

Indigenous Populations and Land Use in the Northern Ecuadorian Amazon

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1. Introduction

Over the last twenty years there has been growing concern about deforestation of the Amazonian rainforests, the world's largest remaining tropical wilderness (Myers, 2000). While the fundamental causes of deforestation in the humid tropics have been found to vary significantly between and within regions, a number of investigators have found small farmers to be primary direct agents of land cover change (Southgate and Whittaker, 1992; Rudel and Horowitz 1993; Pichon, 1997). While investigations of small scale farmers have dealt with both planned and spontaneous colonization, the roles of indigenous peoples and their land use practices are also of primary importance since they inhabit large areas of remaining forest. By gaining a better understanding of the responses of a variety of indigenous populations to demographic change, land characteristics, and market access, we hope to stimulate improvements in policies to achieve more sustainable development, and to ultimately predict how such ongoing changes will translate into further future land conversion and deforestation.

This paper presents early results from a three-year, National Institutes of Health-funded research project on five indigenous populations of the western Amazon. The overall objective of the project is to determine the demographic, socio-economic and biophysical factors determining the intensity of land use by indigenous populations in the Ecuadorian Amazon. The project builds upon another previous study of colonist populations in the region, sponsored by NASA, in which data were collected and analyzed from surveys of migrant farm households carried out in 1999

and from satellite images covering the main area of settlement of colonist populations from the mid 1970s to present.

While the project will eventually compare colonist and indigenous populations in their land use and its determinants, the present paper focuses on the differences among the five indigenous groups in the Ecuadorian Amazon. These populations differ in territorial base, population size and density, and contact with and integration into the market economy. These study populations are expected *a priori* to be located at different places along a gradient measuring the intensity of land use, and their positions along this gradient will be related to demographic, biophysical, and socio-economic factors.

2. Methods

This project uses quantitative and qualitative methods from the fields of demography, landscape ecology, anthropology, economics and political ecology. Data collection, carried out in 2001, involved two phases of fieldwork: (1) an ethnographic study in 8 indigenous communities, and (2) household and community surveys in 36 indigenous communities. In addition, Global Positioning System (GPS) receivers were used in the field to obtain geographic coordinates of communities, households, and agricultural plots to facilitate studying land use on a regional scale as well.

This paper focuses on the information collected in the household survey; preliminary results of the ethnographic study having been presented at PAA and other conferences in 2002 (e.g., Bilsborrow et al, 2002 PAA paper). Sample selection was based upon controlled sampling (see Kish, 1965: 494; Goodman and Kish, 1975:351) to select communities that represent *a priori* a range of different conditions in terms of location/access to roads and towns, biophysical characteristics, and population size and density. A majority of the 36 communities had small populations and all households were interviewed. In a handful of larger communities a sampling frame was created by supervisors in the field and used to randomly select 22 households per community to be interviewed, anticipating successfully interviewing 20. The total actual final

sample size is 554 households in 14 Quichua communities, 10 Shuar communities, 7 Huaorani communities, 3 Cofan communities, and 2 Secoya communities.

In each household interviews were conducted separately with the male head of household and spouse of the head. The male survey obtained information on plot size, location, and land use; migration history; property regimes; agricultural production, market sales, and income; use of modern inputs; perceived soil quality; fallow land; hunting and fishing; household members working outside the community; any government or non-government assistance received; etc. The female questionnaire included questions on household composition; out-migration of household members; access to nearest road and infrastructure; health; fertility and mortality of household members; household assets; etc. These data facilitate addressing many questions about demographic processes, market integration, and land use/ land cover change among indigenous populations that have previously not been quantitatively and comparatively addressed.

3. Analysis of Agricultural Land Use

Traditional indigenous agriculture in Amazonia is a sustainable land use that maintains soil fertility (Anderson and Posey, 1989; Hecht & Posey 1989), vegetative complexity (Balée and Gély, 1989; Smole, 1989), and biodiversity (Anderson and Posey, 1989; Irvine, 1989). Indigenous households cultivate a polyculture of food crops (particularly the staples, manioc and bananas) in multiple swiddens within a matrix of primary and secondary forest (Vickers, 1978, 1983, 1993). Land may be open-access to community members or managed communally under a common property regime (Lu, 2001). However, increasing market integration, settler encroachment on their lands, increasing employment of males in petroleum companies, and rising populations are leading some indigenous communities to begin to alter their agricultural practices in ways that begin to resemble those of non-indigenous colonists (e.g., Walsh et al., 2001). We view these practices as lying along a spectrum of land use intensity in which increasing intensity is associated with shorter forest fallows, more use of external inputs, and more market sales of agricultural products. However, we are also interested in patterns of

extensification, as reflected in the total area occupied per household and community and ethnic group and the spatial spread of agricultural parcels. This paper will examine relationships between these land use practices and outcomes and potential explanatory factors, including demographic, socio-economic and biophysical factors. We will also examine correlations among these factors as we attempt to better define an axis of land use intensity.

Demographic factors that influence land use include household size and composition. We predict that households that are larger and contain more adults will practice agriculture that is both more intensive *and* extensive in order to meet nutritional requirements and to take advantage of available labor. Socio-economic factors that affect land use include ethnicity, access to infrastructure, and duration of residence. We expect that differences in history and culture between the five indigenous peoples will be reflected in land use. We also expect that communities with better access to infrastructure, such as roads and markets, will practice more intensive agriculture to take advantage of market opportunities. Longer durations of residence are expected to be associated with more intensive agriculture, as households have invested more in the land. Biophysical factors that influence agriculture include soil quality. Based on results from the study of colonist land use, we predict that communities with higher quality soil will practice more intensive agriculture, although this may interact with access to markets.

4. Future Developments

The paper will conclude with a discussion of planned future analyses of these data, data and analysis limitations, and implications of the results for policies regarding the tropical forests and indigenous peoples of the study area. The results should also have important implications for conservation and human development policy formulation in the region, given the serious current threats to the survival of forests and indigenous cultures in Ecuador and elsewhere in the Amazon basin.

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