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DEVELOPMENT STRATEGY AND GOVERNANCE DIVISION

April 2005

DSGD Discussion Paper No. 19

Identifying the Drivers of Sustainable Rural Growth and Poverty Reduction in Honduras

Hans G.P. Jansen, Paul B. Siegel and Francisco Pichón

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TABLE OF CONTENTS

LISTS OF TABLES, FIGURES & BOXES

TABLES

FIGURES

BOXES

ABBREVIATIONS AND ACRONYMS

CA	Central American
CAFTA	Central America Free Trade Agreement
CMAT	Modernization and Administration of Lands (component of PAAR Project)
DFID	Department for International Development, UK
ESSD	Environmentally and Social Sustainable Development Department, World Bank
FAO	Food and Agriculture Organization of the United Nations
FPPL	Fund for Producers in Mountain Slopes (component of PAAR Project)
GDP	Gross Domestic Product
GIS	Geographic Information Systems
GoH	Government of Honduras
ha	Hectare
HDI	Human Development Index
HH	household
IFPRI	International Food Policy Research Institute
IHCAFE	Honduras Coffee Institute
IICA	Inter-American Institute for Cooperation on Agriculture
INE	National Statistics Institute, Honduras
InfoAgro	Agricultural Information Department, SAG, Honduras
LAC	Latin America and Caribbean
Lps	Honduras Lempira
LSMS	Living Standard Measurement Survey
Mz	Manzana (land measure equal to 0.7 ha)
NGO	Non Governmental Organization
PAAR	Honduras Rural Land Management Project
PACTA	Honduras Access to Land Project
PATH	Honduras Land Administration Project
PRAF	Family Conditional Cash Transfer Program, Honduras
PROBAP	Biodiversity and Priority Areas Project
PRONADERS	National Program for Sustainable Rural Development, SAG, Honduras
PRSP	Poverty Reduction Strategy Paper
RUTA	Regional Unit for Technical Assistance
SAG	Ministry of Agriculture and Livestock, Honduras
SINIT	Sistema Nacional de Informacion Territorial, Honduras
UNDP	United Nations Development Program
USAID	United States Agency for International Development
US$	United States dollars
WFP	World Food Program, UN
WUR	Wageningen University and Research Center, The Netherlands

ABSTRACT

The overall objective of this paper is to develop an appropriate conceptual and analytical framework to better understand how prospects for growth and poverty reduction can be stimulated in rural Honduras. We employ complementary quantitative and qualitative methods of analysis, driven by an asset-base approach. Emphasis on assets is appropriate given high inequalities in the distribution of productive assets among households and geographical areas in Honduras. Such inequalities are likely to constrain how the poor share in the benefits of growth, even under appropriate policy regimes. We focus on household assets (broadly defined to include natural, physical, human, financial, social and locational assets) and their combinations necessary to take advantage of economic opportunities. We examine the relative contributions of these assets, and identify the combinations of productive, social, and location-specific assets that matter most to raise incomes and take advantage of prospects for poverty-reducing growth. Factor and cluster analysis techniques are used to identify and group different livelihood strategies; and econometric analysis is used to investigate the determinants of different livelihood strategies and the major factors that impact on income. Spatial analysis, community livelihood studies and project stocktakings are brought in to complement some of the more quantitative household survey data used. Our conclusions and recommendations are mainly focused on hillsides and hillside areas since the majority of the available data is for these areas.

Our research resulted in five key findings with important strategic implications. First, there exists significant heterogeneity of rural areas in Honduras in terms of their asset endowments. But even areas with good economic potential often have persistent high rates of poverty because the poor lack the basic asset base to be able to capitalize on this potential. Second, poverty is widespread and deep in rural Honduras, particularly in hillside areas where most households have limited assets on which to base their livelihood strategies. High poverty density in hillside areas and the fact that some 80 percent of all rural poor are located in these areas, should make these areas a target of national rural poverty reduction strategies. Overlap between high poverty rates and high

