OUT-MIGRATION AND RURAL LIVELIHOODS IN THE SOUTHERN ECUADORIAN ANDES

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ABSTRACT

CLARK GRAY: Out-Migration and Rural Livelihoods in the Southern Ecuadorian Andes
(Under the direction of Thomas Whitmore)

This work draws on approaches from migration studies and population-environment research to investigate the drivers and consequences of rural out-migration in the southern Ecuadorian Andes, with a focus on connections to agriculture, the environment, and gender. Rural out-migration represents one of the primary forms of human population redistribution over the past century and is an important form of livelihood diversification for many rural households in the developing world. Out-migration commonly occurs in a context of land scarcity or environmental degradation and agricultural production may be further undermined by the loss of household labor to migration, but few quantitative studies have investigated these connections. To address these issues I conducted a household survey in a probability sample of 36 rural communities in southern Loja Province, Ecuador. The survey collected life histories for migrants and non-migrants as well as cross-sectional and retrospective information on household assets and livelihood activities. The household survey was supplemented by a community-level survey and the construction of a geographic information system that provided contextual information.

To investigate the effects of agrarian and environmental contexts on out-migration I use these data to estimate a multinomial event history model of out-migration to local, rural, urban and international destinations. The results indicate that access to land

decreases migration to urban areas but increases migration to rural and international destinations, particularly for men. Also, positive stable characteristics of the environment (e.g., flat topography) and characteristics that indicate environmental variation (e.g., soil erosion) both tend to increase migration.

To investigate the consequences of out-migration and remittances for rural livelihoods I estimate a series of tobit and Poisson models of participation in various agricultural activities and changes in assets over time. The results reveal that migration and remittances have countervailing effects on agriculture, with primarily positive effects on market-oriented activities. Together, the findings challenge several prevailing assumptions from the literature on migration, development, and the environment and also highlight the utility of quantitative methods for the investigation of rural livelihoods.

ACKNOWLEDGEMENTS

This research would not have been possible without the assistance of a number of individuals and institutions. My graduate training has benefited immensely from the guidance of Thomas Whitmore, who has always been available to provide on-target advice and has worked hard to ensure that my research is conceptually well-founded and clearly explained. This research also benefited greatly from the mentorship and the regional and methodological expertise of Richard Bilsborrow. Many thanks also to my other committee members (Chirayath Suchindran, Stephen Walsh, and Wendy Wolford) for providing useful feedback at key junctures, and to the members of the CPC IGERT program, the Ecuador Projects and the Loja fieldwork team for their friendship and support. This research was primarily funded by a Doctoral Dissertation Improvement Grant from the National Science Foundation and a Research Residency grant from the Carolina Population Center.

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CHAPTER 1

INTRODUCTION

1.1 Aims of the Dissertation

The departure of people from rural areas (i.e., rural out-migration) represents one of the primary forms of human population redistribution over the past century, with profound impacts on urban, frontier, and international destinations as well as on rural origin areas. As a result of rural out-migration, rapid urban growth and international out-migration in many developing countries are paralleled by stagnant or falling rural populations (United Nations, 2005), a process particularly evident in regions where environmental conditions are less favorable for agriculture. In these marginal regions, reliance on natural-resource dependent livelihood strategies such as smallholder agriculture is a risky strategy for household subsistence, and migration of one or more household members is an important form of livelihood diversification that can reduce consumption demands, provide access to needed remittances, and potentially transform origin-area livelihood activities. Many qualitative studies of one or more communities have highlighted these connections between migration and origin-area livelihoods, emphasizing the potential for environmental degradation to displace "environmental refugees" (e.g., Charnley, 1997) and the negative consequences of labor lost to migration for traditional livelihood activities (e.g., Zimmerer, 1993). These studies provide illustrative examples of migration-livelihood connections and have made important

theoretical contributions, but are limited in their ability to generalize or to test hypotheses about causes and effects of rural out-migration. Data collection with structured household surveys followed by multivariate analysis can address these limitations, but studies of migration using these approaches have focused on individual demographic characteristics and economic outcomes, largely ignoring the environmental and agrarian contexts of rural out-migration.

This study draws on novel approaches for survey data collection and analysis to investigate connections between migration and rural livelihoods in the southern Ecuadorian Andes. The study addresses two broad research questions which are frequently discussed in the literature on migration, development and the environment but have been the focus of only a small number of previous quantitative studies.

(1) How do environmental conditions and access to land influence rural out-migration?

(2) How do out-migration and remittances subsequently affect household assets and agricultural activities?

Chapter 2 describes the regional and national context of the study area in southern Loja province. This region is environmentally marginal for agriculture and an important origin area of migrants to urban, frontier and international destinations. Chapter 2 also describes the methodological approach, which drew on migration studies and population-environment research and included a household and community survey. Chapter 3 uses descriptive analyses of the survey data to describe patterns of migration, agriculture and other livelihood activities in the sample communities. Chapters 4 and 5 address the two broad research questions and are structured as extended journal articles, including

discussion of the relevant literature, hypotheses, multivariate analyses and results. Finally, Chapter 6 presents some brief conclusions.

1.2 The Livelihoods Framework

Elements of the livelihoods framework

In addressing connections between migration and rural livelihoods, the primary theoretical approach of this study is the livelihoods framework (Scoones, 1998; Ellis; 2000), illustrated in Figure 1.1. This interdisciplinary framework seeks to describe how rural households in the developing world make a living, with attention to the factors influencing their choices as well as the outcomes of their choices. The household is the key unit of analysis, but households and the preferences of individual members are not assumed to be uniform. As described below, core elements of this framework include the diversity of household livelihood strategies and assets, the role of context, and the importance of examining multiple livelihood outcomes. (This discussion draws on Ellis (2000) and Scoones (1998) except where noted.) I conclude with a discussion of how this framework overlaps with and diverges from other relevant conceptual frameworks, where the research questions fit within this framework, and how the analyses incorporate this approach.

One core element of this approach is that households draw on a diversity of livelihood strategies or activities for their income and subsistence (see third column of Figure 1.1). Potential strategies include agriculture (subsistence cropping, cash cropping, and livestock), wild product collection (e.g., hunting, timber harvesting, and fuelwood collection), wage labor (both agricultural and non-agricultural), self-employment (e.g.,

small-scale commerce, manufacturing, or construction), and migration (both temporary and permanent). Motivations to diversify livelihood activities include ensuring subsistence in the face of risks such as natural hazards, profit maximization given seasonality and diverse assets, and the cultural importance of maintaining traditional activities. Decisions to adopt livelihood strategies are not assumed to be independent, and tradeoffs or synergies may exist between different activities. Among these strategies, agriculture and wild product collection are particularly dependent on natural assets and environmental conditions (see below). Migration of individuals can be also considered a household livelihood strategy because migrants commonly remit to the household or return to the household with their earnings. Rural households in the developing world have commonly been considered to rely primarily on agriculture for their livelihoods, but studies have shown that non-agricultural sources account for 40% or more of rural incomes in Ecuador and other Latin American countries (Reardon et al., 2001), with self-employment and non-agricultural wage labor typically more important than agricultural wage labor and migrant remittances. Nonetheless, agriculture continues to provide the majority of rural incomes in most cases and income from remittances can be important in origin areas of migration (e.g., Jokisch, 2002).

A second core component of this framework is that households commonly draw on a diverse portfolio of assets to construct their livelihoods, including human, social, financial, physical and natural assets or capitals (second column of Figure 1.1). Human assets are the members of the household, including their education, knowledge and work experience. Social assets are connections to individuals, households or organizations that can be drawn on for assistance, including relationships with kin, wealthy patrons,

migrants, governmental and non-governmental organizations, and community networks for mutual assistance or labor exchange. Financial assets include bank accounts, access to credit, and liquid forms of wealth such as livestock. Physical assets include manufactured goods, business or farm equipment, housing, and infrastructure such as roads, telephones and electricity. Natural assets include access to private or communal lands for agriculture or wild product collection, as well as the environmental qualities of these lands such as soil quality and vegetative cover. Studies from a variety of settings have shown all five of these categories of assets to be important to rural livelihoods (Ellis, 2000).

A third key element of this framework is that household livelihood decisions are not made in isolation but in the context of the community, region and nation, extending even to the global context. Important features of the local and broader context include the biophysical or environmental context (e.g., climate and climate change), the social context (e.g., gender norms and migrant networks), the economic context (e.g., prices and employment opportunities), the institutional context (e.g., presence and policies of governmental agencies), as well as the geographic and infrastructural context (e.g., accessibility and roads). Like household strategies and assets, these contextual features are likely to change over time. A large number of qualitative studies (e.g., Deere and León, 1981) and a smaller number of quantitative studies (e.g., Henry et al., 2004) have confirmed the importance of contextual factors to household livelihood decision-making.

Finally, several potential outcomes can be observed as a result of these processes of livelihood construction. These include both traditional (e.g., income and consumption) and non-traditional (e.g., food security and asset accumulation) measures of welfare, which depend directly on household assets and the success of household livelihood

strategies. Livelihood activities may also lead to local impacts on the environment (e.g., deforestation) and may aggregate across households to alter the local social and economic context (e.g., increasing prevalence of migration due to migrant networks).

The livelihoods framework has important commonalities with other approaches to human-environment, development and migration studies including cultural and political ecology, complex human-environment systems, and the new economics of labor migration. Like cultural ecology (Zimmerer, 2004), livelihoods research appreciates the intimate connections between rural livelihoods and the natural environment, as well as the value of traditional agricultural and ecological knowledge. In common with political ecology (Blaikie and Brookfield, 1986; Robbins, 2004), the livelihoods framework recognizes gender norms as key constraints on individual opportunities and household decision-making, the existence of severe inequalities in asset distribution, and the importance of the socio-environmental and political-economic context more generally. Consistent with studies of complex human-environment systems (Holling, 2001), this approach allows that human-environment processes act at different scales and identifies possibilities for positive and negative feedbacks. Finally, livelihood studies shares with the new economics of labor migration (Stark and Bloom, 1985; Taylor, 1999) the conceptualization of migration as a household strategy to diversify income against production risks.

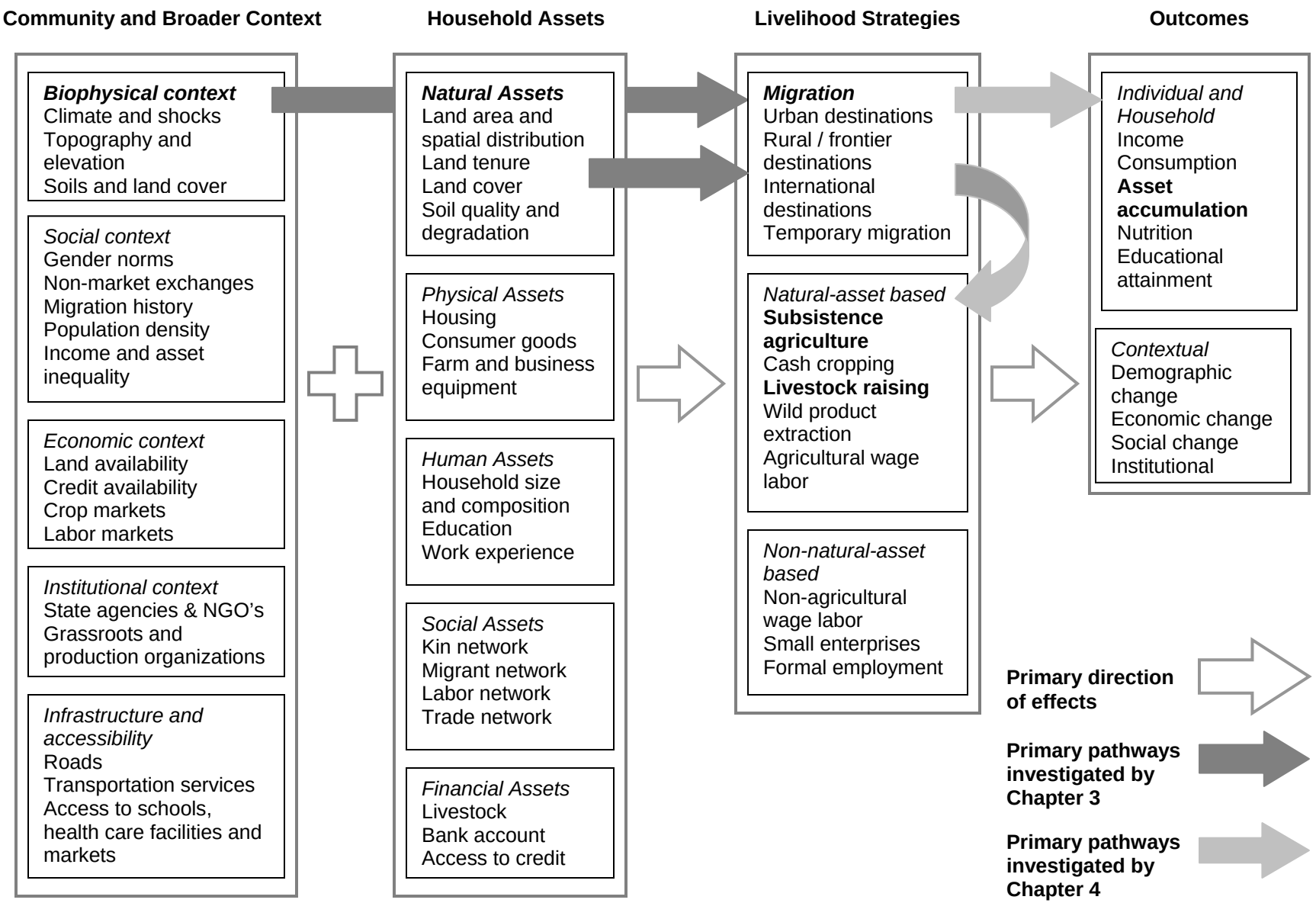
Applying the livelihoods framework

The livelihoods framework is particularly appropriate for the study of migration, the environment and development for at least three reasons. Firstly, the household, placed in its local and broader context and with attention to differences among individuals, is an

appropriate unit of analysis for migration, development and local environmental change, as attested to by the large number of household-centered studies of these processes (e.g., Massey and Espinosa, 1997; Pichón, 1997; Adams, 1998). Secondly, the key conceptual elements are accommodated by this framework, including migration as a livelihood strategy, development as an outcome of livelihood processes, and the environment as part of the context, as a household asset, and also as an outcome. Thirdly, this approach can accommodate both qualitative and quantitative methodological applications (e.g., De Haan and Rogaly, 2002; Jansen et al., 2006).

The livelihoods framework also naturally accommodates the two research questions, as illustrated in Figure 1.1. The first research question examines the influence of the biophysical context and natural assets on migration (one set of livelihood activities). The second research question examines how participation in migration over time influences participation in agriculture (another set of livelihood activities) and asset accumulation (one of the livelihood outcomes). While focusing on these elements, the analyses described in Chapters 4 and 5 do not ignore other contextual features or household assets, instead incorporating many of them as control variables. As described in the following chapters, this dissertation highlights the flexibility of the livelihoods framework and its particular relevance to quantitative studies of migration, development and the environment.

Figure 1.1 Conceptual framework for analysis of migration-livelihood interactions, modified from Ellis (2000).



CHAPTER 2

STUDY AREA AND DATA COLLECTION

2.1 Study Area and Context

This section of the dissertation draws on my experiences in the field and secondary data sources to describe the study area. The study area is located in southern Loja Province in the southern Ecuadorian Andes, and includes the cantons[1] of Calvas, Espindola, Sozoranga, Gozanama and Quilanga (Figure 2.1). As described below, the study area is predominantly isolated, rural and poor; land use is dominated by smallholder agriculture, smalle-scale cattle raising, and coffee-centered agroforestry; environmental conditions are spatially variable but generally marginal for agriculture; and the region is an important source of both internal and international migrants. These factors, along with my familiarity with the region, made it an obvious choice to investigate connections between migration and rural livelihoods in Ecuador.

Location and development

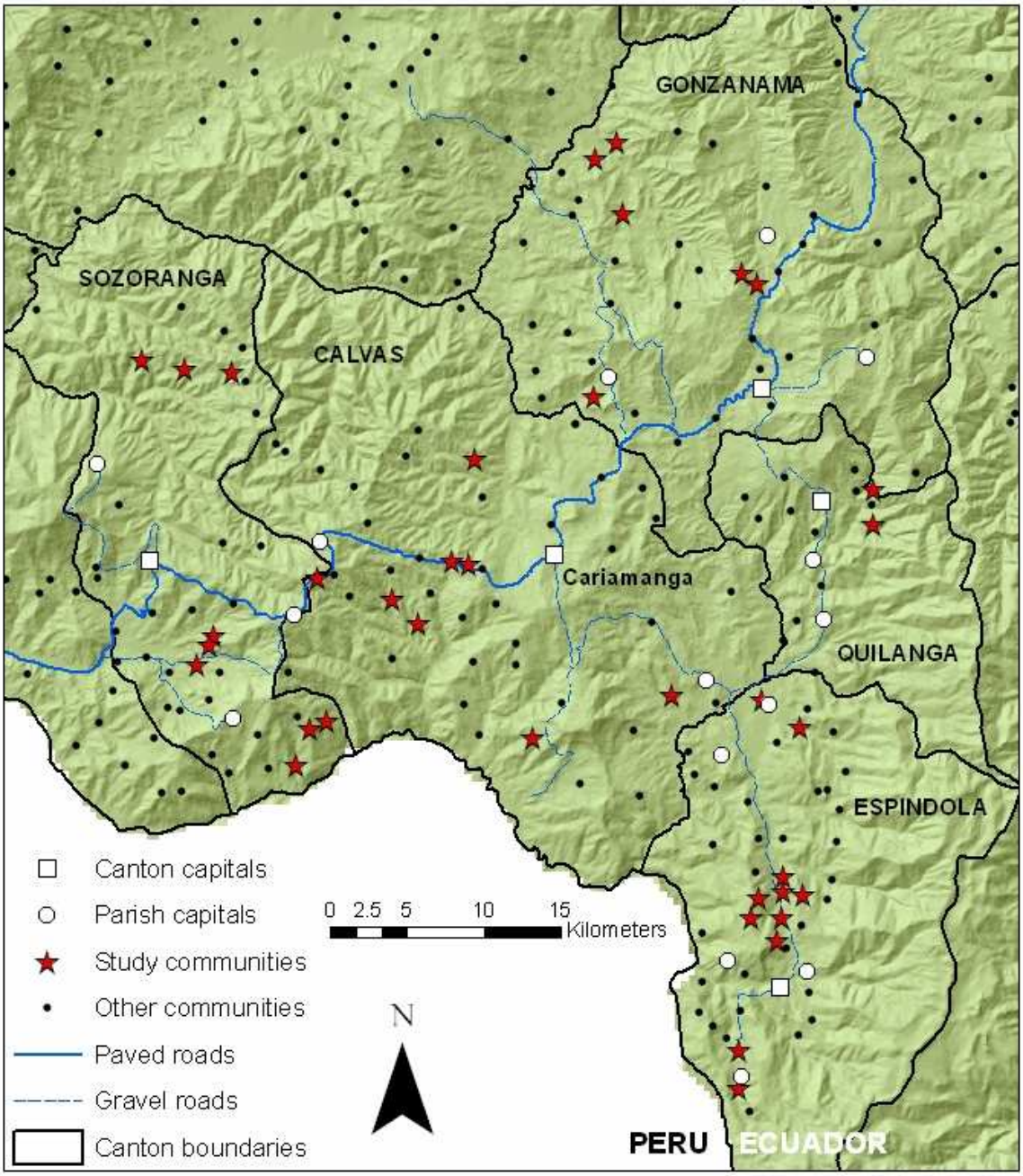
The five cantons of the study area are located in the highlands of southern Loja province adjacent to the border with Peru (Figure 2.1). The region is centered on the town of Cariamanga, the largest regional urban center of approximately 10,000 people, but is relatively remote from larger cities (Figure 2.2). A single paved highway connects Cariamanga to the provincial capital (the city of Loja) three hours to the northeast, and to the city of Machala on the Peruvian border two hours to the southwest. Beyond the main

[1] Cantons are Ecuadorian political units roughly equivalent to US counties.

Figure 2.1 Map of Ecuador with provinces, major cities and the study area.

Source: political boundaries from Universidad de Azuay (2006), map prepared by the author.

Figure 2.2 Map of the study area with study communities, topography and other features.



Sources: political boundaries, roads and non-study communities from Universidad de Azuay (2006); topography from a Digital Elevation Model by Souris (2006); locations of study communities from GPS points collected in the field.

highway, roads connecting to canton and parish capitals (local administrative centers which are usually medium-sized and small towns respectively) are typically gravel and usually allow year-round transportation, whereas connectors to smaller rural communities are universally dirt roads that commonly wash out in the January-April rainy season. Figure 2.3 is a photograph of Amaluza, the capital of Espindola canton, demonstrating its

Figure 2.3 The town of Amaluza in Espindola canton during the wet season.

Source: photograph taken by the author in 2006.

size and rural setting. Outside of canton and parish capitals, rural communities are dispersed across the landscape. Most rural dwellings are located within 15 minutes walking to the community center, but others may be dispersed as far as 30-40 minutes walking. Figure 2.4 is a photograph of the community of Chantaco in Calvas canton,

demonstrating the clustering of dwellings along the ridge in the foreground. Connections from the study area to Peru are minimal and include small-scale commerce at a handful of border crossings.

Figure 2.4 The community of Chantaco in Calvas canton during the wet season.

Source: photograph taken by the author in 2006.

To describe the study population, Table 2.1 presents values of selected measures from the 2001 census (INEC, 2003) and from the World Bank's (2004) *Ecuador Poverty Assessment* for (1) the study area, (2) the rural Ecuadorian highlands as a whole, and (3) the whole of Ecuador. For this analysis the study population was defined as the rural

Table 2.1 Characteristics of the population of Ecuador, the rural highlands and the study area.

Characteristic	Ecuador	Rural Sierra	Study Area
Total population, 2001	12,156,608	2,772,177	55,460
Sex ratio, 2001	0.98	0.97	1.03
Less than 15 years old (%), 2001	33.2%	36.9%	40.7%
Mestizo (%), 2001	77.4%	74.8%	98.1%
Secondary education (%), 2001	50.5%	36.0%	32.9%
Employment in agriculture (%), 2001	26.3%	55.7%	84.3%
Urban migrants (%), 1996-2001[1]	5.5%	4.7%	6.7%
Rural migrants (%), 1996-2001[1]	2.5%	2.3%	3.4%
International migrants (%), 1996-2001[1]	3.4%	3.9%	9.3%
Uses water from river or canal (%), 2001	12.2%	30.0%	38.0%
No toilet with plumbing (%), 2001	16.6%	33.6%	64.8%
No electricity (%), 2001	10.3%	15.7%	30.0%
Cooks with wood (%), 2001	13.0%	33.6%	74.6%
Poverty (%), 1990	40.3%	52.8%	51.4%[1]
Poverty (%), 2001	45.2%	61.7%	73.5%[1]

Source: my calculations using data from the 2001 census (INEC, 2003) and the World Bank's (2005) *Ecuador Poverty Assessment*.
[1] Includes urban areas.

Table 2.2 Characteristics of farms in the five study cantons and Ecuador overall from the 2000 agricultural census (INEC, 2002).

Characteristic	Espindola	Quilanga	Gonzanama	Calvas	Sozoranga	Ecuador
Land use in perennials (%)	5.9%	7.6%	3.9%	3.9%	5.6%	11.0%
Land use in annuals (%)	2.2%	1.3%	1.9%	0.8%	0.5%	10.0%
Land use in fallow (%)	6.2%	2.0%	8.0%	6.6%	13.4%	3.1%
Land use in pasture (%)	47.7%	71.6%	49.5%	55.8%	54.4%	36.3%
Land use in forest (%)	29.6%	17.0%	29.4%	27.9%	24.1%	31.4%
Farms with irrigation (%)	30.2%	28.8%	43.0%	36.4%	46.1%	28.4%
Cattle per farm	4.8	7.8	6.1	5.1	3.9	5.3
Maize yield (tons/ha)	0.48	0.68	0.54	0.54	0.87	1.81
Maize area fertilized (%)	0.0%	17.0%	5.5%	1.0%	21.2%	36.5%
Farms below 5 ha (%)	47.5%	34.1%	47.5%	43.9%	44.3%	63.5%
Farmed by owner (%)	78.2%	70.7%	82.1%	63.2%	42.8%	75.2%
Number of farms	3557	1436	4276	3946	2076	842882

Note: Land uses do not sum to 100% because of "other land uses".

population of the five study cantons, which in 2001 represented 78% of the total population of the five cantons (INEC, 2003). Compared to the populations of Ecuador as a whole and of the rural highlands, the study population is younger, homogenously mestizo, and more likely to work in agriculture. The study area is also quite poor, with lower levels of secondary education, access to electricity, and access to a toilet with plumbing, and higher levels of use of unimproved water sources, use of fuelwood for cooking, and overall poverty[2]. Poverty increased for all three populations during the 1990-2001 period, but increased the most for the study area (World Bank, 2004), reflecting its enduring marginality. The study area is also an important source of internal and international migrants (Table 2.1), as described below.

Environment and agriculture

The study area is characterized by mountainous topography and seasonally dry climates, leading to environmental conditions which are spatially variable but generally marginal for agriculture. Topographically and climactically, this region is part of a zone of transition between the high, moist and temperate valleys of the Andes to the northeast and the arid lowlands to the southwest which are contiguous with the Peruvian coastal desert (Bydekerke et al., 1998). Along this gradient, micro-climates are influenced by elevation and orientation, and range in temperature from temperate to subtropical and in rainfall from humid to semi-arid (600-1100 mm per year). The native vegetation associations are cloudforest and dry tropical forest, but these have largely been cleared for agriculture and grazing (Sierra et al., 2002). Many sites receive regular rainfall only from January to April, making them less suitable for rainfed agriculture than other

[2] A consumption-based measure of poverty developed by the World Bank (2004) using data from the 1990 and 2001 national censuses and the 1994 and 1999 national Living Standards Surveys.

regions of the Ecuadorian Andes (Farrow et al., 2005). This environmental variation is notable in Figures 2.3-2.7, which are photographs from the study area. Figures 2.3 and 2.5 show wetter areas near 2000 m elevation, Figures 2.4 and 2.6 show dryer areas near 1500 m, and Figure 2.7 shows a semi-desert area near 1200 m.

Figure 2.5 View towards the northwest corner of Calvas canton during the wet season.

Source: photograph taken by the author in 2006.

In this marginal and heterogenous environment, rural land use is dominated by smallholder agriculture, coffee-centered agroforestry, and small-scale cattle ranching. Population densities and the intensity of land use are low relative to the densely populated central valleys of the Andes. Table 2.2 presents selected values from the 2000

national agricultural census (actually a national sample survey of farms; INEC, 2002) for each of the five study cantons and for Ecuador as a whole. Pasture and forest (including secondary forest) are the most extensive land uses, followed by fallow, perennials (primarily coffee and fruit trees) and annuals (among which corn and beans are the most important). Relative to Ecuador as a whole, the large proportion of land use in pasture and fallow and the small proportion in annual crops reflect the low agricultural productivity and environmental marginality of the study area. Consistent with the large

Figure 2.6 A rural community in central Calvas canton during the dry season.

Source: photograph taken by the author in 2004.

Figure 2.7 The community of Tabloncillo in Calvas canton during the wet season.

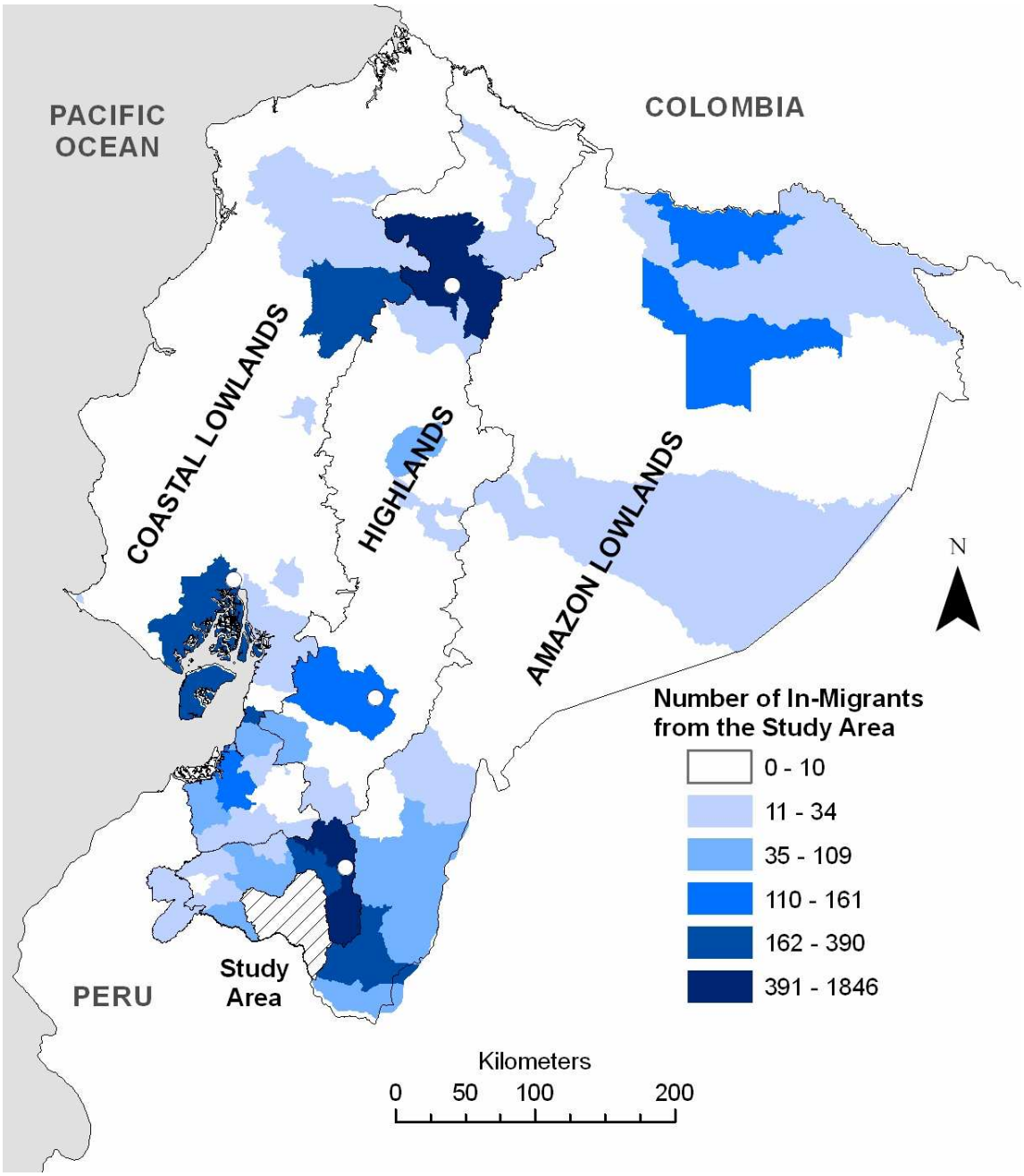
Source: photograph taken by the author in 2006.

areas in pasture and the dry climate, cattle and irrigation are also more important in the study area than in Ecuador as a whole. Among study cantons, perennials and pastures are most extensive in mountainous Quilanga, whereas annuals are most important in Espindola. Yields of maize (500-900 kg/ha) are quite low relative to Ecuador as a whole and to other regions within Latin America (Table 2.2; Wood et al., 2004), reflecting the environmental marginality and low rates of fertilizer application. Compared to Ecuador as a whole, a smaller proportion of farms are less than 5 ha, reflecting both low productivity and significant land redistribution in the 1970s (Chiriboga, 1988, Fauroux, 1988). Farms are also relatively equal in size and primarily managed by their owners (Table 2.2). The World Bank (2004) found southern Loja province along with Bolivar province to have the most equitable land distributions in the Ecuadorian highlands.

A center of out-migration

The study area, along with the rest of southern Loja province, is also an important and nationally-recognized origin area of migrants to internal and international destinations. For decades many Lojanos have out-migrated to Ecuador's major urban areas (Brown et al., 1988), particularly the national capital Quito and the provincial capital Loja where many work in the service sector and in small enterprises (Chapter 3). Many others have departed to rural destinations in Ecuador's Pacific and Amazonian lowlands (including sites in El Oro, Zamora-Chinchipe, and Sucumbios Provinces and the region surrounding the city of Santo Domingo) where many Lojanos have settled on the agricultural frontier or work as agricultural laborers (Brown and Sierra, 1994; Brownrigg, 1981). These movements have occurred as part of national trends towards urbanization as well as population growth and deforestation in the Pacific and Amazonian lowlands. Large-scale out-migrations to the Amazon and elsewhere in the 1970s were linked to a severe regional drought in the late 1960s (OAS, 1992). Figure 2.8 maps the locations of internal out-migrants from the study area from 1996 to 2001 using data from the most recent census, and confirms that nearby regions, major cities and frontier regions in the coast and Amazon are important destination areas. Among 1996 residents in the study area (including urban areas), 6.7% had departed to urban destinations, 3.4% to rural destinations, and 9.3% to international destinations by 2001 (Table 2.1). These migration propensities were higher than the rural Sierra and Ecuador as a whole for the same period, particularly for international migration (Table 2.1). As a result of these migration flows, Loja is one of seven among Ecuador's 22 provinces which experienced absolute declines in rural population during the 1990-2001 intercensal period, a period in

Figure 2.8 Map of Ecuador showing the destinations of internal migrants from the study area during the period 1996-2001.

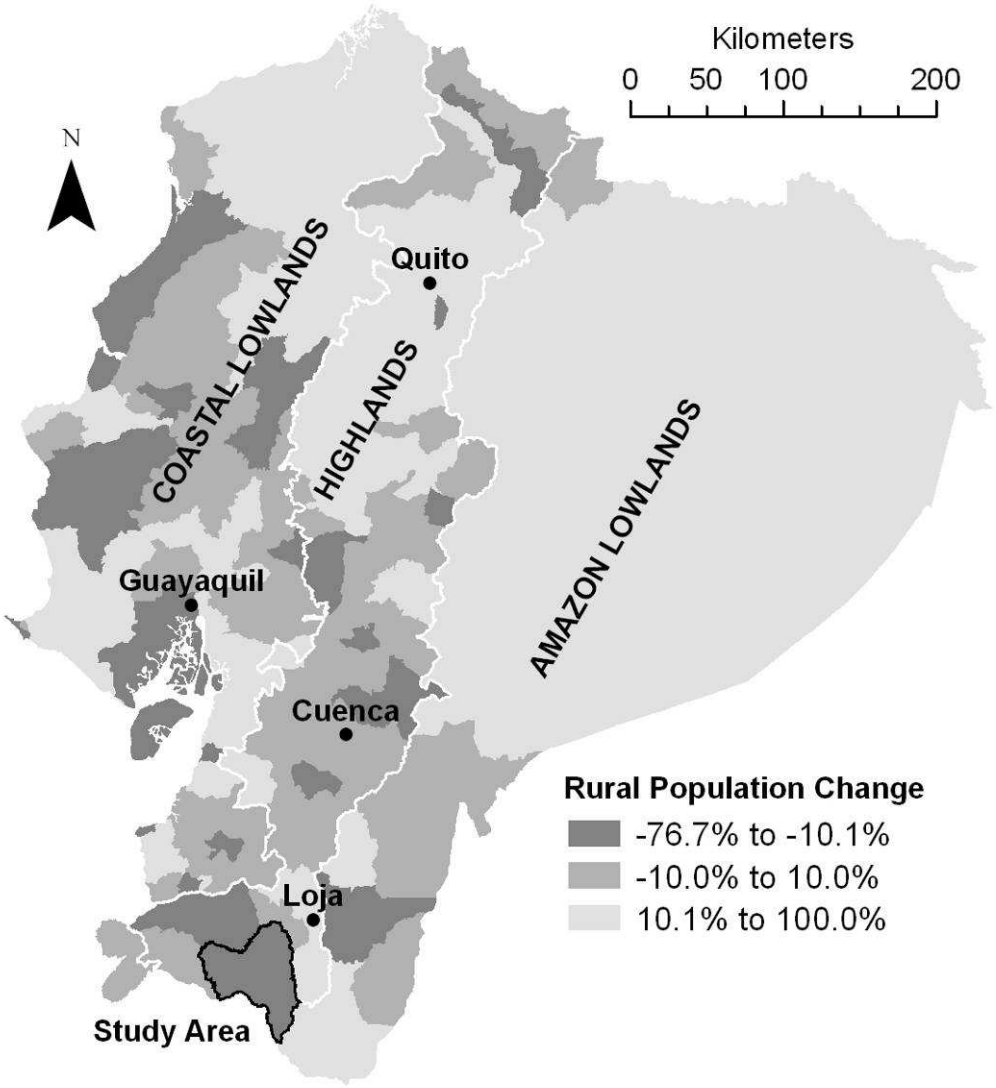


Sources: political boundaries from Universidad de Azuay (2006), number of out-migrants by canton from the 2001 census (INEC, 2003).

which Ecuador's total population grew by 26% (INEC, 2003). Loja experienced the steepest proportionate decrease of 4.9%, a decline which reached 14.9% in the study area (INEC, 2003). Figure 2.9 displays proportionate changes in the rural population for all Ecuadorian cantons using data from the 1990 and 2001 censuses, and confirms that southern Loja province was the largest contiguous area of population decline in the highlands.

