifecycle stages, with a new generation assuming most farm activities, the process is repeated but with initial farming conditions established by former generations, characterized by land and forest scarcity, farm fragmentation, and a higher percentage of land in pasture or permanent crops.

The impacts of household life-cycles on out-migration can be associated with the New Economics of Labor Migration (NELM) (Barbieri, 2007). The NELM views the migration decision process as taking place within a larger context than the domain of isolated individuals, typically the households or families. Also the economic position of households at community level (their ‘relative deprivation’) influences the household behavior with respect to migration. The NELM approach conceives migration as a family strategy whereby migrants and resident household members act collectively not only to maximize income, but also to minimize risks, diversify income earnings and loosen financial constraints through remittances. Migrants and household members at origin maintain connections and cooperation over long distances through a combination of familial loyalty, exchange of transfers and parental asset pooling. If follows that, according to the NELM approach, migration impacts are conceived in term of risk management, income diversification and alleviation of liquidity constraints at household level.

Within this context, the effect of the proportion of adult individuals within the household may have positive or negative impacts on out-migration, depending on the amount of farm land available. A small amount of land relative to the number of adults increases the chance of out-migration. Conversely, a large farm can accommodate households with higher proportions of adults. But size of farm land alone does not warrantee the overall wellbeing of household units. It is imperative that this land is formally secured (titled).

Migrant networks are important socio-structural elements influencing the migration decision-making process at the household level. Such networks represent groups of inter-personal links, connecting recent migrants, old migrants and non-migrants (potential migrants) in areas of origin and destination, through friendship, kin, community and common origin ties (Massey, 1990). Migrant networks work as social structures facilitating or reducing the costs of migration related to transportation, job search, and the psychological stresses of being away from the community of origin. The unit of analysis is not the individual, nor the households, but groups of related people, connected by ties of friendship and kinship.

At the community level

Historical-structural approaches, on the other hand, do not emphasize individuals, households, nor social-networks, but the geo-economic context in which emigration takes place. In the case of frontier areas many are the theoretical proposals highlighting the displacement power associated with the process of frontier development and evolution. The underlying idea is that the advancement of the capitalist mode of production over frontier areas promotes the clash of two fronts: the demographic front, composed of small-scale produces organized around subsistence agricultural practices; and the economic front, marked by the presence of large-scale farmers and ranchers (Neiva, 1949; Martins, 1975). These clashes, in turn, expel those in the demographic front, who are forced to seek other

destinations within the agricultural frontier or in the nearby burgeoning urban centers (Martins 1996; Foweraker, 1981; Henkel, 1982; Findley, 1988).

Working from another epistemological perspective a group of scholars emphasize the impact of access to markets and infrastructure upon migration (Walker and Homma, 1996; Jepson, 2006; Sills, E.O., Caviglia-Harris, 2009). Inspired by von Thunen, scholars postulate that the expansion of frontier settlements and migration into new agricultural areas are deeply intertwined with the growth of urban areas, which, in turn, absorb the local agricultural production, and offer opportunities for off-farm employment. Therefore, distance and other measures of accessibility are crucial to understand the urban-rural nexus, and the resulting migratory flows. Implemented infra-structure at rural areas is also seen as an important factor controlling out-migration. Settlements counting good quality schools, medical facilities, public and private services would tend to enjoy better living standards, thus diminishing the need to out-migrate.

Methods

The State of Roraima is one of the nine units of the Brazilian Amazon, located in the northernmost portion of the country. The State encompasses 225,116,1 Km², having most of its land lying in the Northern Hemisphere. Despite its remoteness, the Roraima was the fastest growing area of Brazil during the 1980's and 1990's, representing the latest booming area in the Brazilian Amazon. Despite this tremendous population growth, little is known of Roraima and most studies dealing with the Brazilian Amazon scarcely contain any reference to the state. Moreover, Roraima mirrors many current and past features and problems of other Amazonian areas as it has experienced fast development, massive road building, colonization programs, competition for land, destruction of natural vegetation, conflicts between indigenous groups and settlers, and a rampant urbanization process. The active agricultural frontier areas of Roraima still attract large numbers of land-less

peasants, from other within the State of Roraima, within the Amazon region, as well as from different areas of Brazil.