poverty densities in many hillside areas means that investments there should reach significant proportions of the country's rural poor with minimal leakages. Third, agriculture should form an integral part of the rural growth strategy in hillside areas, but its potential is limited. Over the past 25 years, agriculture has not been a strong engine of growth in rural Honduras. But high reliance of rural households on agricultural and related income means that any strategy targeted to these areas will have to build upon the economic base created by agriculture. Even though agriculture alone cannot solve the rural poverty problem, those remaining in the sector need to be more efficient, productive and competitive. Strategic actions and investments involving food security, security and access to land and forests, infrastructure provision, improved natural resource management, non-agricultural rural employment and migration are needed to achieve broad-based and sustainable agricultural growth and reduced rural poverty. Fourth, there is a need to move from geographically untargeted investments in single assets to a more integrated and geographically based approach of asset enhancement with proper complementarities. A multisectoral investment program is required to upgrade and improve access to household assets, with proper and more explicit complementarities. Finally, asset investment programs need to be adapted according to the specific needs of regions and households. While some household assets programs should be national in nature, others require more local adaptation and must be carried out in tandem, according to specific needs of regions and households. Investment strategies should be formulated on broad regional bases, but options within regions should be tailored to local asset bases.

IDENTIFYING THE DRIVERS OF SUSTAINABLE RURAL GROWTH AND POVERTY REDUCTION IN HONDURAS

Hans G.P. Jansen, Paul B. Siegel and Francisco Pichón*

1. INTRODUCTION

Major economic, political and social changes have taken place in Central America over the past decade. While these changes have stimulated some improvements in well-being and reductions in poverty, particularly in urban areas, the region is still characterized by persistent and stark inequalities in assets and well being (Tejo, 2000; Morley, 2001; Morley and Hazell, 2003). Broad-based growth is heavily constrained by unequal asset distribution. This inequality is most manifest in landholdings, but many productive, social and location assets are equally poorly distributed (Attanasio and Szekeley, 2001).

Honduras is still a predominantly rural country with about 60% of the population living in rural areas, the vast majority of them in areas classified as hillside areas with limited agricultural potential (Box 1 and Díaz Arrivillaga 1996 and UNDP 1998 for a definition of hillside areas). The dominance of food and agriculture-related activities in the livelihoods of most rural people and the fact that most of the poor are located in hillside areas raises important questions about how agriculture can serve as an important engine of growth to reduce poverty. Also, will small farms be able to survive in the future in hillside areas as trade is liberalized under the Central America Free Trade Agreement (CAFTA)?

The need for new strategies to promote sustainable poverty-reducing economic growth in rural Central America is now widely recognized.[1] There is growing consensus

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that agriculture cannot serve as the sole engine of poverty reducing growth in the rural economy, and that a balanced and integrated spatial and multi-sectoral approach is needed. Such an approach needs to consider the appropriate role of agricultural and non-agricultural activities, linkages across space, and the relationship between household and community conditions and decisions. Heterogeneity of environmental conditions, access to infrastructure and services, household assets and livelihood strategies, and formal and informal institutions within countries highlight the need for a spatially differentiated approach to rural development.

This paper is based on one of the three country case studies[2] that form part of the Central American regional study, "Identifying Drivers of Sustainable Rural Growth and Poverty Reduction", commissioned by the Environmentally and Socially Sustainable Development (ESSD) Department and the Central American Department in the Latin America and Caribbean Region (LAC) of the World Bank (World Bank, 2004d). The overall goal of the regional study is to analyze the underlying causes of persistent rural poverty in Central America and identify the most appropriate mix of interventions to promote broad-based growth that can significantly reduce this poverty. The next Chapter provides an overview of the specific issues that stimulated the Honduras case study.

Each of the country case studies has adopted an *asset base approach* (where assets are broadly defined to include natural, physical, financial, human, social, and locational assets) to help assess the causes of poverty and to provide guidance for the design of policies and investment strategies that can lead to rural economic growth that is both poverty-reducing and environmentally and socially sustainable. Underlying the asset base approach is the recognition that households' livelihood strategies and well-being are largely determined by their endowments of different types of assets, the policy and risk context they face, and the way in which households allocate their assets. Asset portfolios help shape income generation and risk management strategies, and stronger

[1] For example, de Janvry and Sadoulet, 2000a; Echeverría, 2001; IFAD, 2001, 2002; USAID, 2001, 2002; ODI, 2003; Valdés and Mistiaen, 2001; Wadsworth et al., 2004; World Bank, 2002.