Beginning in the late 1990s during a period of national political and economic crisis, Lojanos also pioneered and participated in large numbers in a new transnational migration to Spain (Jokisch and Pribilsky, 2002; Ramírez-Gallegos and Ramírez, 2005). This migration was facilitated by relatively lax Spanish entry requirements under which Ecuadorians could obtain a visa upon entry if they held enough cash to present themselves as tourists. Funding was most commonly obtained through a loan, with the trip and transaction costing approximately US$4,000 (Jokisch and Pribilsky, 2002). Restrictions on entry for Ecuadorians have since tightened, but many Ecuadorians in Spain have been able to regularize their residency status (Cuesta, 2007). This migration flow was notable for including a large proportion of women and individuals with secondary and tertiary education (Ramírez-Gallegos and Ramírez, 2005; Cuesta, 2007; Gratton, 2007). In Spain, many male migrants work in agriculture and many female migrants in domestic services (Gratton, 2007). A smaller number of Lojanos have also followed a longer-established migrant route to the United States, pioneered in the 1980s by migrants from Azuay and Cañar provinces. This trip costs upwards of US$10,000 and commonly includes travel with *coyotes* in a boat from the Ecuadorian coast to Central

Figure 2.9 Map of Ecuador showing canton-level changes in the rural population from 1990-2001.



Sources: political boundaries from Universidad de Azuay (2006), rural population change calculated by the author using 1990 and 2001 census data (INEC, 2003).

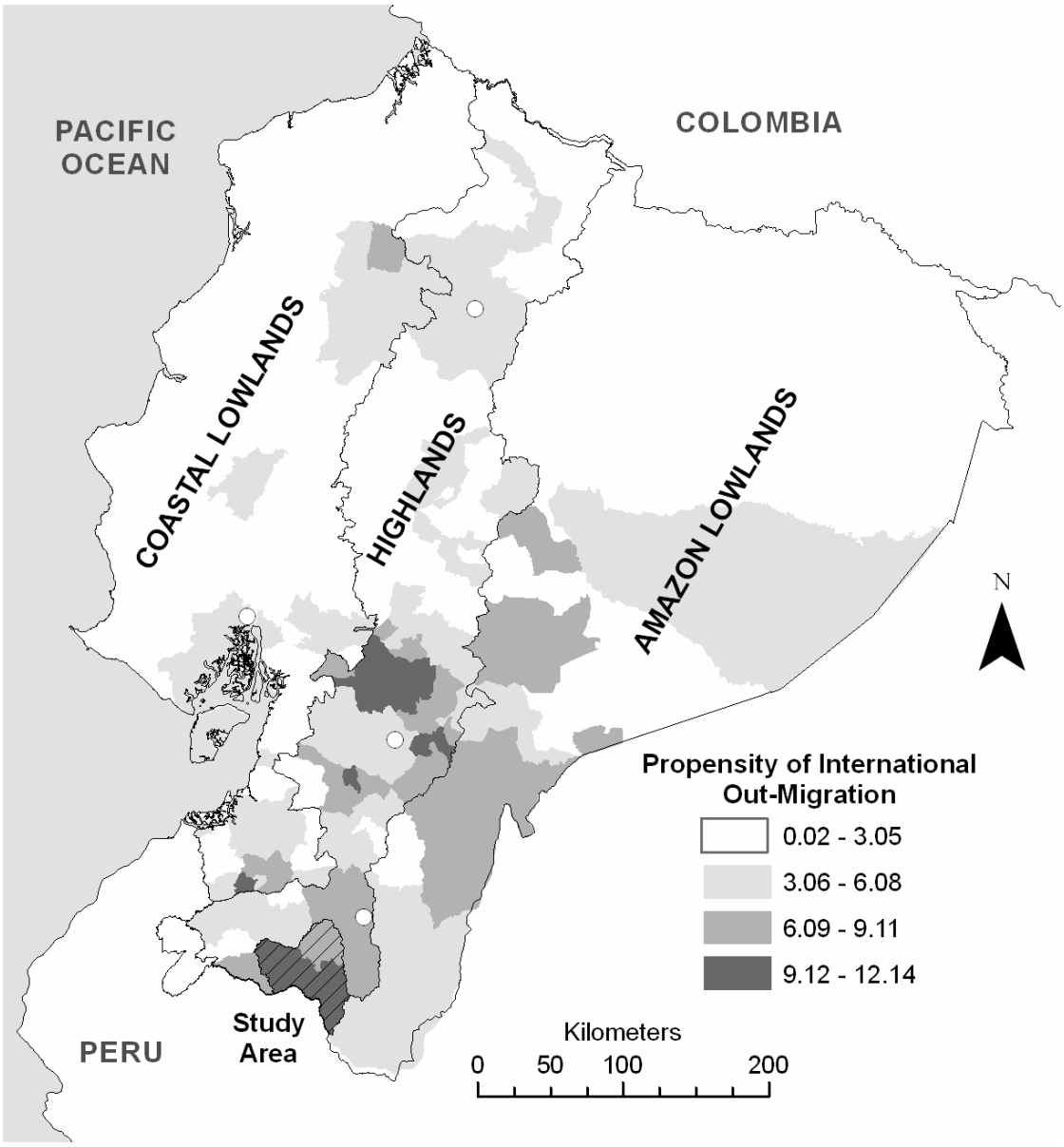
America and then overland to the US-Mexican border, which is then crossed illegally (Jokisch and Pribilsky, 2002). Ecuadorians in the US are concentrated in the New York metropolitan area (Gratton, 2007). Since 1990 more than one million Ecuadorians have emigrated, primarily to Spain or the US, out of a current population of approximately fourteen million (Jokisch, 2007). Remittances from these migrants represented 6.4% of Ecuador's Gross Domestic Product in 2005 (IADB, 2006). Figure 2.10 maps the canton-level international out-migration propensity[3] for the period 1996-2001, confirming that the study area was a center of international out-migration.

National context

Out-migration from the study area occurs in a national context of pervasive inequality and persistent economic and political instability. (The following discussion draws on the World Bank's (2004) *Ecuador Poverty Assessment* except where noted.) Along with other Latin American countries, Ecuador is one of the world's least equitable societies, with large divides between white and non-white populations (mestizo, indigenous, and Afro-Ecuadorian) as well as between rural and urban areas. The Gini index (a measure of inequality ranging from complete equity at 0 to complete concentration at 1) is 0.57 for income and 0.81 for land ownership, levels which are comparable to many other Latin American countries but high compared to other world regions (World Bank, 2004). This pattern is a legacy of Ecuador's colonial past which has been continuously reinforced by non-democratic regimes, corruption, an urban bias in state spending, and elite domination of the state. The country underperforms relative to

[3] I calculated propensity as the number of migrants during the interval over the number of 1996 residents in the canton as measured by the 2001 census (INEC, 2003). Migrants were assumed to have departed from the current residence of the origin household.

Figure 2.10 Map of Ecuador showing canton-level international out-migration propensities for 1996-2001.



Note: I calculated propensity as the number of migrants during the interval over the number of 1996 residents in the canton as measured by the 2001 census (INEC, 2003). Migrants were assumed to have departed from the current residence of the origin household.

Sources: political boundaries from Universidad de Azuay (2006), international out-migration propensities calculated by the author using data from the 2001 census (INEC, 2003).

its income level on health and education outcomes, and the proportion of GDP spent on state health and education services has fallen since 1990 under neoliberalism (World Bank, 2004). Despite being buoyed by increasing state revenues from oil exports, since 1990 the country has experienced a series of economic and political crises resulting in twelve changes of government and the adoption of the US dollar as the national currency in 2000. The peak of the economic crisis in the late 1990s coincided with the take-off of migration to Spain (Jokisch and Pribilsky, 2002). Recent changes in state policy have not significantly improved the situation of the rural poor, with one key exception: the introduction in 2001 of a welfare-like system of small cash transfers to poor households (León and Younger, 2007), a program accessed by many rural households in the study area.

2.2 Fieldwork and Data Collection

To investigate connections between migration and rural livelihoods in the study area I designed and conducted a structured household and community survey in early 2006. Structured survey approaches allow standardization across study households and communities as well as multivariate analyses that control for confounding explanations, and the use of probability sampling permits generalization beyond the sampled households. Similar approaches have been widely used in migration studies (e.g., Massey and Espinosa, 1997) and have been adopted by increasing numbers of studies of human-environment interactions (e.g., Pichón, 1997; Henry et al., 2004). By incorporating variables at individual, household, and community levels and drawing on an interdisciplinary theoretical framework, this approach gives insight into both “agency”

and "structure" (Chowdury and Turner, 2006) without making strong assumptions about the economic rationality of decision-making processes. As described below, the specific approach of this study combined life history and multilevel survey approaches from social demography (Bilsborrow et al., 1984; Axinn et al., 1997; Massey and Zenteno, 2000) with survey and spatial data collection about environmental conditions in the tradition of population-environment research (Walsh and Crews-Meyer, 2002). The result is a novel approach to investigating migration-livelihood interactions that addresses the limitations of past studies, primarily qualitative case studies of one or a small number of communities. This approach is not offered as a replacement for the theoretical and empirical insights of previous qualitative studies (e.g., Jokisch, 2002), but rather as a complementary approach that is particularly suited to testing causal hypotheses at regional scales.

Sampling

Data collection was preceded by a two-stage sampling procedure (Lohr, 1999). In the first stage, 18 rural census sectors (roughly equivalent to US census blocks) representing a population-weighted sampling fraction of 12% were selected from the five study cantons through systematic random sampling with probability proportional to population size[4]. A list of census sectors and their populations from the 2001 census (provided by CPC-partner institution CEPAR[5]) was used to generate the sampling frame. Since the focus of the study is on agrarian livelihoods, census sectors in canton or parish

[4] Sampling of census sectors with equal probability would have led more equal probabilities of selection across households (and thus increased statistical power), but differences in selection probabilities were not large given that most census sectors were of similar size. Sampling with equal probability would also have led to increased costs due to the selection of a larger number of sectors with fewer households.

[5] The Centro de Estudios de Población y Desarrollo Social in Quito.

capitals were excluded, as these are typically medium-sized and small towns respectively. Following these exclusions, the sampling frame included 199 census sectors with a total population of 49,651 individuals in the 2000 census (INEC, 2003).

Following selection of the sample of census sectors, I visited each sector to identify the constituent rural communities or villages (Figure 2.2), one to four of which were contained within the boundaries of each sample sector[6]. These visits also included meetings with community leaders and small groups of community members to explain the nature of the project and to begin the household listing operation and community-level data collection. Following my explanations and those of accompanying local staff (see below), community leaders and members were overall very receptive to the project. A similar explanation was provided to each sample household as part of the discussion of human subjects protections prior to the household interviews. In the household listing operation, community leaders and members were asked to list all households resident in the community along with the number of migrants that had departed from the household since 1995 categorized by broad destination type[7]. Given the small size of the communities (15-100 households), the spatial clustering of households, and the existence of customary boundaries between communities, participants were easily able to list all resident households. A household was defined as individuals who lived in the same

[6] Only in a small number of cases did the sector boundaries exclude a portion of one of the included communities, in which case that portion of the community territory was excluded from data collection.

[7] Among information collected in the household listing, the list of resident households and household sizes were quite accurate. Information on the destinations of out-migrants since 1995 was less accurate, and led to the misclassification of 33% of the sampled households into the four sampling strata. This information was nonetheless sufficient to enable an oversample of migrant-sending households. These misclassifications should not influence the overall results because households were sampled from all four strata and variations in the sampling probability are accounted for using selection weights in Chapters 5 and 6.

dwelling[8]. This definition is appropriate for the study area because unrelated individuals rarely live in the same dwelling and family members living in different dwellings typically do not share a large proportion of their income or assets.

In the second stage of sampling, in each community I used information from the household listing to select a sample of households stratified by migrant status. Given that migrants to certain destination types (e.g., international or Amazonian) are relatively rare in the population, oversampling households that sent these types of migrants (i.e., sampling with higher probability) included more of them in the sample and increased statistical power for the analyses presented in Chapters 4 and 5. Using the information from the household listing in each community, I classified each household into one of four strata based on the destination of migrants: the Ecuadorian Amazon, international (but not Amazon), internal (but not international or Amazon), and none. Because of my special interest in migration to the Amazon frontier, households that were reported to have sent migrants to Amazonian provinces were automatically included in the sample[9]. In the second stage of sampling an equal number of households were selected at random from each of the remaining three strata. This number was determined by a rule that I designed to create roughly equal probabilities of selection across communities of different sizes. When the number of households in the stratum was equal or less than the number determined by the sampling rule then all households were selected. For example, the community of Algodonal Norte had 18 households, and the rule indicated that in

[8] For cases where the entire set of individuals in a dwelling moved to a new dwelling in the same community they were considered to be the same household and non-migrants. For cases where some but not all of the individuals moved to a new residence in the same community these individuals were considered to constitute a separate household.

[9] Ultimately the number of such households was insufficient to permit separate analyses of migration to the Amazon as I had hoped to conduct, but these households nonetheless boosted the otherwise small number of rural-rural migrants.

communities with 10-19 households I would sample two households each from the international, internal and non-migrant strata. Based on the household listing, two households had sent migrants to the Amazon, one household had sent a migrant to another country, seven households had sent migrants within Ecuador, and eight had not sent migrants. Both Amazon-sending households were included automatically, as was the international-sending household since fewer were present that the number to be sampled. Two households were randomly sampled from among the internal-sending households and two from the non-migrant households to complete the sample for that community. Ultimately the sampling fraction across all sample communities was 100% for Amazon-migrant-sending households, 47% for international-migrant-sending households, 48% for internal-migrant-sending households, 29% for non-migrant households, and 40% across all four strata. This sampling strategy ensured that the sample contained a diverse set of migrants, a relatively large set of communities, and enough information from each community to derive contextual measures from the household survey. As this strategy also lead to unequal probabilities of selection across households and communities, sampling weights (calculated as the inverse of the probability of selection) have been incorporated into the analyses presented in Chapters 4 and 5.

Logistics

Prior to household data collection, I used contacts from Richard Bilsborrow and CEPAR to hire two supervisors with previous survey experience and college degrees and to recruit a pool of potential interviewers from Cariamanga and Loja, primarily teachers and college students with some previous survey experience. I then organized a week-long training program covering administration of the household questionnaire and human

subjects protections, which also served as an opportunity to improve the questionnaire and to select among those interested in working as interviewers. From twelve candidates I hired nine interviewers and organized them into three teams of three interviewers and one supervisor, including myself as one of the three supervisors. My survey team and one other were based in Cariamanga and included the interviewers who lived there. The members of the third team lived in Loja and would travel from there each week to work out of small towns near the most remote sample communities. The teams had their own vehicles and each day would travel separately to different sample communities, and I would subsequently review the completed questionnaires later in the week. Transportation to the study communities was a major logistical challenge given the remoteness of some sampled sectors (up to four hours from Cariamanga) and repeated weather-related deterioration of road conditions, but was also greatly facilitated by the use of local drivers who were familiar with the region.

The household survey

In each sample household, a structured household questionnaire (Appendix 1) was completed with the male or female household head or another knowledgeable adult, who also served as the proxy respondent for other adult household members and departed migrants. Following an explanation of the study and human subjects protections, individuals/households that agreed to participate (397 in total, over 97% of sample households) were interviewed for one to two hours. This interview collected limited retrospective information on an annual basis back to 1995 on the characteristics and activities of individuals, of the household, and on each agricultural parcel. Retrospective information was collected using a life history approach which allowed for comparison of

related characteristics across time and across individuals in the same household (e.g., Appendix 1 Section C). Similar proxy response and retrospective approaches have been used and validated by a large number of survey-based studies (Nelson et al., 1990; Smith and Thomas, 2003). Recall errors were also limited by restricting data collection on migration to departures of six months or longer, and by the twelve-year window of data collection, which is shorter than many previous migration studies using life history methods (e.g., Massey and Espinosa, 1997). This time frame also captured the largest international migration flows from the study area, which increased greatly after 1998. Proxy response errors were limited by the close relationships between proxy respondents and departed migrants (who were most often the children of the respondents), and by the small number of variables that were collected for each year.

Individual life histories collected annual information on location of residence, educational attainment, marital status, types of work and temporary migration (Appendix 1 Section C). Information was also collected on locations of residence prior to 1995. For migrants, questions were included on the decision to migrate and remittances sent to the household (Appendix 1 Section D1). Individual histories were compiled with separate rosters of current and previous household residents to describe household demographic composition and migrant networks over time (Appendix 1 Sections B and D2). This information included migrants who departed prior to 1995 but data were not collected on individuals who died during the study period. The household history collected annual information on the number and tenancy of agricultural parcels used, as well as participation in small enterprises, development projects, loans, and the government's anti-poverty cash transfer program (Appendix 1 Section E). More detailed cross-sectional

questions also asked about current asset ownership, housing quality, agrobiodiversity, and agricultural labor and input use, with limited data collected also for 1995 (Appendix 1 Sections E and G). For each agricultural parcel owned or used since 1995, annual information was collected on parcel tenancy, size and irrigation, and cross-sectional information was collected on recent land use, production, and harvests (Appendix 1 Section F). This section also inquired about stable parcel characteristics such as soil type and topography as well as experiences with soil erosion, soil depletion and crop pests in 1995 and 2006. Following the completion of the data collection, household survey data were entered at CEPAR by staff experienced in data entry. The data entry used an interface that I designed in CSPro and was supervised by myself and one of the field supervisors.

Community-level data

To provide information on the context of out-migration decisions, in each community a community questionnaire was implemented and Global Positioning System (GPS) points were collected to be incorporated into a geographic information system (GIS). The community questionnaire (Appendix 2) was implemented with a community leader or group of community residents, and collected information on biophysical conditions, the history of services and infrastructure in the community, out-migration of individuals and households, and other community characteristics over time. GPS points were collected in the center of each community and later were combined in a GIS with the following coverages: mean annual precipitation at 1 km resolution (Hijmans et al., 2005), a 30 m digital elevation model (Souris, 2006) and a vector layer of the road network (Universidad de Azuay, 2006). The GIS was used to extract distance from the

community center to the closest paved road as well as mean slope and precipitation in a 1 km buffer surrounding the community center. This buffer size minimized overlap between adjacent communities and corresponded to my field experience regarding the spatial extent of the study communities. The GIS and community questionnaires, together with data aggregated from the household surveys, allowed the construction of time-varying contextual variables for the event history analysis.

Uses and limitations

This data collection approach allows analyses of both the determinants and the effects of out-migration. In Chapter 4, I use information on individual, household and community characteristics during and at the beginning of the study interval to construct event history models of the determinants of out-migration. In Chapter 5, I use information on migration and remittances during the interval, changes in asset ownership, and agricultural activities in 2006 to construct multivariate models of the effects of migration on livelihood assets and activities.

Nonetheless it is important to note the limitations of this approach relative to more expansive approaches. In addition to the potential for recall errors and proxy response errors as noted above, selectivity is an issue for this and all origin-based migration studies because households that departed the study community prior to the survey are not available to be interviewed (Bilsborrow et al., 1984). This limitation was addressed through a special community-level data collection on entire out-migrating households (see results in Chapter 3), which revealed that these households represented only 20% of the total number of migrants. An additional limitation is that due to the single region and short time period of data collection, this approach cannot address the

influence of region-scale or national-scale factors such as economic growth and political instability, nor can it directly address time-varying factors such as prices or immigration policies in destinations countries. More expansive approaches that could address these concerns include data collection at multiple points in time (e.g., a prospective or panel approach) as well as data collection from both origin and destination areas (Bilsborrow et al., 1984), though given their cost these approaches have been applied by only a small number of migration studies (e.g., Massey and Zenteno, 2000; Rindfuss et al., 2007). Given the limited resources of this and most other studies, the approach described here is a cost-effective way to collect representative information on migration, development and the environment, and could be usefully adapted to investigate a wide variety of questions in development, human-environment, and population geography.

CHAPTER 3

DESCRIPTIVE ANALYSES

3.1 Dataset Construction

This chapter uses descriptive analyses of data from the household and community surveys (Chapter 2) to describe out-migration from the study area as well as agricultural and other livelihood activities of rural households. The results supplement the analyses of secondary data sources presented in Chapter 2 and provide context for the multivariate analyses presented in Chapters 4 and 5.

In preparation for the analyses presented in this chapter and in Chapters 4 and 5, I prepared seven separate datasets from the household and community survey data, which contained information about the following: individuals, migrants prior to 1995, agricultural parcels, resident households, communities, person-years, and departed households. The individual dataset (n = 1,866) was extracted from Sections B and C of the household questionnaire (Appendix 1) and contains information on all adults (ages 14 and older) who resided in a sample household for six months or more from 1995-2006, including migrants and non-migrants. The prior migrant dataset (n = 491) was extracted from Section D2 of the household questionnaire and contains information on children of the household heads who migrated prior to 1995. (This dataset is not used in this chapter but provided variables for the analyses in Chapters 4 and 5.) The parcel dataset (n = 624) was extracted from Section F of the household questionnaire and contains information on

all agricultural parcels managed by the sample households from 1995-2006, including owned, rented, and borrowed parcels. The household dataset (n = 397) contains information on the sample households from all portions of the household questionnaire, including information aggregated from the individual, parcel and prior migrant datasets. The community dataset (n = 36) contains information on the sample communities extracted from the community survey (Appendix 2) and the GIS, and aggregated from the household dataset. The person-year dataset (n = 12,637) was derived from the other datasets and contains information on each year of life from 1996-2006 for individuals in the individual dataset, including characteristics of the household and community. Individuals enter the dataset when they turn fifteen years old, leave the dataset the year after they migrate, and reenter the dataset the year if they return to the origin household[10]. Finally, the departed households dataset (n = 111) was extracted from information collected in the community survey (Appendix 2) on households that lived in the community after 1995 but all members departed prior to the survey.

Each of the tables below notes in parentheses the dataset from which it was extracted. For consistency the tables present unweighted values of both frequencies and means[11]. The use of weights and of subsets of the data in Chapters 4 and 5 mean that the descriptive values presented in those chapters differ slightly from those presented here.

[10] Note that the numbers of migrants differ slightly between the individual dataset and this dataset due to the following characteristics of the person-year dataset: (1) the inclusion of return migrants who depart a second time, and (2) the exclusion of migrants who departed in 1995. These migrants were excluded because the person-year dataset was constructed to examine the determinants of migration, and information on the year prior to departure is missing for these migrants.

[11] Only Figures 3.1 and 3.2 incorporate weights, because they generalize to the study population. Comparisons indicate that the inclusion of weights in other analyses would only result in small changes in the proportions and mean values presented.

3.2 Migration

As noted in Chapter 2, the study area is an important origin of out-migrants to both internal and international destinations, and collecting information on migration was one of the primary goals of the household data collection. Table 3.1 presents the top ten most common destinations of individuals who departed from the sample households during the study period. The national capital Quito was the top destination, followed by Spain, the provincial capital Loja, coastal El Oro province, and other households within the same community. These top five destinations account for over 70% of all departures by both men and women. Men outnumbered women to international and predominantly

Table 3.1 Top ten destinations of departing individuals by sex, 1995-2006 (individual dataset).

Destination	Total (%)	Male (% of males)	Female (% of females)	Rank
Quito	207 (31%)	99 (28%)	108 (35%)	1
Spain	122 (19%)	77 (22%)	45 (15%)	2
Loja (city)	62 (9%)	22 (6%)	40 (13%)	3
El Oro Province (coast)	48 (7%)	32 (9%)	16 (5%)	4
Same community	45 (7%)	22 (6%)	23 (7%)	5
Cariamanga	25 (4%)	8 (2%)	17 (5%)	6
Zamora Province (Amazon)	25 (4%)	15 (4%)	10 (3%)	7
Loja Province, other	17 (3%)	12 (3%)	5 (2%)	8
United States	16 (2%)	13 (4%)	3 (1%)	9
Guayas Province (coast)	12 (2%)	7 (2%)	5 (2%)	10
All destinations	659	349	310	NA

rural destinations such as Spain and El Oro province, but women outnumbered men to urban destinations such as Quito. These results confirm that migrants from the study area depart to a diversity of both internal and international destinations, and suggest that gender plays a role in destination choice. Consistent with previous descriptions of

migration streams (e.g., Henry et al., 2004), departing individuals were categorized for the subsequent analyses into four migrant types based on their first destination for six months or more after departure. Those who departed to another household or community within the same canton (including the canton capital) were considered local movers. Those who departed to a rural destination outside the canton but within Ecuador were considered rural migrants, and those who departed to an urban destination outside the canton were considered urban migrants. Finally, those who departed to another country were considered international migrants.

Table 3.2 Migration by destination type and year of departure (person-year dataset).

Year	Non-migrant	Local	Rural	Urban	International	Total migrants (%)
1996	981	3	3	14	4	24 (2.4%)
1997	1018	2	7	18	7	34 (3.2%)
1998	1043	4	7	21	7	39 (3.6%)
1999	1062	13	11	38	14	76 (6.7%)
2000	1053	10	10	34	24	78 (6.9%)
2001	1114	5	5	24	23	57 (4.9%)
2002	1105	9	7	43	22	81 (6.8%)
2003	1131	3	13	54	25	95 (7.7%)
2004	1128	10	10	43	16	79 (6.5%)
2005	1142	8	13	46	5	72 (5.9%)
Total	11985	69	87	349	147	652 (5.2%)

To better describe the patterns of out-migration, Tables 3.2-3.5 display migration frequencies by year, age, sex, and relation to the household head. Rates of migration after 1995 generally increased over time (Table 3.2), with the exception of international migration which peaked in 2003, consistent with the national trends described in Chapter 2. The youngest individuals were most likely to migrate, with migration rates dropping off sharply after age 30 for all streams (Table 3.3), consistent with a large literature on

Table 3.3 Migration status by age, 1996-2006 (person-year dataset).

Migration	Age 14-19	Age 20-29	Age 30-39	Age 40-49	Age 50-59	Age > 59	Total
No migration	2821	1699	1619	1912	1750	2184	11985
Local move	28	31	6	2	0	2	69
Rural migration	48	29	4	3	3	0	87
Urban migration	227	101	13	1	5	2	349
International migration	62	69	13	3	0	0	147
Total migrations	365	230	36	9	8	4	652
Total person-years	3186	1929	1655	1921	1758	2188	12637
Migrations per person-year	11.5%	11.9%	2.2%	0.5%	0.5%	0.2%	5.2%

the relationship between migration and age (White and Lindstrom, 2005). Migration rates also differed by sex and relationship to the household head (Table 3.4). Consistent with Table 3.1, men represented a larger proportion of rural and international migrants, whereas women represented a larger proportion of local movers and urban migrants. Compared to the male and female household heads, the children of the heads and other households members were much more likely to migrate across all migration streams, consistent with previous studies of migration in Ecuador (Bilsborrow et al., 1987; Laurian and Bilsborrow, 2000).

Table 3.4 Migration status by sex and relation to household head, 1995-2006 (individual dataset).

Migrant status	Sex		Relation to household head			Total
	Male	Female	Head	Child	Other relation	
Non-migrant	617	590	669	415	123	1207
Local mover	30	41	1	64	6	71
Rural migrant	62	24	5	76	5	86
Urban migrant	165	192	12	320	25	357
International migrant	92	53	12	123	10	145
Total migrants	349	310	30	583	46	659
Total individuals	966	900	699	998	169	1866
Proportion migrants	36%	34%	4%	58%	27%	35%

Table 3.5 Migration by destination, sex, and co-occurrence with marriage, 1996-2006 (person-year dataset).

Migration	Men		Women	
	Person-years	% Marriage	Person-years	% Marriage
No migration	6234	0.6%	5751	0.5%
Local move	29	58.6%	40	52.5%
Rural migration	64	6.3%	23	56.5%
Urban migration	161	2.5%	188	16.5%
International migration	92	4.3%	55	5.5%

The survey also collected information on migration decision-making and motivations. In most cases respondents reported that migrants had made the decision to depart themselves, though often with the influence of their parents and/or spouse. Approximately half of respondents (mostly household heads) wanted their children or grandchildren to migrate in the future, suggesting that parents likely supported the decision in many cases. The migrant typically knew a family member or friend in the destination prior to departing. This contact commonly gave them a place to stay and/or helped them find work, and in many cases the migrant also received financial assistance from his/her parents, reinforcing the importance of social and financial capital in enabling migration. The most important proximate reasons reported for migration were to find work (75% of migrants), to join family (16%), to improve the quality of life (15%), and to pursue education (4%). In the year prior to migration almost all migrants are single, but in the case of local mobility by men and women and the rural migration of women the migrant married in the year of departure more than half of the time (Table 3.5), suggesting that participation in these migration flows is commonly linked to the decision to marry and that women are more likely to move with marriage. In the destination area, most migrants work for a wage (Table 3.6), with the exception of female local movers

Table 3.6 Primary activity by location of current residence, 2006 (individual dataset).

Migrant status	Schooling	Home-based domestic labor	Farm work	Wage labor	Not working	Total
Non-migrant	122	453	476	146	30	1227
Local mover	2	31	15	19	1	68
Rural migrant	2	15	1	56	1	75
Urban migrant	17	53	0	225	9	304
International migrant	0	6	0	170	1	177
Total	143	558	492	616	42	1851

and female rural migrants. The following types of destination-area waged employment were most common: domestic services for women in urban and international destinations, agricultural wage labor for men in rural and international destinations, construction for men in urban and international destinations, and other low-skill service jobs for men and women in urban destinations.

The survey data also provide insight into the demographic and economic effects of migration. Figure 3.1 is an age pyramid for the study population, derived from weighted totals from the individual dataset. The deficiency of individuals aged 30-44 (along with their young children) is notable and reflects the age pattern of out-migration described above. As households typically contain 2-4 adults (Table 3.7) the departure of one or more migrants is likely to have significant impacts on both labor availability and consumption demands in the household. Reflecting gender norms regulating participation in livelihood activities, men in the origin community are more likely to work on the farm (either part-time or as their primary activity) and to work for a wage (Table 3.8), suggesting that the consequences of migration for the origin household are likely to differ between male and female migrants. Respondents to the community survey commonly

Figure 3.1 Age pyramid for individuals resident in the study area, 2006 (individual dataset with weights).

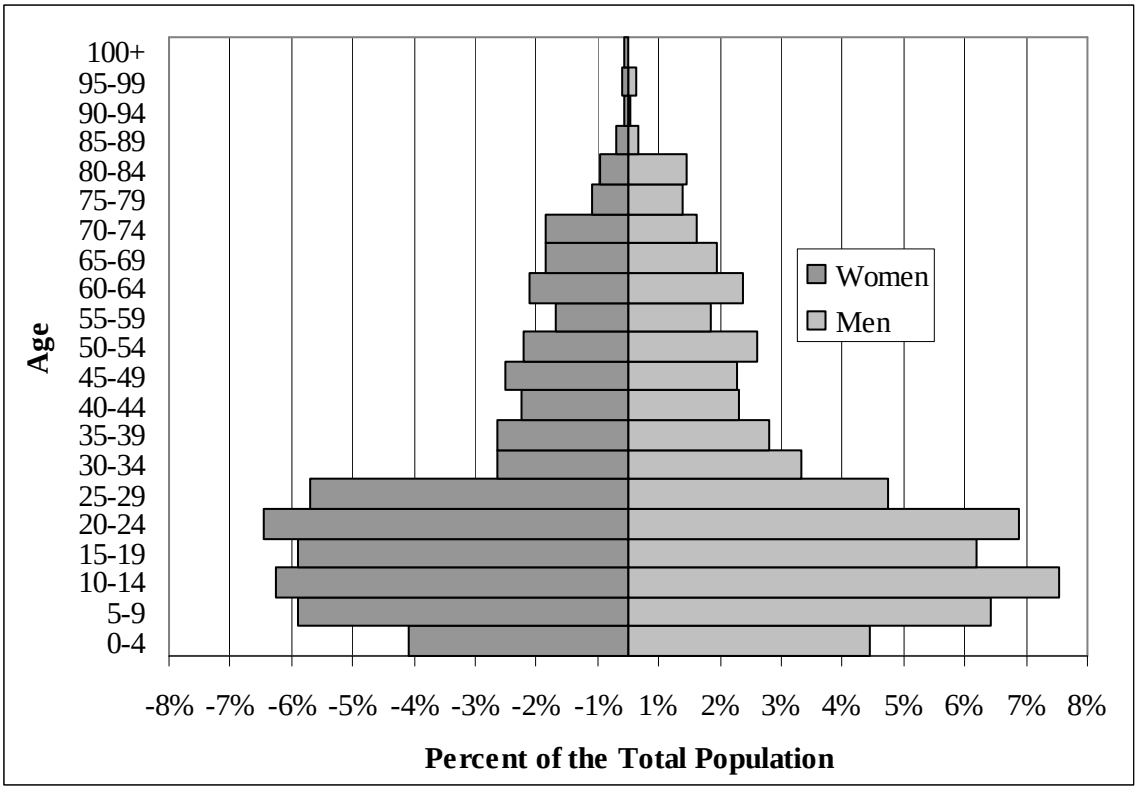


Table 3.7 Mean household age composition by age of the male household head, 2006 (household dataset).

Household members	Age of the male household head			
	< 50	50-59	60-69	> 69
Ages 0-14	3.39	1.94	1.46	0.66
Ages 15-29	1.16	1.56	1.07	0.52
Ages 30-59	1.52	1.84	0.84	0.47
Ages 60-100	0.19	0.20	1.43	1.56
Total household size	6.26	5.54	4.81	3.20
N	116	94	99	88

Table 3.8 Participation rates (by adults in the origin not enrolled in school) in farm and wage labor by sex, 2005 (individual dataset).

Variable	Men	Women
Works on farm	93.6%	64.1%
Works on farm as primary activity	73.1%	9.6%
Works for a wage	46.3%	5.3%
N	566	510

Table 3.9 Mean annual migrant remittances sent by current migrant residence and sex of the migrant, 2006 (individual dataset).

Migrant residence	Sex	% Remitting	Number remitting	Mean remittances
Rural	Men	32%	17	$341
	Women	32%	7	$60
Urban	Men	45%	63	$181
	Women	34%	55	$219
International	Men	73%	70	$727
	Women	75%	53	$599

Notes:
1. Source of remittances is based on location of residence of the migrant in 2006.
2. Excludes 15 migrants with missing data on the value of remittances.

reported labor shortages connected to out-migration, but none reported any resulting dramatic changes in the landscape or agricultural practices.