Given its remoteness, Roraima remained isolated for centuries. It was not until the 18th century that the Portuguese managed to establish themselves in the area (Ambtec, 1994; Barros, 1994 and 1995). Roraima's isolation was partially broken during the Amazonian Rubber Boom when the local economy expanded substantially. Nonetheless, the chief activity at the time was not rubber tapping, but beef production. Local rubber trees yielded low quality latex, but the cattle ranches located in the northern savannas proved to be profitable endeavors (Barros, 1995). With the demise of the rubber economy, mining become the dominant economic activity. Still, Roraima remained sparely populated, counting on 28,304 inhabitants by 1960 (Silveira and Gatti, 1988; Magalhães, 1986). The post-1964 military administrations brought massive infrastructural investments to the region, and also created a series of agricultural colonization projects. Nonetheless, the massive occupation of Roraima took place after the construction of BR174, a road linking Roraima to Manaus in the late 1970's.

Roraima became the fastest growing Brazilian State during the 1980s and early 1990s, constituting the latest booming area in the Amazon. According to estimates, the local population is presently 420,000 inhabitants, of which roughly 60% are concentrated in the capital city of Boa Vista. Roraima also displays the largest indigenous population of Brazil: some 13,000 natives. Despite this tremendous population growth, little is known of Roraima and most studies dealing with the Brazilian Amazon scarcely contain any reference to the state (IBGE 1992 and 2009, MacMillan 1995). Moreover, Roraima mirrors many current and past features and problems of other Amazonian areas as it has experienced fast development, massive road building, colonization programs, competition for land, destruction of natural vegetation, conflicts between indigenous groups and settlers, and a rampant urbanization process (Furley and Mougeot, 1994).

Field data were gathered during the dry season, between November/97 and March/98. The survey was based on a semi-structured instrument, which explored household heads' social-economic conditions, as well as their past and present mobility behaviors. Before household heads could be sampled, the 45 colonization projects of Roraima were classified based on the four-tier development typology (see Diniz, 2003). Once the classification phase was completed, colonies representative of each phase of evolution were sampled via multi-stage cluster sampling (Sarndal, 1992). In the process, three colonies (clusters) were randomly selected within each evolutionary type: Confiança III, Maranhão, Sumaúma (Pioneer); São Francisco, Confiança II, Roxinho (Transitional); Alto Alegre, Confiança I, Vila Iracema (Consolidated); Alto Alegre, Vila Iracema, and Cantá (Urbanized) (Figure 1). Household units were then selected systematically from within each cluster, based on up to date official maps of agricultural settlements generated by INCRA and ITERAIMA. Sampling intervals were defined by the ratio between the number of plots officially distributed by land granting agencies, and the number of interviews to be recorded. A total of 30 household heads were interviewed in each settlement.

Out of the 360 interviewed settlers only 159 were land owners who fully engaged in subsistence agriculture and dwelling in their rural properties. The remaining individuals were either in the process of acquiring land or were engaged in other economic activities, especially in the service market. As this work is concerned with the factors controlling the sojourns of subsistence farmers an OLS model was developed using length of residence in the colonization project among these 159 land owners engaged in agriculture as dependent variable. The predictors, listed below, were organized according to the level of aggregation in which they operate (individual, household, and community), bearing direct association with at least one of the major theoretical constructs discussed earlier (Table 1).

Results

Descriptive statistics indicate that household heads have been living in the frontier for 6.4 years, on average, at the time of the survey (Table 2). These individuals are predominantly males, with little formal education. Upon arrival they were 37.1 years old, on average, and were for the most part married.

The majority of these individuals migrated from within the Amazon region itself, coming mostly from an agricultural background. Predominantly, settlers entered present destinations with family members and/or friends, and most had local acquaintances prior to move.

Off farm work is a common risk aversion and money-making strategy, and settlers are part of household units in which 56.89% of its members farm the land they occupy. This land was for the most part purchased, instead of claimed or received from official land-granting agencies. The majority of these plots is formally titled and average 91 ha in size. Nonetheless, very few individuals were able to increase the size of their properties after settlement.

Contextually, colonization areas were 5.1 years old when household heads reached them, counting on a few feeder roads. These communities were located, on average, 90 kilometers away from the capital city of Boa Vista, the largest regional market.

OLS results are presented in Table 3. The adjusted r^2 is moderately high at 0.61 and the overall model is statistically significant. The assumptions of linearity, homoscedasticity and no high multicollinearity among the independent variables were examined. To ease interpretation predictors are grouped according to their level of aggregation (individual, household and geographical context).