[2] The other two case studies concern Guatemala (World Bank, 2004b) and Nicaragua (World Bank, 2004c).

asset bases can lead to sustained improvements in well-being over time. In applying the asset base approach, both quantitative and qualitative methods were used to examine key spatial and household-differentiated factors.

Box 1. Defining 'Hillsides', 'Hillside Areas' and 'Valleys'

'Hillsides' are areas with slopes of more than 12%. 'Hillside areas' also include flat-floored valleys, 300 to 900 meters in elevation, which are scattered throughout the interior hillsides. 'Valleys' refer mainly to the lowland areas in the north and northwest of the country, which are generally considered as high-potential areas for agriculture. In Honduras, hillside areas account for roughly 80% of the total land area where the major economic activity consists of smallholder farming focusing on production of basic grains, coffee and livestock. Agricultural potential in hillside areas varies with agro-ecological factors such as elevation, rainfall, and soil characteristics. However, compared to areas with lower slope and elevation, agricultural options in hillside areas are constrained. Rather than profit maximization, food security is the most important objective of most smallholder households living in hillsides areas. Many hillside areas also have less access to transport infrastructure and services.

We use the asset based approach to address the following key questions:

1. What are the asset bases and livelihood strategies of rural households in Honduras and how do individual assets and combinations of assets influence the choice of livelihood strategies?
2. How do livelihood strategies and asset endowments influence household income?
3. How do some current projects fit into the countries' rural development strategies and contribute to improving the asset bases of rural households?
4. On what types of assets or combinations of assets should public investments concentrate in order to have maximum impact on income and poverty reduction, and what is an appropriate sequencing of such investments?

The next Chapter provides a brief background to the economic and policy context of Honduran hillsides, and then Chapter 3 introduces our conceptual framework and methods. In Chapter 4 we provide a spatial overview using GIS data which provides the foundation for the interpretation of the main analytical results of the study in Chapter 5.

Chapter 5 begins with an analysis of descriptive statistics about household assets of the survey samples. Using household survey data, we then investigate the main determinants of household income and their linkages with asset endowments and livelihood strategies. Factor and cluster analysis techniques are used to identify and group different livelihood strategies; and econometric analysis is used to investigate the determinants (e.g., individual assets and combinations of assets) of different livelihood strategies and the major factors that impact on income. We also draw upon several qualitative analyses to complement the quantitative analysis. Community livelihood studies were carried out in some areas to complement the quantitative household survey data collected. In addition, "project stocktakings" of a number of rural development projects were carried out using participatory methods with project beneficiaries. The principal objectives of these exercises were to examine how these projects in Honduras contribute to growth and poverty reduction, and to identify "missing assets" and "successful" livelihood strategies. Finally, Chapter 6 presents general conclusions and some implications for priority setting of investments and other appropriate interventions.

2. BACKGROUND

The Socio-Economic Situation in Honduras

Honduras has a total population of 6.8 million and a relatively high population growth rate of 2.6% per year. It is one of the poorest and most unequal countries in the Latin America and Caribbean region. Per capita income is US$ 920 per year (data refer to 2002, see World Bank 2004a). Social indicators such as child malnutrition rate (17%), life expectancy at birth (66 years), child mortality rate (32 per 1000 births), and literacy rate (less than three-quarters of the population) are among the poorest in the LAC region. Honduras has acquired Highly Indebted Poor Country (HIPC) status and prepared a Poverty Reduction Strategy Paper (PRSP) in 2001.

Like most other Central American countries, Honduras has adopted a range of macroeconomic stabilization programs that are part of a continuing process of structural adjustment. Beginning in the early 1990s, Honduras gradually replaced the traditional economic import substitution model by an export growth-led model focused on market and trade liberalization. Major elements of the reform process included reduction of trade barriers and protection of domestic manufacturers, more flexible exchange rate arrangements, liberalization of financial markets and agricultural trade, adjustments of public utility tariffs, and the development of a legal framework to strengthen property rights.[3]

Rural growth and poverty reduction have been constrained by a series of recent shocks. The decline in international commodity prices for major export crops such as coffee and bananas have severely impacted resource-poor farmers and agricultural laborers. The global economic slowdown has exacerbated problems of unemployment. Negative economic impacts have resulted from natural shocks including Hurricane

[3] See World Bank, 1994; ASIES, 1996; Pino et al., 1994; UNDP, 1998; Thorpe et al., 1995; Walker and Medina, 2000.

