

POPULATION MOBILITY AND LAND FRAGMENTATION: LAND USE-COVER CHANGE IN BRAZIL AND GUATEMALA¹

Julia Côrtes^{*}; Laurel Suter[†]; Álvaro D'Antona[¶]; David Lopez-Carr[‡]

Introduction

In the agricultural frontier agrarian change is driven by the consolidation of large properties and land concentration. Some researchers, however, have drawn attention to an opposite process, in which the properties are fragmented in smaller parcels (D'Antona et al. 2011; Côrtes & D'Antona 2012; Pan et al. 2004; Suter & Carr 2010; Barbieri et al. 2005; Sherbinin et al. 2007). Land fragmentation has different implications, such as increasing the number of households in a given area and decreasing the size of each resultant property, sometimes to below the land unit area necessary to sustain a rural family. This set of modifications promotes a new condition in the rural area, providing a fresh population-environment relation to study environmental change.

A more profound understanding of this phenomenon (Pan et al. 2004) demands further investigation on the influence of demographic factors on fragmentation, and further clarification of its implications for land use-cover change. The objective of the present study is to investigate the connections between population mobility - including non-mobility- and land fragmentation, from the perspective of household and family dynamics. For that, we intend to compare two areas of dynamic land use and household changes, one located in the municipality of Santarém in the Brazilian Amazon and the other in Sierra del Lacandon National Park (SLNP) in northwestern Guatemala. These areas were selected for comparison because of the similarity of phenomena taking place in the two regions (land consolidation and parcel fragmentation) and comparable panel-data collected during roughly the same period. Comparisons between these two areas contributes to the literature on population and environmental relations, from both a methodological perspective on survey development and data usage, and from an empirical perspective for examining how contextual factors affect pertinent processes to impact variable outcomes in different circumstances. This helps us to identify how local and contextual factors interact, a necessary understanding when attempting to increase the scale of analysis from the local to global.

The Brazilian Amazon and Guatemalan lowlands are recognized for their dense tropical forests and high rates of deforestation in the recent decades, consequently receiving special attention in studies of land use-cover change. The study areas are located in regions of agricultural frontier expansion, though they represent different local contexts. The study will compare the areas based on their particular features and the phenomenon of parcel fragmentation and consolidation. Whereas Santarém constitutes a more mature frontier area,

¹ Working paper to International Union for the Scientific Study of Population - XXVII International Population Conference – Busan, Korea - 26-31 August 2013

^{*} University of Campinas / Brazil (jccortes@nepo.unicamp.br)

[†] University of California, Santa Barbara/ USA (laurel@geog.ucsb.edu)

[¶] University of Campinas / Brazil (alvaro.dantona@fca.unicamp.br)

[‡] University of California, Santa Barbara/ USA (carr@geog.ucsb.edu)

with recent expansion of soybean plantations, the site in Guatemala encompasses a younger frontier within a conservation area. Real estate speculation and consolidation in both areas (soybean plantations in Santarém, ranching, teak, and fruit plantations in the case of the SLNP), as well as the restriction of agricultural expansion within the SLNP have limited the access of the subsistence population to land. This scenario promotes a new situation for the local population who must reformulate the strategies of livelihood, especially with respect to the second generation.

Theoretical focus

The land structure polarization (D'Antona et al. 2011), which describes the land concentration but also the concomitant multiplication of small properties, has prompted the interest of land use-cover change researchers. The increase in the quantity of properties and the size reduction can reflect the changes to the household demographic profiles and the decision making about land use (Pan et al. 2004; Suter & Carr 2010; Côrtes & D'Antona 2012). Fragmentation is not a simple and one-dimensional process; the intensity, location and settings of the subdivisions have an important role in impacting the livelihood of rural families (Pan et al. 2004; Côrtes & D'Antona 2012).

Many factors have been used to explain the land fragmentation and its relation with demographic patterns. Some of these factors are: The age of the household head, the household demographic composition, the number of households in the property (Pan et al. 2004), population mobility and spatial distribution of rural population, delayed marriage and age of leaving parents' house, farm size, return migration (Côrtes & D'Antona 2012), out-migration, income generation and source diversity, and acquisition time of ownership (Suter & Carr 2010).

Once the properties are split, there is a structural change in the population-environment connection. For example, there may be an increment in population by new household or an increase in density per area by the reduction of property size. The property extent emerge as a significant variable related to land transition in frontier regions (D'Antona et al. 2006; Pan et al. 2004). The lot size has been associated with the forest conservation capacity, the proportion of the parcel covered by forest and crops, and agricultural strategies, such as technologies and management systems. The size reduction has been related to the production intensification (Suter & Carr 2010) and the adoption of non-agricultural activities, such as grocery stores and other commercial activities (Côrtes & D'Antona 2012; D'Antona et al. 2011).

Data and research methods

Santarém is an old city located in eastern Amazonia, with strong regional economic importance in the state of Pará, Brazil. There have been spontaneous settlements, as well as planned settlements made by Federal Government projects in the 1960s. More recently, the land conversion has been stimulated by soybean production, which started in the early 2000s. The Sierra del Lancandón National Park is a protected area declared in 1990 in northern Guatemala, with human settlements located within its borders. Most settlements were established in the late 1960s through the 1990s. The area that communities and their agricultural areas may occupy is circumscribed by the National Council of Protected Areas of Guatemala,,though most communities experience positive population growth from in-migration and natural growth.