In addition to demographic impacts, migration can also have important economic impacts through migrant remittances. As expected, the average value of remittances sent by international migrants is more than five times larger than the value sent by internal migrants (Table 3.9). Men and women remitted in similar proportions and amounts from urban and international destinations, but women remitted little from rural destinations relative to men and relative to women in urban destinations, likely because these migrations are often for marriage (see above) and few wage labor opportunities are

Table 3.10 Mean annual migrant remittances received by remittance status of the household, 2006 (household dataset).

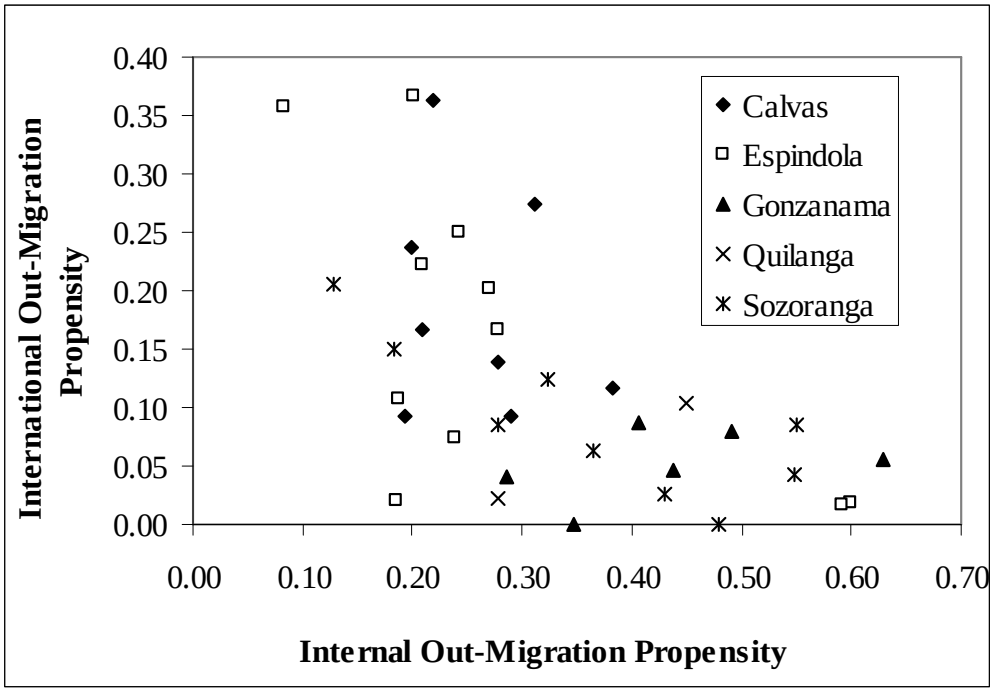
Household status	Number of households (%)	Remittance source		
		Internal	International	Total
All households	384 (100%)	$77	$194	$272
Internal-receiving	77 (20%)	$386	$185	$571
International-receiving	69 (18%)	$93	$1,081	$1,174

Notes:
1. Source of remittances is based on location of residence of migrants in 2006.
2. Excludes 14 households with missing data on the value of remittances.

available for women in rural areas. The 19% of sample households that received international remittances in the year prior to the survey reported receiving US$1,174 on average in internal and international remittances, which is approximately equal to the average household's total cash income excluding remittances (Table 3.10). Most international migrants sent remittances using a wire service, whereas internal migrants typically remitted in person, via friends, or using a courier service offered by the bus companies. Daily expenses were the most common reported use of remittances by recipient households, followed by health care, education and agricultural expenses. Despite these large remittance inflows, ostentatious displays of wealth are not visible in the study communities. However, the town of Cariamanga does appear to have significantly benefited from remittances, as witnessed by the significant amount of improved construction and a large number of pick-up trucks.

Two additional analyses provide insight into the drivers of migration, which are more fully explored in Chapter 4. Figure 3.2 plots the estimated internal and international migration propensities for each of the 36 study communities for the 1995-2006 study period. Propensities were estimated as the total number of internal or international

Figure 3.2 Community-level international migration rates versus internal migration rates by canton, 1995-2006 (community dataset).



Note: Data points are communities and symbols indicate the canton in which they are located.

migrants from 1995-2006 recorded in the household listing divided by the number of community residents who turned age 15 by 2006[12]. The overall 12-year propensities to out-migrate (for individuals who turned 15 in the interval) were 32% to internal destinations and 14% to international destinations. Note that these propensities are not directly comparable to those calculated from census data and presented in Chapter 2 because in this analysis the time interval is longer and the denominator has been adjusted

[12] To estimate the number of community residents who turned age 15 by 2006, I summed the following: (1) the total number of out-migrants from 1995-2006 from the household roster, (2) the total population in 2006 as measured by the household roster adjusted to remove individuals under age 15 (using the age structure as measured by the household survey), and (3) the total population of whole departing households, again adjusted to remove individuals under age 15. Note that individuals who died in the interval were not included in the total because data was not available.

for the age structure of the community. All communities had propensities of internal migration of 8% or higher but some had near-zero propensities of international migration (Figure 3.2). No communities had high rates of both internal and international migration (i.e., the upper right quadrant of Figure 3.2), suggesting that these migration flows act as substitutes. The community propensities tend to cluster by sector (not shown) and to a lesser degree at the canton level (Figure 3.2). Also of interest is that the communities with the three highest propensities of international migration are accessible and relatively wealthy communities, whereas the three with the highest rates of internal migration are both isolated and relatively poor, suggesting that wealth may encourage international migration over internal migration.

One important caveat for the results presented above (with the exception of Figure 3.2) is that they do not include whole departing households, those households which existed in the study area after 1995 but in which all members departed or died prior to 2006. However, as mentioned above and in Chapter 2, I collected limited data on these households at the community level. Using these data together with information on still-resident households, I constructed Table 3.11, which presents selected characteristics for three categories of households: households still resident that sent no migrants during the period, households still resident that sent internal or international migrants, and whole departing households. Characteristics are from the year prior to departure for whole departing households, and from 2001 (the mean year of departure) for other households. This table does not present statistical tests and the results do not include multivariate controls, but the results do suggest that the selectivity of migration may differ between

Table 3.11 Mean values for characteristics of non-migrant-sending, migrant-sending, and whole departing households (household dataset with weights and departed household dataset).

Characteristics	Non-migrant-sending	Migrant-sending		Departing	
		Internal	International	Internal	International
Household size (#)	3.98	7.19	6.86	4.68	4.23
Education of head (years)	4.56	4.98	4.43	4.76	6.00
Wage labor by head (%)	54%	46%	29%	63%	86%
Area of owned land (ha)	3.71	2.80	8.21	2.87	8.64
Cattle (#)	2.03	1.85	5.49	1.87	1.36
N	127	163	77	95	16

Notes:
1. Households that sent both internal and international migrants are categorized as international-sending.
2. Values are for year prior to departure for migrating and migrant-sending households and for 2001 for non-migrant households (the mean year of migrant departure).
3. The number of cattle for non-migrant and migrant-sending households was interpolated as the mean of values for 1995 and 2006.
4. Households created after 1995 and three returned whole migrating households were excluded.

migrant-sending and wholly departing households. The largest households were more likely to send migrants rather than send no migrants or depart completely, likely reflecting resource constraints for large households and a lower probability of complete departure for multi-generational households. Households where the male head worked for a wage were more likely to depart completely, suggesting that work experience promotes this form of migration. Households with educated male heads were more likely to wholly depart to international destinations, consistent with previous descriptions of educational selectivity for long-distance migrations (Adams, 2003). Both forms of international migration increased with area of owned lands, and sending of international migrants increased with cattle ownership, suggesting that these forms of wealth may facilitate international migration. These potential differences in selectivity between these two

forms of migration indicate that future origin-area studies of migration should attempt to collect more detailed data on whole departing households in order to incorporate them into multivariate analyses.

3.3 Agriculture and Rural Livelihoods

In addition to migration, agriculture and other household livelihood activities were an important focus of the survey data collection. Rural households in the study area commonly own multiple spatially distributed agricultural parcels, and also access land through land renting and borrowing. Rented and borrowed parcels are typically owned by households not resident in the community. Table 3.12 presents mean values for characteristics of agricultural parcels by parcel tenancy. Reflecting the smaller size of the most productive parcels, a majority of parcels have black soil and flat topography, but fewer than 20% have access to irrigation. Maize and beans (often intercropped) are the most important land uses, followed by pasture, fallow and shrubs, other crops, and coffee. (Note that these measures of land use, which are percentages averaged across parcels managed by resident households, cannot be directly compared to the figures from the agricultural census presented in Chapter 2, which are percentages of total area across all parcels.) Owned parcels tend to be larger, have more diverse land uses, and are the most likely to have irrigation and flat topography. Rented parcels tend to be smaller (less than one hectare on average), are more likely to have fertile black soil, and are mostly used to plant maize and beans. Borrowed parcels are intermediate in most respects between owned and rented parcels, but more often have steep topography.

Table 3.12 Mean values for characteristics of agricultural parcels by tenancy, 2006 (parcel dataset).

Characteristic	All parcels	Owned	Rented	Borrowed
Land area (ha)	2.65	3.14	0.77	2.04
Irrigation	19.2%	23.6%	4.9%	9.3%
Black soil	52.7%	50.3%	65.0%	50.0%
Sandy soil	10.4%	10.5%	4.9%	20.4%
Gravel soil	26.3%	27.6%	21.4%	24.1%
Clay soil	10.6%	11.6%	8.7%	5.6%
Steep topography	23.2%	21.6%	24.3%	35.2%
Hilly topography	14.9%	14.6%	18.4%	11.1%
Flat topography	61.9%	63.8%	57.3%	53.7%
Area in maize and beans	41.5%	31.2%	78.0%	60.2%
Area in coffee	5.6%	6.8%	0.3%	5.9%
Area in other crops	14.2%	15.2%	10.9%	11.4%
Area in pasture	21.5%	25.5%	7.2%	13.9%
Area in fallow and shrubs	14.3%	17.7%	2.8%	6.8%
Area in trees	2.9%	3.5%	0.9%	1.8%
N	624	467	103	54

Table 3.13 presents characteristics of household farms for the twelve months prior to the survey, including all of the parcels managed by the household. The average household had access to 4.2 hectares of land in 1.6 parcels, of which 75% of the area was owned, 16% rented, and 10% borrowed. Despite the relative equity of land distribution in the study area compared to other regions of Ecuador (Chapter 2), the land distribution is still quite inequitable. The richest 10% of households had access to 58% of the land area, and 21% of households did not own any land, though all but 2% of households are able to access land either through ownership, renting or borrowing. The Gini index for owned land was 0.68, compared to 0.81 for the country as a whole (World Bank, 2004). Small farms, those with less than 0.75 hectares of owned, rented and borrowed lands, were used primarily to plant maize and beans and had few cattle. These households access 44% of

Table 3.13 Mean values for farm characteristics by farm size, 2006 (household dataset).

Characteristic	All farms	Small Farms	Medium farms	Large farms
Land area (ha)	4.24	0.40	1.69	12.37
Number of parcels	1.60	1.20	1.62	1.97
Proportion owned	74.5%	55.9%	76.6%	89.6%
Proportion rented	15.7%	24.1%	17.8%	4.0%
Proportion borrowed	9.8%	20.0%	5.7%	6.4%
Area in maize and beans	42.7%	62.4%	44.3%	20.2%
Area in coffee	5.5%	5.8%	5.8%	4.7%
Area in other crops	12.9%	16.1%	13.3%	8.8%
Area in pasture	18.9%	5.1%	16.6%	36.3%
Area in fallow and shrubs	16.4%	10.0%	16.7%	22.2%
Area in trees	3.4%	0.6%	2.5%	7.7%
Number of cattle	1.98	0.34	0.93	5.40
Pest problems	88.6%	93.3%	88.1%	84.9%
Crop disease problems	80.4%	83.7%	81.4%	75.5%
Erosion problems	46.3%	44.2%	43.5%	52.8%
Soil depletion problems	54.5%	55.8%	52.0%	57.5%
Chemical fertilizer use	24.2%	21.9%	21.3%	31.1%
Pesticide use	20.6%	25.7%	18.0%	19.8%
Herbicide use	51.4%	46.7%	53.4%	52.8%
Improved maize seed use	14.1%	11.2%	11.0%	22.0%
Hired labor use	59.4%	45.7%	63.5%	66.0%
Reciprocal labor use	52.2%	56.2%	51.7%	49.1%
N	390	106	178	106

Note: Small farms are those with less than or equal to 0.75 ha of land area, medium farms are those with more than 0.75 ha but less than or equal to 3 ha, and large farms are those with greater than 3 ha.

their land area on average through renting or borrowing. In contrast, large-farm households (accessing more than 3 hectares) had large proportions in pasture and fallow, had larger numbers of cattle, and owned 90% of the farm on average. Respondents to the community survey indicated that the number of cattle declined during the study period in

most communities, but responses across communities were mixed as to whether the area of fallow and shrubs had increased, stayed the same, or decreased.

Across all farm sizes, most households reported problems with crop pests and diseases, and a majority also reported problems with soil erosion and depletion. In the face of these problems, 24% of households used chemical fertilizers in the past year, 21% used pesticides, 51% used herbicides, and 14% used improved varieties of maize. Among households who planted corn, 15% planted multiple local varieties, and among those who planted beans 21% planted multiple local varieties. From the community survey, most communities reported typical maize harvests of 450-900 kilograms per hectare[13], which are consistent with the values from the agricultural census presented in Chapter 2. To supplement household agricultural labor, 59% of households hired labor in the past year and 52% used reciprocal labor, a traditional form of labor exchange common in the rural Andes (Guillet, 1980). The importance of hired labor relative to reciprocal labor increased with farm size.

Agriculture and out-migration are both central livelihood strategies for rural households in the study area, but other activities are also important sources of income and subsistence. Table 3.14 presents, for various income sources, the proportion of households participating in the activity as well as mean values for cash income from that source. The survey collected data on income from crop sales, animal sales, agricultural wage labor, non-agricultural wage labor, temporary migration, small enterprises, international remittances, and internal remittances. Over 90% of households had cash income from one or more of these sources. This analysis provides insight into the relative

[13] I present these values for yields from the community survey because the household survey collected information on current land use and the most recent harvest, which turned out to be from two different agricultural cycles since data were collected during the planting season.

Table 3.14 Participation rates and mean cash income by income source and farm size, 2006 (household dataset).

Income Source	All households		Small farms and landless		Medium farms		Large farms	
	% with income	Mean income	% with income	Mean income	% with income	Mean income	% with income	Mean income
Crop sales	46.3%	$179	30.1%	$62	48.9%	$104	59.4%	$432
Animal sales	32.2%	$91	21.2%	$28	25.3%	$41	55.7%	$243
Agricultural wages	40.8%	$287	50.4%	$375	36.5%	$248	37.7%	$258
Non-agricultural wages	10.6%	$265	12.4%	$298	10.1%	$293	9.4%	$184
Temporary migration	16.9%	$85	18.6%	$79	14.0%	$73	19.8%	$111
Small enterprises	8.3%	$91	7.1%	$62	6.7%	$47	12.3%	$197
International remittances	19.1%	$227	9.7%	$66	19.7%	$223	28.3%	$403
Internal remittances	20.4%	$78	15.9%	$54	25.8%	$72	16.0%	$114
Total cash income	89.7%	$1,294	89.4%	$1,014	87.6%	$1,089	93.4%	$1,939
N	397		113		178		106	

Notes:
1. Mean income is the mean value for all households, including participating and non-participating households.
2. Small farms are those with less than or equal to 0.75 ha of land area, medium farms are those with more than 0.75 ha but less than or equal to 3 ha, and large farms are those with greater than 3 ha.

importance of various market-oriented livelihood strategies, but note that it does not include income interpolated for subsistence agricultural production, nor does it include income from the government's cash transfer program or the rural social security program.

Among included activities, crop sales, animal sales and agricultural wage labor were the most frequent, but agricultural wage labor, non-agricultural wage labor and international remittances provided the largest incomes on average across all households. Income from crop sales came primarily from sales of coffee, beans, corn and peanuts, whereas income from animal sales was primarily from cattle. Common forms of non-agricultural wage labor in the origin area included domestic service and jobs in the public

sector. Temporary migration to urban and rural destinations[14] and small enterprises such as stores and trading agricultural products also make important contributions to household income. Unsurprisingly, total cash income for landless households and those with small farms is approximately half of that of households with large farms. Landless households and those with small farms rely on wage labor for nearly half of their cash income, whereas income from agriculture, small enterprises and international remittances are more important for households with medium and large farms.

Together, these analyses describe key dimensions of out-migration and rural livelihood activities in the study area and provide context for the subsequent analytical chapters. Chapter 4 draws on this description of migration to analyze the drivers of out-migration, focusing on the effects of environmental conditions and access to land. Chapter 5 builds on this description of agriculture by analyzing how out-migration and remittances in turn influence agricultural activities.

[14] The most frequent destinations for temporary migrants (those departing for less than six months) were El Oro province, Zamora province, Quito, and the provincial capital of Loja.

CHAPTER 4

ENVIRONMENT, LAND AND RURAL OUT-MIGRATION

4.1 Significance

In attempting to understand the origins of migration flows, previous quantitative studies have focused on and demonstrated the importance of a series of demographic, social and economic factors, including age, gender, education, migrant networks and wage rates (White and Lindstrom, 2005). Paralleling these advances in migration studies, ecologists and human-environment researchers have drawn attention to the rapid rate of environmental change in many rural areas, including soil degradation, deforestation, and climate change, and the related displacement of potentially large numbers of "environmental refugees" (Bates, 2002; Myers, 2002). The importance of environmental change and other processes of rural transformation such as land fragmentation are widely recognized within development studies (e.g., Rigg, 2006), but few quantitative studies of migration have focused on the effects of these changes or on other elements of the agrarian and development context (De Haan and Rogaly, 2002; Beauchemin and Schoumaker, 2005).

Recently a small number of quantitative studies of migration have focused on the effects of environmental conditions and access to land, revealing nonlinear effects of land ownership on out-migration that differ by destination type (Barbieri, 2005; VanWey, 2005; Mendola, 2008), and relatively weak environmental effects that are not consistent

with predictions regarding environmental refugees (Henry et al., 2004; Massey et al., 2007). This chapter addresses these issues by investigating the effects of land ownership and environmental factors on out-migration to local, rural, urban and international destinations from the study area in the southern Ecuadorian Andes. Specifically, I construct a multinomial event history model including the effects of household land area, soil type and erosion, topography, precipitation, fluctuations in agricultural harvests, and a large set of controls. By including interactions with gender, the study also complements a growing number of studies which have compared influences on migration for men and women (e.g., Massey et al., 2006). The results do not support common assumptions about the effects of land ownership and environmental conditions, and indicate that the effects of these and other factors differ substantially across migration streams and between men and women.

4.2 Environmental Influences on Out-Migration

The environment in theories of migration

Consistent with the paucity of empirical studies, commonly-invoked theories of migration do not explicitly include environmental factors, but several theories can accommodate them. Overall, migration theories share the core idea that migrants compare opportunities between the origin area and potential destinations, and that their decisions are influenced by personal characteristics and experiences, household assets and constraints, contextual characteristics of the origin and destination, and connections to potential destinations such as migrant networks (Massey et al., 1993; Massey and Espinosa, 1997; White and Lindstrom, 2005). Environmental factors enter here as

elements of the household or community context and might include natural disasters such as flooding or earthquakes, incremental environmental changes such as soil degradation and deforestation, and static environmental conditions such as elevation and topography (Bates, 2002). Potentially relevant environmental factors thus range over multiple spatial and temporal scales and across multiple resource domains (e.g., climate, soils and land cover). The overall importance of these factors to agricultural activities, other natural-resource-dependent activities such as fuelwood collection, and overall household decision-making is supported by large literatures in cultural ecology and agricultural economics (e.g., Reardon and Taylor, 1996; Sandor and Furbee; 1996).

Straightforward interpretations of commonly-cited theories of migration do not lead to consistent predictions regarding the expected direction of environmental effects on out-migration. In Petersen's (1958) general typology of migration, negative environmental qualities such as soil degradation could be considered to be "push factors", and in the neoclassical microeconomic approach (DaVanzo, 1981) they could be considered to be location-specific disamenities (Hunter, 2005). In this view, the perception of a degraded environment or of the consequently lowered productivity of agricultural or other natural-resource-dependent activities would encourage individuals to migrate. Conversely, access to environmentally-valuable lands would discourage out-migration. These formulations are consistent with the literature on environmental refugees in predicting that negative environmental conditions will promote out-migration, and I refer to this prediction as the *environmental-amenity hypothesis*.

Household-centered theories such as the new economics of labor migration (NELM) and the sustainable livelihoods framework provide two additional hypotheses

for the potential effects of environmental factors. NELM considers migration to be a household strategy for income diversification in the face of production risks and lack of credit in the origin area (Stark and Bloom, 1985; Taylor, 1999). The sustainable livelihoods framework similarly focuses on household livelihood diversification, emphasizing the role of human, social and natural capital in enabling diversification (Ellis, 2000). The livelihoods framework has not commonly been applied in studies of the determinants of migration, but alone among these approaches it explicitly includes both contextual and environmental factors.

One element of these theories is that migration can serve as a form of diversification against economic risk (Rosenzweig and Stark, 1989), which could be extended to include the risk of environmental degradation (e.g., soil degradation) or environmental fluctuations (e.g., drought) and associated declines in agricultural production. In this view, environmental conditions indicating exposure to risk should lead to increased migration as a form of diversification. I refer to this prediction as the *environmental-risk hypothesis*. As environmental variation could also be viewed as a disamenity, this hypothesis is closely related to the environmental-amenity hypothesis. These theories also identify access to capital, potentially including natural capital, as a factor facilitating investment in income diversification, including migration. In this view, households might be able to draw on natural capital to facilitate costly migrations, either through increased productivity of agriculture or by using high quality lands as collateral for a loan. I refer to this prediction as the *environmental-capital hypothesis*.

These arguments also apply in part to the effects on migration of access to land. In previous studies land has primarily been treated as a proxy for household wealth, but as

discussed by VanWey (2005) land can also serve as a source of employment, an opportunity for investment of migrant remittances, or an indicator of social status. Where land is primarily a source of employment then it should serve as an amenity, discouraging out-migration, but where it is primarily a form of capital then it should facilitate out-migration. Given large differences in the costs of different types of migration, land ownership is likely to increase out-migration to more costly international destinations relative to less costly internal destinations.

The influences of both environmental conditions and land ownership on migration are likely to differ between men and women given the strongly gendered nature of participation in agriculture and other natural-resource-based activities in many parts of the developing world, as well as gendered practices in land inheritance and in access to employment in migrant destinations (Davis and Winters, 2001). In Ecuador and elsewhere in Latin America where agriculture and land are typically controlled by men (Deere, 2005) environmental conditions and land ownership might affect men more strongly than women. Alternatively, these factors might affect women more strongly given their overrepresentation in some migration flows and lesser access to non-farm employment in rural areas. Women's migration is likely to be more dependent on household networks and resources in strongly patriarchal societies (Massey et al., 2006).

Previous studies

A large number of previous studies have included land ownership as a predictor of migration behavior (e.g., Shaw, 1974). Consistent with the amenity hypothesis, land ownership tends to have a negative effect on out-migration, but studies controlling for community-level migrant networks have also found positive effects (VanWey, 2005). A

subset of these studies has examined the effects of land ownership more carefully by allowing for nonlinear effects of land area and for differences across migration streams. VanWey (2005) found that internal and international out-migration decreased with household land area in Mexico, but that internal out-migration in Thailand was least likely at intermediate values of land area. In contrast, Davis et al. (2002) found that ownership of rainfed land had positive but diminishing effects[15] on out-migration from Mexico to the US and that ownership of irrigated land had similar effects on out-migration to internal destinations for agricultural work. In that study land holdings had no effect on internal out-migration for non-agricultural work. Mendola (2008) showed that temporary and internal out-migration decreased with household land area in Bangladesh but that international out-migration increased. Finally, in a study from the Ecuadorian Amazon, Barbieri (2005) showed that out-migration to both rural and urban destinations decreased with household land ownership. Overall, these studies confirm that negative effects of land assets on out-migration are most common, but they also reveal that effects are commonly nonlinear and are likely to differ across migration streams and between origin areas.

Several studies, both quantitative and qualitative, have investigated the effects of land ownership on migration specifically in the Ecuadorian Andes. Qualitative studies by Jokisch (1997) and Pribilsky (2007) revealed that lack of access to land was an important direct and indirect contributor to international out-migration from the provinces of Azuay and Cañar. Among quantitative studies, Bilsborrow and colleagues (1987) used household survey data from a sample of highland cantons to show that rural-urban

[15] This refers to a nonlinear effect in which rainfed land increases migration but at high values of land ownership further increases have little effect on migration.

migration of men increased with land area for land-poor households and decreased with land area for land-rich households, though these effects were mitigated by distance from the primary urban destination. In that study land had no effect on the out-migration of women. Laurian and Bilsborrow (2000) used data from a similar household survey to show that rural-urban migration of men decreased with land area but that land had no effect on women's out-migration. Brown and colleagues (1988) combined individual-level census data from the highlands with indices created from canton-level variables to show that out-migration increased with indices for long-standing settlement and modern socio-economic structure and decreased with indices for subsistence-oriented agriculture and large-sized farms. These studies confirm that land and agrarian structure are important influences on out-migration in the Ecuadorian Andes, and suggest that the effects of land ownership are likely to differ between men and women. The analysis described below extends these studies by comparing four different migration streams, comparing men and women, allowing nonlinear effects of land area, and including several measures of environmental conditions.

Five quantitative studies from Mexico have also explored gender differences in the drivers of international migration (Kanaiaupuni, 2000; Cerrutti and Massey, 2001; Davis and Winters, 2001; Curran and Rivero-Fuentes, 2003; Massey et al., 2006). Overall these studies indicate that being married reduces out-migration of women but not men; that male migrants but not females are negatively selected for education, and that same-sex migrant networks generally have larger effects than opposite-sex networks for both men and women. Particularly relevant to this study, Massey and colleagues (2006) found that land ownership decreased international out-migration among women but increased it

among men, and argue that this is due to men's control over land as a form of wealth in the patriarchal society of Mexico. However Davis and Winters (2001) found that irrigated land decreased male out-migration and rainfed land marginally increased female out-migration, and argue that is because irrigated land provides employment for men. These studies confirm that the effects of land and other factors are likely to differ between men and women. The current study complements these studies by extending this comparison to Ecuador, and by comparing the effects of land ownership and environmental conditions for men and women.

Many authors have discussed the potential for environmental degradation to displace "environmental refugees", with some estimating the number of those displaced in the millions (e.g., Westing, 1992; Hugo, 1996; Myers, 2002). Human displacement associated with the construction of large-scale infrastructure projects such as the Three Gorges Dam (Heming and Rees, 2000) has clearly illustrated this phenomenon[16], but investigation of more pervasive environmental influences on migration has been hampered by lack of appropriate datasets and enduring disciplinary boundaries between migration studies and environmental studies. Thus only a handful of previous multivariate studies have investigated these effects (see below), leading some authors to argue that such claims are largely unfounded (Lonergan, 1998; Black, 2001; Paul, 2005).

Previous quantitative studies of environmental effects on out-migration include two which investigated the effects of climate and two focused on local environmental changes. Regarding the effects of climate, Henry and colleagues (2004) found that rainfall variability in Burkina Faso increased out-migration of men to rural areas,

[16] Other such cases include the shrinking of the Aral Sea in Central Asia (Small et al., 2001) and of the Mesopotamian Marshes of Iraq (Coast, 2002) and the failure of New Orleans' levees in the wake of Hurricane Katrina in the United States (Groen and Polivka, 2007).

decreased out-migration of men to international destinations, and decreased out-migration of women to urban destinations. Gutmann and colleagues (2005), using historical data from the 1930s US Great Plains, showed net migration to increase with fluctuations in precipitation in the origin but to decrease with fluctuations in temperature. Addressing local environmental changes, Massey and colleagues (2007) found for Nepal's Chitwan Valley that time to gather firewood increased short-distance migration of men, perceived agricultural productivity decline and the percent of community land without vegetation increased short-distance migration of women, and the time to collect fodder increased long-distance migration of women. Finally, Rindfuss and colleagues (2007) showed that individual and household out-migration both increased with community forest cover in Nang Rong Thailand, though this may relationship may be partially explained by correlated and uncontrolled differences in community accessibility. Overall, these previous studies do not consistently support the environmental-amenity hypothesis implicit in the literature on environmental refugees, but they do suggest that environmental effects are likely to differ between men and women. The analysis described below extends this approach by jointly considering the effects of several environmental characteristics on four migration streams and for men and women separately.

4.3 Analysis of Migration

To test the hypotheses presented above for the effects of the environment and land on out-migration, I estimated a multivariate event history model of out-migration to local, rural, urban and international destinations with multiple measures of land ownership and

environmental conditions included as predictors. Below I describe the dataset, the migration outcomes, the predictors, my hypotheses, and the event history model.

The dataset

As described in Chapter 3, I used the data sources described in Chapter 2 to construct a person-year dataset including migrants and non-migrants. This dataset contains time-varying and time-invariant variables at individual, household and community levels, and each case represents one year in the life (i.e., a person-year) of a person at risk for out-migration as defined below. Migration outcomes (from year *t*) are lagged one year after predictors (year *t-1*) to reduce the possibility of endogeneity with the migration decision; thus complete data are available for 1996-2006[17] (year *t*). Consistent with previous studies from Ecuador (Bilsborrow et al., 1987; Laurian and Bilsborrow, 2000), male and female household heads/spouses[18] and individuals over 50 years old in year *t* were excluded from the analysis dataset as they had very low propensity for out-migration. Of 397 households in the dataset, this excluded 96 households (primarily older couples and young families) that had no members at risk of migration during the study period. Additionally, 22 households that had not yet formed or taken residence in the community in 1995 were also excluded due to missing data on the predictors[19]. Following these exclusions, the analysis dataset includes 279 households with 1005 adults at risk for out-migration during the study period. Children of the head

[17] Migration propensities were lower for 2006 due to the short interval of data collection (January to March). This is accounted for by allowing the baseline hazard (α_{rt}) to vary with each year in the event history models described below.

[18] In the event that the individual identified as the household head was not in residence for part of the study interval, headship was assigned to the head's spouse or to another adult relative in the absence by both the head and spouse.

[19] These households were not an important source of out-migrants relative to households established prior to 1995.

and other non-head members of the household enter the dataset after 1995 when they are age 14 or older and resided primarily in the community in year *t-1*. Individuals leave the dataset when they out-migrate after 1995, turn 50 years old, or are censored at data collection in 2006. Return migrants re-enter the dataset in each year (*t-1*) that they reside primarily in the community.

The outcome

Migration was defined as a departure from the origin household for six months or longer in year *t*, with four outcome categories defined by the first place of residence (for six months or longer) outside of the origin household. The four outcome categories are local mobility, rural migration, urban migration, and international migration. Local mobility was defined as a change of residence to a different household or community within the canton, including the canton capital and other households within the same community. Rural migration was defined as a change of residence to a site in another canton outside of canton and provincial capitals. Urban migration was defined as a change of residence to a site in another canton within a canton or provincial capital. International migration was defined as a change of residence to another country. For the sake of brevity I refer to these outcomes collectively as migration. Corresponding to these categories, the outcome variable (i.e., dependent variable) is coded 1 to 4 corresponding to the four forms of out-migration for all person-years in which migration occurred, and in all other person-years is coded 0.

The dataset contains 1005 individuals, including 426 non-migrants (2378 person-years) and 579 migrants who departed their origin household one or more times (2642 person-years). Non-migrants include 191 women and 235 men, and migrants include 277

women and 302 men. Counting the multiple moves of 12 individuals who returned and departed their origin household a second time, the dataset contains 591 migration events, including 63 local movements, 74 rural migrations, 325 urban migrations, and 129 international migrations. Among these, 35 local movements, 21 rural migrations, 176 urban migrations, and 49 international migrations were by women, and men made 28 local movements, 53 rural migrations, 149 urban migrations, and 80 international migrations. Primary destinations included other households in the same community for local movers, neighboring El Oro and Zamora provinces for rural migrants, the provincial and national capitals for urban migrants, and Spain and the United States for international migrants. (See Chapter 3 for additional descriptive analyses of out-migration.)

The predictors

Definitions and mean person-year values for the predictors[20] (i.e., independent variables) are given in Table 4.1. Consistent with the livelihoods framework (Chapter 1) and previous studies of the determinants of migration (Massey et al., 1993; White and Lindstrom, 2005), the model includes as control variables measures of demographic characteristics, human capital, social capital, physical capital and financial capital, in addition to measures of natural capital which are the focus of the study (described below). As described in Table 4.1, the predictors include both time-varying and stable characteristics at individual, household and community levels. Measures of demographic composition include the following: age, gender, marital status and relationship to the household head of the individual; the age-sex composition of the household and the age

[20] To account for missing data, 0.2% of person-year values of predictors were manually interpolated based on other information in the questionnaire.

Table 4.1 Definitions and weighted mean person-year values for the migration predictors.

Variable	Unit	Level	Time-varying	Mean	Definition
Demographic Characteristics					
Female	1/0	Indiv	N	0.45	Gender is female, reference is male.
Age	years	Indiv	Y	21.0	Age in years
Union	1/0	Indiv	Y	0.14	Married or in a cohabitating union
Other relation to head	1/0	Indiv	Y	0.13	Other relation to HH head, reference is child
Age of head	years	HH	Y	55.4	Age of head in years
Minors	#	HH	Y	2.60	HH residents ages 0-14
Young women	#	HH	Y	0.99	Male HH residents ages 15-29
Young men	#	HH	Y	1.20	Female HH residents ages 15-29
Adult women	#	HH	Y	1.15	Male HH residents ages 30+
Adult men	#	HH	Y	1.11	Female HH residents ages 30+
Community population	10 persons	Com	N	18.4	Population of community in 1995 divided by 10[1]
Human Capital					
Primary education	1/0	Indiv	Y	0.50	Complete primary education[2]
Secondary education	1/0	Indiv	Y	0.33	Some or complete secondary education[2]
HH secondary education	#	HH	Y	1.01	HH residents ages 15+ with secondary education
Social Capital					
HH rural migrants	#	HH	Y	0.37	Current rural migrants from the HH
HH urban migrants	#	HH	Y	1.08	Current urban migrants from the HH
HH international migrants	#	HH	Y	0.49	Current international migrants from the HH
Com rural migrants	#	Com	Y	11.1	Current rural migrants from the Com[1]
Com urban migrants	#	Com	Y	35.0	Current urban migrants from the Com[1]
Com international migrants	#	Com	Y	12.5	Current international migrants from the Com[1]
Physical Capital					
Distance to road	km	HH	N	0.71	Distance from the home to the nearest road
Distance to highway	10 km	Com	N	12.1	Distance to the closest paved road from GIS
Services	#	Com	Y	2.69	Number of services[3]
Financial Capital					
Cattle	#	HH	N	3.66	Number of cattle owned in 1995
(continued below)					

Variable	Unit	Level	Time-varying	Mean	Definition
(continued from above)					
Land Ownership					
Land area	ha	HH	Y	4.95	Area of agricultural lands owned by HH members
Parcels	#	HH	Y	1.23	Number of agricultural parcels owned
Environmental Conditions					
Flat land	1/0	HH	Y	0.24	HH owns flat agricultural land
Black soil	1/0	HH	Y	0.46	HH owns agricultural land with black soil
Soil problems	1/0	HH	N	0.57	HH experienced soil erosion or depletion in 1995
Bad harvest	1/0	HH	Y	0.09	Bad harvest reported
Good harvest	1/0	HH	Y	0.05	Good harvest reported
Slope	degrees	Com	N	31.8	Mean surface slope in 1km buffer from GIS
Precipitation	cm/year	Com	N	101	Mean annual precipitation in 1km buffer from GIS
Land per person	ha/ person	Com	N	0.84	Hectares of agricultural lands per resident in 1995[1]

Indiv: Individual, HH: Household, Com: Community

Note: Household and community measures exclude individuals who died before 2006.