Mitch,[4] destructive and erratic rainfall,[5] and recurrent droughts. Unequal distribution of assets and inadequate public policies dampen low factor productivity, especially land and labor productivity. Over the past decade, income distribution in rural areas has worsened (Figure 1), with increasing numbers of people at both tails of the distribution that exhibits a virtually stagnant mean.

The economic crisis in the rural sector and is occurring at a time when adjustments are expected in comparative advantage of agricultural and other enterprises, as Honduras has committed itself to a continuation of the process of market liberalization as a part of CAFTA.[6] Sensitive commodity imports include food staples that are important for the typical Honduran diet (primarily maize and beans but also dairy products and sugar), all of which are produced to a substantial extent by small farmers. Free trade of these staples could bring positive welfare effects for the poor who are net purchasers of such goods and create opportunities for growth. For others, accelerating the long deteriorating time trend of terms of trade for agriculture will critically affect the cash value of the production surplus. The recent US Farm Bill has exacerbated the problem for maize producers by putting pressure on its international price. But the economic crisis takes its toll in urban areas as well: the increasing prevalence of armed youth gangs (so-called *maras*) in several of the major cities is an example.

Rural Poverty

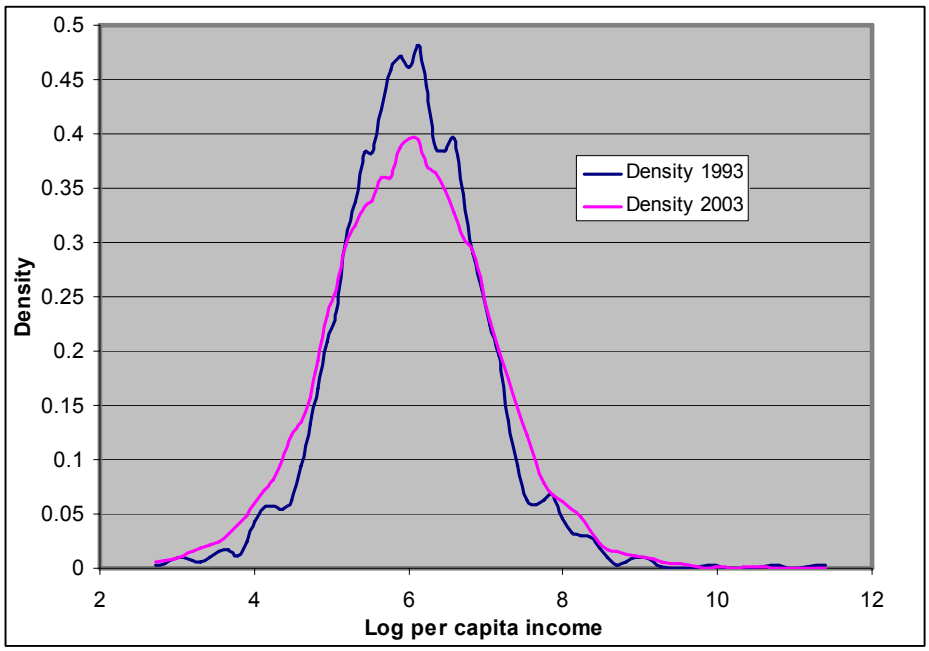
The lack of economic growth has led to high and (at least in absolute terms) increasing poverty levels. But poverty estimates for Honduras (Munoz and Meza Palma, 2000), and especially estimates of rural poverty are questionable because of the lack of an in-depth statistically representative national household survey, such as the Living