At the individual level

Curiously, age upon arrival, education, and previous experience in agriculture were not statistically significant predictors in the presence of other variables operating at the individual and other levels of aggregation. Concurrently, other socioeconomic traits such as gender and whether individuals were married upon arrival display barely significant associations with length of stay (at the 0.15 level). These findings challenge the ideas advanced by the Migration Selectivity and Human Capital approaches, as length of residence has no statistical bearing on whether settlers are men, young, married, educated and knowledgeable about agriculture.

Another unexpected result has to do with the negative and statistically significant sign associated with previous experience in the Amazon. One would expect from those migrating from within the region to display longer stays. After all, by accumulating knowledge about the region, especially about the specificities of local agriculture, they would be more prone to success. This surprising finding may be associated with the fact that the Brazilian Amazon, especially its northern fringes, can still be considered an open frontier area, as land is still available for settlement. As a result the Brazilian Amazon is marked by intense intra-regional mobility, and settlers display long migration histories within the region, as a series of push and pull factors operate amidst the various colonization fronts. Notice that the vast majority of settlers in the database immigrated from within the region (Table 2). Therefore, besides becoming knowledgeable about how to claim land and how to bring it into production, Amazonian settlers also learn that there is a wide range of economic opportunities in the region, and by moving around they can explore and benefit from them.

At the household level

OLS results bring partial support for the hypotheses embedded in the Life-Cycle and NELM approaches, and identify no statistical relevance associated with the

importance of Migration Networks in predicting length of stay. Statistical results indicate that two of the production strategies deployed by households, namely the percentage of members working the land, and whether or not settlers are engaged in off farm work proved to be statistically insignificant. The presence of acquaintances prior to arrival had the same fate contradicting the expectations about the role of migrant networks in improving the chances of success, and, consequently, of longer stays.

Among the factors operating at the household level, the most statistically significant predictor is whether individuals migrated as part of a group of family members or friends, as opposed to individually. The positive sign indicates that longer stays are related to the support of kin throughout the entire stay. Field work suggests that a myriad of strategies are deployed by groups of related settlers, from the selection of more suitable plots, to the formation of labor exchange groups, which have direct impact on the adaptability and success of settlers.

Also noteworthy is the fact that most variables associated with the unit of production display statistically significant results. The sheer size of land and the fact that this land is titled display positive associations with length of stay. Larger and legalized assets represent significant pull factors for frontier settlers. On the other hand, the fact that this land was originally purchased, as opposed to claimed or received from governmental agencies display a negative association with length of stay. This result is fruit of the process of frontier evolution and the instauration of land markets in colonization areas. Those arriving earlier in the frontier have wide access to free plots of pristine land. As time progresses infrastructure is implemented in and around the settlement; plots are benefited; and land markets established. Thus, those arriving late, despite displaying shorter lengths of residence in the area, discovered that land was no longer available, having to purchase the properties they presently occupy.

At the community level

All together, the most significant predictors of length of stay are found among the contextual variables. Age of the agricultural settlement at time of arrival has a negative relationship with length of stay, suggesting that those who arrived during the earlier stages of development of settlement areas display longer residences, versus those arriving later in the process. Arriving earlier at the frontier gives settlers the advantage of choosing better plots (with fertile soils, appropriate drainage and shorter distances to feeder roads), substantially increasing the probability of higher agricultural production, success, and longer stays.

The number of feeder roads has also a highly significant impact on the length of stay, contrasting with distance to Boa Vista, the largest regional market. This is a very interesting outcome that suggests that distance to markets is less important than accessibility in predicting length of stay. In fact, one is better off being located at a larger distance, but counting on a denser and more reliable road network; than being physically closer to markets, but relying on a single precarious access.

Conclusion

The colonization projects of the Brazilian Amazon, both directed and spontaneous, have historically displayed low migrant retention rates, which in turn fuel the hectic regional mobility system. Displaced settlers either move into the burgeoning urban centers of the region, adding more pressure to the already depleted job markets, or further advance the agriculture frontier, with severe environmental repercussions. Some sources estimate that smallholders clear at least 600,000ha each year, implying that they significantly contribute to deforestation. Therefore, understanding the factors that control out-migration is fundamental to curb the rampant regional urban growth, frontier expansion and environmental depletion.