[1] Estimated as a weighted sum from the household survey data, adjusted for whole departed households.

[2] Reference is less than primary education.

[3] Includes the presence of the following services: a school, a daycare, a store, electricity and piped water.

of the household head; and the population of the community. Human capital is measured by the educational attainment of the individual and the number of household members with secondary education. Social capital is measured by migrant networks, including the number of current migrants to rural, urban and international destinations who previously resided in the household and in the community. The level of physical capital is measured by the accessibility of the dwelling and the community as well as the availability of services in the community[21]. Finally, cattle serve as the most important form of financial capital for rural households in the study area.

[21] These measures have not commonly been included as predictors in previous studies of migration but have been shown to influence out-migration (Rudel and Richards, 1990; Beauchemin and Schoumaker, 2005) and may be correlated with environmental and agrarian conditions.

To test the effects of land ownership, I include the area of land owned by the household[22] in year *t-1* (*land area*), the square of area to allow for a nonlinear effect, and the number of parcels owned in year *t-1* (*parcels*). As controls for the environmental quality and cattle ownership are included (see below), the effects of land area can be interpreted as independent of land quality and cattle ownership, which is the primarily additional form of agricultural wealth. The number of parcels captures the effects of fragmentation and spatial distribution of the land area.

To test the effects of environmental conditions, I include the following five predictors at the household level[23]: ownership of flat land in year *t-1* (*flat land*), ownership of land with fertile black soil in year *t-1* (*black soil*), problems with soil erosion or depletion in 1995 (*soil problems*), experiencing an unusually good harvest in year *t-1* (*good harvest*), and experiencing an unusually bad harvest in year *t-1* (*bad harvest*). These measures were selected in consultation with local informants and collected by the household survey (Chapter 2) in order to capture the environmental quality of household lands as well as the timing of agricultural shocks. I also include three environmental measures at the community level[24]: the mean slope of community lands (*slope*, derived from the GIS), the mean annual precipitation of community lands (*precipitation*, from the GIS), and the agricultural land area per person in 1995 (*land per person*, aggregated from the household survey). These measures capture unmeasured

[22] Land ownership is the primary form of access to land in the study area (Chapter 3), and preliminary models including rented and loaned area revealed that these did not have important effects on migration.

[23] Preliminary models also included ownership of land with coffee and with irrigation as predictors, but these were consistently non-significant and were removed for the sake of parsimony.

[24] Elevation was not included as a community-level predictor because it is highly correlated with annual precipitation.

characteristics of household lands and the availability of other productive lands in the community. Total *precipitation* is a key variable given the seasonal climate[25] (Chapter 2), and *slope* provides information about the average quality of parcels not indicated to be *flat land*, as well as information about the difficulty of access to agricultural parcels, to the dwelling and to the community. Given the inclusion of various measures of environmental quality, *land per person* can be interpreted as an indicator of land availability in the community, whether for land rental, borrowing, or future land purchases (see Chapter 3).

Hypotheses

Table 4.2 presents hypotheses for the effects of land area and environmental conditions on out-migration to local, rural, urban and international destinations under the environmental-amenity/risk hypotheses and the environmental capital hypothesis. Given their similarity, the predictions of the environmental amenity and risk hypotheses are combined in Table 4.2 and in this discussion, with one exception as noted. Under the amenity/risk hypotheses, negative environmental conditions or those that associated with increasing risk (e.g., soil erosion/depletion) are expected to increase migration, whereas positive environmental conditions or those associated with decreasing risk (e.g., precipitation) and increased land area are expected to decrease migration. Only for the case of good harvests, a positive environmental characteristic that also indicates environmental variation, do my predictions for the two hypotheses diverge. Under the environmental-capital hypothesis, positive environmental characteristics and increased land area are expected to increase migration and negative environmental conditions to

[25] At the community-scale, spatial information is available on mean annual precipitation but not on variation in precipitation over time. The effects of environmental variation over time are captured in part by the household's experiences with good and bad harvests.

decrease it. Consistent with the findings of Massey and colleagues (2007), in both cases I expect environmental conditions to be more important for shorter distance migrations,

Table 4.2 Hypotheses for the effects of land area and environmental conditions on local, rural, urban and international migration under the environmental amenity/risk hypotheses and the environmental capital hypothesis.

Predictor	Environmental amenity/risk				Environmental capital			
	Local	Rural	Urban	International	Local	Rural	Urban	International
Land area	-	-	-	-	+	+	+	+
Flat land	-	-	-	-	+	+	+	+
Black soil	-	-	-	-	+	+	+	+
Soil problems	+	+	+	+	-	-	-	-
Bad harvest	+	+	+	+	-	-	-	-
Good harvest	-/+	-/+	-/+	-/+	+	+	+	+
Slope	?	+	+	+	?	-	-	-
Precipitation	?	-	-	-	?	+	+	+
Land per person	?	-	-	-	?	+	+	+

Notes
1. Minus signs indicate predicted negative effects, plus signs indicate predicted positive effects, and question marks indicate no prediction, with size indicating relative strength of the effects.
2. Predictions for the amenity and risk hypotheses are equivalent with the exception of good harvests, in which case the two predictions are separated by a slash.

given that potential local and internal migrants are more likely to be poor and thus more sensitive to threats to subsistence production. However, the effects of community-level environmental variables on local migration are difficult to predict given that local destinations include new residences within the same community as well as outside the community. For the case of land area, however, it's role as an amenity is likely to be

more important for poorer potential local and internal migrants, whereas the role of land as capital is likely to be more important for wealthier potential international migrants.

Beyond these predictions, the effects of environmental conditions and access to land are also likely to differ between men and women. Given the greater involvement of men in agriculture in the study area (Chapter 3) and their greater control over wealth in patriarchal societies (Massey et al., 2006), environmental conditions and access to land are likely to have greater effects on men than on women. Nonetheless, these factors may be more important for women in the migration streams where they predominate, such as urban migration.

The model

I analyzed these data using a multinomial discrete-time event history model (Allison, 1984). This model is appropriate for exposure to a mutually exclusive set of competing risks over time (e.g., out-migration to alternative destinations) where time is measured in discrete units. In this model, the log odds of experiencing a migration event of type *r* relative to no mobility (event *s*) are given by

$$\ln\left(\frac{\pi_{rit}}{\pi_{sit}}\right) = \alpha_{rt} + \beta_r X_{it-1}$$

where π_{rit} is the probability of mobility to destination type *r* for individual *i* in year *t*, π_{sit} is the probability of no migration for individual *i* in year *t*, α_{rt} is the baseline hazard of migration to destination type *r* in year *t*, X_{it-1} is a vector of predictor variables for individual *i* in year *t-1*, and β_r is a vector of parameters for the effects of the predictors on migration to destination type *r*. Thus this model allows investigation of the influences of various predictors (X_{it-1}) on the odds of out-migration over time to alternative destinations

(r), while accounting for changes in the rate of different migrations over time (α_{rt}). Changes in the baseline hazard of each form of migration over time (α_{rt}) are captured by a set of dummy variables that indicate the year t, one dummy variable each for 1997-2006 with 1996 as the reference category.

In this model the exponentiated form of the parameters (e^{β}), known as the odds ratio, can be interpreted as the multiplicative effect of a one unit increase of the predictor on the odds of that type of migration relative to the odds of no migration. A derivation of this equation can also be used to calculate the predicted probabilities of migration given the year and a set of values of the predictors. I estimate the model using Huber-White robust standard errors with clustering set at the level of the census sector, which corrects for the multilevel nature of the predictors and the clustering of person-years within individuals, households, communities and census sectors (Angeles et al., 2005). To account for unequal probabilities of selection across census sectors and households, I include household-level weights in the models, calculated as the inverse of the probability of selection. In fitting the model I tested for nonlinear effects by including squared terms for the continuous predictors (e.g., land area). To investigate differences in the effects for women and men, I also estimated a separate model in which all of the predictors were allowed to interact with gender.

Potential sources of bias

Models of migration such as this one can potentially be biased by endogeneity of the predictors or by the influence of unobserved characteristics (Mora and Taylor, 2005), but I argue that in this case both problems are likely to be of limited scope. Endogeneity could arise if past migration or remittances influenced land area or quality, such as

through investment of remittances in land purchases. To limit this problem, variables capturing decisions likely to be simultaneous with migration, including labor market participation or land use, were excluded as predictors, along with measures of housing quality or manufactured goods likely to be affected by remittances. Land sales are relatively infrequent in the study area and international migration with its sizable remittances only became widespread after 1998, limiting the possibilities for significant endogeneity in land area and quality. The effects of land and environmental conditions are also robust to the inclusion of additional measures of migrant networks capturing previous migration experience[26], again suggesting that land and environmental effects are not endogenous to migration. The potential scope of bias from unobserved characteristics is similarly small given the large number of control variables, which include the most important individual, household and community-level factors relevant to the study area and shown in previous studies to influence migration.

4.4 Results for Migration

The results from the event history analysis are displayed in Table 4.3, including odds ratios and the results of significance tests. Below I briefly discuss the effects of each of the categories of control variables before discussing in depth the effects of land ownership and environmental conditions. The discussion focuses on the statistically significant ($p < 0.05$) and marginally significant effects ($p < 0.10$).

[26] These predictors included measures of individual migration experience and the number of previous migrants in the household and community. These were not strong predictors of migration and were removed for the sake of parsimony.

Table 4.3 Odds ratios from the event history analysis of local, rural, urban and international migration.

Variable	Level	Local	Rural	Urban	International
Demographic Characteristics					
Female	Indiv	1.590+	0.403**	1.344**	0.644+
Age	Indiv	1.507**	1.082	1.742***	2.554***
$(Age)^2$	Indiv	0.993*	0.999	0.988***	0.981**
Union	Indiv	0.719	1.323	1.303	1.926*
Other relation to head	Indiv	0.346	0.541	0.395***	0.902
Age of head	HH	1.066	0.954	0.906+	1.147
$(Age\ of\ head)^2$	HH	1.000	1.000	1.001	0.999+
Minors	HH	1.300*	1.104	1.049	0.815***
Young women	HH	1.371+	1.063	1.430*	0.940
Young men	HH	1.233	1.027	0.949	0.804
Adult women	HH	0.400**	0.645	1.531+	0.599*
Adult men	HH	0.394**	0.740	0.947	0.681
Community population	Com	1.093**	0.989	0.992	1.038
Human Capital					
Primary education	Indiv	1.248	2.069	2.046	2.601***
Secondary education	Indiv	0.911	1.995	1.667	1.966*
HH secondary education	HH	1.081	1.254	0.954	1.329*
Social Capital					
HH rural migrants	HH	1.247	1.338+	0.882	0.843
HH urban migrants	HH	0.814	1.066	1.344***	0.925
HH international migrants	HH	1.134	0.427*	0.977	1.299+
Com rural migrants	Com	0.962+	1.030	1.003	0.999
Com urban migrants	Com	0.989	1.002	1.002	0.985+
Com international migrants	Com	0.968	0.990	0.979*	0.987
Physical Capital					
Distance to road	HH	1.463**	1.277	1.088	0.936
Distance to highway	Com	0.959**	1.007	1.008	1.050***
Services	Com	0.896	1.160	0.849**	1.162
(continued below)					

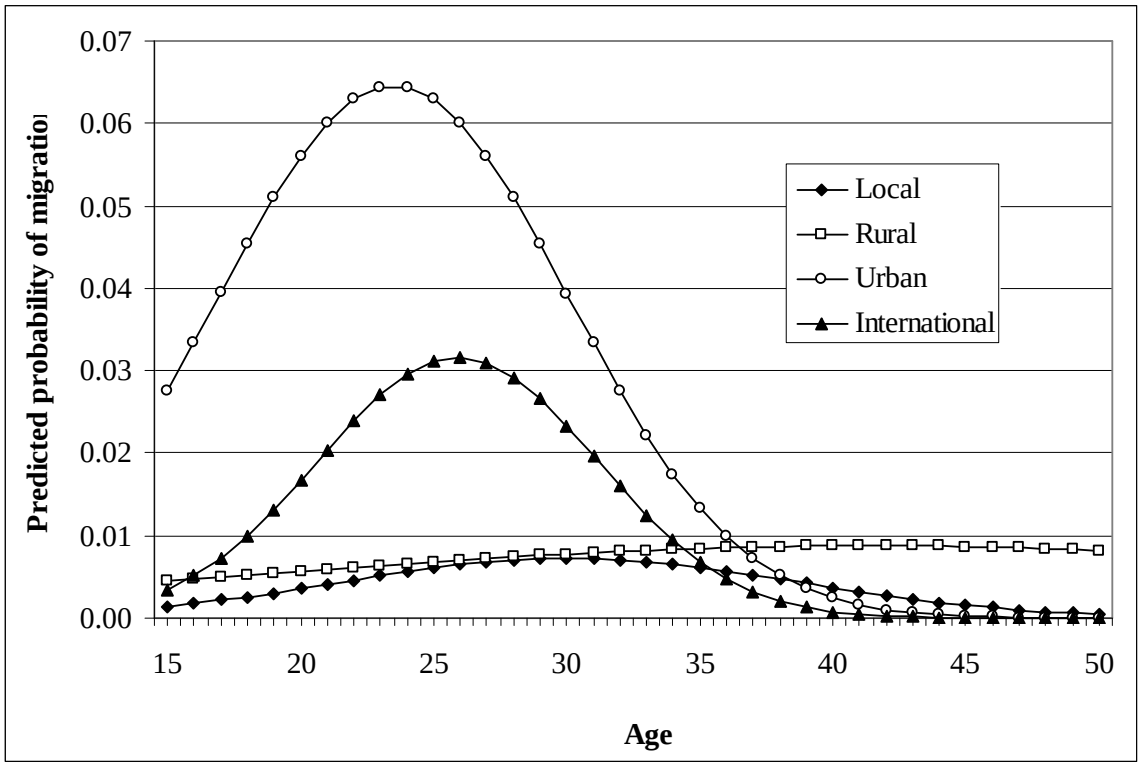
Variable	Level	Local	Rural	Urban	International
(continued from above)					
Financial Capital					
Cattle	HH	1.151	1.117+	1.053	0.952
$(\text{Cattle})^2$	HH	0.992	0.994**	0.999	1.001
Land Ownership					
Land area	HH	0.921+	1.112	0.922*	1.057**
$(\text{Land area})^2$	HH	0.999	0.996+	1.001+	1.000*
Parcels	HH	1.405**	0.972	0.991	0.828
Environmental Conditions					
Flat land	HH	2.853**	0.731	1.303	1.264
Black soil	HH	0.427*	0.856	1.456*	0.974
Soil problems	HH	1.288	1.803*	1.337	0.737
Bad harvest	HH	1.603	1.825	1.815*	1.245
Good harvest	HH	3.819*	1.366	1.661+	1.464
Slope	Com	1.104*	0.941**	1.002	0.998
Precipitation	Com	1.005	1.010	0.983**	0.974
Land per person	Com	2.662**	0.938	1.478***	1.089
Year Dummies					
1997	Year	0.338*	2.143	0.906	1.556
1998	Year	1.156	1.396	0.912	1.225
1999	Year	3.107*	2.892	2.440**	2.604+
2000	Year	1.971	1.873	2.407*	3.953**
2001	Year	1.255	1.582	1.482	3.755+
2002	Year	3.254**	1.196	2.937**	3.544+
2003	Year	0.695	3.525+	3.651***	4.594**
2004	Year	3.547+	2.855	3.955***	2.696
2005	Year	2.597	4.937*	4.102***	0.515
2006	Year	0.737	0.000***	0.986	0.000***

Indiv: Individual, HH: Household, Com: Community

$(\text{Variable})^2$ represents the squared term from a quadratic fit for a continuous predictor

*** p<0.001; ** p<0.01; *p<0.05; + p<0.10

Figure 4.1 Predicted probabilities of migration by destination type and age with mean values of the other predictors and the mean baseline hazard from 1996-2005.



Demographic characteristics

Overall, the effects of the control variables are largely consistent with previous studies but also reveal important differences across the four migration streams (Table 4.3). The effects of demographic characteristics were jointly significant[27] for all four streams but least important for rural migration. Relative to men, women were significantly less likely to be rural migrants, marginally less likely to be international migrants, significantly more likely to be urban migrants, and marginally more likely to be local movers. These results are consistent with previous studies from Ecuador and elsewhere in Latin America showing a predominance of women in rural-urban migration

[27] These effects were jointly significant (i.e., collectively significant when tested together) by a post-estimation Wald test using Stata's *test* command.

and of men in international migration (Jokisch and Pribilsky, 2002; Katz, 2003). The effects of age of the individual were jointly significant for all streams except rural migration, consistent with Davis and colleagues (2002) and Mora and Taylor (2005). As displayed in Figure 4.1, urban migration peaked at age 22, international migration at age 25 and local mobility at age 29, indicating that these forms of migration tend to occur at somewhat different points in the lifecycle. Individuals in a union were more likely to migrate internationally, in many cases probably in order to follow a previously-departed spouse. Individuals who were not children of the head were less likely to be urban migrants. These individuals likely have less access to household migration networks which, as described below, are particularly important for urban migration.

Among household-level demographic factors, the age of the household head was jointly marginally significant only for urban migration, on which it has negative but diminishing effects which likely reflect the decreased ability of the youngest heads to support the household. Household composition had complex effects: local mobility increased with minors in the household but decreased with the number of older adults, urban migration increased with the number of women, and international migration decreased with the number of minors and older women. These effects differed substantially between men and women, and are discussed in detail below in Section 4.5. Finally, local mobility also increased with the population of the community, likely reflecting increased opportunities for new household formation in larger communities.

Human capital

The effects of education were significant only for international migration, which increased with individual primary and secondary education and with the number of

household members with secondary education. International migration in this case thus positively selects for education, consistent with other studies of costly and distant international migrations (Adams, 2003). The non-significance of effects for internal migration contrasts with previous studies from Ecuador (Bilsborrow et al., 1987; Laurian and Bilsborrow, 2000; Barbieri, 2005), but the analysis of gender interactions below does reveal important effects that differ between men and women.

Social capital

The effects of migrant networks were jointly significant for all four streams, but household-level network effects were more important than community-level effects. At the household level, the number of current migrants to rural, urban and international destinations each increased migration to the respective destinations as expected. Rural migration also significantly decreased with current international migrants, suggesting competition between these streams. Competition was evident at the community level as well: urban migration significantly decreased with the number of international migrants from the community, local mobility marginally decreased with the number of rural migrants, and international migration marginally decreased with the number of urban migrants. These results suggest that household-level networks primarily promote migration to the target destination whereas community-level networks primarily suppress migration to alternative destinations. The non-importance of community-level effects may reflect the pervasiveness of out-migration in the study area (Chapter 2) which gives nearly all households access to contacts in various destination areas through their extended social networks.

Physical capital

Measures of accessibility and infrastructure were jointly significant for all streams except rural migration. Local mobility increased with household distance from local roads but decreased with community distance from paved highways, likely because individuals far from local roads tend to move to be near them and those near paved highways tend to move to the canton capital. In contrast, international migration increased with community distance to highways, highlighting the rural origins of this migration stream. In contrast to the findings of Beauchemin and Schoumaker (2005) for Burkina Faso, urban migration decreased with the number of services in the community, likely because these services reduce the incentive to migrate to an urban area where many services are available. More generally, accessibility and infrastructure variables are among the most easily collected of contextual characteristics, and these results suggest they should be included in future multilevel studies of migration.

Financial capital

Finally among control variables, the effects of cattle ownership were jointly significant only for rural migration, which peaked with ownership of nine animals, well above the mean value of four. Potential rural migrants likely compare opportunities for cattle ownership between the origin and rural destinations but are not sensitive to accessibility and community infrastructure (above). Cattle do not appear to serve as important form of wealth to finance other forms of migration.

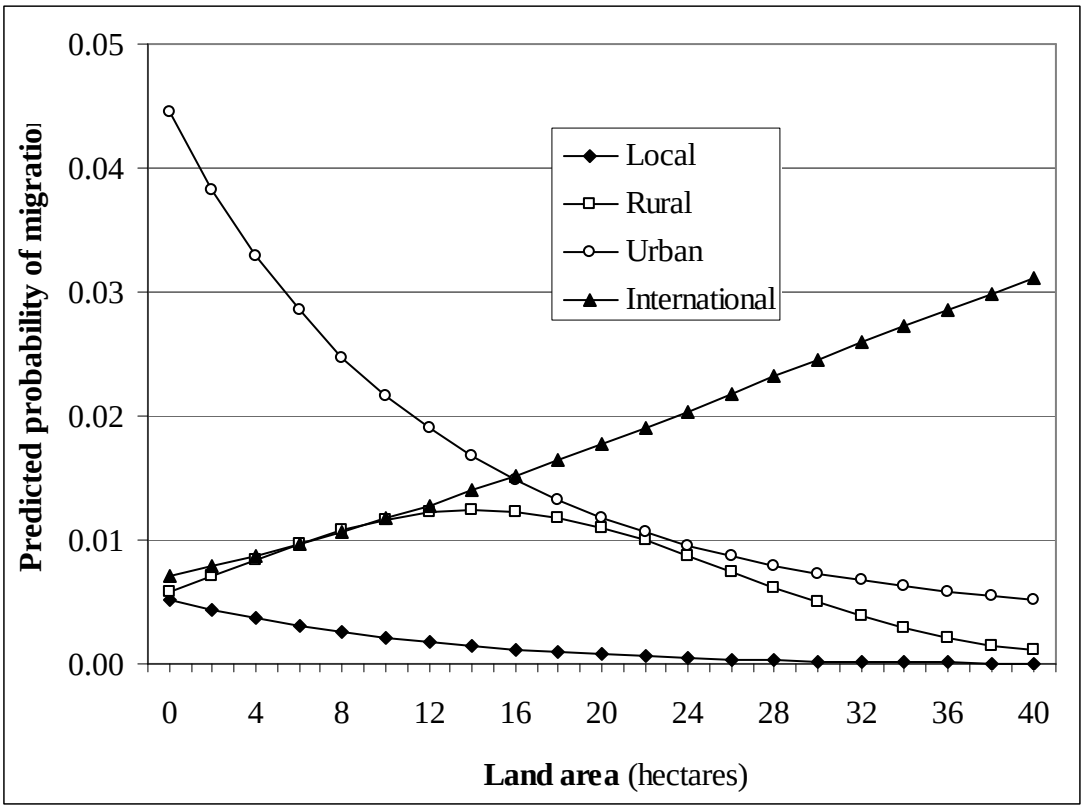
Land ownership

Of primary interest to this study, the nonlinear effects of land area on out-migration are displayed in Figure 4.2. These effects were jointly significant for all four

migration streams but differ substantially across them. Local mobility is highest for landless households and declines to near zero for land-rich households. Rural migration initially increases with land area but peaks at 14 hectares and declines with larger areas. Urban migration is highest from landless households and declines rapidly with land area but at a diminishing rate. Finally, international migration is lowest among landless households and increases nearly linearly with land area. A comparison of landless households to those owning 15 hectares (at the 90^{th} percentile of land ownership) is illustrative of the differences across streams. With other predictors held at their mean values, individuals in landless households had a 4.4% probability per year of departing to urban destinations, but only a 0.5-0.7% probability of departing to local, rural or international destinations. In contrast, individuals in households owning 15 hectares of land had an approximately 1.2-1.6% probability per year of departing to rural, urban and international destinations but only a 0.1% probability of local mobility.

Overall, these effects of land area are consistent with the prediction that land ownership would increase out-migration to costly international destinations relative to less costly internal destinations, and that land would act primarily as an amenity for short-distance migrations and more often as capital for long-distance ones. Urban migration and local mobility are most common from landless households, and these are also likely the least costly options for migration given the proximity of local destinations and the relatively low barriers to entry in the urban job market (Laurian et al., 1999). Rural migration, which peaked at relatively high levels of land ownership, may involve the purchase of land in the destination and is also likely more attractive to individuals

Figure 4.2 Predicted probabilities of migration by destination type and land area with mean values of the other predictors and the mean baseline hazard from 1996-2005.



with previous experience in farm management. Among the various functional forms found by previous studies for the effects of land on out-migration (Section 3.2), these results are most consistent with those of Mendola (2008) who found that land area had a negative effect on internal out-migration but a positive effect on international out-migration in Bangladesh.

In addition to land area the model also controlled for the number of agricultural parcels (Table 4.3), which had a positive effect on local mobility but did not significantly influence other forms of migration. Ownership of multiple spatially-distributed parcels

possibly encourages new household establishment near parcels far from the current residence.

Environmental conditions

Also of primary interest to this study, the effects of environmental conditions on out-migration were jointly significant for local, rural and urban migration, though the patterns of the direction and significance of effects differed strongly across streams (Table 4.3). Environmental conditions did not significantly influence international migration. At the household level, positive environmental characteristics such as black soil and flat topography did not consistently increase or decrease local and internal out-migration. Local mobility significantly increased with ownership of flat land but decreased with ownership of lands with fertile black soil. In contrast, urban migration significantly increased with black soil, and rural migration increased with past soil erosion or depletion. Migration also tended to increase with both good and bad harvests. Urban migration increased significantly with poor harvests and marginally with good harvests, and local mobility increased significantly with good harvests. Environmental conditions at the community level similarly had mixed effects. The mean slope of community lands had a significant positive effect on local mobility but a negative effect on rural migration. Total precipitation decreased urban migration, and the land area per person increased both local mobility and urban migration.

Overall, these results indicate that environmental conditions are important influences on local mobility and internal migration but not on international migration, supporting the hypothesis that environmental effects would be more important for shorter-distance migrations. Potential local and internal migrants, who tend to be land-

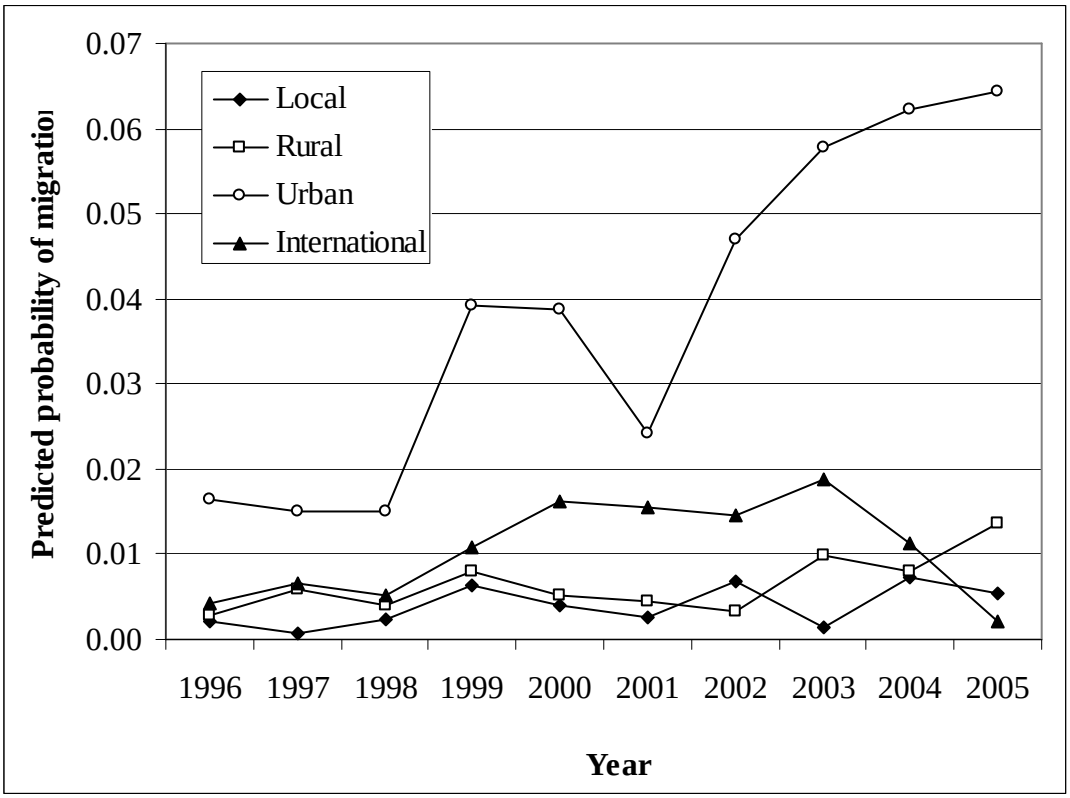
poor, are more likely to carefully consider environmental conditions given their immediate importance to the subsistence of these households. The directions of environmental effects do not consistently support any of the three hypotheses (amenity, capital or risk), but consideration of the temporal scale of each of the environmental characteristics does reveal a pattern. Relatively stable characteristics of the environment such as topography, soil type and land per person tended to conform to the environmental-capital hypothesis: migration mostly increased with high environmental quality and decreased with low environmental quality. These stable characteristics are perhaps more easily drawn upon as capital to facilitate migration. In contrast, characteristics of the environment indicating environmental variation such as erosion/depletion, fluctuations in harvests and precipitation tended to conform to the environmental-risk hypothesis: migration increased with soil problems and harvest fluctuations (both up and down) and decreased with total precipitation, which is likely negatively correlated with the risk of drought. Households likely respond to uncertainty in environmental conditions and agricultural production by sending local and internal migrants.

Overall the environmental effects are consistent with the two most relevant previous studies. Massey and colleagues (2007) also found that environmental factors were more important for shorter-distance migrations, and Henry and colleagues (2004) similarly showed that out-migration could increase or decrease with favorable environmental conditions depending on the destination type.

Change over time

Finally, Figure 4.3 shows the change of migration probabilities over time (1996-2005)[28] with the predictors held at their mean values. These patterns were captured by including dummy variables for each year as described in Section 3.3 and displayed in Table 4.3. Figure 4.3 and Table 4.3 show that, controlling for other time-varying factors, the probability of urban migration increased over time (though with a sharp dip in 2001) and the probability of international migration increased beginning in 1999 and peaked in 2003. Local mobility showed little trend over time but rural migration increased towards

Figure 4.3 Predicted probabilities of migration by destination type and year (1996-2005) with mean values of the other predictors.



[28] Migration probabilities were much lower for 2006 due to the short interval of data collection (see Footnote 2) and thus are not displayed in Figure 4.3.

the end of the study period. These results suggest that the national economic and political crises beginning in 1999 increased both urban and international migration, but that international migration has declined recently with the strengthening of immigration controls in Spain and in the corridor to the United States. The recent rise of rural migration is likely connected to the decline in international migration given the negative effects of international migration networks on rural migration described above and the similar land-ownership profiles of households sending rural and international migrants.

4.5 Results for Migration and Gender

Table 4.4 displays effects for women and men separately as well as significance tests for the interaction of each predictor with gender. These results were produced by first estimating a model with interactions between *male* (a dummy variable for male gender) and all other predictors, and then a corresponding model with interactions between *female* (a dummy variable for female gender) and all other predictors. The main effects of these two corresponding models are displayed in Table 4.4, along with significance tests for the interaction terms (which are identical across the two models). The significance of each interaction term can be interpreted as a comparison of the effect for women and men, with a significant test indicating that the effect of the predictor differs between men and women. Year dummies were included in the model but were not interacted with gender due to a small number of migrants for some gender-year-destination combinations. The discussion below focuses on effects which significantly differed between men and women, as the other effects are consistent with the model without interactions described above.

Table 4.4 Odds ratios by gender and tests for the significance of interactions of the predictors with gender from the event history analysis of local, rural, urban and international migration.

		Women				Men				Gender Comparison			
Variable	**Level**	**Local**	**Rural**	**Urban**	**International**	**Local**	**Rural**	**Urban**	**International**	**Local**	**Rural**	**Urban**	**International**
Demographic Characteristics													
Age	Indiv	0.953	8.788*	1.792**	2.133*	6.236*	0.941	1.706**	4.048***	*	**		
$(Age)^2$	Indiv	1.004*	0.952*	0.988*	0.985*	0.964*	1.002	0.989*	0.972**	*	*		
Union	Indiv	1.126	0.417	1.074	3.252+	0.360	2.057+	1.596	2.374*				
Other relation to head	Indiv	0.350	0.081	0.232**	0.659	0.148	0.771	0.800	0.840			*	
Age of head	HH	1.081	0.628+	1.002	1.075	1.289	1.073	0.909	1.187		+		
$(Age\ of\ head)^2$	HH	1.000	1.004	1.000	1.000	0.998	0.999	1.001	0.998+				
Minors	HH	1.365***	1.150	1.065	0.677***	0.988	1.145+	1.070	0.877	+			*
Young women	HH	1.288	1.613	1.712***	1.510	1.362	1.042	1.203	0.606**				**
Young men	HH	0.949	1.149	0.817	0.989	1.527	1.103	1.126	0.592+				*
Adult women	HH	0.084***	2.551+	1.418	0.398	1.619	0.574+	1.474	0.524	**	*		
Adult men	HH	0.343+	0.907	0.854	0.604	0.308+	0.655	0.961	0.712				
Community population	Com	1.110**	0.965+	1.005	1.027	1.101*	1.011	0.977	1.057+		+		
Human Capital													
Primary education	Indiv	2.023	5.422*	1.400	2.295+	4.753	2.149	3.952	2.542*				
Secondary education	Indiv	2.648	4.060**	0.932	1.932	2.696	2.503	6.019*	1.496			***	
HH secondary education	HH	1.120	0.981	1.054	1.122	0.763	1.132	0.711	1.535*			+	
Social Capital													
HH rural migrants	HH	1.557**	1.683*	0.928	0.902	0.984	1.208	0.775	0.785	+			
HH urban migrants	HH	0.916	0.966	1.326**	0.820	0.483	1.187	1.452***	0.789				
HH international migrants	HH	1.082	0.968	1.185	1.177	0.951	0.320*	0.729*	1.456*			***	
Com rural migrants	Com	0.966	1.052	1.009	0.945*	0.997	1.015	0.994	1.006				*
Com urban migrants	Com	0.984	1.020	0.998	1.002	0.995	0.993	1.002	0.978*		+		***
Com international migrants	Com	0.979	0.976	0.967*	0.990	0.990	0.989	0.999	0.994			*	

(continued below)

		Women				Men				Gender Comparison			
Variable	**Level**	**Local**	**Rural**	**Urban**	**International**	**Local**	**Rural**	**Urban**	**International**	**Local**	**Rural**	**Urban**	**International**
(continued from above)													
Physical Capital													
Distance to road	HH	1.239	1.643*	0.970	0.878	1.534+	1.402	1.227	0.990				
Distance to highway	Com	0.990	1.026	0.991	1.069***	0.856+	0.986	1.023*	1.055***	+		*	
Services	Com	0.851	0.705	0.824+	0.937	1.035	1.317	0.992	1.329				*
Financial Capital													
Cattle	HH	0.891	1.359***	1.068	0.957	1.200	1.103+	1.070	0.938*		**		
$(\text{Cattle})^2$	HH	1.000	0.990***	0.999	1.001	0.994	0.994+	0.997+	1.002+				
Land Ownership													
Land area	HH	0.896+	1.085	0.921+	0.993	1.311	1.101	0.924*	1.111***				*
$(\text{Land area})^2$	HH	1.001	0.996*	1.000	1.000	0.987	0.996	1.001*	0.999**				+
Parcels	HH	0.918	1.263	1.188	1.356	2.180**	0.855	0.797	0.709	*			
Environmental Conditions													
Flat land	HH	4.237**	0.783	0.847	0.523	0.349	0.851	2.074*	1.732	+		+	
Black soil	HH	0.423	0.630	1.172	0.763	0.566	1.032	1.949*	1.073				
Soil problems	HH	1.071	2.092+	1.386	0.438+	2.119	2.103*	1.180	0.955				+
Bad harvest	HH	1.367	0.825	2.172*	0.548	0.930	1.986*	1.539	0.740				
Good harvest	HH	1.569	1.297*	1.573	0.553	3.821+	0.654	1.700	1.717		+		
Slope	Com	1.088	0.948	1.007	0.938*	1.042	0.938*	0.992	1.069**				***
Precipitation	Com	0.994	1.078	0.983	1.022	1.042	0.996	0.977*	0.939*				*
Land per person	Com	3.605***	1.062	1.451*	1.303	0.679	0.949	1.657***	1.051				

Gender Comparison reports the significance of the interaction between gender and the predictor for that migration stream.