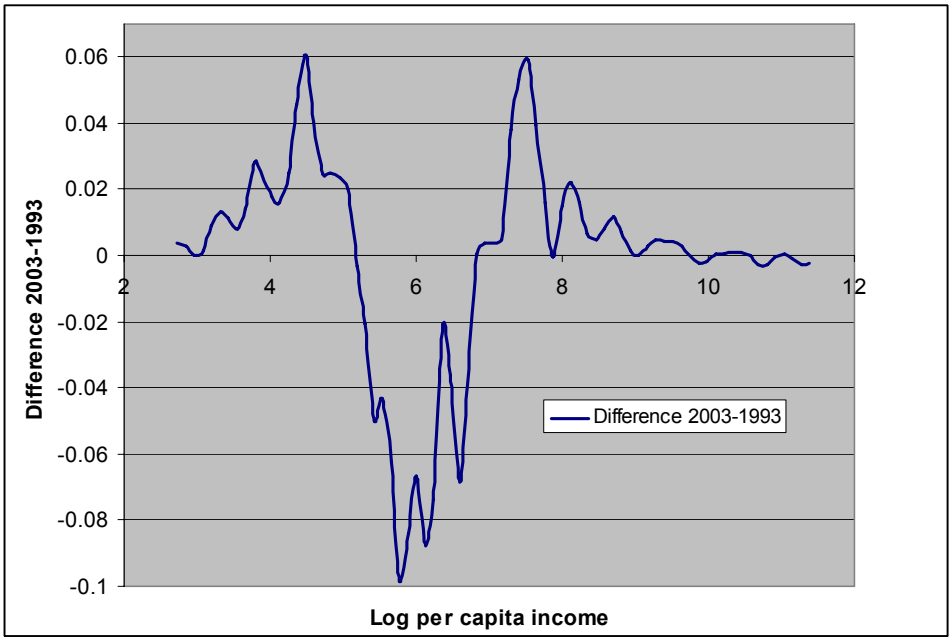
[4] Hurricane Mitch hit the country from October 25 to November 1, 1998, causing 5,600 deaths and about $4 to $5 billion in damage. Impacts on infrastructure, the destruction of vast agricultural areas, and estimated crop losses of $1 billion affected as much as 35 percent of the rural population (Meltzer 2001).

[5] For example, tropical storm Michelle affected Honduras in the fall of 2001.

[6] Honduras started negotiations for the Central America Free Trade Agreement (CAFTA) in January 2003 and reached an agreement in December 2003. The CAFTA agreement was signed on May 28 2004 and ratified by the Honduras Congress on March 3, 2005.

Figure 1. Changes in Income Distribution in Rural Honduras, 1993-2003





***Source**: Based on data from the Permanent Household Surveys 1993 & 2003, National Statistics Institute (INE), Honduras*

Standards Measurement Surveys (LSMS) carried out in Nicaragua and Guatemala (Box 2). Official poverty estimates are 66% at the national level and 75% in rural areas (SAG, 2004).[7] Tejo (2000) estimates rural poverty at 82% based on ECLAC data for 1999, with about three-quarters of rural households in extreme poverty. Estimates of rural poverty by the National Statistical Institute (INE) based on the 2001 Population Census (INE, 2002) are closer to the higher estimates by ECLAC: According to the recent poverty map at the municipal level (INE, 2003), two out of every three people in Honduras are poor (per capita income < US$ 1.50/day) and three out of every four poor people are extremely poor (per capita income < US$ 1.00/day). In all cases, regardless of the definition of poverty and the data used, there is no doubt that poverty in Honduras is highly correlated with living in a rural area: most of the poor are found in rural areas and much of the rural population is poor. Nationally, 59% of all poor households and 65% of the extremely poor live in rural areas. As might be expected, food insecurity is also most pervasive in rural areas (GoH/WFP, 2003).

Rural poverty is particularly deep in the hillside areas: Jansen et al. (2003a) estimate that more than 90% of the population located in hillside areas live on less than US$ 1.00/day/capita. In contrast to the concentration of poverty in hillside areas, most areas with lower poverty incidence are located in the "T of development" (Box 3), large parts of which are classified as urban area.[8]

[7] Using a poverty line measure based on income data, estimates indicate a reduction in overall poverty levels between 1991 and 1998 from 75% to 63% of all households (with 45% as extreme poor). Rural poverty (71% poor, 63% extremely poor) significantly exceeds urban poverty (56% poor, 27% extremely poor) (World Bank, 2003). Besides income-based measures, there exist other indicators of poverty. A measure often used by nutritionists is height-for-age, i.e. the proportion of school-aged children whose height is below a certain standard considered normal for their age. Using this measure, rural poverty increased by nearly 20% between 1993 and 1999, as indicated by an increase in the proportion of children with height too low for their age from 40.6 to 47.6% (PRAF, 1998). This is consistent with some government estimates that suggest an increase in the absolute number of rural poor of about 1 million during the period 1992-2002 (Government of Honduras, 2004).