The data used in this present study comes from panel surveys conducted independently in both areas, with questionnaires that include information on household composition and age structure, reproductive history, farming and property features, and the current location and livelihoods of offspring. The data will be compared between the fragmented and not fragmented properties to assess the specific factors associated with the dynamic division of land. The investigation will be focus on household demographic dynamics, including the resident composition and the out-migration of individuals from the household, in an attempt to understand the implications of population mobility on changes in land structure. Because of that, understanding the movements (or non-movements) of the second generation is a relevant approach for this study. The analyses are performed independently for each specific region, for subsequent comparative evaluation. This will be followed by a discussion of the implications of this process in land use and cover change studies.

In Santarém the survey was administered in 2003 to the households residing on 311 properties, with researchers returning to the same units in 2009, 392 properties at the time because the land fragmentation. The follow up methodology was administered in all the properties (and all households inside the property), including new properties created with fragmentation and other properties when the owners live in other area (rural or urban). Former owners who have sold their properties between 2003 and 2009 were also interviewed if they still were living live in Santarém. We surveyed 404 household in 2003 and 539 in 2009. Our analysis includes 48 former owners, 311 current owners (which 49 of that were new owners and 63 were living in another place in Santarém), and 2892 children of the household heads, 372 of whom have migrated during the analysis period, which 237 have left the parental household during the study period (167 have continued in Santarém).

In the SLNP, the survey was administered to the household heads of 247 households in 1998 and to the household heads of 481 households in 2009. Of these 247 household heads in 1998, 186 were property owners at that time (either with usufruct rights to the land or with legal tenure). The majority of non-owners rented farming land from others, though six households had no access to farming land in 1998. The 186 owned land parcels identified during the 1998 interviews belonged to 186 households at that time, and to 273 households in 2009. We interviewed 193 of these current owners in 2009. In the case of the 80 non-interviewed households in 2009, we were unable to determine or locate the current owner of 19 of the 1998 properties of interest, and two of the 1998 properties had been converted from agricultural land to housing lots in the intervening eleven years, housing 61 households in 2009. Of the 186 landowning households in 1998, 101 of those households still owed all or some of their 1998 landholdings in 2009 (nine of these households had also acquired additional land of interest), while the remaining 85 original properties belonged to 95 unique households (five of whom had acquired multiple properties of interest). We were also able, in 2009, to interview 33 households that were the former owners of the 1998 parcels of interest still living in the area or nearby, but who had neither retained their parcel of interest nor by coincidence acquired a different parcel of interest by 2009. The other 52 households who had sold their land in the intervening time had typically moved away from the area. We therefore interviewed in 2009 a total of 226 current or former owners of the 186 parcels identified during interviews in 1998. Our analysis includes these households and their 505 children, 83 of whom have left the parental household during the study period.

Findings to date

In Santarém, 15% of the 311 properties in 2003 (n=44) were fragmented. Land fragmentation was associated with death of the head of the household and division for inheritance, family dynamics, and financial interest. Fragmented properties have a higher average number of members per property (including all households) before the split than non-fragmented properties. The 44 properties in 2003 became 113 in 2009, composing a picture where 42% of all fragmented properties in 2009 have less than one hectare and 27% have between one and five hectares. Fragmentation most likely occurs in small properties resulting in a mosaic of micro-properties. Fragmentation was also shown to be associated with population increase in the area, which translates in the creation of new domestic units (50% with new head of household), as well as in the increase in the number of residents in the households that remained in the period (47% of those households has increased their members), attracting both heirs and non-heirs.

In the SLNP of Guatemala, after discounting the parcels which have become effectively “urbanized”, the former 186 parcels from 1998 are in approximately 231 fragments by 2009, an increase of 24% in the number of sub-parcel units. Average size of an owned parcel (as opposed to a rented parcel) reduced significantly ($p < 0.001$) from 44 ha in 1998 to 34 ha in 2009. Additionally, the proportion of households paying rent for their farm land increased significantly between 1998 and 2009, almost doubling from approximately 23% of farming households in 1998 to 43% in 2009. In 2009, 35% of farming households employ 5 ha or less of land.

With the deepening analysis of these data and the comparison of the results obtained in both areas, this study intends to associate the process of land fragmentation with demographic parameters to understand how different contexts may lead to a similar or distinct phenomenon, as well as to elucidate the implications of this transformation in both regions. We believe that the results will contribute to a better understanding of the links between population and the environment within the framework of land use-cover change, contributing to the development of policies focused on the livelihood of rural populations, food security and forest conservation.

References

- Barbieri, A.F., Bilsborrow, R.E. & Pan, W.K., 2005. Farm Household Lifecycles and Land Use in the Ecuadorian Amazon. *Population and Environment*, 27(1), pp.1–27.
- Côrtes, J.C. & D’Antona, Á.O., 2012. Urbanização do rural : mobilidade populacional e dinâmica do uso da terra em Santarem, Brasil. In *V Congresso ALAP*. Montevideo: ALAP.
- D’Antona, Á.O., VanWey, L.K. & Hayashi, C.M., 2006. Property Size and Land Cover Change in the Brazilian Amazon. *Population and Environment*, 27(5-6), pp.373–396. Available at: <http://www.springerlink.com/index/10.1007/s11111-006-0031-4>.
- D’Antona, Á.O., VanWey, L.K. & Ludewigs, T., 2011. Polarização da estrutura fundiária e mudanças no uso e na cobertura da terra na Amazônia. *Acta Amazonica*, 41(2), pp.223–232.
- Pan, W.K., Carr, D.L. & Bilsborrow, R.E., 2004. Causes and consequences of farm fragmentation in Ecuador’s Amazon. In *Conference on Land Use and Rural Sustainability*. Aberdeen, Scotland: International Geographical Union.
- Sherbinin, A. de et al., 2007. Population and environment. *Annual Review of Environment and Resources*, 32, pp.345–373.
- Suter, L. & Carr, D.L., 2010. Land parcel fragmentation in the agricultural frontier: Sierra del Lacandón National Park, Guatemala.