Indiv: Individual, HH: Household, Com: Community

$(\text{Variable})^2$ represents the squared term from a quadratic fit for a continuous predictor

*** p<0.001; ** p<0.01; *p<0.05; + p<0.10

Year dummies are included in the model but not shown.

Demographic characteristics

Among control variables, notable gender differences include the effects of age, household composition, education, migrant networks, accessibility, and cattle ownership (Table 4.4). The effects of age differed between men and women for local mobility and rural migration. For women, local mobility increased with age, and rural migration peaked[29] at age 22. For men, local mobility peaked at age 25, and age did not significantly affect rural migration. These patterns likely result from marriages in which women move to a new household in their husband's community, and from older women forming new households in the same community. Descriptive analysis of the life history data confirms that women's rural migrations often correspond with the timing of marriage, but rarely for men (Chapter 3).

Household composition had stronger effects on the migration of women than that of men (Table 4.4). For women, local mobility increased with the number of minors and decreased with the number of adult women and men, likely because women with children are more likely to move locally but are less likely to move if they are supported by or helping to care for older relatives. Men's local mobility was only affected by the number of adult men, which marginally increased it. Rural migration of women increased marginally with the number of adult women, but rural migration of men decreased marginally, perhaps because the domestic labor and consumption demands of adult women encourage other women to migrate but discourage men. Women's urban migration increased with the number of fellow young women but this predictor had no effect on men's urban migration, likely an effect of excess availability of women's

[29] These values were dervied through the calculation of predicted probabilities of migration with age, equivalent to the results presented in Figure 4.1.

domestic labor relative to household demands. Women's international migration decreased with the number of minors, likely due to increased demands for domestic labor, while men's international migration decreased with the number of young men and women, perhaps due to increased competition for household resources that could facilitate costly migrations.

Human capital

Gender differences were also evident in the effects of education (Table 4.4). Primary and secondary education strongly increased rural migration of women, while secondary migration increased urban migration of men. The effect of men's education likely reflects greater availability of skilled employment for men in urban areas, necessitating more education. The effects of women's education suggest that status and/or social networks gained from additional education facilitate rural migration, which for women commonly coincides with marriage (Chapter 3).

Social capital

Migrant networks also affected men and women differently (Table 4.4). Previous rural migration from the household was most important for women, increasing local and rural migration, whereas previous international migration was most important for men, decreasing rural and urban migration and increasing international migration. Community-level networks also had distinct effects for men and women. For women, community-level rural networks reduce international migration and international networks reduce urban migration, whereas for men urban migration networks reduce international migration. These results indicate that migrant networks operate differently for men and women, especially for urban and international destinations and for networks at the

community level. These differences potentially reflect the gender composition of networks (Davis et al., 2002; Curran and Rivero-Fuentes, 2003) as well as the relative importance of networks for access to gendered employment opportunities in different destination areas.

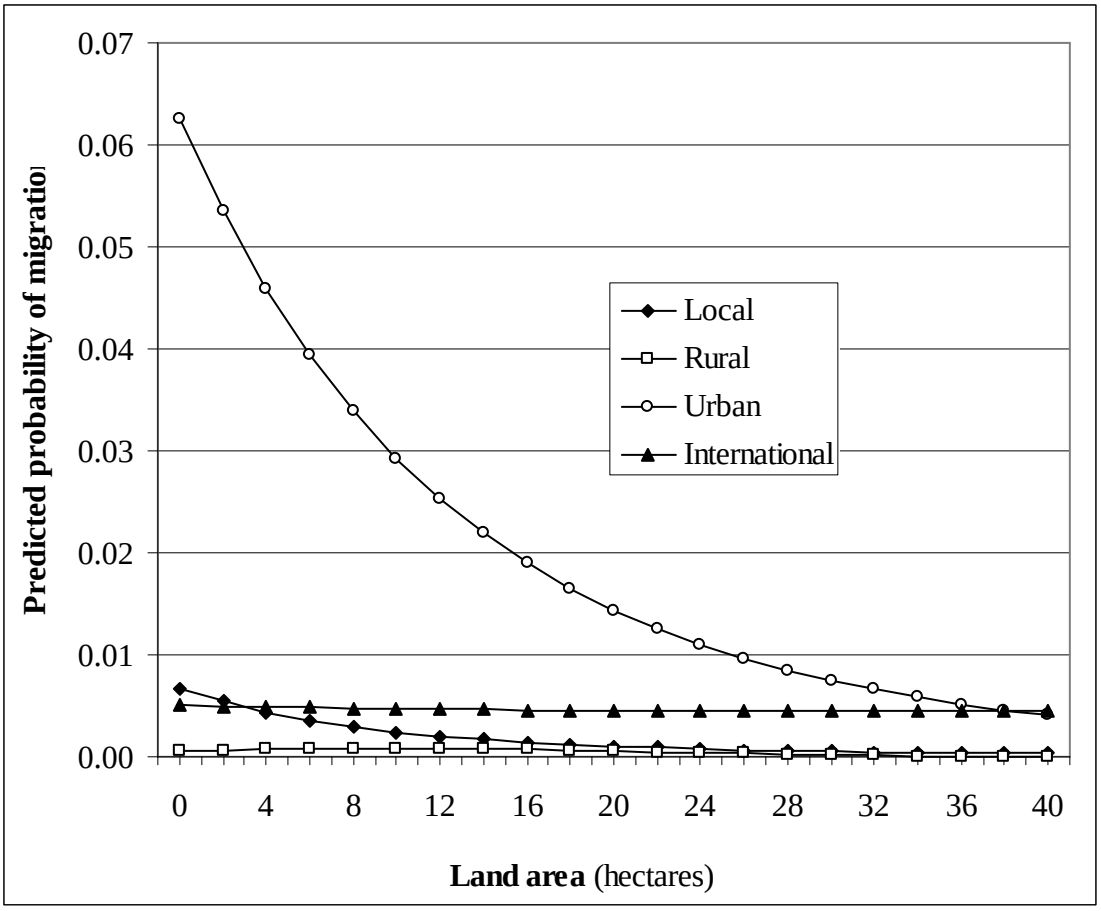
Physical capital

Among measures of accessibility and infrastructure, distance to a paved highway marginally decreased men's local mobility but not women's, increased men's urban migration but not women's, and increased both men's and women's international migration (Table 4.4). Men thus appear to be more sensitive to community accessibility, and accessibility encourages them to move locally rather than migrating to urban destinations (as well as international ones), likely because accessibility serves as an amenity that discourages migration.

Financial capital

Finally, the effects of cattle ownership were jointly highly significant for local and rural migration of women but only marginally significant for rural migration of men (Table 4.4). Women's local mobility decreased with cattle ownership but rural migration peaked at nine cattle (well above the mean of four), suggesting that cattle enable rural migration in place of local mobility by women. Given that women's rural migrations are commonly linked to marriage (Chapter 3), the results suggest that women from wealthier households are more likely to move to another rural canton with marriage, consistent with the results for education presented above.

Figure 4.4 Predicted probabilities for the migration of women by destination type and land area with mean values of the other predictors for women and the mean baseline hazard from 1996-2005.



Land ownership

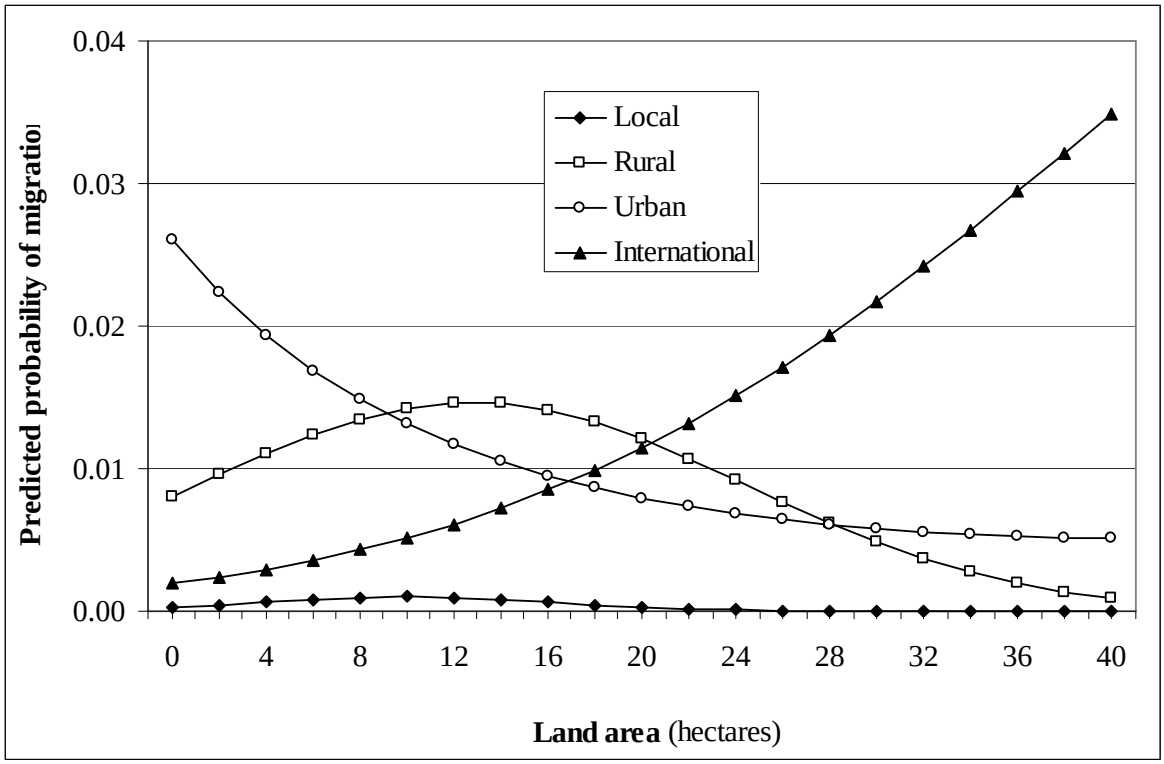
The effects of land ownership were also distinct between women and men, as displayed in Figures 3.4 and 3.5. The joint effects of agricultural land area were significant for local mobility of women, international migration of men, and rural and urban migration of both men and women. Among women, urban migration is by far the most common but rapidly declines with land ownership (Figure 4.4). Among men, urban migration is most common for the land-poor, rural migration is most common for the

land-rich with 10-20 hectares, and international migration is most common for the wealthiest (Figure 4.5). These findings suggest that, for women, land serves primarily as an amenity that discourages migration, whereas for men land also serves as capital that enables rural and international migration. Wealthy households thus facilitate the migration of young men but not of young women, likely because wealthy households are better able to enforce gender norms regarding work and migration (see Deere, 2005). These results are consistent the findings of Massey and colleagues (2006) for international migration in Mexico, and partially consistent with the prediction that land ownership would be more important for men than women. Additionally, the number of agricultural parcels increased men's local mobility but had no effects on women's migration (Table 4.4), likely because men are more likely to have access to one of the household's parcels after a local move.

Environmental conditions

Men and women also responded differently to environmental conditions, though not as distinctly as for household composition and migrant networks (Table 4.4). Consistent with my prediction, environmental conditions were somewhat more important for men, with jointly significant effects on all four streams, than for women, with jointly significant effects on local mobility, urban migration and international migration. Notably, when gender interactions are included environmental effects on international migration become jointly significant for both women and men, in contrast to the non-significant pooled effects described above. This result is due to countervailing effects on women and men of slope and precipitation, as described below. Among the four streams, local mobility of women increased with access to flat land and was unaffected by access

Figure 4.5 Predicted probabilities for the migration of men by destination type and land area with mean values of the other predictors for men and the mean baseline hazard from 1996-2005.



to black soil, whereas urban migration of men increased with flat land and black soil. These findings reinforce that land acts primarily as an amenity for women but as a form of capital for men. Soil problems affected both groups similarly, but good and bad harvests did not. Rural migration of men increased with bad harvests, whereas rural migration of women increased with good harvests, suggesting that rural migration is a less-favored option for men but that rural migration of women may be financed by good harvests. Contextual characteristics of the environment also affected men and women differently. In dry, steeply sloped communities women were less likely to be international migrants but men were more likely, perhaps reflecting lesser opportunities for cropping

relative to cattle raising in these communities (see Chapter 4). Land area per person had a strong positive effect on local mobility of women but no effect on local mobility of men, suggesting that women are more likely to move locally where land is more available.

Summary

Overall the results of the interaction models highlight the importance of gender roles in structuring the life experiences and migration decisions of women and men in the study area. For women, household composition has a particularly important role that is likely connected to a preference for women to work in home-based production. Among other variables, contrasts are particularly evident for rural and international migration. Relative to men, rural migration by women is more dependent on education, migrant networks, cattle ownership and good harvests. Relative to women, international migration by men is more influenced by migrant networks, land ownership and contextual environmental characteristics.

4.6 Discussion

These results have important implications for future studies of migration streams and of the relationships between migration, land ownership and the environment. This analysis of men and women's participation in four migration streams reveals that the drivers of out-migration from the study area differ strongly by destination type and gender, a result consistent with other studies. Local mobility was particularly responsive to household composition, accessibility and environmental factors, and rural migration was especially influenced by cattle ownership and unresponsive to age. Urban migration in turn was particularly responsive to relation to the head of household, migrant

networks, community services and environmental factors. Finally, international migration was especially influenced by demographic factors, human capital, and community accessibility. Overall, household composition was particularly important for women, land ownership was particularly important for men, and environmental characteristics were somewhat more important for men. The implication of these findings for future empirical studies of origin areas with diverse migrant destinations is that the traditional single-equation dichotomous approach to modeling migration is likely to conceal considerable heterogeneity, and a multinomial and gender-separated approach is more appropriate. The implication of these findings for policy is that development and environmental policies are likely to affect migration streams and men and women's migrations differently given the considerable differences in their underlying drivers. For example, extension of the network of paved roads in the study area would be most likely to increase men's local mobility, decrease men's urban migration, and decrease international migration by both men and women.

This analysis of the effects of land ownership supports the importance of land in determining the overall probability of migration as well as selection into particular migration streams. Consistent with the role of land as a key form of household wealth, urban migrants and local movers were negatively selected on land ownership, international migrants were positively selected, and rural migrants had a complex non-linear response, results which were particularly evident for men. These results do not support the commonly-held view that migration will always be most frequent among the land-poor (e.g., Shaw, 1974; Potts, 2006), and they suggest that land redistribution policies in the study area could potentially increase migration to rural and international

destinations. Given the wide variation in the direction and functional form of land effects across studies, even from within Ecuador, these effects are likely to be specific to the southern Ecuadorian Andes. Across the developing world, land management and tenure systems vary substantially within and across countries, and one challenge for future larger-scale studies will be to identify the contextual characteristics that influence the nature of the migration-land relationship.

This analysis of environmental effects on out-migration supports the overall importance of environmental factors for internal migration but does not consistently support the environmental-amenity, environmental-capital or environmental-risk hypotheses. Static environmental factors tend to act as capital, particularly for men, in that positive environmental characteristics increase out-migration, but measures that indicate environmental risk such as soil erosion and low rainfall also increase out-migration. These results and those of other studies suggest that the assumptions of the literature on environmental refugees should not be accepted uncritically: negative environmental conditions may decrease instead of increasing out-migration, and international migrants are less likely to be affected. Future studies of migration and the environment should examine additional measures of environmental conditions such as land cover, and should investigate the roles of agricultural productivity and access to credit in mediating environmental effects on migration. Among the demonstrated environmental effects, those indicating environmental risk are most amenable to policy intervention. The results suggest that policies designed to mitigate agricultural and environmental risks such as disaster relief and subsidized crop insurance are likely to reduce internal migration but might have no overall effect on international migration.

Conversely, future climate changes that decrease the predictability of agricultural production are likely to increase internal migration.

Thus land ownership and environmental conditions have important effects on out-migration in the study area. But how does out-migration subsequently affect household land use? Chapter 5 addresses this follow-up question.

CHAPTER 5

OUT-MIGRATION AND SMALLHOLDER AGRICULTURE

5.1 Significance

A long-running debate has weighed the implications of rural out-migration for social, economic, and ecological change in origin areas. Migration pessimists argue that out-migration undermines traditional rural livelihoods and social institutions by removing the young, healthy and educated, and that migrant remittances are spent largely on conspicuous consumption (Reichert, 1981; Binford, 2003). Migration optimists respond that remittances can make important poverty-reducing contributions to household incomes, with multiplier effects that benefit households not receiving remittances (Taylor et al., 1996; Durand et al., 1996). Ecologists wonder if out-migration will lead to land abandonment and reforestation as part of a "forest transition" (Rudel et al., 2005), but large-scale examples of this process from the developing world are few (Perz, 2007).

Amidst this uncertainty, a growing number of studies have drawn on household survey data and multivariate methods to examine the consequences of out-migration and remittances for origin-area households, including on their incomes, assets, and livelihood activities. Overall these studies reveal net positive effects on household income and consumption and weak positive effects on asset accumulation (e.g., Taylor et al., 2003; Adams and Page, 2005). The impacts of out-migration on agricultural assets and activities are of particular interest given the enduring importance of agriculture to rural

incomes (Reardon et al., 2001) and the environmental consequences of agricultural land use, but few quantitative studies have investigated these effects. Qualitative studies indicate a large range of potential impacts of out-migration and remittances on agriculture, including abandonment of labor-intensive practices (e.g., Zimmerer, 1993), intensification of commercial agriculture (e.g., De Haas, 2006), and the absence of any clear effects (e.g., Jokisch, 2002).

This chapter draws on the survey dataset (Chapter 2) and multivariate analyses to investigate the consequences of internal and international out-migration for agricultural assets and activities in the study area. This study advances previous quantitative studies by separately testing for the effects of male and female out-migration as well as the effects of internal and international remittances on multiple components of the smallholder agricultural system. The first set of analyses exploits the longitudinal aspect of the household survey data to examine the effects of out-migration and remittances over an eleven-year period on household assets, including cattle, access to rented land, and consumer goods. The second set of analyses exploits detailed cross-sectional data from the household survey to examine the effects of out-migration and recent remittances on agricultural activities and outcomes in the past year, including harvests, agrodiversity, and the use of land, labor and chemical inputs. Analyses are conducted using tobit and Poisson models which control for other household characteristics and for contextual fixed effects. The results reveal that out-migration and remittances do not lead to a dramatic transformation of rural livelihoods, but rather a series of shifts in assets and strategies that reflect the costs of migration and the benefits of remittances.

5.2 Impacts of Out-Migration on Rural Livelihoods

Potential impacts

Drawing on a variety of theoretical frameworks, previous authors have suggested a number of pathways by which out-migration might influence rural livelihoods including smallholder agriculture (Skeldon, 1990; Black, 1993; Taylor et al., 1996; Jokisch, 2002). The immediate consequences of the departure of a migrant for household livelihoods are likely to be largely negative. Departure leads to an immediate decline in the amount of labor available to the household. When the decline in labor availability is greater than the migrant's previous consumption demands, out-migration may lead to adoption of labor-saving strategies, the abandonment of labor-intensive strategies, or an overall decrease in agricultural activities. Departure also removes access to the skills, knowledge, and social contacts of the migrant and may entail significant expenses, thus potentially reducing the household's human, social and financial capital. Departure of either a male or female migrant also alters the sex ratio of adults in the households, potentially altering livelihood strategies given the strong gender norms which influence participation in agriculture and other activities in Ecuador and much of the developing world (Katz, 2003; Deere, 2005).

Longer-term implications of out-migration are more likely to be positive for the sending household, particularly in the case of international migration. The receipt of migrant remittances, both monetary and in-kind, contributes to household income and may improve living standards and increase assets, though cancellation of migration-related debts might also be a significant initial expense. Particularly in favored areas, remittances can encourage new investments and the expansion of economic activities (De Haas, 2006), but remittances might also act as a substitute for household production and

lead to a decline in productive activities (Reichert, 1981). As a source of cash income, remittances can also encourage participation in markets and the monetization of previously subsistence-focused rural economies (Hull, 2008). Migration also creates destination-area social capital which may facilitate further out-migration from the household (Massey, 1990). Finally, migrants who return bring new human capital and different consumption preferences and can potentially act as key agents of social and economic change.

Beyond the migrant-sending household itself, out-migration can also alter the community context more broadly. The departure of migrants from the community and the receipt of remittances may lead to a reduction in the number of hired or reciprocal laborers available for agricultural activities and an increase in the wage rate (Taylor and Dyer, 2006), though opportunities for wage labor will likely decline if agricultural disintensification occurs. Where agricultural activities decline with out-migration, land is likely to become more available for rent, loan or purchase, but where remittances are invested in land or agricultural production land may become less available (Preston and Taveras, 1980). Increasing cash incomes, wage rates and emphasis on market participation might also lead to a decline in traditional social institutions such as reciprocal labor practices and common property management (Reichert, 1981).

Previous studies

This multitude of potential migration-livelihood connections calls for a multivariate approach that can test for countervailing effects of out-migration and remittances and compare the consequences of internal and international out-migration. Toward this end, a growing number of studies have used survey and statistical methods to

investigate the effects of out-migration and remittances on rural livelihoods, though studies to date have primarily focused on the effects of remittances on economic outcomes such as household consumption and income. Descriptive analyses of survey data on household consumption have consistently shown that a large proportion of remittances are spent on housing and consumer goods, contributing to concerns that that the potential of remittances to promote development has not been fully harnessed (Taylor et al., 1996; De Haas, 2005). Consistent with these descriptive findings, multivariate studies have found positive impacts of remittances on the share of spending in these categories (Adams, 2006; Taylor and Mora, 2006; Airola, 2007, Quisumbing and McNiven, 2007).

Studies of household income and poverty have shown that remittances decrease poverty in a number of countries, though effects on income inequality appear to be contextually dependent (Adams and Page, 2005; Taylor et al., 2005; Acosta et al., 2006; McKenzie and Rapaport, 2007). Studies of income-generating activities have found predominantly positive effects of out-migration and remittances on income from livestock, predominantly negative effects on wage labor, and mixed effects on cropping income and self-employment (Funkhouser, 1992; Massey and Parrado, 1998; De Janvry and Sadoulet, 2001; Rodriguez and Tiongson, 2001; Yang, 2004; Mora, 2005; Acosta, 2006; Amuedo-Dorantes and Pozo, 2006a and 2006b; Wouterse and Taylor, 2008). Overall, studies of income and consumption indicate that remittances in many cases do improve standards of living for recipient households, but the potential of out-migration and remittances to promote sustainable local development more broadly are still unclear. Additionally, few studies have accounted for the effects of both internal and international

migration and potential countervailing effects between out-migration and remittances (for exceptions see Adams, 2006; Mora, 2005; Wouterse and Taylor, 2008).

Beyond studies of income and consumption, a small number of studies have used longitudinal data to examine the effects of out-migration and remittances on asset accumulation, which has been proposed as an alternative measure of development and well-being (Moser, 1998; Filmer and Pritchett, 2001). Among these, three studies have investigated the effects of internal migration and remittances on assets in Thailand. Entwisle and Tong (2005) found that productive assets declined with the number of out-migrants and were unaffected by remittances, whereas consumer assets were unaffected by the number of out-migrants and increased with remittances. Using data from the same study area and a different methodology, Garip (2007) found that out-migration without remittances had no effect, but that out-migration with remittances led to a decline in productive assets. Using data from a different region of Thailand, Ford and colleagues (2007) showed that assets declined with the number of out-migrants in rice-growing and cash-cropping areas but not elsewhere, and that remittances in these areas had no effects.

Two other studies, from Pakistan and the Phillipines respectively, specifically examined agricultural assets including land and cattle. Adams (1998) found that international remittances had positive effects on land ownership but no effect on cattle, and that internal remittances had no effects on either. Finally, Quisumbing and McNiven (2007) showed that housing and consumer assets declined with out-migration and increased with remittances received but that land and cattle were unaffected. Together, these studies indicate that effects of out-migration on assets are complex and contextually specific, revealing a need for additional case studies that distinguish the effects of out-

migration from those of remittances. The first set of analyses described below extends these studies by comparing the effects of internal and international out-migration and male and female out-migrants and three types of assets.

Beyond aggregate measures of household welfare, a smaller set of studies, employing ethnographic, ecological and survey methods, have investigated the impacts of out-migration on agricultural activities specifically. Among these, a majority of studies have employed ethnographic methods, revealing a range of potential impacts on agriculture (reviewed by Jokisch, 2002). Among studies from the Andes, Zimmerer (1993) found that out-migration in the Peruvian highlands led to labor shortages, disintensification of agriculture, and increased erosion. Preston and colleagues (1997) showed that out-migration in the Bolivian highlands led to decreases in the number of cattle, increases in shrublands, and decreases in erosion. Brown (1987) found that temporary labor migration lead to the decline of traditional reciprocal labor exchanges in the Peruvian altiplano. In the Ecuadorian highlands, both Preston and Taveras (1980) and Jokisch (2002) found few effects of out-migration on smallholder agriculture despite large out-flows of migrants, though Jokisch witnessed substantial construction of improved housing financed by international remittances.

Several ecological studies have examined the effects of aggregate measures of out-migration on agricultural abandonment and the subsequent growth of shrubs and secondary forest. Consistent with forest transition theory (Rudel et al., 2005), these studies have found positive effects of out-migration on the growth of secondary vegetation in Puerto Rico (Rudel et al., 2000), Mexico (López et al., 2006), Switzerland (Gellrich et al., 2007) and Albania (Muller and Sikor, 2006).

Survey-based studies have examined the effects of out-migration on both total agricultural production and on specific agricultural practices such as the use of land, labor and modern inputs. Among studies examining total production, Lucas (1987) used aggregate data to show that crop production in four southern African countries decreased in the short-term with temporary labor migration but increased in the long-term with cumulative wages from labor migration, suggesting a short-term negative effect from lost labor but a long-term positive effect from investment of remittances. For rural China, Taylor and colleagues (2003) found that farm income and yields declined with the number of out-migrants but increased with remittances, and thus that out-migration and remittances had countervailing effects. Among studies examining specific agricultural activities, McCarthy and colleagues (2006) showed that in rural Albania international out-migration led to declines in the household land area planted in staples, land use diversity and hours worked in agriculture, but to increases in the number of livestock and agricultural income. Gray and colleagues (2008) found that cultivated area decreased with remittances for indigenous households in the Ecuadorian Amazon but that the number of out-migrants had no effect. Hull (2008) showed that households in rural Thailand with out-migrants but no remittances were less likely to plant rice, whereas households with both out-migrants and remittances were more likely to hire agricultural labor. Finally, Mendola (2008) found that international out-migration led to increased adoption of high-yielding crop varieties but that internal and temporary out-migration led to decreased adoption. Together, these findings suggest that migrant departure and remittances can have opposing effects on agricultural activities, potentially explaining the mixed effects found by qualitative studies. The second set of analyses described below

advances these studies by considering the gender of out-migrants, both internal and international remittances, and seven agricultural outcomes.

5.3 Analysis of Assets

Dataset

The first set of analyses exploits the longitudinal aspect of the household survey data (Chapter 2) to examine the effects of out-migration and remittances over an eleven-year period on household assets, including cattle, access to rented land, and consumer goods. The household was selected as the unit of analysis for both sets of analyses because it is the primary locus of agricultural decision-making and control of assets, and because direct effects of out-migration and remittances on migrant-sending households are likely to be stronger than community-level contextual effects. From the 397 completed household interviews, the dataset for the first set of analyses includes 341 households resident in the communities from 1995 to 2006 and excludes households which departed or were created in their entirety after 1995.

Outcomes

The three outcomes (i.e., dependent variables), measured in 2006, are the area of land rented by the household, number of cattle owned, and number of consumer goods owned from a list of fifteen items[30] (Table 5.1). These outcomes were selected because they are important assets to rural households, could reasonably be measured retrospectively, and exhibited significant change over the eleven-year period as measured by the household survey. Household land ownership, for example, changed little over the

[30] These outcomes were extracted from Sections F, G24, and G25 respectively of the household questionnaire (Appendix 1).

Table 5.1 Definitions, sample sizes and weighted descriptive statistics for the outcomes from the analysis of assets.

Outcome	Unit	Overall		Positive values[1]		Definition
		N	Mean	N	Mean	
Rented land	tareas[2]	341	3.53	70	16.4	Area of rented land, 2006[3]
Cattle	#	341	2.21	129	5.92	Number of cattle owned, 2006[3]
Goods	#	341	3.46		-	Number of goods owned from a list, 2006[4]

[1] Includes only households with values greater than zero for the outcome.

[2] One *tarea* , a local unit of area, is equal to 1/20 of a hectare.

[3] Transformed by $ln\,(y + 1)$ for the regression analysis.

[4] Number owned from a list of common household goods, including a stereo, radio, television, DVD/VHS player, stovetop, oven, blender, refrigerator, shower, telephone, cell phone, sewing machine, chainsaw, motorbike and automobile.

period, but the area of rented land did vary. I consider rented land in this analysis along with two more traditional forms of assets (cattle and consumer goods) because descriptive analyses indicate that land rental in the study-area is often a long-term arrangement that is an important form of access to land for land-poor households (Chapter 3). Descriptive analyses also reveal that rental plots are primarily used to cultivate maize and beans, the predominant subsistence crops (Chapter 3).

Definitions and descriptive statistics for the three outcomes are displayed in Table 5.1. In 2006, 21% of households rented land with a mean area of 16.4 *tareas*[31] (0.82 hectares), representing 40% of agricultural land area for these households. This represented a slight increase from 1995 when 18% of households rented land with a mean area of 16.0 tareas (0.80 hectares). Cattle, which are a key form of wealth for rural households throughout the Andes (Kristjanson et al., 2007), were owned by 38% of households in 2006 with a mean herd size of six head. This represented a slight decrease from 1995 when 40% of households owned cattle with a mean herd size of eight head. Over the eleven-year period cattle ownership decreased for 27% of households, increased for 19%, and stayed the same for the remaining 55%, many of whom did not own cattle in either year. (See Chapter 3 for a more detailed description of land tenancy and use in the study area.) Households in 2006 also owned on average 3.5 types of consumer goods from a list of fifteen such goods[32], an increase from 1.3 types of goods in 1995. The most commonly owned goods in 2006 were a radio, a stovetop/*cocineta*, a television, a blender and a sewing machine.

[31] Area is measured in *tareas*, a local unit equaling one twentieth of a hectare.

[32] Goods on the list included a stereo, radio, television, DVD/VHS player, stovetop, oven, blender, refrigerator, shower, telephone, cell phone, sewing machine, chainsaw, motorbike and automobile.

Models

Any model of these assets must account for the fact that some households have zero cattle, rented land or consumer goods and that positive values cluster around small numbers, i.e. the outcomes are left-censored and right-skewed. Among the three outcomes, the area of rented land and the number of cattle both have a large proportion of zero values (Table 5.1) and a distribution that is nearly continuous (i.e., a large number of potential values). The tobit model is designed for censored outcome such as these[33] and models the dichotomous decision to participate and the continuous level of participation with a single set of coefficients. This model has the following form:

$$y_i = \begin{cases} y_i^* = \mathbf{x}_i\beta + \varepsilon_i & if\ \ y_i^* > 0 \\ 0 & if\ \ y_i^* \le 0 \end{cases}$$

where y_i is the censored outcome for individual i, y_i^* is a continuous latent variable representing the propensity to own/rent the asset, $\mathbf{x}_i$ is a vector of predictors for individual i, $\boldsymbol{\beta}$ is a vector of coefficients for the effects of the predictors on the outcome, and ε_i is an error term for individual i (Long, 1997). The coefficients of this model can be interpreted as effects on the continuous latent variable representing the propensity to own/rent the asset, which is observed only after passing a certain threshold. I focus my interpretation on the significance and direction of the effects but also derive and report marginal effects

[33] Alternative models for censored outcomes include two-part models in which the dichotomous decision to participate and the continuous level of participation are modeled separately (Smith and Brame, 2003), e.g., a logit model of participation followed by linear regression on the positive values. I instead elected to use the tobit model for the following reasons: (1) the small number of censored or positive values for some outcomes, (2) an interest in overall effects on participation and the extent of participation, and (3) parsimony, given the large number of models. A comparison of the results reveals that the direction and significance of effects are largely consistent across the two approaches.

for coefficients of particular interest[34]. Prior to estimating the models I transformed the positive values by *ln* (y + 1) to reduce skewness and heteroscedasticity. Thus the marginal effects can be interpreted as the percentage change in the outcome due to a one unit change in the predictor among households with outcomes greater than zero. In cases where the predictor is also log-transformed (e.g., own land; Table 5.2), the marginal effect can be interpreted as the effect of a 1% increase in the value of the predictor.

The third outcome, the number of goods owned, can be considered a count variable because the number of potential outcomes and the proportion of zeros are small. Poisson regression[35], which has the following form, is designed for these outcomes:

$$E(y_i) = \exp(\mathbf{x}_i\boldsymbol{\beta})$$

where $E(y_i)$ is the expected value of the outcome for individual *i*, $\mathbf{x}_i$ is a vector of predictors for individual *i*, and $\boldsymbol{\beta}$ is a vector of coefficients for the effects of the predictors on the outcome (Long, 1997). The coefficients of this model were transformed by exp(β), and these exponentiated coefficients can be interpreted as the multiplicative effect of a one unit increase in the predictor (i.e., independent variable) on the value of the outcome. Thus, in these models, exponentiated coefficients less than one indicate a negative effect.

All models also include controls for asset ownership/rental in 1995, sector-level fixed effects, and household-level weights. Because controls are included for ownership of cattle and consumer goods as well as land rental in 1995 (see below), the model coefficients can be interpreted as effects on asset accumulation over the study period. All

[34] Marginal effects were calculated using Stata's *mfx* command for effects on the outcome conditional on the outcome being greater than zero.

[35] This model was selected over the negative binomial model because the additional parameter in negative binomial models was consistently non-significant.

Table 5.2 Definitions and weighted descriptive statistics for the predictors from the analysis of assets.