[8] The latest government document regarding the agriculture and forestry sector explicitly recognizes the urban bias of past public investments (Government of Honduras 2004, p. 7).

Box 2. Problems with Measuring Rural Poverty in Honduras

The National Statistical Institute (INE) carries out periodic national surveys of households. These surveys (called *Encuesta Permanente de Hogares de Propósitos Múltiples*) are very short, but have wide coverage of households. However, rural households tend to be under-represented in these national surveys, and income data for rural households is highly questionable because the manner in which income data is collected leads to significant underreporting of income and overstating of poverty. INE recently produced a municipality-level poverty map based on an application of a statistical relationship between household income and a number of welfare indicators obtained from the *Encuesta Permanente de Hogares de Propósitos Múltiples* and applied this relationship to the 2001 population census data (INE, 2003). Although the methodology used to impute rural poverty is sound, due to the questionable rural income data, the accuracy of the poverty map is likewise questionable. The national level, statistically representative LSMS household-level survey scheduled which started in the second half of 2004 will generate more accurate information on rural poverty. See World Bank (1994) for additional details about problems measuring poverty in Honduras and Annex 1 for a comparison between INE's poverty estimates and estimates based on our own detailed household surveys.

Box 3. The "T of Development" in Honduras

The so-called "T of Development" in Honduras comprises 55 counties located along the fertile north coast and the central corridor area, connecting the capital city of Tegucigalpa in the south and San Pedro Sula, the industrial center of the country in the north. These are also the counties with the highest human development index (HDI) values. The HDI as calculated by UNDP (1998) for each *municipio* (equivalent to county) in Honduras is based on a composite of separate indices for income, health and education. Most counties that make up the "T of Development" are located in the valleys and/or close to urban areas. Hillside areas are by-and-large excluded from the T of development.

Throughout Latin America, rural households that diversify their economic activities into occupations outside the agricultural sector tend to earn higher incomes than those who rely exclusively on primary agricultural production. However, a salient characteristic of rural Honduras is the relative lack of non-agricultural activities (and corresponding employment opportunities) compared to other Central American countries (Box 4). In 1997 such activities accounted for 22% of total rural income on average, compared to 60% in Costa Rica, 42% in Nicaragua, and 38% in El Salvador (Reardon et al., 2001). Non-agricultural rural activities are most common in areas located near the industrial corridor in the north of the country and near the capital city of Tegucigalpa (largely coinciding with the rural parts of "T of Development"; see also Cuellar, 2003).

Box 4. Off-farm Versus Non-agricultural Rural Employment in Honduras

The supply of labor in rural Honduras is mainly dependent on quantity and quality of available land (Ruben and van den Berg, 2001). For example, households with smaller farms and more hillside land are most likely to be engaged in farm wage labor. With about "half of the rural population operating less than 5 hectares of land, considered as a minimum for a viable family farm" (ibid, p.550), and another quarter landless, there is a large pool of poor and illiterate (mostly male) farm wage laborers, and considerable un- and under-employment. Households with land who work as farm wage laborers engage in "off-farm" agricultural employment, while those without land are called farm laborers. Non-agricultural activities are relatively rare in rural Honduras, but the majority of households engaged in such activities are middle-income households in non-agricultural wage employment and higher income households in non-agricultural self-employment activities such as small and medium sized enterprises. Some of these households have land and also engage in agricultural activities, whereas others do not.