This work attempted to contribute to the empirical knowledge about the factors responsible for the sojourns of agricultural settlers in the Brazilian Amazon. In order to achieve this goal, we embraced the growing trend in the literature towards the use of multiple theoretical perspectives in a multi-scalar fashion to attempt to better understand the complexities of the regional mobility system. By doing so we were able to draw a few major conclusions.

Echoing the outcomes of previous studies (Barbieri et al. 2008 and Browder et al. 2008), results suggest that the Amazonian mobility system is extremely complex and challenges the unitary use theories and epistemological approaches. No single theory deployed here was sufficient to fully explain why settlers stay as opposed to leave colonization areas. In fact, empirical results offer, at best, partial support to the claims embedded in the Life-Cycle and NELM approaches; while, refuting the hypotheses intrinsic to classical migration selectivity, and Human Capital approaches, when a group of variables is simultaneously taken into account.

Empirical evidence challenges even more the claims of Historical-Structural approaches, which state that the path of frontier development, marked by the increasing presence of the capitalist modes of production, would inevitably lead to the expulsion of peasants and the consolidation of subsistence plots into large ranching and farming operations. Field observation and statistical results presented here suggest that landless peasants are still arriving at the frontier in places undergoing full blown labor and land markets. Moreover, many of those who arrived in earlier stages of development were able to resist the “overwhelming forces of expulsion” and were able to establish prosperous livelihoods.

With the help of an OLS model, we were able to identify the relative importance of multiple factors operating concomitantly at the individual, household and community levels. The reality of Roraima suggests that when taken together, household and contextual determinants are stronger predictors of length of stay than measures pertaining to individuals. Results indicate that settlements enjoying

better infra-structure, especially accessibility to markets, and more secure land tenure systems tend to facilitate the permanence of settlers. The arrival of groups of related individuals at the frontier also leads to longer sojourns. Conversely, taking all the other variables in the model into account, classical predictors of out-migration operating at the individual level such as age, marital status, schooling and occupation fail to statistically account for the variation in the length of stay.

These results have direct policy implications, as the formation of more stable and sustainable forms of agricultural settlements in the Brazilian Amazon must take into account the need to provide settlers with basic transportation and service infra-structure, along with secure land tenure systems. By doing so, we would be able not only to curb the ongoing population pressure upon the local environment, but also alleviate part of the hardships undergone by the rural poor.

Table 1
List of predictors

Variables	Theoretical construct	Expected sign
Individual		
Gender (1 = men)	Migration Selectivity and Human Capital	+
Schooling years		+
Age upon arrival		-
Civil status upon arrival (1 = married)		+
Previous region of residence (1 = Amazon)		+
Main occupation at previous residence (1 = agriculture)		+
Household		
Had acquaintances upon arrival	Social Networks	+
Migrated with kin/family members (1 = yes 0 = migrated individually)		+
% of household members working the land	Life cycle/NELM	+
Household head engages in off farm work seasonally (1 = yes)		+
Land acquisition (1 = purchased)		+
Legal status of land (1 = titled)		+
Land size		+
Increased size of plot since arrival (1 = yes)		+
Geographic context		
Age of agricultural settlement upon arrival	Community Factors	-
# of major feeder roads upon arrival		+
Distance from settlement to Boa Vista		-