Predictor	Unit	Mean	Definition
Migration and Remittances			
Internal migrants, 1995-2006	#	0.92	Migrants to internal destinations, 1995-2006[1]
International migrants, 1995-2006	#	0.37	Migrants to international destinations, 1995-2006[1]
Male internal migrants, 1995-2006	#	0.43	Male migrants to internal destinations, 1995-2006[1]
Female internal migrants, 1995-2006	#	0.49	Female migrants to international destinations, 1995-2006[1]
Male international migrants, 1995-2006	#	0.20	Male migrants to international destinations, 1995-2006[1]
Female international migrants, 1995-2006	#	0.17	Female migrants to international destinations, 1995-2006[1]
Remitting internal migrants, 1995-2006	#	0.41	Migrants to internal destinations who have remitted, 1995-2006[1]
Non-remitting internal migrants, 1995-2006	#	0.51	Migrants to internal destinations who have not remitted, 1995-2006[1]
Remitting international migrants, 1995-2006	#	0.31	Migrants to international destinations who have remitted, 1995-2006[1]
Non-remitting international migrants, 1995-2006	#	0.07	Migrants to international destinations who have not remitted, 1995-2006[1]
Control Variables			
Prior internal migrants, pre-1995	#	1.30	Migrants to internal destinations prior to 1995[1]
Prior international migrants, pre-1995	#	0.14	Migrants to international destinations prior to 1995[1]
Local movers, 1995-2006	#	0.17	Movers within the canton, 1995-2006
New members, 1995-2006	#	0.24	New household members excluding births, 1995-2006
Births, 1995-2006	#	1.28	Births to household members, 1995-2006
Good harvests, 1995-2006	years	0.55	Years with good harvests, 1995-2006
Bad harvests, 1995-2006	years	1.14	Years with bad harvests, 1995-2006
Children, 1995	#	2.32	Household residents ages 0-14, 1995
Young men, 1995	#	0.52	Male household residents ages 15-29, 1995
Young women, 1995	#	0.52	Female household residents ages 15-29, 1995
Adult men, 1995	#	0.86	Male household residents ages 30+, 1995
Adult women, 1995	#	0.82	Female household residents ages 30+, 1995

(continued below)

Predictor	Unit	Mean	Definition
(continued from above)			
Age of head, 1995	years	48.0	Age of the male (or single female) household head, 1995
Single male head, 1995	1/0	0.15	Single resident household head, male, 1995, reference is dual-headed
Single female head, 1995	1/0	0.16	Single resident household head, female, 1995, reference is dual-headed
Mean education, 1995	years	4.98	Mean years of education of HH members ages 15+, 1995
Own land, 1995	tareas[2]	84.3	Area of lands owned by the household, 1995[3]
Loaned land, 1995	tareas[2]	3.15	Area of lands loaned to the household, 1995[3]
Rented land, 1995	tareas[2]	2.86	Area of lands rented by the household, 1995[3]
Parcels, 1995	#	1.44	Number of agricultural parcels managed by the household, 1995
Flat land, 1995	1/0	0.30	Household managed a parcel that is predominantly flat, 1995
Black soil, 1995	1/0	0.54	Household managed a parcel with predominantly black soil, 1995
Irrigation, 1995	1/0	0.25	Household managed a parcel with irrigation, 1995
Coffee, 1995	1/0	0.34	Household managed a parcel with coffee, 1995
Cattle, 1995	#	0.78	Number of cattle owned, 1995[3]
Goods, 1995	#	1.30	Number of goods owned from a list, 1995
Business, 1995	1/0	0.06	Household owned a small business, 1995
Electricity, 1995	1/0	0.40	Home had electricity, 1995
Distance to road	km	0.64	Distance to the closest road

N = 341 households

[1] Internal and international migrants were classified based on location of residence in 2006.

[2] One tarea, a local unit of area, is equal to 1/20 of a hectare.

[3] Transformed by log(x + 1) for the regression analysis.

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models include census-sector-level fixed effects (i.e., one dummy variable for each census sector) to account for unobserved contextual factors that might influence both migration and assets[36]. To account for unequal probabilities of sample selection across census sectors and households, all models also incorporate household-level weights, calculated as the inverse of the probability of selection.

Predictors

To investigate the effects of out-migration on assets and to account for other influences, all models included as predictors multiple measures of out-migration and 27 control variables (Table 5.2), as well as sector-level fixed effects as described above. To account for different aspects of the effects of out-migration and remittances, three models were estimated for each outcome including different sets of migration predictors. These are labeled Models A, B and C in Table 5.3. To account for differing effects of internal and international out-migration, the first and simplest set of migration predictors (Model A) includes the number of internal migrants and the number of international migrants sent by the household over the study period, defined as individuals resident in the household in 1995 who in 2006 were resident in a different Ecuadorian canton or a different country. In total the 341 households sent 355 internal migrants and 155 international migrants over the study period. (See Chapter 3 for additional information on out-migration from the study area.)

Effects of out-migration are also likely to differ by gender of the migrant as livelihood activities in the study area are strongly affected by gender norms (Chapter 3).

[36] For this chapter I selected this strategy to accommodate contextual effects over the strategy used in Chapter 3 due to concerns about the influence of unobserved characteristics (see below). Sector-level fixed effects were selected over community-level fixed effects because of the small number of sample households in some communities.

In the year prior to departure 95% of male migrants participated in farm labor and 39% in wage labor, compared to 46% and 5% respectively for female migrants, a gender division of labor which is typical for the rural Andes (Deere and Leon, 1981). To account for these differences, the second set of migration predictors (Model B) separates internal and international migrants by gender. Among internal migrants, 51% were women, as opposed to 43% of international migrants.

To separate the effects of lost labor and remittances, the third set of migration predictors (Model C) includes the number of remitting and non-remitting internal migrants as well as the number of remitting and non-remitting international migrants, based on whether the migrant has remitted money since departure from the household. Among internal migrants, 48% had remitted, as compared to 85% of international migrants. Men and women remitted at similar rates and in similar amounts from both internal and international destinations (Chapter 3).

To account for other influences on asset ownership, all models also incorporate 27 control variables[37], including out-migration prior to 1995, changes in household composition (other than out-migration) and agricultural shocks during the eleven-year interval, and asset ownership and other household characteristics in 1995 (Table 5.2). These controls are consistent with previous studies of asset accumulation (Adams, 1998; Entwisle and Tong, 2005) and with the livelihoods framework (Chapter 1), and are included to reduce the bias from unmeasured household characteristics on the estimated effects of migration and remittances (see below). The focus of this analysis is on migration from 1995-2006 (Chapter 2), but migration prior to 1995 could also influence

[37] To account for missing data, 0.2% of predictor values were manually interpolated based on other information in the questionnaire.

asset accumulation, such as through continuing migrant remittances. Thus the numbers of internal and international migrants sent by the household prior to the study period are included as controls. These include 447 internal migrants and 54 international migrants. In addition to migration, the models also account for other changes in household composition during the study period including the number of members who departed to live elsewhere in the canton, the number of new adult residents (e.g., new spouses or return migrants), and the number of children born in the household. To account for unexpected agroecological shocks that might have influenced both out-migration and asset accumulation, models also include the number of unusually good and bad harvests reported by the household during the study period. Finally, the models also control for a large number of household characteristics in 1995, including demographic composition, adult education levels, size and quality of agricultural lands owned by and loaned to the household, ownership of a small business, access to electricity, and distance from the home to the closest road.

Hypotheses

Given this approach, a number of predictions are possible regarding the effects of migration and remittances. Land rental in the study area is primarily for subsistence cultivation and thus likely to decline with out-migration, particularly of men, but effects from the departure of women may be smaller given their smaller contributions to agriculture under the prevailing gender division of labor. Remittances might lead to investment in land rental due to the removal of a capital constraint, or to disinvestment through a substitution effect. In this and all cases the effects of international remittances are likely to be larger and more significant than the effects of internal remittances given

the larger magnitude of international remittances. Cattle are an important form of easily-convertible wealth and a source of income with low demands on household labor. Given these characteristics, the loss of agricultural labor through out-migration, particularly of men, might lead to increased investment in cattle as a lower-labor alternative to agriculture. Conversely, cattle might also be sold in order to finance the costs of out-migration. The receipt of remittances could either lead to investment in cattle as a way to store wealth or disinvestment in cattle since a new source of cash income is available. Finally, the number of consumer goods is likely to decline with labor lost to migration but to increase with remittances, given that household expenses were the primary use of remittances reported by respondent households.

Potential sources of bias

The estimated effects of migration and remittances on assets could potentially be biased by unmeasured household characteristics that influenced both out-migration and asset accumulation. However, the inclusion of sector-level fixed effects and a large set of controls limit the potential scope of this bias as all contextual influences and many household-level influences have been accounted for. Some previous studies (e.g., Garip, 2007) have addressed the effects of unobserved characteristics by using contextual measures of migration as instrumental variables for household participation in migration. That approach assumes that the departure of migrants from the community affects household migration decisions but does not affect assets through other pathways, and thus ignores the various potential pathways for such effects described above. Additionally, available measures of community-level migration networks are weak predictors of out-migration in the study area (Chapter 4), indicating that they would likely

not be useful as instrumental variables. Thus, consistent with recent studies (Entwisle and Tong, 2005; Wong et al., 2007; Wouterse and Taylor, 2008) my approach is to include un-instrumented measures of migration as predictors, but also to interpret the causal nature of the effects cautiously.

5.4 Results for Assets

The results of the analysis of assets are presented in Table 5.3, including model coefficients, significance tests and fit statistics. Marginal effects for the migration predictors in the tobit models are presented in Table 5.4 (see Section 5.3). Below I discuss the results for each of the three outcomes in turn, synthesizing across Models A-C and focusing on the measures of migration and significant ($p < 0.05$) and marginally significant ($p < 0.10$) effects, before concluding with a summary of the results.

Land rental

Land rental increased with both the number of internal ($p = 0.025$, Model A) and international ($p = 0.008$, Model A) migrants, particularly in the case of female migrants ($p_{joint} = 0.010$, Model B) [38], and remitting international migrants ($p = 0.001$, Model C) (Table 5.3). Among households that rented land, the marginal effect of one additional migrant was a 4.6% increase in the area of land rented for internal migrants and a 7.7% increase for international migrants (Table 5.4). As the effects of internal and international migration only held for female migrants (Model B), these results suggest the departure of women promotes land rental for cropping, either to expand the existing subsistence area

[38] Effects indicated by *joint* were jointly significant by a post-estimation Wald test using Stata's *test* command.

Table 5.3 Results from the regression analysis of assets.

Predictor	Tobit[1]						Poisson[2]		
	Rented land			Cattle			Goods		
	Model A	Model B	Model C	Model A	Model B	Model C	Model A	Model B	Model C
Migration and Remittances									
Internal migrants, 1995-2006	0.292*	-	-	-0.178*	-	-	0.947*	-	-
International migrants, 1995-2006	0.490**	-	-	0.132	-	-	1.059+	-	-
Male internal migrants, 1995-2006	-	-0.010	-	-	-0.020	-	-	0.976	-
Female internal migrants, 1995-2006	-	0.461**	-	-	-0.305**	-	-	0.928*	-
Male international migrants, 1995-2006	-	0.297	-	-	0.208	-	-	1.041	-
Female international migrants, 1995-2006	-	0.586*	-	-	0.086	-	-	1.090+	-
Remitting internal migrants, 1995-2006	-	-	0.257+	-	-	-0.311**	-	-	0.973
Non-remitting internal migrants, 1995-2006	-	-	0.430*	-	-	-0.079	-	-	0.890***
Remitting international migrants, 1995-2006	-	-	0.642**	-	-	0.061	-	-	1.040
Non-remitting international migrants, 1995-2006	-	-	-1.198	-	-	0.539+	-	-	1.230*
Control Variables									
Prior internal migrants, pre-1995	0.067	0.077	0.054	-0.121*	-0.122*	-0.115*	1.034+	1.033+	1.032+
Prior international migrants, pre-1995	0.190	0.129	0.089	0.386**	0.406**	0.423***	1.101*	1.105*	1.110*
Local movers, 1995-2006	0.191	0.015	0.261	-0.157	-0.108	-0.104	0.994	0.997	1.002
New members, 1995-2006	0.431+	0.463+	0.490+	0.288*	0.297*	0.265*	1.127**	1.129**	1.132**
Births, 1995-2006	0.216+	0.192+	0.196+	0.120+	0.121+	0.110+	0.971	0.972	0.970
Good harvests, 1995-2006	0.270**	0.262*	0.287**	0.091	0.083	0.105+	0.999	0.999	0.997
Bad harvests, 1995-2006	0.059	0.052	0.036	0.028	0.030	0.025	0.970+	0.971+	0.972+
Children, 1995	-0.222*	-0.210+	-0.254*	0.062	0.058	0.068	1.069***	1.067***	1.071***
Young men, 1995	-0.234	-0.070	-0.234	-0.314*	-0.374**	-0.313*	0.997	0.996	0.998
Young women, 1995	-0.028	-0.105	-0.014	0.053	0.131	0.049	1.120**	1.119*	1.119**
Adult men, 1995	0.800+	0.948*	0.795+	0.186	0.125	0.257	1.022	1.016	1.034
Adult women, 1995	-0.786	-0.847+	-0.912+	0.549*	0.524*	0.499*	1.107	1.101	1.144+
Age of head, 1995	-0.057***	-0.059***	-0.056**	0.009	0.010	0.007	0.993**	0.993**	0.992**

(continued below)

Predictor	Tobit[1]						Poisson[2]		
	Rented land			Cattle			Goods		
	Model A	Model B	Model C	Model A	Model B	Model C	Model A	Model B	Model C
(continued from above)									
Single male head, 1995	-1.486*	-1.615*	-1.744*	-0.207	-0.187	-0.149	0.867	0.860	0.876
Single female head, 1995	-0.952	-0.832	-1.069	-0.203	-0.279	-0.101	0.838	0.828	0.850
Mean education, 1995	0.042	0.043	0.053	0.008	0.008	-0.003	1.078***	1.078***	1.079***
Log (own land, 1995)	-0.086	-0.059	-0.098	0.279***	0.282***	0.280***	1.034	1.033	1.033
Log (loaned land, 1995)	-0.597*	-0.534+	-0.650*	0.515***	0.506***	0.548***	1.037	1.029	1.033
Log (rented land, 1995)	1.447***	1.442***	1.416***	0.057	0.067	0.125	1.041	1.038	1.036
Parcels, 1995	0.228	0.223	0.340	0.329*	0.327*	0.326*	1.086	1.086	1.078
Flat land, 1995	-0.807*	-0.755*	-0.906**	0.072	0.035	0.071	0.828*	0.827*	0.839*
Black soil, 1995	0.071	0.151	0.021	0.084	0.041	0.062	1.058	1.050	1.064
Irrigation, 1995	-1.678***	-1.754***	-1.774***	0.255	0.272	0.267	1.149+	1.149+	1.141+
Coffee, 1995	0.432	0.538	0.465	0.050	0.018	0.131	1.198*	1.201*	1.212**
Log (cattle, 1995)	-0.516*	-0.584*	-0.544*	0.636***	0.658***	0.606***	1.038	1.038	1.038
Goods, 1995	-0.071	-0.064	-0.064	0.110*	0.099*	0.125**	1.132***	1.130***	1.130***
Business, 1995	2.306***	2.457***	2.392***	0.252	0.214	0.221	0.839	0.844	0.866
Electricity, 1995	-0.717+	-0.719+	-0.857*	-0.241	-0.243	-0.223	1.251**	1.253**	1.250**
Distance to road	-0.432*	-0.444**	-0.464**	-0.311***	-0.328***	-0.343***	0.989	0.989	0.978
Constant	-0.011	-0.179	0.258	-3.950***	-3.902***	-3.945***	0.741	0.763	0.719
σ	1.479***	1.463***	1.455***	1.022***	1.018***	0.994***	-	-	-
Log psuedolikelihood	-4201	-4175	-4153	-6175	-6141	-6084	-14590	-14580	-14512

N = 341

[1] Tobit results are untransformed coefficients, for which values less than zero represent a negative effect.

[2] Poisson results are exponentiated coefficients, for which values less than one represent a negative effect.

Models also include sector-level fixed effects, not shown.

Log (variable) represents a predictor transformed by $ln(x + 1)$

*** p<0.001; ** p<0.01; *p<0.05; + p<0.10

Table 5.4 Marginal effects of selected predictors from the tobit models of land rental and cattle ownership[1].

Predictor	Rented land			Cattle		
	Model A	**Model B**	**Model C**	**Model A**	**Model B**	**Model C**
Internal migrants, 1995-2006	0.0461 *	-	-	-0.0523 *	-	-
International migrants, 1995-2006	0.0773 **	-	-	0.0388	-	-
Male internal migrants, 1995-2006	-	-0.0016	-	-	-0.0058	-
Female internal migrants, 1995-2006	-	0.0723 **	-	-	-0.0893 **	-
Male international migrants, 1995-2006	-	0.0465	-	-	0.0608	-
Female international migrants, 1995-2006	-	0.0919 *	-	-	0.0252	-
Remitting internal migrants, 1995-2006	-	-	0.0386 +	-	-	-0.0919 **
Non-remitting internal migrants, 1995-2006	-	-	0.0648 **	-	-	-0.0234
Remitting international migrants, 1995-2006	-	-	0.0966 ***	-	-	0.0181
Non-remitting international migrants, 1995-2006	-	-	-0.1803	-	-	0.1593 +

*** p<0.001; ** p<0.01; *p<0.05; + p<0.10

[1] Marginal effects on the outcome conditional on the outcome being greater than zero, derived from the tobit models presented in Table 5.3 using Stata's *mfx* command.

or to move production onto more favorable lands. Under the prevailing gender division of labor, the departure of women likely decreases consumption demands but does not strongly affect the household supply of agricultural labor (Radcliffe, 1986), leading to an increased emphasis on labor-intensive cropping. The increase in rented area with the number of non-migrant adult men and the marginal decrease with the number of non-migrant adult women are consistent with this explanation. Among international migrants, the positive effect came only from remitting migrants (Model C), suggesting that remittances are partially invested in land rental.

Among control variables, land rental decreased with the number of children and adult women, the age of the head, single male headship, loaned lands, access to flat land and irrigation, cattle, access to electricity, and distance to a road. Land rental also increased with new household members, births, adult men, previous land rental, good harvests, and ownership of a small business. These results indicate that rental is most important for households that are relatively poor (with few cattle or little irrigated land), have surplus household agriculture labor (more men than women and children), and are engaged with the market economy (close to a road and with a small business).

Cattle

Ownership of cattle was significantly negatively affected by the departure of internal migrants ($p = 0.036$, Model A), particularly female internal migrants ($p = 0.007$, Model B) and internal migrants that sent remittances ($p = 0.007$, Model C) (Table 5.3). For households that owned cattle, the marginal effect of the departure of one migrant was a decrease of 5.2% in the number of cattle for an internal migrant, 8.9% for a female internal migrant, and 9.2% for an internal remitting migrant (Table 5.4). Cattle also

increased marginally ($p = 0.056$) with the number of non-remitting international migrants (Model C). Across all three models, cattle ownership also decreased with the number of internal migrants prior to 1995 and increased with international migrants prior to 1995. These results suggest two non-exclusive explanations. The first is that cattle are sold to finance the internal migration of women, who subsequently are obligated to remit to the household to replace this investment. This explanation is consistent with the positive effects of cattle ownership on female rural migration described in Chapter 4, and with theories such as the new economics of labor migration that consider migration and remittances to be part of an implicit contract between household members. A second explanation is that the departure of women leads to a decrease in subsistence demands, an increase in surplus agricultural labor (beyond subsistence demands), and consequently a decreased emphasis on labor-extensive cattle ranching relative to labor-intensive cropping. The decrease in cattle with the number of young men and the increase with the number of adult women are consistent with this explanation. The marginal increase in cattle with the number of non-remitting international migrants (Model C) suggests these households invest in cattle as an alternative source of cash income in the absence of international remittances.

Among control variables, the number of cattle increased with new household members, births, adult women, land and parcel ownership, loaned lands, and the number of previously owned goods and cattle, and decreased with the number of young men and distance to a road.

Thus cattle ownership increased the most for households that are land-rich, growing in size (through births and new members), and have limited agricultural labor available relative to subsistence demands (i.e., more women and fewer men).

Consumer goods

Ownership of consumer goods decreased with internal migration ($p = 0.024$, Model A) and increased marginally with international migration ($p = 0.051$, Model A) (Table 5.3). In both cases the effects were more important for female migrants ($p_{joint} = 0.001$, Model B) and non-remitting migrants ($p_{joint} < 0.001$, Model C). The number of goods decreased by 5.3% for each internal migrant and increased by 5.9% for each international migrant (Table 5.4). Goods owned also increased with prior internal and international migrants. The negative effects of women's departure on the accumulation of goods (Model B) are consistent with women's greater role in home-based production and likely greater demand for these goods. The positive effects of young and adult women on goods are consistent with this explanation. The highly significant negative effect of non-remitting internal migrants (Model C) suggests that labor loss compounded by a lack of remittances reduces accumulation of goods. The positive effects of non-remitting international migrants (Model C) are more difficult to explain but may reflect outstanding debts from international migration among households that subsequently receive remittances.

Among control variables, goods owned also increased with new household members, children, young and adult women, education, irrigation, coffee, previously owned goods, and electricity, and declined with age of the household head and access to flat land. Thus wealthy households (with irrigation, coffee, education and electricity) with

many women, children and new members most increased their ownership of consumer goods.

Summary

Overall the results reveal mixed effects of out-migration and remittances on asset accumulation. The change in household sex ratios associated with female out-migration appears to promote labor-intensive cropping on rented land at the expense of cattle ranching, which likely contributed to the decline in cattle ownership over the study period. Thus, contrary to expectations, migration in this case appears to promote an intensive form of land use (land rental) in place of an extensive land use (cattle raising). For cattle and consumer goods, both traditional assets, internal migration led to a decline and international migration to an increase, supporting the expectation that international migration would have more positive effects on asset accumulation. Overall, however, the effects from remitting international migrants are quite modest, suggesting that international remittances will not lead to dramatic changes in the ownership of agricultural and other assets despite the large magnitude of remittances flows to the study area.

5.5 Analysis of Agricultural Activities

Outcomes and models

The second set of analyses draws on detailed cross-sectional information from the household survey to test the effects of out-migration and remittances on agricultural

Table 5.5 Definitions, sample sizes and weighted descriptive statistics for the outcomes from the analysis of agricultural activities.

Outcome	Unit	Overall		Positive values[1]		Definition
		N	Mean	N	Mean	
Subsistence area	tareas[2]	385	16.2	357	17.6	Area of maize and beans planted in the past year, 2006[3]
Reciprocal labor	person-days	380	4.96	182	9.79	Days of reciprocal agricultural labor used in the past year, 2006[3]
Hired labor	person-days	380	11.0	211	20.8	Days of hired agricultural labor used in the past year, 2006[3]
Input use	$US	383	26.8	203	53.6	Expenses for chemical inputs in the past year, 2006[3]
Maize production	quintales[4]	385	11.6	331	13.5	Harvest of maize in the past year, 2006[3]
Female laborers	persons	357	0.92	-		Number of adult female household members working on the farm in the past year, 2006
Bean diversity	varieties	287	1.18	-		Number of local varieties of common beans planted in the past year, 2006

[1] Includes only households with values greater than zero for the outcome.

[2] One tarea, a local unit of area, is equal to 1/20 of a hectare.

[3] Transformed by ln(y + 1) for the regression analysis.

[4] One quintal, a Latin American unit of mass, is equal to 100 pounds or 45.4 kilograms.

activities. These analyses include 385 households[39] that resided in the study communities in 2005 and had access to land. The seven outcomes capture agricultural activities in the previous 12 months, and include the area planted in maize and beans; the use of reciprocal, hired, and female household labor; the use of chemical inputs; maize production; and the number of varieties planted of common beans (Table 5.5). These activities are all key components of smallholder agricultural livelihoods in the study area and elsewhere in the developing world, and are dependent on household labor and other assets and thus likely to respond to out-migration.

I refer to the area planted in maize and beans as subsistence area, as these are the primary subsistence crops and are often intercropped. Maize and/or beans were planted in the past year by 93% of households, and the average household (across all households) planted 16.2 tareas (0.81 hectares), representing 18% of 89.5 tareas (4.48 hectares) of household agricultural land including owned, loaned and rented parcels. Through serving primarily for subsistence, 25% of households also sold some maize and/or beans in the past year. Other important land uses included pasture (34% of agricultural area), shrubs and fallow (29%), trees (8%), coffee (4%) and a variety of other crops including bananas, cassava, sugar cane and peanuts (8%). (See Chapter 3 for additional descriptive analyses of agricultural activities.)

Reciprocal labor, also known as labor exchange or *prestamanos*, is a common practice in the rural Andes (Guillet, 1980). Use of reciprocal labor and hired labor were defined as the number of person-days of labor used of each type on the farm in the past year. Reciprocal labor was used by 48% of households for an average across these

[39] Due to missing data on the outcome five cases were excluded from the analyses of reciprocal and hired labor and two cases were excluded from the analysis of maize production.

households of 9.8 person-days, and hired labor was used by 56% of households for an average of 21 person days across these households. The use of chemical inputs including fertilizers, pesticides, and herbicides was measured as the amount spent on these products over the past year. These were used by 53% of households, costing these households $54 on average in the past year[40]. Maize was harvested by 86% of households in the past year, and these households on average produced 13.5 *quintales*[41] (613 kilograms)[42]. These outcomes are all censored and were log-transformed and analyzed using tobit models as described in Section 5.3.

Analyses of female agricultural labor and bean diversity, which are count variables, were conducted for subsets of relevant households using Poisson models (Section 5.3). For 357 households (93% of households) that included an adult female in 2006, the number of women working on the farm in 2006 was analyzed as a measure of women's involvement in agricultural activities[43]. Among young and adult women 58% were reported to work on the farm in 2006. For 287 households (75% of households) that planted common beans (*porotos*) in the past year, the number of local varieties planted

[40] This is a large amount relative to the average daily wage for an agricultural laborer of approximately US$5.

[41] A *quintal* is a Latin American unit of mass equal to 100 pounds or 45.4 kilograms.

[42] These values together with those for subsistence area cannot be used to directly calculate the maize yield because production was measured from the previous agricultural cycle (since data collection took place in the season of planting) whereas land use was measured from the current agricultural cycle. The subsistence area also includes areas planted in beans (both intercropped and beans alone). See Chapters 2 and 3 for information on maize yields.

[43] This question, as interpreted by the respondents, likely excludes activities such as tending cattle, food processing, and preparing food for agricultural laborers. Measures of individual time use by agricultural activity would have provided a more precise picture of women's involvement in agriculture, but these were not collected in the survey. A parallel individual-level model of dichotomous participation by women in agricultural labor produced similar results for the effects of migration.

was analyzed as a measure of agrodiversity[44]. These households planted 1.2 local bean varieties on average.

These outcomes are clearly closely related but none are correlated at more than $r \approx 0.5$. Subsistence area, maize production, and input use are the most strongly correlated, suggesting that out-migration and remittances may affect these outcomes in similar ways[45].

Predictors

To investigate the effects of out-migration on these agricultural activities and to account for other influences, all models included as predictors four measures of out-migration and 17 control variables (Table 5.6), as well as sector-level fixed effects as described for the previous analysis. The four measures of out-migration are the number of male and female out-migrants since 1995 and the amount of remittances received from internal and international migrants in the past twelve months[46]. The inclusion of the number of current male and female migrants captures the effects of lost labor and reduced consumption demands on agricultural activities. Since controls for current household composition are included (see below) these predictors capture only effects beyond simple adjustment to the post-migration household size. Thus if migrant-sending households change their agricultural activities to reflect the new household composition following out-migration but do not change agricultural activities in any other way then the effects of migration in the models will be non-significant. Separate measures were included for the

[44] Improved varieties, which were planted by few households, were excluded from this measure.

[45] The modeling approach does not attempt to account for potential tradeoffs or synergies between these outcomes. These could be incorporated through a seemingly-unrelated tobit model (Chapter 6).

[46] I also explored dividing migrants by destination rather than gender as well as remittances by gender of the migrant rather than by destination, but I found the specification described to provide the best fit.

numbers of male and female migrants because the agricultural activities of men and women in the study area are heavily influenced by gender norms (Chapter 3). Overall, from 1995 to 2005 the 385 households sent 185 male internal migrants, 104 male international migrants, 189 female internal migrants and 73 female international migrants.

Remittances were measured as the value of monetary remittances in the past year from internal and international migrants who departed the household since 1995. Remittances were separated into those from internal and international migrants since the amount, frequency and timing of these two types of remittances are likely to differ. This separation is also consistent with previous studies which have found such differences (Adams, 2006; Mora, 2005; Wouterse and Taylor, 2008). Among the 46% of sample households with internal migrants, 45% received remittances from them in the past year, averaging US$400. Among the 25% of households with international migrants, 79% received remittances from them in the past year, averaging US$1162. Men and women remitted at similar rates and in similar amounts from both internal and international destinations (Chapter 3). As the remittance measures are right-skewed in a manner similar to the outcomes, they were log-transformed prior to inclusion in the model to reduce the influence of outlying values. Among the four measures of migration and remittances, all pairwise correlations are positive but none exceed $r = 0.30$, suggesting that introducing them together will not lead to problems with collinearity.

In addition to these measures of migration and remittances, all models include a set of 17 control variables which were also expected to influence agricultural activities (Table 5.6)[47]. These included household-level measures of demographic composition,

Table 5.6 Definitions and weighted descriptive statistics for the predictors from the analysis of agricultural activities.

Predictor	Unit	Mean	Definition
Migration and Remittances			
Male migrants, 1995-2005	#	0.62	Male HH residents since 1995 who left the canton by 2005
Female migrants, 1995-2005	#	0.61	Female HH residents since 1995 who left the canton by 2005
Internal remit, 2006	$US	65.5	Remittances in the past year from HH internal migrants, 2006[2]
International remit, 2006	$US	173.8	Remittances in the past year from HH international migrants, 2006[2]
Control Variables			
Children, 2005	#	2.05	HH residents ages 0-14, 2005
Young men, 2005	#	0.52	Male HH residents ages 15-29, 2005
Young women, 2005	#	0.47	Female HH residents ages 15-29, 2005
Adult men, 2005	#	1.01	Male HH residents ages 30+, 2005
Adult women, 2005	#	0.95	Female HH residents ages 30+, 2005
Age of head, 2005	years	55.9	Age of the male (or single female) household head, 2005
Single head, male, 2005	1/0	0.12	Single male head of household, reference is dual-headed, 2005
Single head, female, 2005	1/0	0.15	Single female head of household, reference is dual-headed, 2005
Mean education, 2005	years	5.31	Mean years of education of HH members ages 15+, 2005
Own land, 2005	tareas[1]	80.7	Area of lands owned by or loaned to the household, 2005[2]
Loaned land, 2005	tareas[1]	4.73	Area of lands owned by or loaned to the household, 2005[2]
Parcels, 2005	#	1.31	Number of owned and loaned land parcels, 2005
Flat land, 2005	1/0	0.27	HH manages a parcel that is predominantly flat, 2005
Black soil, 2005	1/0	0.48	HH manages a parcel with predominantly black soil, 2005
Irrigation, 2005	1/0	0.26	HH manages a parcel with irrigation, 2005
Coffee, 2005	tareas[1]	3.26	Area of coffee managed by the household, 2005
Distance to road	km	0.66	Distance to the closest road

Notes: n = 397 households, HH = household

[1] One tarea, a local unit of area, is equal to 1/20 of a hectare.

[2] Transformed by $ln\,(x + 1)$ for the regression analysis.

[47] To account for missing data, 0.3% of predictor values were manually interpolated based on other information in the questionnaire.

adult educational attainment, the area and characteristics of lands owned by and loaned to the household, and accessibility to a road[48]. These controls are consistent with the analysis of assets, with the livelihoods framework described (Chapter 1), and with previous studies of the determinants of land, labor and input use as well as agrodiversity (e.g., Benjamin, 1992; Foster and Rosenzweig, 1995; Walker et al., 2002; Gilligan, 2004; Van Dusen and Taylor, 2005). The controls are included to reduce the bias from unmeasured household characteristics on the estimated effects of migration and remittances.

Hypotheses

Given this approach and the discussion above, a number of predictions can be made regarding the effects of out-migration on the seven agricultural activities. If lost-labor effects are strong, the number of migrants from the household should have negative effects on subsistence area, maize production and crop diversity given the labor demands of these activities. The number of migrants should also have positive effects on the use of reciprocal labor, hired labor, female household labor, and input use given that these activities can replace the labor of migrants. As men tend to work more hours on the farm, the departure of male migrants is likely to have a larger effect in all cases. However, if households are able to absorb migrant departure through the labor of remaining household members and with no effects beyond adjustment to the new household size then effects from the numbers of migrants will not be significant.

As described in Section 5.2, migrant remittances might promote investment or disinvestment in productive activities depending on whether they relieve capital

[48] The following potential control variables were excluded as likely to have been influenced by out-migration: cattle, small businesses, consumer goods, electricity and rented land.

constraints or substitute for household production. If remittances promote investment, then remittances should have positive effects on subsistence area, hired labor, input use, maize production, and female household labor, with negative effects if remittances substitute for household production. Reciprocal labor and bean diversity might be affected similarly, but if remittances promote integration with markets for hired labor and improved crop varieties then they might be affected negatively despite investment in agriculture. In all cases international remittances are likely to have larger per-dollar effects than internal remittances given their larger magnitude.

5.6 Results for Agricultural Activities

The results of the analysis of agricultural activities are presented in Table 5.7, including model coefficients, significance tests and fit statistics. Marginal effects for the migration predictors in the tobit models are presented in Table 5.8 (see Section 5.3). Below I discuss the results for each of the seven outcomes, focusing on the measures of migration and significant ($p < 0.05$) and marginally significant ($p < 0.10$) effects, before concluding with a summary of the results.

Subsistence area

Consistent with the findings of Jokisch (2002), migration and remittances did not have significant effects on the area cultivated in maize and beans (Table 5.7). Among control variables, subsistence area significantly increased with land area and black soil and decreased with age of the head, single female headship and irrigation. Given the significant effects of land area and biophysical conditions and the non-significant effects

Table 5.7 Results from the regression analysis of agricultural activities.

	Tobit[1]					Poisson[2]	
Predictor	**Subsistence area**	**Reciprocal labor**	**Hired labor**	**Input use**	**Maize production**	**Female laborers**	**Bean diversity**
Migration and Remittances							
Male migrants, 1995-2005	-0.103	-0.073	0.075	0.050	-0.220*	1.048	0.982
Female migrants, 1995-2005	0.003	0.233*	-0.412**	0.189	0.013	0.976	0.969
Log (internal remit), 2006	0.007	0.046	0.000	0.039	0.013	1.040*	1.023+
Log (international remit), 2006	0.022	-0.048	0.176**	0.200***	0.058+	0.983	1.019
Control Variables							
Children, 2005	0.002	0.064	-0.035	-0.104	0.016	0.988	0.945***
Young men, 2005	-0.006	0.309*	0.079	0.334+	0.046	1.037	1.018
Young women, 2005	0.087	0.154	-0.190	0.039	0.044	1.454***	1.044
Adult men, 2005	0.053	0.399+	-0.789*	0.417	0.111	0.944	0.957
Adult women, 2005	0.056	0.708**	-0.068	-0.818**	0.088	1.492***	1.178**
Age of head, 2005	-0.012**	-0.046***	-0.012	-0.051***	-0.015**	1.002	0.993*
Single head, male, 2005	-0.273	0.045	-1.341*	-0.626	0.046	0.757	1.012
Single head, female, 2005	-0.349+	-0.274	-0.751	-0.743+	-0.151	1.187	0.814*
Mean education, 2005	0.038	-0.126+	0.171**	-0.149*	0.070*	0.971	1.002
Log (own land), 2005	0.293***	-0.029	0.488***	0.195*	0.203***	0.981	1.006
Log (loaned land), 2005	0.173**	-0.199	-0.062	0.230	0.048	1.043	1.030
Parcels, 2005	-0.002	0.660***	-0.018	-0.030	0.015	1.078	1.052
Flat land, 2005	-0.186	-0.255	0.325	0.023	0.058	0.892	0.922
Black soil, 2005	0.265*	0.067	0.084	-0.132	0.471***	1.025	1.047
Irrigation, 2005	-0.509***	-0.734*	0.693*	0.179	-0.336*	0.937	1.020
Log (coffee), 2005	0.006	-0.113	-0.090	0.093	-0.100	1.088+	1.018
Distance to road	-0.015	0.011	-0.050	0.013	0.051	1.010	1.032
Constant	1.656***	2.543**	-0.345	-0.487	0.673	0.296*	1.880*
σ	0.891***	1.699***	1.968***	1.871***	1.061***	-	-
Log psuedolikelihood	-12288	-12162	-13337	-11761	-13502	-9108	-7953
N	385	380	380	383	385	357	287

[1] Tobit results are untransformed coefficients, for which values less than zero represent a negative effect.