Agricultural Sector Developments

Agricultural sector policy reforms were also implemented in the 1990s, notably a much-reduced role of government, including drastic reductions in public sector institutions such as state extension services.[9] In addition, after more than three decades of heavy government intervention in support of land distribution and rural credit provision, a number of land market liberalization initiatives were introduced while rural interest rates were liberalized in an effort to stimulate commercial bank lending (Box 5 on land issues).[10] Also, direct support measures such as consumer subsidies on staple foods (which had a regressive effect since they mostly benefited better-off urban dwellers) and guaranteed producer prices were gradually abolished, culminating in the elimination of the former Institute of Agricultural Marketing. For a short period of time, agricultural credit was subsidized, but classical problems such as poor targeting, high default rates, and the lack of sustainable financial institutions led to the abolishment of

[9] The public extension system, which reached less than 10% of all farmers (Díaz Arrivillaga and Cruz, 1993), was privatized in 1992 when DICTA (Science and Technology Directorate for the Agricultural Sector) was created. Currently in the hillsides, the Fund for Technical Asssistance to Hillside Farmers (*Fondo para Productores de Ladera, FPPL*) established by the World Bank in the year 2000 as part of the PAAR project, is the only source of technical assistance for farmers, but coverage is limited to about 6,000 households in the provinces of Yoro, Olancho and Francisco Morazán (Hanson et al., 2003). In Chapter 5 we present findings from a stocktaking of the FPPL.

[10] These measures included strengthening individual property rights to land, extending titling efforts including the privatization of cooperative lands, activating land rental markets and private credit markets, and removing government from all direct land redistribution efforts that did not involve market mechanisms. For details see Boucher et al. (2002).

these programs. Distortions in the markets of traditional export commodities (e.g. taxes on coffee and banana exports) were (partially) corrected, while the focus on agricultural policies shifted from a focus on food security (i.e., basic grains crops) and traditional exports to the production of high-value non-traditional export crops.

Box 5. Land Issues in Honduras

In Honduras, lack of access to land (which affects as many as 250,000 rural households) and insecurity of land tenure are widely regarded as critical constraints to asset creation and poverty reduction, as well as a major source of social instability (Government of Honduras, 2001). Despite past attempts to transfer significant areas of underutilized private and public land with agricultural potential to *minifundistas* (loosely defined as households with less than 1 ha of land) and rural landless households, Honduras continues to have a highly skewed land distribution. About 70% of landholdings account for about 10% of land in farms; and a little over 1% of farmers own 25% of the land. Of the 465,000 households registered in the 1993 Agricultural Census, 97% held less than 50 ha of land, 80% of them held less than 5 ha of land, and 27% held no land at all (Barham et al., 2002a). Insecurity of land tenure affects especially smallholders: most landholdings of less than 5 ha are not titled, nor are most of them eligible for titling because they represent rented or borrowed land under informal, short-term agreements, or because they are plots within public forest lands ineligible for titling. Tenure security thus is closely related to landholding size: whereas only 42% of all farms below 5 ha have secure tenure, this percentage is 76% for farms > 50 ha (SAG, 2002). On the other hand, a recent household survey found that only 25% of all parcels in hillside areas have secure tenure (Jansen et al, 2003a). Over the recent years, Honduras has undertaken serious efforts to modernize the land administration system, provide land titles to settlers in frontier areas and indigenous communities, and improve access to land using market-based mechanisms. However, the fact that about 80% of Honduras' land area is classified as public lands complicates the land access and tenure security situation. In addition, there is evidence that the necessary complementary reforms in the credit and other input markets are not forthcoming, thus preventing the poor from taking advantage of land market reforms (Barham et al., 2002a).