Table 2
Descriptive statistics

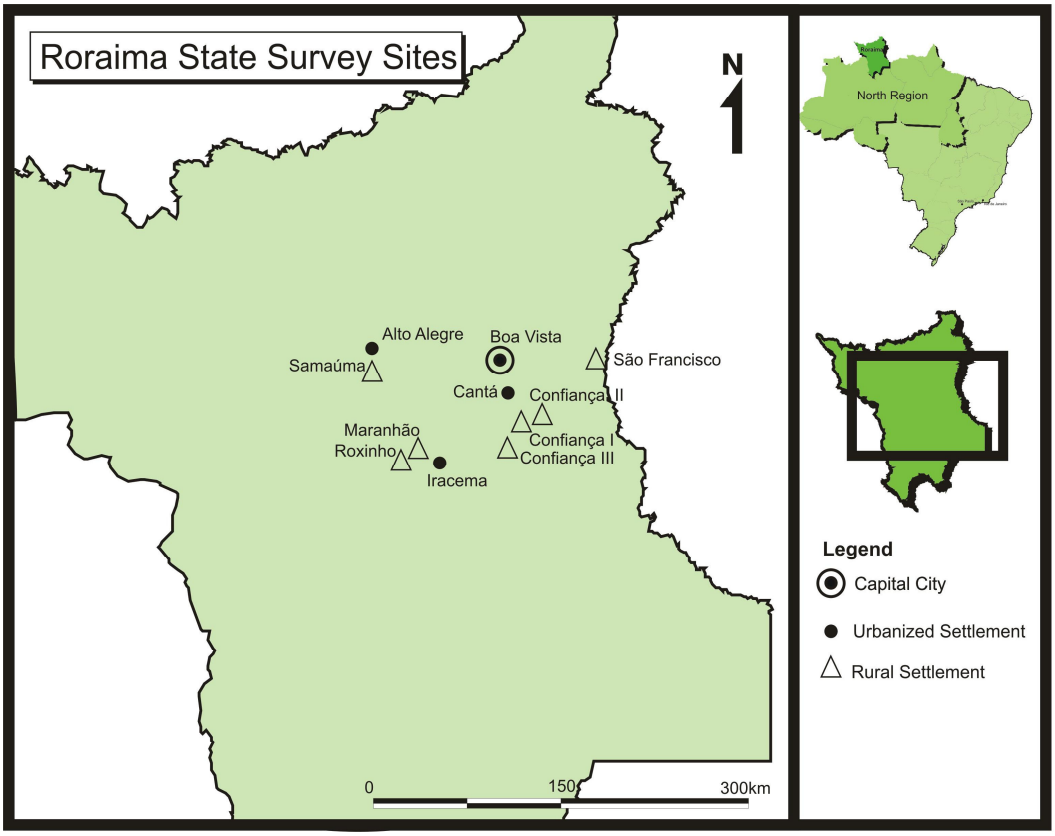
Variables	Mean	Std. Dev.
DEPENDENT		
Length of residence	6.459	5.154
INDEPENDENT		
Individual		
Gender (1 = men)	0.956	0.206
Schooling years	2.192	2.678
Age upon arrival	37.107	12.063
Civil status upon arrival (1 = married)	0.792	0.407
Previous region of residence (1 = Amazon)	0.918	0.275
Main occupation at previous residence (1 = agriculture)	0.673	0.471
Household		
Migrated with kin/family members (1 = yes 0 = migrated individually)	0.711	0.455
Had acquaintances upon arrival	0.774	0.420
% of household members working the land	56.890	32.793
Engage in off farm work seasonally (1 = yes)	0.679	0.468
Land acquisition (1 = purchased)	0.491	0.501
Legal status of land (1 = titled)	0.660	0.475
Land size	91.698	51.610
Increased size of plot since arrival (1 = yes)	0.101	0.302
Geographical context		
Age of agricultural settlement upon arrival	5.157	7.434
# of major feeder roads upon arrival	5.943	5.038
Distance from settlement to Boa Vista	89.950	43.726

N=159

Table 3
OLS regression results,
Determinants of length of residence at the frontier

	Coef.	P>t
Individual		
Gender (1 = men)	1.324695	0.146
Schooling years	-	
Age upon arrival	-	
Civil status upon arrival (1 = married)	-0.90568	0.147
Previous region of residence (1 = Amazon)	-2.53609	0.089
Main occupation at previous residence (1 = agriculture)	-	
Household		
Had acquaintances upon arrival	-	
Migrated with kin/family members (1 = yes 0 = migrated individually)	1.768196	**0.039**
% of household members working the land	-	
Engage in off farm work seasonally (1 = yes)	-	
Land acquisition (1 = purchased)	-1.16701	**0.049**
Legal status of land (1 = titled)	1.43332	0.149
Land size	0.037268	**0.045**
Increased size of plot since arrival (1 = yes)	-	
Geographical context		
Age of agricultural settlement upon arrival	-0.39714	**0.001**
# of major feeder roads upon arrival	0.685282	**0.0001**
Distance from settlement to Boa Vista	-	
Constant	1.799138	0.558
# of odds	159	
F	21.33	
Prob > F	0.0001	
R-Squared	0.6199	
Root MSE	3.3637	
# of clusters	9	

Figure 1
Roraima State



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