[2] Poisson results are exponentiated coefficients, for which values less than one represent a negative effect.

Models also include sector-level fixed effects, not shown.

Log (variable) represents a predictor transformed by $ln\,(x + 1)$

*** p<0.001; ** p<0.01; *p<0.05; + p<0.10

Table 5.8 Marginal effects of selected predictors from the tobit models of agricultural activities[1].

Predictor	Subsistence area	Reciprocal labor	Hired labor	Input use	Maize production
Male migrants, 1995-2005	-0.0987	-0.0294	0.0318	0.0184	-0.1741 **
Female migrants, 1995-2005	0.0028	0.0936 *	-0.1751 **	0.0697	0.0102
Log (internal remit), 2006	0.0072	0.0184	-0.0002	0.0144	0.0104
Log (international remit), 2006	0.0214	-0.0194	0.0748 **	0.0736 ***	0.0458 +

*** p<0.001; ** p<0.01; *p<0.05; + p<0.10

[1] Marginal effects on the outcome conditional on the outcome being greater than zero, derived from the tobit models presented in Table 5.7 using Stata's *mfx* command.

of migration and household composition, the results suggest that the area planted in maize and beans is primarily determined by the natural capital available to the household rather than that labor availability or consumption demands. Similarly the results for remittances suggest that they are not invested in the short term in the expansion of the subsistence area. This finding contrasts with the previous findings for land rental (Section 5.4), which increased with migration over an eleven-year period, suggesting that increases in land rental allow previously cultivated areas to be fallowed or moved into other uses.

Reciprocal labor

The use of reciprocal agricultural labor significantly increased with the number of female migrants ($p = 0.034$) but was not affected by the number of the male migrants or remittances (Table 5.7). For households that used reciprocal labor, the marginal effect of one additional female migrant was an increase of 9.4% in the number of person-days of reciprocal labor (Table 5.8). This result suggests that households use reciprocal labor to replace the previous part-time agricultural labor of female migrants, likely because the

departure of a female migrant does not strongly impair the household's ability to participate in reciprocal work exchanges with other households. This mechanism is supported by the results for the effects of household composition, which indicate that reciprocal labor use increases with the number of young men, adult men and adult women in the household but is not affected by the number of young women, who are presumably less frequent participants. The absence of effects from remittances indicate that they are likely not invested in food and alcohol to be distributed at reciprocal work events, but neither does this traditional exchange appear to be imperiled by the influx of remittances. Among other control variables, reciprocal labor declined with age of the head, household education, and access to irrigation, and increased with the number of agricultural parcels, suggesting that young, poorer households with spatially distributed parcels are most likely to rely on reciprocal labor.

Hired labor

The use of hired labor responded differently, decreasing with the number of female migrants ($p = 0.009$) and increasing with international remittances ($p = 0.003$) but remaining unchanged with male departure and internal remittances (Table 5.7). For households that used hired labor, the marginal effect of one additional female migrant was a 17.5% decrease in the number of person-days of hired labor and the effect of a doubling of international remittances was a 7.5% increase (Table 5.8). These results suggest that female out-migration promotes a shift towards the use of shared labor and away from hired labor. The use of shared labor likely becomes more attractive than hired labor following female migration due to a decrease in subsistence demands and a consequent increase in the agricultural labor surplus beyond subsistence demands. The

negative effect of adult men on hired labor use is consistent with this explanation. However, in a countervailing effect, international remittances are partly invested in hired labor, likely in order improve yields and reduce labor demands on remaining household members since no effect was evident on subsistence area. Among control variables, use of hired labor increased with education, land area, and irrigation, and decreased with the number of adult men and single male headship, indicating that wealthier households with limited household labor are most likely to hire agricultural workers.

Input use

The use of chemical inputs increased with international remittances but was not affected by internal remittances or migrant departure (Table 5.7). A doubling of international remittances led to a 7.4% increase in spending on chemical inputs, and the effect was highly statistically significant ($p < 0.001$) (Table 5.8). Remittance-receiving households likely use chemical inputs to improve yields and reduce labor demands on remaining household members. Thus in this case remittances appear to promote the monetization of agricultural activities but lost-labor effects from out-migration are not evident. These findings differ from those of Jokisch (2002) who found using bivariate analysis that input use did not appear to change with international migration in Azuay and Cañar provinces. These differing results may be due to agroecological differences between the two study areas (Azuay and Cañar provinces are considerably higher and wetter) or because of the lack of multivariate controls in Jokisch's analysis. Among control variables, input use increased with the number of young men and land area, and decreased with the number of adult women, age of the head and education, indicating that

younger, less-educated households and those with more land and household agricultural labor use the most inputs.

Maize production

Maize production significantly decreased with male migration ($p = 0.010$) and marginally increased with the amount of international remittances ($p = 0.073$) but was not affected by female migration or internal remittances (Table 5.7). For households that harvested maize, the marginal effect of one additional male migrant was a 17.4% decrease in maize production, and the effect of a doubling of international remittances was a 4.6% increase in production (Table 5.8). For a simulated household that sent one male international migrant and received the average value of remittances sent by male international migrants, the positive effect of remittances is greater than the negative effect of departure, leading to net increase in maize production of 11.3%[49]. Using the same logic, a household that sent a male internal migrant would experience a net decrease in production, whereas a household that sent a female international migrant would experience a large increase given that male and female migrants remit in similar amounts. Thus this outcome reveals another tradeoff between the effects of agricultural labor lost to migration and the investment effects of remittances. The fact that maize production significantly declines with male migration but area planted in maize and beans does not (see above) suggests that labor inputs per unit area planted and subsequent yields both decline with the loss of male agricultural labor. The increase in production with international remittances is consistent with the positive effects of remittances on hired labor and chemical input use and the expected effects of those inputs on yields. These

[49] This value was calculated by multiplying the natural logarithm of the mean value of remittances ($530, Chapter 3) by the marginal effect of international remittances on maize production (Table 5.8), and adding to it the marginal effect from the departure of one male migrant (Table 5.8).

findings correspond to those of Taylor and colleagues (2003) who found that cropping income and yields declined with out-migration but the mean value of remittances more than made up for losses due to out-migration.

Among control variables, production increased with education, land area, and black soil and decreased with age of the head and irrigation, indicating that younger, educated households with larger land area and fertile soil are able to produce more maize. Irrigated areas are commonly used for other crops and thus have a negative effect on maize production.

Female laborers

The number of women in the household working on the farm increased with internal remittances ($p = 0.027$) but was unaffected by international remittances or the number of migrants (Table 5.7). A doubling of internal remittances led to a 4.0% increase in the number of female household agricultural laborers (Table 5.7), a small effect which reflects the large household variation in remittances and the small variation in the number of female laborers. The significance of this effect relative to that of international remittances was unexpected, and suggests that internal remittances serve a special role in encouraging women to participate in farm labor and thus may contribute to the feminization of agricultural activities (Katz, 2003; Deere, 2005). A likely mechanism for this effect is that women have greater control over the use of internal remittances relative to international remittances, perhaps because of the smaller magnitude of internal remittances or their method of delivery (i.e., often directly by the visiting migrant). The number of female workers also increased with the number of young and adult women in

the household as expected as well as with the household area planted in coffee, which is harvested by both women and men.

Bean diversity

Bean diversity also marginally increased with internal remittances ($p = 0.093$) and was unaffected by migrant departure or international remittances (Table 5.7). With a doubling of internal remittances the number of number of local bean varieties increased by 2.3% (Table 5.7), a small effect which reflects the large household variation in remittances and the small variation in the number of bean varieties. Alone, international remittances had a non-significant positive effect, but together the effects of both kinds of remittances were jointly marginally significant ($p = 0.094$). Given that this effect occurred in the absence of any remittance effect on subsistence area, it suggests that remittance-receiving households manage more crop varieties in the same area. Since many rural households in the region prefer to consume local crop varieties (Abbott, 2005), remittances may be used to gain access to additional varieties or to free the labor needed to manage additional varieties. This effect might also be related to the increase in women's farm labor with internal remittances and their potential control over these remittances, given that bean diversity also increases with the number of women in the household and women have often been recognized as important repositories of traditional agricultural knowledge (Zimmerer, 2003). Again in this case migration does not appear to undermine (and in fact promotes) the traditional practice of managing multiple crop varieties. Among control variables, the number of adult women had a positive effect on bean diversity and the number of children, age of the head, and single female headship

had negative effects, indicating that young households with many adults manage the most bean varieties.

Summary

Overall the results reveal important effects from the loss of labor and changes in the sex ratio following out-migration, as well as investment-promotion effects due to receipt of internal and international remittances. The loss of male labor led to decreased maize production and the loss of female labor increased reliance on shared labor and decreased reliance on hired labor. The receipt of international remittances increased the use of hired labor and chemical inputs and the receipt of internal remittances increased agrodiversity and women's participation in farm labor. Subsistence area, reciprocal labor and bean diversity are, among the inputs examined here, the ones most associated with traditional agricultural practices, and overall were weakly positively affected by out-migration and remittances. Hired labor and chemical input use involve interaction with agricultural markets and were both promoted by international remittances, suggesting that out-migration can promote the monetization of agriculture at the same time that traditional non-market activities are preserved.

5.7 Discussion

Previous studies have found mixed and contradictory effects of out-migration on smallholder agriculture and asset accumulation, and this study is no exception. Overall, out-migration and remittances had negative effects on cattle ownership; mixed effects on maize production, consumer goods, and the use of hired labor; and positive effects on land rental, agrodiversity, women's farm labor, and the use chemical inputs. As expected

the gender division of labor played an important role and the departure of men and women did not have equivalent impacts on activities and assets, and the departure of women unexpectedly had larger effects in multiple cases. Male out-migration decreased maize production but female out-migration increased land rental, decreased cattle ownership, and led to a shift from hired to reciprocal labor.

Similarly, the effects of internal and international remittances differed as expected but the effects of internal remittances were unexpectedly important, perhaps connected to women's greater control of internal remittances. International remittances increased the use of land rental, hired labor and chemical inputs, while internal remittances increased agrodiversity and female participation in farm work and also appeared to buffer against declines in consumer goods. Thus, the impacts of out-migration on rural livelihoods in the study area are complex, with important roles for male and female out-migration as well as internal and international remittances.

Overall the results do not support the most optimistic or pessimistic of previous accounts of out-migration and agricultural change, nor are they consistent with the expectation of no effects. In particular the results do not consistently support the arguments that out-migration and remittances will undermine traditional livelihoods and agricultural production, and ultimately lead to agricultural abandonment and reforestation. Instead, households in the study area engage in a series of interconnected shifts in livelihood assets and activities in order to mitigate the effects of out-migration and to benefit from remittances. In response to lower consumption demands following female out-migration, households shift into land rental for cultivation and away from cattle ranching, and towards the use of reciprocal instead of hired labor. To benefit from

international remittances and mitigate the effects of lost labor, households invest remittances in hired labor and chemical inputs. These shifts in livelihood strategies do not appear to endanger traditional agricultural practices such as reciprocal labor or management of diverse local cultivars, but they do appear to result in increased interaction with markets and thus a gradual monetization of the agricultural system. Taken together, these shifts do not represent a dramatic transformation, and it appears that smallholder agriculture in the study area is likely to continue in a similar form despite large out-flows of population and in-flows of remittances, highlighting the flexibility and resiliency of rural livelihoods in the face of significant economic and demographic change.

This study also has important methodological implications for future studies of migration and rural livelihoods. In this study, the incorporation of multiple measures of out-migration in models of multiple outcomes revealed complex effects of migration, effects which would not have been visible to a study using a single measure of migration (e.g., remittances) and examining a single outcome (e.g., agricultural income), nor to a study that did not incorporate multivariate analysis. Consistent with previous studies, this study drew on limited retrospective data and more detailed cross-sectional data to examine longitudinal changes in asset ownership and cross-sectional determinants of agricultural activities. A challenge for future studies will be to collect or analyze panel datasets with information on agricultural activities at multiple points in time in order to better tease out the complex and contradictory effects of migration on agricultural change.

CHAPTER 6

CONCLUSION

This work used survey and statistical methods to investigate the drivers and effects of rural out-migration in the southern Ecuadorian Andes, with a focus on connections to agriculture, the environment and gender. The results have important implications for theory, policy, and research methods.

5.1 Implications for Theory

The findings presented here challenge several empirical generalizations which are commonly accepted in the literature on migration, environment and development. Lack of access to land is commonly assumed to promote out-migration in the developing world (e.g., Shaw, 1974; Potts, 2006), but the analysis of migration presented in Chapter 4 suggests that this generalization is incomplete. In this case, rural-urban migration did decrease with land ownership but rural-rural and international migration genreally increased, particularly for men. These findings suggest that gender norms allow men but not women to draw on land as capital to facilitate rural and international migrations. These findings are consistent with a small number of previous studies which have tested for and found nonlinear relationships between land and migration that vary across migration streams, though the specific form of the relationship differs across studies (e.g., VanWey, 2005). The results are also consistent with a larger number of studies (e.g.,

Kanaiaupuni, 2000) which have demonstrated important differences in the drivers of migration for men and women. Future studies should thus examine nonlinear effects of land area and test for differences in effects for men and women. Cross-regional studies (e.g., Massey et al., 2006) will likely be necessary to elucidate how large-scale contextual factors such as gender norms, production systems and credit markets alter the nature of migration-land and migration-gender relationships.

Negative environmental conditions are also commonly assumed to promote out-migration (e.g., Myers, 2002), but in this case negative environmental conditions did not consistently increase migration and were more important for internal migration, contrary to the literature on environmental refugees (Chapter 4). Instead, stable environmental characteristics such as flat topography appear to act as environmental capital, facilitating an increase in out-migration to internal destinations. Negative environmental characteristics that indicate risk such as fluctuating harvests also increase out-migration to internal destinations, suggesting that migration can both draw on stable environmental capital and serve as a form of diversification against environmental risk. Environmental conditions had few significant effects on international migration, likely because potential international migrants, who tend to depart from wealthier households, are less concerned about risks to subsistence production. Previous studies of migration by Massey and colleagues (2007) and Henry and colleagues (2004) tested fewer environmental variables than this study but also found mixed effects that were more important for shorter-distance migrations. Future studies of migration should test the effects of these and other categories of environmental variables (e.g., access to forest products and exposure to

natural hazards) and explore interactions between land area and environmental conditions to further clarify the nature of environmental effects on out-migration.

The consequences of out-migration and remittances for rural livelihoods have also been the subject of debate, with various authors perceiving predominantly positive (e.g., Taylor et al., 1996), predominantly negative (e.g., Binford, 2003) or few overall effects (e.g., Jokisch, 2002). Chapter 5 examined the consequences of migration and remittances for asset accumulation and agricultural activities, and the results indicate a more nuanced story than any of these three generalizations. In this case, households suffered negative consequences from out-migration but also benefited from remittances and adjusted livelihood strategies to cope with these changes. Highlighting the importance of gender norms for participation in agricultural activities, the departure of female migrants was particularly important and led to increased reliance on renting land relative to cattle ranching and on the use of reciprocal labor for agriculture relative to hired labor. Among the agricultural activities examined, traditional activities such as reciprocal labor and management of diverse crop varieties were not negatively affected by out-migration, but market-oriented activities such as renting land, hiring labor and purchasing chemical inputs were positively affected, suggesting that migration can promote the monetization of agriculture at the same time as traditional activities continue. To test the generality of these findings future studies of the consequences of migration should compare the effects of male and female out-migrants on both market and subsistence-oriented activities, and investigate other aspects such as the effects of return migration.

Beyond these advances, at least three other relevant theoretical issues remain to be addressed by future quantitative studies. Firstly, this and other studies have

demonstrated environmental effects on out-migration (Chapter 4; Henry et al., 2004; Massey et al., 2007), but the specific mechanisms of these effects are not clear. Do environmental effects on out-migration occur because of altered agricultural yields, the perception of altered yields in the future, the ability to use environmentally-valuable lands as collateral for loans, or some other mechanism? Datasets with information on out-migration, agricultural yields, credit use, and environmental conditions over time will be needed to address these questions.

Secondly, at what scales are environmental effects on out-migration most important? This study identified important environmental effects on out-migration at household and community scales (Chapter 4), but many anecdotal accounts of "environmental refugees" focus on larger scales, such as accounts from the regional-scale drought in the study area in the 1970s (OAS, 1992). Larger scale datasets, perhaps combining county-level environmental data with census data on migration, will be needed to test for these effects. Similarly, this and other studies have documented effects of out-migration on sending households (Chapter 5; Adams, 1998; Taylor et al., 2003), but few studies have investigated contextual effects of migrant departure and remittances at the scale of the community or beyond (for exceptions see Entwisle and Tong, 2005; Ford et al., 2007).

Finally, does out-migration alter environmental conditions in a way that either promotes or reduces further out-migration? This study addressed environmental effects on migration as well as subsequent effects of migration on agriculture, but was not able to "complete the circle" and test for feedback effects or bidirectional causality between migration and environmental change. Similar feedbacks might exist between migration

and household wealth or education. Data on migration, agricultural activities and environmental conditions from multiple points in time will be necessary to test for these effects.

5.2 Implications for Development and Conservation

These findings are also relevant to development policies in the study area and other regions of out-migration. Among policy-makers in Ecuador and elsewhere in Latin America, migration is largely presumed to originate from poverty and to have negative effects on rural livelihoods. Slowing out-migration is a frequently voiced (e.g., Associated Press, 2007) if rarely implemented policy goal. This study shows that while urban migration is most common among the land-poor, assets such as land and cattle actually enable migration to rural and international destinations (Chapter 4). Thus, success in rural development efforts may increase rather than decrease migration in some cases (Beauchemin and Schoumaker, 2005). Specific policies that should be evaluated for their impact on migration include school construction and the extension of other services, the construction and improvement of transportation infrastructure, and the implementation of welfare-like cash transfer systems such as Ecuador's Human Development Bond. The results presented in Chapter 4 suggest that urban migration would likely decrease with increased access to rural services, and that international migration would likely decrease with further extension of the network of paved roads but might increase with easier access to education. These results contrast with those of Beauchemin and Schoumaker (2005) for Burkina Faso, who found that rural-urban migration increased with rural services and infrastructure, perhaps reflecting the deeper

poverty of that setting. Stecklov and colleagues (2005) and Gonzalez-Konig and Wodon (2005) showed respectively that two Mexican anti-poverty programs, PROGRESA and PROCAMPO, both reduced rural out-migration, suggesting that Ecuador's program could have similar effects. Beyond the origin area, policy changes in destination areas, such as regarding frontier settlement in the Amazon or migrant entry into Spain, are also likely to influence migration.

These results also suggest that migration does not necessarily undermine rural livelihoods, but instead that migration and remittances have complex and countervailing effects on agriculture (Chapter 5). Thus the results do not support the need for specific policies to mitigate the effects of migration, but the deep poverty of the study area (Chapter 2) nonetheless demands increased state investment in education, health services, transportation infrastructure and microcredit. Improvements to rural roads are a particular necessity given the near-inaccessibility of many communities during the 3-4 month rainy season. Overall, the consequences of international migration and remittances were largely positive for origin households (Chapter 5), suggesting that policies to facilitate international migration and remittances would provide a net benefit to impoverished origin areas such as southern Loja.

The findings are also relevant to policies for environmental conservation. Conservationists have been among the most prominent in promoting the narrative of "environmental refugees" (e.g., Myers, 2002) as part of a larger story connecting poverty and environmental degradation. Conservationists should take note that this study and others which have tested for environmental effects on migration do not provide consistent support for the assumptions implicit in that narrative (Chapter 4; Henry et al., 2004;

Massey et al., 2007). Similarly, studies which have examined connections between poverty and environmental degradation do not support a strong connection (reviewed by Duraiappah, 1998). Conservationists have hypothesized that rural out-migration would lead to land abandonment and reforestation as part of a "forest transition" in origin areas of migration (Rudel et al., 2005). This hypothesis has been supported by studies from middle-income countries (e.g., Albania: Muller and Sikor, 2006), but in a poor and environmentally marginal setting the present study finds no effects of out-migration on the area in subsistence cultivation (Chapter 5). The number of cattle owned per household, however, did decrease over time and with migration, suggesting that peripheral grazing areas may be left to secondary forest succession in the future. This study supports an additional link between migration and the environment in that the use of chemical inputs for agriculture including fertilizer, pesticides and herbicides increased with international migrant remittances (Chapter 5). Use of these inputs can lead to human exposure to toxins as well as impacts on freshwater ecosystems and wildlife, suggesting that increased outreach on these dangers is likely warranted in the study area.

Beyond their implications for specific policies, the results provide insight into possible conservation and development futures for the study area. Given the apparent acceleration of rural-urban migration in the latter part of the study period (Chapter 4), rural population decline is likely to continue, as are significant remittance flows given the large number of current international migrants. In the longer term, remittance flows to the study area are likely to decline given the slowing of international out-migration after 2003 (Chapter 4) and stricter border enforcement on the part of Spain and United States (Chapter 2). To date, the impacts of labor lost to out-migration on agriculture and rural

land use appear to have been modest (Chapter 5). In the future some communities may reach a population decline threshold at which large areas of agricultural land are abandoned, but given the lack of examples of this process from elsewhere in Ecuador this seems unlikely to occur in the near future. Similarly, international remittances are likely to partially alleviate rather than dramatically improve the endemic poverty of the study area, reflecting its low agricultural productivity, isolation, and poor transportation infrastructure. Instead of the rural communities that were the focus of the study, the central town of Cariamanga is likely to benefit the most from international remittances, given the preference for return migrants to live in an urban setting, the use of remittances to purchase goods at regional markets, and the high concentration of international migrants from Cariamanga itself. Life in rural communities is most likely to remain largely the same, absent another devastating drought or a dramatic increase in state investment.

5.3 Implications for Research Methods

Finally, this study points to new directions in survey data collection and analysis, as well as to opportunities for integration of other types of methods. Drawing on approaches from social demography and population-environment research, this study applied a novel combination of methods to study migration, development, and the environment. These included a structured community survey, construction of a GIS, a structured household survey that collected life histories and information on each agricultural plot, and analysis using nonlinear multivariate models. This approach allowed me to test multivariate hypotheses about both the drivers and consequences of

migration, with results that are generalizable to the entire study area. The methods are also replicable by future studies of migration, and are relevant to other human-environment and development issues such as land use change and the impacts of conservation and development policies. Nonetheless, the sample size of this study is modest compared to some quantitative studies of migration (e.g., Massey and Espinosa, 1997), and remains to be replicated at a larger scale. This would allow more detailed investigation of how the relationships described differ across regions and across sub-populations, as well as the incorporation of a larger number of contextual measures given a larger sample of communities. There are also several potential extensions of the methods for survey data collection and statistical analysis, as described below.

Potential extensions of the survey methods include the collection of measures of time use and attitudes, more detailed data collection on whole departing households, and a follow-up survey with the same households. Methods for survey data collection focusing on individual time use and attitudes have been developed by other social science disciplines (e.g., DeGraff et al., 1994) but have not commonly been incorporated in studies of out-migration. Incorporation of these approaches would provide additional end points to measure the impacts of migration, e.g., on perceptions of migration or on time dedicated to different agricultural tasks by men and women. These measures likely could not be collected retrospectively, but a study with data collection at multiple time points could use measures of attitudes and decision-making at time one to examine how gender norms, for example, influence subsequent out-migration of men and women. New methods for incorporating latent variables with multiple indicators into event history models would likely be useful in this effort (Muthén and Masyn, 2005). Another useful

extension of the survey data collection would be to collect more detailed information on entire departed households in order to incorporate them into multivariate models. This data could be collected from multiple community members or from the household or individual in the community indicated to be most knowledge about the departed household, and would allow an assessment of how the drivers of out-migration differ for migrant-sending households and whole departing households.

An additional extension would be to implement a follow-up survey in the future with the same households and individuals, which could potentially include tracking out-migrants to be interviewed in their destinations. This approach, though obviously demanding a study of longer duration and larger scale, circumvents many of the limitations of retrospective data collection, and as described above would potentially allow a number of novel analyses. If migrants could be tracked over a long enough period of time (perhaps 20-40 years) it would also be possible to examine the influence of time-varying regional and macro-scale factors such as economic growth, inflation, agricultural prices, droughts, and immigration policies in destination countries (e.g., Massey and Espinosa, 1997). These and similar methods have been applied to collect information on migration at multiple points in time by a small number of large-scale survey-based projects, including the Nang Rong Projects (Rindfuss et al., 2007), the Chitwan Valley Family Study (Massey et al., 2007), the Mexican Migration Project (Massey and Espinosa, 1997), and the connected Latin American Migration Project (LAMP, Massey et al., 2006). As cited, these projects have produced many of the key studies in this field, but ultimately even multi-country projects such as LAMP typically do not include enough countries to assess the influence of national-scale characteristics on migration, and thus

for that purpose it is typically necessary to resort to aggregate statistics from censuses and other less detailed data sources (e.g., Clark et al., 2004).

In addition to these extensions of the survey methods, at least three important extensions of the statistical methods described in Chapters 4 and 5 are also desirable. Firstly, the multinomial event history model described in Chapter 4 includes predictors at multiple levels (individual, household and community), and this clustering was accounted for by including the Huber-White correction of the standard errors (Angeles et al., 2005). The *multilevel* multinomial event history model is an extension of this approach that explicitly addresses the hierarchical nature of the predictors by incorporating a shared random effect (i.e., error term) for all members of the same higher-level unit, e.g. for each individual within a given household (Steele et al., 2004). This model allows more precise estimation of higher-level effects but cannot be estimated in standard statistical packages. Secondly, the tobit and Poisson models presented in Chapter 5 do not incorporate any corrections for the potential endogeneity of migration, though the sector-level fixed effects and the large set of controls likely account for many factors that influenced both migration and assets or agriculture. Following Taylor and colleagues (2003) and Garip (2007), instrumental-variable methods could be used to address this potential endogeneity, although these methods require relatively restrictive assumptions about the direction of causal pathways. This approach could be further extended to examine how land, input and labor use are influenced by migration and subsequently affect outcomes such as harvests. Thirdly, the tobit and Poisson models estimated in Chapter 5 do not address tradeoffs and synergies affecting accumulation of different assets (e.g., land rental and cattle) or participation in different agricultural activities (e.g.,

use of hired labor and chemical inputs). These tradeoffs and synergies could be addressed by estimating a multi-equation seemingly-unrelated tobit model, which would allow the regression errors to correlate across households (Huang, 1999), though again this model cannot be estimated in standard statistical packages.

In addition to these extensions to the core survey and statistical methods, opportunities also exist to integrate these methods with qualitative and spatial approaches. The majority of previous studies of migration and rural livelihoods have drawn on ethnographic methods to provide rich local detail and insight into possible causal mechanisms. The approach of this study complements ethnographic methods by allowing replication, hypothesis testing, and generalization, and the two approaches can usefully be combined in the same study area. Examples of linkages between the two approaches include a prior qualitative effort that informs the survey (beyond the typical survey pre-testing; see Holt et al., 2004), simultaneous structured and qualitative interviewing in the same communities (e.g., Massey and Zenteno, 2000), and follow-up qualitative interviews to clarify quantitative results or investigate anomalous cases (e.g., Pearce, 2002). Structured surveys can also better address the interests of qualitative researchers by including questions about perceptions and attitudes, as mentioned above. This quantitative-qualitative combination has been applied by studies in other fields (e.g., Kanbur and Shaffer, 2007) but by few large-scale studies of migration or human-environment relationships (for an exception see Simmons et al., 2007). Qualitative researchers have commonly criticized quantitative approaches as positivist and reductionist (e.g., Binford, 2003), but my hope is that this study demonstrates that survey

and statistical methods can be part of a nuanced, postpostivist approach that addresses issues of interest to human geographers such as gender and context.

Opportunities also exist to further integrate the survey methods of this study with spatial methods from GIScience. This study incorporated a relatively simple GIS including community locations, a digital elevation model, a precipitation surface, and a map of the road network. Additional useful spatial data sources would include spatial locations of household agricultural plots, a time series of remotely-sensed imagery, and time-varying spatial information on precipitation. Together, these data sources would allow the creation of additional time-varying household and community-level variables measuring environmental suitability, such as a soil moisture index (Parker, 1982) for the primary household agricultural plot or an annual measure of vegetation greenness for the community territory as a whole. These measures would complement the primarily survey-based measures used in this study, and would be particularly useful to measure of the severity of environmental shocks and environmental variation over time. A key challenge for future studies will be to determine which environmental measures and data sources best predict out-migration. GIScientists have also begun to use cellular automata and agent-based models to simulate human-environment relationships such as those described by this study (Parker et al., 2003). These models are still at an early stage of development and their data requirements are substantial, but in the future the results presented here could be used to inform such a model, potentially providing a novel approach to investigate feedbacks between migration, development and environmental change.

APPENDIX 1

Universidad de Carolina del Norte
ENCUESTA DE MIGRACIÓN Y RECURSOS NATURALES
Loja, Ecuador, 2006

A1. Cantón:_____ **A2.** Parroquia:_____

A3. Sector censal:_____ **A4.** Comunidad:_____

A5. No. de la lista de hogares:_____ **A6.** Estrato de la muestra:_____

A7. Nombre del jefe/jefa:_____

A8. Nombre de la esposa/esposo:_____

A9. Distancia de la vivienda a la escuela de esta comunidad:_____m / km (No hay escuela___)

A10. Distancia de la vivienda a una vía transitable por carro (temporal o permanente):

_____ m / km

A11. Ubicación y descripción de la vivienda:_____

_____

OJO: Cualquier habitante de la vivienda mayor de 20 años se puede considerar como entrevistado posible, pero indagar bien para verificar que tiene un conocimiento amplio del las actividades y historia del hogar.

A12. Resultados: Si cambia el entrevistado, llenar otra columna.

	1ª Visita	2ª Visita	3ª Visita
Entrevistador/a			
Fecha (día/mes)			
Entrevistado/s			
Código del entrevistado/s (B1)			
Secciones contestadas			
Hora que empezó			
Hora que terminó			
Resultado (códigos)			
Próxima visita			

Resultado: 1. Completada satisfactoriamente **2**. Incompleta **3**. Se negó a responder
4. No se encuentra el jefe ni la esposa en la casa. **5**. No se pudo encontrar la casa.
6. No se pudo llegar a la casa. **7**. Otro: especifique

A13. Comentarios generales del entrevistador y supervisor:_____

_____

_____

Códigos universales: NS = No sabe NA = No aplica NQ = No quiere contestar

B1. HABITANTES PERMANENTES DE LA VIVIENDA: Por favor indique los nombres de todas las personas que viven permanentemente en esta vivienda, empezando con la persona que tiene el cargo económico principal. **(Incluir personas que salen temporalmente pero han vivido en la casa por 6 meses o más de los últimos 12 meses, los que trabajan afuera pero vuelven a la casa cada fin de semana, y los recién llegados que van a permanecer en la casa**. Excluir personas que solo vienen para visitar.)

#	Nombre	Sexo Hombre..1 Mujer….2	Parentesco con el jefe y la esposa (código)	Edad <1 año….0 NS: estimar	Llenar C para personas mayor de 15 años: Sí...1 No...0
1			1		
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Parentesco: **1**. Jefe/a **2**. Esposo/a **3**. Hijo/a de jefe/esposa **4**. Padre/madre de jefe/esposa
5. Hermano/a de jefe/esposa **6**. Nieto de jefe/esposa **7**. Otro pariente **8**. No pariente

B2. HABITANTES DE LA VIVIENDA QUE HAN SALIDO
¿Hay una persona o personas que desde 1995 han vivido con Ustedes en esta vivienda por más de seis meses contínuos pero ha salido para vivir en otra vivienda u otro lugar, incluyendo niños? Excluir personas muertas.
No___ Sí___ → Por favor indique los nombres de estas personas.

#	Nombre	Sexo Hombre..1 Mujer….2	Parentesco con el jefe y la esposa (código)	Edad actual <1 año….0 NS: estimar	¿En qué año salió de la casa definitivamente?	Llenar C para los que tenían 15 años o más cuando salieron: Sí...1 No...0
21						
22						
23						
24						
25						
26						
27						
28						

C1. HISTORIA INDIVIDUAL: Hoja ____ de ____ Nombre:_____ Código de la parte B:_____

Llenar una hoja para cada habitante actual que tiene 15 años o más **(del B1),** y cada habitante que tenía 15 años o más cuando salió de la casa **(del B2).**

Voy a preguntarle acerca de algunas eventos en la vida de [persona X] empezando en el año 1995.

Actividad / Año	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**Otras Preguntas y Comentarios**
Edad													
¿**Donde vivía**? Esta casa...0 Otra casa de esta comunidad…9 Otro lugar…(enumerar (1-4) y anotar)													Desde 1995, ¿**salió esta persona para vivir en otro cantón o país** por seis meses o más? No___ Sí___ (→ **D1**)
1. Cuidad, Cantón o País:_____ Provincia:_____ Es: Campo___ Ciudad___ **2**. Cuidad, Cantón o País:_____ Provincia:_____ Es: Campo___ Ciudad___ **3**. Cuidad, Cantón o País:_____ Provincia:_____ Es: Campo___ Ciudad___ **4**. Cuidad, Cantón o País:_____ Provincia:_____ Es: Campo___ Ciudad___													
¿Qué **nivel de educación** alcanzó? (código)													
¿**Asistía a una escuela**, colegio o universidad? No…0 Sí…1												X	
¿Cuál era su **estado civil**? (código)													Si estaba unido o casado en 1995: ¿**En que año se casó** o se unió?_____
¿**Ha trabajado en un terreno familiar** o arrendado para una actividad agropecuaria? No…0 Sí…1													

Nivel de educación: **1**.Ningún **2**.Primaria incompleta **3**.Primaria completa **4**.Secundaria incompleta **5**.Secundaria completa **6**.Escuela técnica **7**.Universidad

Estado civil: **1**. Soltero **2**. Casado **3**. Unión libre **4**. Separado **5**. Divorciado **6**. Viudo

C1. Nombre:_____ Código de la parte B:_____

Actividad / Año	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**Otras Preguntas y Comentarios**
¿**Ha trabajado por dinero** afuera de su casa, sin salir a dormir en otro lugar? No…0 Sí…1													Si ha trabajado en '05 o '06: ¿**Cuánto ha ganado** en promedio mensual **de estes trabajos** desde hace 12 meses?_____
Si ha trabajado por dinero desde 1995: ¿**Qué tipos de trabajo ha hecho desde 1995**? (respuesta múltiple) Jornalero agrícola___ Ganaderia___ Comercio___ Albañil___ Sector público___ Empleada domestica___ Transporte___ Otro: especifique_____													
¿**Ha hechos trabajos temporales en otro lugar de seis meses o menos**, teniendo que dormir allí? Exlcuir trabajos mencionados arriba. No...0 Sí....1													Si ha hecho trabajos temporales en '05 o '06: ¿**Cuánto ha ganado** en promedio mensual **de los trabajos temporales** desde hace 12 meses?_____
Si ha hecho trabajos temporales: ¿**Adondé ha hecho trabajos temporales desde 1995?** A. Ciudad o Cantón:_____ Provincia:_____ Es: Campo___ Ciudad___ B. Ciudad o Cantón:_____ Provincia:_____ Es: Campo___ Ciudad_ C. Ciudad o Cantón:_____ Provincia:_____ Es: Campo___ Ciudad___ D. Ciudad o Cantón:_____ Provincia:_____ Es: Campo___ Ciudad___													
¿Cuál era su **actividad principal**? (código)												X	

Actividad principal: 1. Estudios **2.** Estudios y trabajo **3.** Ama de casa o tareas del hogar **4.** Trabajar en la finca familiar **5**. Trabajo pagado afuera del hogar **5.** Negocio familiar **6.** Servicio militar **7.** Desempleado, buscando trabajo **8.** Jubilado, pensionado **9.** No puede trabajar, discapacitado **10.** Otro

C2. ¿Vivió esta persona fuera del cantón por seis meses o más antes de 1995?

No___ → **D1 o la proxima persona** Sí___ → ¿En qué otros lugares ha vivido?

A. Ciudad, Cantón o país:_____ Provincia:_____ Era: Campo___ Ciudad___

B. Ciudad, Cantón o país:_____ Provincia:_____ Era: Campo___ Ciudad___

C. Ciudad, Cantón o país:_____ Provincia:_____ Era: Campo___ Ciudad___

D. Ciudad, Cantón o país:_____ Provincia:_____ Era: Campo___ Ciudad___

C3. ¿**En qué año llegó esta persona para vivir en la comunidad definitivamente**, sin salir nuevamente por seis meses o más?_____

D1. SALIDAS DE LA VIVIENDA

Revisando la segunda fila de C, ¿han salido habitantes de la vivienda para vivir en otro cantón, otra provincia, o otro país por seis meses o más desde 1995? **Incluir habitantes actuales que han regresado (de B1) y habitantes que han salido definitivamente (de B2).**
No___ → **D2** Sí___ Llenar para la ultima salida del cantón de cada persona que ha salido.

Migrante	1	2	3	4	5	6
Código de la parte B:						
Nombre:						
Destino:						
¿Qué factores le influyó para salir? (respuesta múltiple)						
¿Cuáles fueron sus fuentes de información acerca del destino?(respuesta múltiple)						
¿Quiénes influyeron en la decisión? (respuesta múltiple)						
¿Recibió alguna ayuda para viajar o establecerse allá? No...0 Sí...1						
Si recibió ayuda: ¿Quién le ayudo? (respuesta múltiple)						
Si recibió ayuda:¿Qué tipo de ayuda recibió? (respuesta múltiple)						
¿Desde que salío, les ha mandado o traido dinero? No...0 Sí...1						
Si ha mandado dinero: ¿Cómo se lo manda? (respuesta múltiple)						
Si ha mandado dinero: ¿Ha mandado o traido en los últimos doce meses? No...0 Sí...1						
Si ha mandado dinero en el ultimo año: ¿Cuánto ha mandado? (respuesta múltiple)						
Si ha mandado dinero en el ultimo año: ¿En qué gastaron lo que mandaron? (respuesta múltiple)						

¿Qué factores?: **1**. Trabajo **2**. Educación **3**. Familia **4**. Amigos **5**. Calidad de vida. **6**. Tierra.
7. Servicio militar **8.** Problemas en la agricultura **9**. Problemas en la comunidad **10**. Otro
Fuentes de información: **1**. Visitas previas **2**. Familiares **3**. Amigos, contactos
4. Agencia de empleo, coyote. **5**. Radio, televisión, periódicos **6**. Otro
¿Quiénes le influyeron?: **1**. Padres del migrante **2**. Esposo/a **3**. Hijo/s **4**. Otros parientes
5. Amigos, contactos aquí **6**. Amigos, contactos allí **7**. El migrante **8**. Nadie **9**. Otro
¿Quien le ayudo?: **1**. Padres del migrante **2**. Esposo/a del migrante **3**. Hijo/s del migrante
4. Otros parientes **5**. Amigos, contactos aquí **6**. Amigos, contactos allí **7**. Nadie **8**. Otro
¿Tipo de ayuda?: 1. Dinero, préstamo **2.**Buscar trabajo, tierra **3.**Hospedaje, comida. **4**.Otro: especifique
¿Cómo lo manda?: 1. Por banco, Western Union, Delgado Travel, similares. **2.** Con amigos, familiares.
3. Entrega personalmente **4.** Otro
¿En qué lo gastaron?: **1**. Animales **2**. Cultivos **3.** Construir o mejorar la casa **4**. Pagar deuda
5. Gastos medicinales **6**. Comprar insumos agropecuarios **7**. Víveres para la familia **8**. Educación
9. Viaje a otro país. **10**. Otro

D2. OTROS HIJOS DEL JEFE Y LA ESPOSA

Aparte de las personas ya mencionadas, ¿tienen el jefe y su esposa otros **hijos que salieron de la casa antes de 1995 y viven fuera del cantón**?

No___ → **D3** Sí___ → ¿Cómo se llaman? Usar una fila para cada lugar en que han vivido, empezando con el primer destino afuera del cantón.

#	Nombre	Sexo Hombre..1 Mujer….2	Edad	Lugar de residencia:		Es: 1.campo 2.ciudad	¿En qué año empezó a vivir allá?	Si vivió en otro sitio después, llenar otra fila. Sí...1 No...0
				Ciudad, Cantón o país	Provincia			
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

D3. ¿Piensa Usted salir de la comunidad? No___ → **D5** Sí___ No sabe___

D4. Si piensa salir: ¿Adónde piensa salir? No sabe___ Ciudad, Cantón o País_____ Provincia_____

D5. ¿Desea que sus hijos o nietos salgan de la comunidad? No___ → **E1** Sí___ NS___ NA___

D6. Si desea que salgan: ¿Si salen, adónde prefiere Usted que vayan?

_____

E1. ACTIVIDADES ECONÓMICAS DE LA VIVIENDA: Estas preguntas refieren a todas las personas que vivieron en esta vivienda en el año indicado. Empezar en 1995 o el primer año que vivió un miembro del hogar en esta vivienda. Poner X para años antes de que ocuparon la vivienda.

Actividad / Año	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**Otras Preguntas y Comentarios**
¿Cuál fue la **fuente más importante de ingresos y sustento familiar**? (código)													
¿**Son o han sido dueños de uno o más terrenos** de uso agropecuario? Incluir tierras botadas. No...0 Uno o más...(enumerar)													Calcular el numero de terrenos propios differentes que han manejado desde 1995: _____
¿Usan o han usado **otros terrenos arrendados o prestadas**? No...0 Sí...(enumerar)													Calcular el numero de terrenos arrendados o prestados diferentes que han manejado desde 1995: _____
Aparte de los productos de la finca, ¿tenían algún **negocio familiar**? No…0 Sí…(respuesta múltiple)													Si tenía en '05 o '06: ¿Cuánto ha ganado mensualmente en promedio de los negocios desde hace 12 meses? $_____
¿Han recibido algún **préstamo**? No…0 Sí… (enumerar y anotar)													Si ha recibido un préstamo: ¿Cuánto debe todavía? $_____
1. Fuente____ ¿En qué gastó?____ **2**. Fuente____ ¿En qué gastó?____ **3**. Fuente____ ¿En qué gastó?____ **4**. Fuente____ ¿ En qué gastó?____													
¿Ha recibido algun miembro del hogar el **Bono Solidario**? No…0 Sí…1	X	X	X										
¿Tenían una **casa propia**? No…0 Sí…1													
¿Ha recibido **asistencia técnica** de alguna institución? No…0 Sí… (enumerar y anotar)													
1. Tipos: ___ Fuente: _____ ¿Fue útil? No___ Sí___ **3**. Tipos: ___ Fuente: _____ ¿Fue útil? No___ Sí___													
2. Tipos: ___ Fuente: _____ ¿Fue útil? No___ Sí___ **4**. Tipos: ___ Fuente: _____ ¿Fue útil? No___ Sí___													

Fuente de ingresos: **1**. Trabajo pagado **2**. Cultivos **3**. Animales **4**. Negocio familiar **5**. Remesas de migrantes **6**. Otro
Negocios familiares: **1**. Tienda **2**. Servicio de transporte **3**. Chanchero, galpón de pollos, criadero de cuyes. **4**. Carpintería, mueblería. **5**. Construcción de casas. **6**. Commerciante agropecuario. **7**. Comedor, preparación de comida. **8.** Otro
Fuente del préstamo: **1**. Amigo, pariente **2**. Fondos de la comunidad **3**. Chulquero **4**. Banco, cooperativa **5**. Commerciante agropecuario. **6**. Otro
¿En qué gastó el préstamo?: **1**. Animales **2**. Cultivos **3.** Construir o mejorar la casa **4**. Pagar deuda **5**. Gastos medicinales **6**. Comprar insumos agropecuarios **7**. Víveres para la familia **8**. Educación **9**. Viaje a otro país. **10**. Otro
Tipo de asistencia: 1. Cultivos **2.** Animales **3.** Negocios pequeños. **4.** Bosques, árboles, medio ambiente. **5.** Otro

E2. ACTIVIDADES AGRÍCOLAS DE LA VIVIENDA

Del E1, ¿ha manejado el hogar uno **o más terrenos agrícolas, sea propia o arrendado**, desde 1995?
No___ → **G** Sí___

Del E1,¿Manejó el hogar un terreno agropecuario **en 2005**?
No___ → **E2.9** Sí___

E2.1 En los últimos 12 meses, ¿han pagado jornaleros para trabajar en los terrenos?
No___ → **E2.2** Sí___ → ¿Cuántos jornales?_____

E2.2 En los últimos 12 meses, ¿han trabajado personas de otras viviendas como prestamanos en sus terrenos? No___ → **E2.3** Sí___ → ¿Cuántos jornales?_____

E2.3 ¿Han sembrado maíz en los últimos doce meses? No___ → **E2.5** Sí___

E2.4 ¿Cuantos variedades o híbridos sembraron? ____
¿Cuantos variedades criollas? ____ ¿Cuantos variedades mejoradas? ____

E2.5 ¿Han sembrado poroto en los últimos doce meses? No___ → **2.7** Sí___

E2.6 ¿Cuantos variedades o híbridos sembraron? ____
¿Cuantos variedades criollas? ____ ¿Cuantos variedades mejoradas? ____

E2.7 ¿Han tenido estes problemas en los últimos 12 meses? Ninguno___ → **2.8**
Plagas___ Heladas___ Erosión de suelos___ Suelos cansados___

E2.8 ¿Han usado estes insumos en los últimos 12 meses?
Ninguno___ → **E2.9**
Fertilizantes, urea___ → ¿Cuánto ha gastado en los últimos 12 meses? $_____
Gallinaza, caca de animales___ → ¿Cuánto ha gastado en los últimos 12 meses? $_____
Pesticidas___ → ¿Cuánto ha gastado en los últimos 12 meses? $_____
Herbicidas, matamontes___ → ¿Cuánto ha gastado en los últimos 12 meses? $_____
Insumos veterinarios ___ → ¿Cuánto ha gastado en los últimos 12 meses? $_____

E2.9 Desde 1995, ¿qué años ha sido de buenas o malas cosechas?
Solo cosechas regulares___ → **E2.10**
Malas___ → ¿Qué años?_____
Buenas___ → ¿Qué años?_____

E2.10 Hace 10 años (o el año que empezaron a trabajar los terrenos), ¿pagaron jornaleros para trabajar en los terrenos? No___ Sí___

E2.11 Problemas en los terrenos	Plagas	Heladas	Erosión de suelos	Suelos cansados
¿Tenía este problema hace 10 años (o el año que empezaron a trabajar los terrenos)? No…0 Sí…1				
Si tenía el problema: ¿Desde 1995 (o el año que empezaron a trabajar los terrenos) el problema ha ...? Empeorado...1 Mantenido igual...2 Mejorado...3				

F1. CARACTERÍSTICAS DEL TERRENO: Terreno ____ de ____ total indicado en E1.1.

Llenar para cada terreno, sea propio o arrendado. Empezar en 1995 o el primer año que tenían o manejaron el terreno. Poner X para años en que no tenían o manejaron el terreno.

F1.1 Ubicación del terreno:_____

F1.2 Actividad / Año	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
¿**De qué tamaño** era el terreno? Si mide en tareas, especificar que sea una tarea de 12 por 12 brazas.	ha cuadtar	ha cuadtar	ha cuadtar	ha cuadtar	ha cuadtar	ha cuadtar	ha cuadtar	ha cuadtar	ha cuadtar	ha cuadtar	ha cuadtar	ha cuadtar
¿**A quién pertenecío el terreno**? Persona que vivió en otra casa...0 Persona que vivió en esta casa..1 →												
Si pertenecío a otro vivienda: ¿**Este terreno fue...** Arrendado...1 Prestado...2 Al partir...3												
Si pertenecío a este vivienda: ¿**Quién manejó el terreno principalmente**? Personas que vivieron en otra casa...0 Personas que vivieron en esta casa...1												
¿**Tenía riego**? No…0 Sí...1												

F1.3 ¿La topografía predominante del terreno es...? Plano___ Ondulado___ Pendiente___

F1.4 ¿Qué tipo de suelo tiene principalmente?
Negro___ Arenoso___ Cascajoso___ Amarillo/rojo___

F1.5 ¿La calidad del suelo es…? Muy buena___ Buena___ Regular___ Mala___

F1.6 ¿La calidad del suelo ha empeorado, mantenido igual o mejorado desde 1995 (o el año que empezaron a manejarla)? Empeorado___ Igual___ Mejorado___

F1.7 Si ha tenido riego: ¿La cantidad de agua de riego para este terreno ha bajado, mantenido o subido desde 1995 (o cuando empezó a manejarla)? Bajado___ Igual___ Subido___

F1.8 Si consigueron un terreno propio desde 1995:
¿Cómo lo consigueron? Comprado___ Herencia o regalo___ Comuna___

F1.9 Si arrendaron de otros personas en ’05 o ‘06:
¿Cuánto pagaron en arriendo en los últimos 12 meses? $_____

F2. USO DE TIERRA: : Terreno ____ de _____ total indicado en E1.1.

¿Manejaron el terreno en 1995 o en 2005-2006? No___ → **Proximo terreno o G** Sí___

Si mide en tareas, especificar que sea una tarea de 12 por 12 brazas. Para cultivos mezclados, dividir el área igualmente entre los cultivos.

Cultivo u Otro Uso	¿**Cuánta tierra** tiene para este uso?	¿Tenía tierra para este uso **en 1995**? Sí...1 No...0	¿Cómo ha cambiado la **superficie** de tierra en este uso desde 1995? (código)	¿Cómo ha cambiado la **productividad** de este cultivo desde 1995? (código)	**La cosecha desde hace 12 meses:**		
					Cosecha	**Vendida**	**Precio unitario**
Maíz	ha cuad tar				qq lib arr	qq lib arr	**$**
Granos de vaina	ha cuad tar				qq lib arr	qq lib arr	**$**
Café	ha cuad tar				qq lib arr	qq lib arr	**$**
Caña	ha cuad tar				qq lib arr	qq lib arr	**$**
Yuca	ha cuad tar				qq lib arr	qq lib arr	**$**
Maní	ha cuad tar				qq lib arr	qq lib arr	**$**
Guineo y plátano	ha cuad tar				racimos	racimos	**$**
Arboles frutales	Núm arboles				X	X	X
Otro: _____	ha cuad tar				qq lib arr	qq lib arr	**$**
Otro: _____	ha cuad tar				qq lib arr	qq lib arr	**$**
Otro: _____	ha cuad tar				qq lib arr	qq lib arr	**$**
Otros cultivos menores	ha cuad tar						
Pasto	ha cuad tar						
Arboles	ha cuad tar			Área en 2006 en: Arboles silvestres_____ Arboles sembrados_____			
Rastrojo, botado	ha cuad tar						
Chequear el área total contra F1	ha cuad tar	X	X				

Cambios: **1**. Bajado desde 1995 **2**. Subido desde 1995 **3**. Se ha mantenido desde 1995.

G. CONDICIONES DE VIDA

G1. ¿Cuántos cuartos tiene la vivienda?_____

G2. ¿De qué material es el techo? El predominante

Losa de hormigón___ Eternit___ Zinc___ Teja___ Otro: especifique_____

G3. ¿De qué material es el piso? El predominante Entablado___ Parquet, baldosa, vinil___

Ladrillo o cemento___ Tierra___ Otro: especifique_____

G4. ¿De qué material son las paredes exteriores? El predominante

Hormigón, ladrillo, bloque___ Adobe___ Madera___ Bahareque___ Otro: especifique___

G5. ¿Cuenta la vivienda con luz? No___ → **G7** Sí___

G6. ¿Tenía luz en 1995? Sí ___ → **G7** No___ → ¿Desde qué año tuvo luz?_____

G7. ¿Qué tipo de servicio higiénico tiene la vivienda?

Excusado y alcantarillado____ Excusado y pozo séptico____ Excusado y pozo ciego____

Letrina____ Campo abierto____ Otro: especifique_____

G8. ¿Generalmente en dónde obtienen el agua para beber? Tubería dentro de la vivienda___ Tubería fuera de la vivienda ___ Tubería de uso público___ Río, quebrada, acequia____

Pozo abierto ____ Otro: especifique_____

G9. ¿Salen de la propiedad para traer agua? No___ → **G13** Sí___

G10. ¿Generalmente, cuántas veces lo hacen por día?_____ veces

G11. ¿Cuántos minutos demora para ir a traer una vez?_____ minutos

G12. ¿Quiénes lo hacen generalmente? Nombres:_____

Códigos de la parte B1:_____

G13. ¿Qué combustibles usan para cocinar? (respuesta multiple)

Gas___ Leña___ Otro:especifique_____

G14. Si usan más que uno: ¿Cuál usan más?

Gas___ Leña___ Otro:especifique_____

Si NO usan leña, pasar a G18.

G15. ¿Cuántas veces a la semana recogen leña generalmente?_____ veces

G16. ¿Cuántos minutos demora para ir a recoger una vez?_____ minutos

G17. ¿Generalmente, quiénes la recogen? Nombres:_____

Códigos de la parte B1:_____

G18. ¿Qué combustibles usaron para cocinar en 1995?

Gas___ Leña___ Kerex___ Otro:especifique_____

G19. Si usaron más que uno: ¿Cuál usaron más?

Gas___ Leña___ Kerex___ Otro:especifique_____

Si NO usan leña actualmente y también en 1995, pasar a G21.

G20. ¿Desde 1995 la disponibilidad de leña ha empeorado, mantenido igual o mejorado?

Empeorado___ Igual___ Mejorado___

G21. ¿En los últimos quince días, han tenido siempre comida suficiente? Sí___→**G23** No___→

G22. ¿En los últimos quince días, cuántos días les ha faltado comida? _____

G23. ¿Generalmente, quiénes en el hogar toman decisiones acerca de...?

Decisiones sobre...	Nombres (o NA)	Códigos de la parte B
Plantar y cosechar cultivos		
Comprar y vender ganado		
Educación de los hijos		
Comprar viveres		
Trabajo fuera de la comunidad		

G24. ¿Cuáles de estos bienes tienen en la vivienda?

Artefacto	¿Tenían en 1995? No…0 Sí….1	¿Tienen? No…0 Sí….1
Equipo de sonido		
Grabadora		
Televisión		
DVD o VHS		
Cocineta		
Cocina		
Licuadora		
Refrigerador		
Ducha		
Teléfono convencional		
Teléfono celular		
Máquina de coser		
Motosierra		
Moto		
Carro		

G25. ¿Qué animales tienen?

Animal	Numero	Ingresos en el ultimo año*
Ganado vacuno		
Caballos, burros		
Ovejas		
Chanchos		
Pollos		
Cabras		
Cuyes		
Otro:_____		

***** Incluir ventas de animales y productos como leche y huevos.

G26. ¿Tenían ganado vacuno en 1995 (o el primer año que vivieron en la casa)?

No___ → **G27** Sí___ → ¿Cuántos animales tenían?_____

G27. ¿Desde 1995, su vida ha mejorado, empeorado, o se ha mantenido igual?

Mejorado____ Empeorado____ Igual____

G28. ¿Cuáles son los problemas más grandes para la vida en la comunidad?

_____

_____

G29. ¿Cuáles son los problemas más grandes para la agricultura en la comunidad?

_____

_____

APPENDIX 2

Universidad de Carolina del Norte
ENCUESTA DE MIGRACIÓN Y RECURSOS NATURALES
Loja, Ecuador, 2006

A1. Cantón:_____ **A2.** Parroquia:_____

A3. Sector:_____ **A4.** Comunidad:_____

A5. Entrevistados

Nombre	Puesto comunitario	Sexo Hombre...1 Mujer……2	Secciones contestadas

A6. Resultados

	1ª Visita	2ª Visita	3ª Visita
Entrevistador/a			
Fecha (día/mes)			
Hora que empezó			
Hora que terminó			
Resultado (códigos)			
Próxima visita			

Resultado: 1. Completada satisfactoriamente **2**. Incompleta **3**. Se negó a responder **4**. Otro: Explicar

A7. Coordenadas GPS

Lugar	Waypoint	Waypoint Easting	Waypoint Northing
Centro			
Otro:_____			
Otro:_____			
Otro:_____			

A8. Comentarios generales del entrevistador y supervisor:_____
_____
_____
_____

Códigos universales: NS = no sé NA = no aplica

B. POBLACIÓN

B1. De las personas residentes en la comunidad en 1995, ¿han salido unos para vivir en otro cantón, provincia, o país? No___ → **B5** Sí___ →

B2. ¿Qué factores (en la comunidad y afuera) les influyeron para salir desde 1995?

_____

_____

_____

B3. ¿Cuáles han sido sus destinaciones principales desde 1995?

Localidades	Cantón / País	Provincia	Es: urbano...1 rural...2	Desde 1995, ¿en qué año salió la primera persona de esta comunidad a este lugar?

B4. ¿Qué efectos han tenido en la comunidad las salidas de estas personas?

_____

_____

B5. ¿Hubo otras destinos importantes antes de 1995? No___ Sí___ →

¿Cuáles?_____

B6. ¿Hubo otros factores que influyeron la salida de personas antes de 1995?

No___ → **C1** Sí___ → ¿Qué factores?_____

_____

C. INGRESOS Y EMPLEO

C1. ¿Cuáles son las tres fuentes de ingresos más importantes para la comunidad?

1._____

2._____

3._____

C2. ¿Han cambiado las tres fuentes de ingresos más importantes desde 1995?

No___ → **C3** Sí___ → ¿Cuáles eran las tres fuentes más importantes en 1995?

1._____

2._____

3._____

C3. ¿Hay personas que viven en la comunidad y que salen temporalmente para dormir y trabajar en otros lugares? No___ → **D** Sí___ → ¿Adónde se van?

Localidades	Cantón o País	Provincia	Actividades (códigos)	¿En qué año empezaron a trabajar allí? (Estimar)	¿Cuántos han trabajado allí desde hace 12 meses?

Actividades: 1. Jornalero agrícola **2.** Transportista, chofer **3.** Comerciante, tienda **4.** Profesional **5.** Empleada domestica **6.** Construcción, carpintería **7.** Otro: especifique

C4. ¿Hay una institución, empresa, plantación o hacienda que tiene dos o más empleados de esta comunidad? No___ → **C4** Sí___ → ¿Qué son?

Nombre	Tipo de actividad	¿Dónde se ubica? comunidad...1 capital cantonal...2 otro...3	¿En qué año empezaron a trabajar allí gente de la comunidad?	¿Cuántas personas de la comunidad trabajan allí?	¿Cuántas personas en total trabajan allí?

D. TIERRA, AGRICULTURA Y GANADERÍA

D1. ¿De qué tamaño es la finca más grande de la comunidad?
_____ en cuadras___, tareas___, o hectáreas___

D2. ¿Hay hogares que no tienen terrenos? No___ → **D6** Sí___ → ¿Cuántos? _____

D3. ¿Había hogares en 1995 que no tenían terrenos? No___ Sí___

D4. ¿Cuánta tierra tiene el hogar tipico de la comunidad?
_____ en cuadras___, tareas___, o hectáreas___

D5. ¿Ha cambiado desde 1995? No___ → **D4** Sí___ →

D6. ¿Cuánta tierra tenía el hogar tipico en 1995?
_____ en cuadras___, tareas___, o hectáreas___

D7. ¿Cuánto vale la tierra aquí en promedio?
$_____ por cuadra___, tarea___, o hectárea___

D8. ¿Hay hogares en la comunidad que arriendan tierra de otras personas para cultivar?
No___ → **D8** Sí___ → ¿Dónde? _____

D9. ¿Había hogares que arriendaron tierra en 1995? No___ → **D9** Sí___

D10. ¿Hay conflictos de tierra en la comunidad? No___ → **D16** Sí___ →
¿Cuántas parcelas están en conflicto? _____

D11. ¿Había conflictos de tierra en 1995? No___ Sí___

D12. ¿Hay terrenos con riego en la comunidad? No___ → **D19** Sí___ →

D13. ¿De donde viene el agua? Río, lago___ Pozo___ Otro: especifique_____

D14. ¿Cuántos hogares tienen terrenos con riego? _____

D15. En toda la comunidad, ¿cuánta tierra tiene riego?

_____ en cuadras___, tareas___, hectáreas___, o metros cuadrados___

D16. ¿La cantidad de agua de riego disponible ha subido, mantendio o bajado desde 1995?

Subido___ Mantenido___ Bajado___

D17. ¿Ha fallado esta fuente desde 1995? No___ → **D18** Sí___ → ¿En qué años?_____

D18. ¿Hay conflictos en el manejo del agua de riego? No___ Sí___

D19. ¿Cuáles son los tres cultivos más importantes en la comunidad?

Cultivo			
¿El área en este cultivo ha subido, mantenido o bajado desde 1995? Subido...1 Mantenido...2 Bajado..3			
¿Cuánto se cosechó en preomedio el la ultima cosecha?	qq lib rac arroba por cuadra tarea ha	qq lib rac arroba por cuadra tarea ha	qq lib rac arroba por cuadra tarea ha
¿La cosecha por hectárea de este cultivo ha subido, mantenido o bajado desde 1995? Subido...1 Mantenido...2 Bajado..3			
¿Se vende a veces un parte de la cosecha? ¿Qué proporción de la cosecha se vende normalmente?	No___ Sí___→ _____	No___ Sí___→ _____	No___ Sí___→ _____
[Si se vende:] ¿En la última cosecha a cómo se vendió?	$ qq lib rac arroba	$ qq lib rac arroba	$ qq lib rac arroba
[Si se vende:] ¿Adónde venden el cultivo? En la comunidad...1 En el capital del cantón...2 Otro...Especifique			
¿A veces se usa pesticidas o herbicidas para este cultivo? ¿En qué año empezó este uso?	No___ Sí___→ _____	No___ Sí___→ _____	No___ Sí___→ _____
¿A veces se usa abonos naturales para este cultivo? (gallinaza, abono de oveja, vaca o cuy)	No___ Sí___	No___ Sí___	No___ Sí___
¿A veces se usa fertilizantes para este cultivo? ¿En qué año empezó este uso?	No___ Sí___→ _____	No___ Sí___→ _____	No___ Sí___→ _____
¿A veces se usa semillas mejoradas para este cultivo? ¿En qué año empezó este uso?	No___ Sí___→ _____	No___ Sí___→ _____	No___ Sí___→ _____
¿ A veces se cultiva mezclado con otros cultivos? ¿Cuáles?	No___ Sí___→ _____	No___ Sí___→ _____	No___ Sí___→ _____
¿Es necesario cambiar del cultivo o descansar la tierra después de un tiempo? ¿Después de cuántas siembras? ¿Por cuantós años hay que descansar la tierra?	No___ Sí___→ _____ _____	No___ Sí___→ _____ _____	No___ Sí___→ _____ _____
[Si hay riego:] ¿Se cultiva con riego?	No___ Sí___	No___ Sí___	No___ Sí___
¿Tienen problemas de plagas o enfermedades con este cultivo? ¿Cuáles plagas?	No___ Sí___→ _____	No___ Sí___→ _____	No___ Sí___→ _____
¿Tienen problemas de heladas con este cultivo?	No___ Sí___	No___ Sí___	No___ Sí___

D20. ¿Desde 1995, se ha introducido nuevos cultivos o nuevas maneras de producción en la comunidad?
No___ → **D21** Sí___ → ¿Cuáles?

1._____

2._____

3._____

D21. ¿Hay hogares en la comunidad que tienen ganado? No___ → **E** Sí___

D22. ¿Cuántos hogares tienen ganado? _____

D23. ¿Ahora los hogares tienen más, menos, o el mismo número de ganado que en el año 1995? Más___
Menos___ Igual___

D24. ¿Cuánto es el número máximo de ganado que tiene un hogar de la comunidad? _____

D25. Desde 1995, ¿El area en pastos ha subido, mantendio o bajado en la comunidad?
Subido___ Mantenido___ Bajado___

D26. ¿Se arrienda pastos para ganado en la comunidad? No___ Sí___ →
¿Cuánto cuesta normalmente? $ _____ por cuadras___, tareas___, o hectáreas___

D27. ¿Hay hogares que usan fuego para limpiar los pastos o otros terrenos? No___ Sí___ →
¿Cada qué tiempo normalmente?_____

E. RECURSOS NATURALES

E1. ¿Qué tipo de suelo es más comun en la comunidad?
Negro___ Amarillo/rojo___ Arenoso___ Cascajo___

E2. ¿Generalmente los suelos de la comunidad son...?
Muy buenos___ Buenos___ Regulares___ Normales___

E3. ¿Hay hogares en la comunidad que cocinan con leña? No___ → **E6** Sí___ →

E4. ¿Desde 1995, ha subido, mantenido, o bajado la disponibilidad de leña?
Subido___ Mantenido___ Bajado___

E5. ¿Hay áreas de bosque en la comunidad?
Sí___ → ¿Cuántas hectareas en total?_____
→ ¿Este area ha subido, mantenido o bajado desde 1995?
Subido___ Mantenido___ Bajado___
No___ → ¿En qué año se acabó el bosque? (Estimar) _____

E6. ¿Hay áreas de arbustos o rastrojo en la comunidad que no tienen uso agropecuario?
No___ Sí___ →
¿Este area ha subido, mantenido o bajado desde 1995? Subido__ Mantenido__ Bajado__

F. INFRAESTRUCTURA

F1. Infraestructura	¿Existe? No...0 Sí...1	Si existe] ¿Existía en 1995? Sí...1 No...0 →	[Si llegó despúes de 1995] ¿Desde qué año existe?	
Luz de la red				
Agua entubada				
Tienda				¿Dónde generalmante hacen las compras?
Carretera transitable todo el año				*Si no hay carretera transitable todo el año*: ¿Cuánto tiempo demorra para caminar a la carretera?
Servicio de bus				
Servicio de ranchera				
Servicio de camioneta				
Guardería				
Escuela primaria				*Si no hay escuela*: ¿Adónde se van los niños de la escuela?
Colegio				*Si no hay escuela*: ¿Adónde se van los jovenes del colegio?

F2. ¿En el verano, cómo viajan a la cabecera cantonal normalmente? (respuesta multiple)

A pie___ A bestia___ En bus___ En ranchera___ En camioneta___

F3. ¿Cuánto tiempo se demora? ____ min

F4. ¿Cuánto cuesta? $_____

Si la comunidad pertenece a la parroqioa de la cabecera cantonal, pase a **F8.**

F5. ¿En el verano, cómo viajan a la cabecera parroquial normalmente? (respuesta multiple)

A pie___ A bestia___ En bus___ En ranchera___ En camioneta___

F6. ¿Cuánto tiempo se demora? ____ min

F7. ¿Cuánto cuesta? $_____

F8. ¿Aparte de la cabeceras del cantón y de la parroquia, viajan a algun otro lugar para hacer compras?

No___ → **F8** Sí___ →¿Adónde?_____

F9. ¿En el verano, cómo viajan normalmente a este sitio? (respuesta multiple)

A pie___ A bestia___ En bus___ En ranchera___ En camioneta___

F10. ¿Cuánto tiempo se demora? ____ min

F11. ¿Cuánto cuesta? $_____

G. INSTITUCIONES

G1. ¿Qué organizaciones hay con miembros de la comunidad? ¿Había otros que existían después de 1995 pero ya no? Incluir la asamblea comunitaria y los pades de famila.

Organización	Tipo de organización (códigos)	¿Qué actividades hacen?	¿Desde qué año existe?	¿Cuántos miembros tiene en la comunidad?	¿Todavía existe? No...0 → Sí...1	¿En qué año se terminó?

Tipo de organización: **1**. Asamblea comunitaria **2**. Cooperativa agrícola **3**. Padres de familia **4**. Iglesia, religiosa **5**. Grupo de mujeres **6**. Deportes **7**. Político **8**. Otro

G2. ¿Hacen trabajos comunitarios o mingas en la comunidad? No___ Sí___ →

¿Cuántos trabajos han hecho desde hace 12 meses? _____

G3. ¿Desde 1995, alguna institución ha hecho un proyecto o otras actividades aquí?

No___ Sí___ → ¿Qué actividades han hecho?

Organismo	¿Qué actividades hace?	¿Desde qué año trabaja aquí?	¿Todavía trabaja aquí? No...0 → Sí...1	¿En qué año se terminó?	¿Ha sido útil para la comunidad? No...0 Sí...1

G4. ¿Hay problemas de delincuencia en la comunidad? No___ Sí___ →

¿De qué tipo? Robos___ Asaltos___ Otro: especifique_____

LISTA DE VIVIENDAS: Por favor listar todos las viviendas ocupadas de la comunidad, con el nombre del jefe/a del hogar y el numero de habitantes. Adémas, nos interesa saber si desde 1995 ha salido uno o más personas de esta vivienda para vivir en otro cantón, provincia o país definitivamente.

#	Nombre del jefe/a	Numero de habitantes	¿Han salido uno a más personas para vivir en otro cantón desde 1995? No…0 Sí…1 →	Numero de personas					*Uso del Equipo*		
				A otro cantón de Loja	A otra provincia de la Sierra	A una provincia de la Costa	A una provincia del Oriente	A otro país	*Estrata*	*Probabilidad*	*Selección No…0 Sí…1*
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

LISTA DE HOGARES QUE HAN SALIDO: Además de los hogares listados arriba, ¿hay otros hogares que desde 1995 vivían en la comunidad pero después todos sus miembros salieron definitivamente? No___ Sí___ → Por favor listar todos estos hogares, excluyéndolos en que uno o más miembros ha quedado en la comunidad.

Hogares		1	2	3	4	5	6	7	8	9	10
Nombre del jefe/a											
¿Cuántas personas salieron al ultímo?											
¿En qué año salieron los ultimos?											
¿Salieron todos juntos al mismo lugar?		No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__
¿Adonde vivieron en el año después de salir de aquí? [Si no salieron juntos, el destino del jefe]	Cantón o País										
	Provincia										
¿Antes de salir, hasta que nivel de educación alcanzó el jefe? (códigos)											
¿Antes de salir, eran dueños de una casa?		No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__
¿Antes de salir, eran dueños de terrenos? ¿De cuánta tierra?		No__ Sí__ _____ cuadra tarea ha	No__ Sí__ _____ cuadra tarea ha	No__ Sí__ _____ cuadra tarea ha	No__ Sí__ _____ cuadra tarea ha	No__ Sí__ _____ cuadra tarea ha	No__ Sí__ _____ cuadra tarea ha	No__ Sí__ _____ cuadra tarea ha	No__ Sí__ _____ cuadra tarea ha	No__ Sí__ _____ cuadra tarea ha	No__ Sí__ _____ cuadra tarea ha
¿En el año antes de salir, tenían ganado vacuno? ¿Cuántos?		No__ Sí__ _____	No__ Sí__ _____	No__ Sí__ _____	No__ Sí__ _____	No__ Sí__ _____	No__ Sí__ _____	No__ Sí__ _____	No__ Sí__ _____	No__ Sí__ _____	No__ Sí__ _____
¿En el año antes de salir, hacía algún miembro del hogar trabajo pagado?		No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__	No__ Sí__

Nivel de educación: **1**.Ningún **2**.Primaria incompleta **3**.Primaria completa **4**.Secundaria incompleta **5**.Secundaria completa **6**.Escuela técnica **7**.Universidad

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