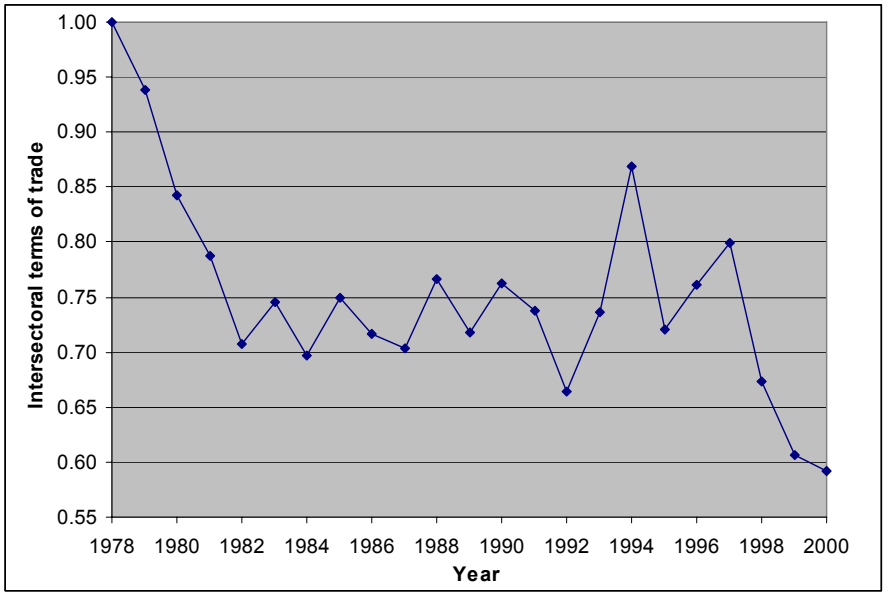
It was expected that the economic reform process would increase the competitiveness of the agricultural sector *vis-à-vis* the non-agricultural sectors, leading to higher incomes and decreases in rural poverty. But this has not been the case. Growth in the agricultural sector lagged behind other sectors in the 1990s (Table 1) and prices for most agricultural products declined, along with agricultural incomes and wages. The intersectoral terms of trade of the agricultural sector relative to the non-agricultural sectors have decreased substantially over the past two decades (Figure 2).

Table 1. Shares in GDP and Growth Rate by Economic Sector in Honduras, 1983-2003

	GDP % shares			Annual % Growth Rates	
	1983	**1993**	**2003**	**1983-1993**	**1993-2003**
Agriculture	21.2	20.6	13.5	3.8	2.2
Industry	25.3	30.1	30.7	3.9	3.2
Services	53.5	49.3	55.8	3.4	3.6

***Source**: www.worldbank.org/data/countrydata/aag/hnd_aag.pdf*

Figure 2. Terms of Trade of the Honduran Agricultural Sector, 1978-2000



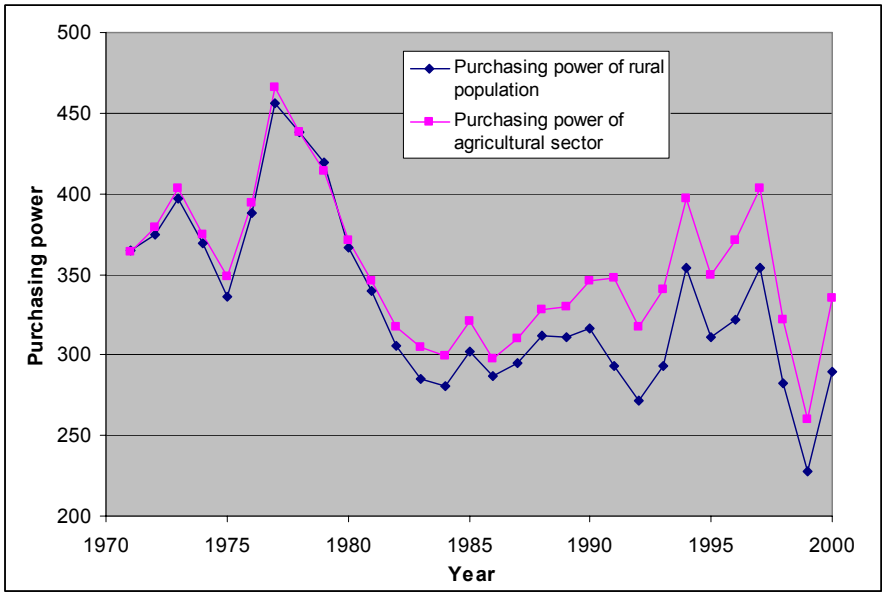
***Source**: Based on data in Table A11 in Cotty et al. (2001).*

Within the agricultural sector virtually all sub-sectors have lost a substantial part of their purchasing power. Small farmers, whose often already poor livelihoods rely to a substantial extent on basic grains[11] production, were particularly hard-hit, losing about one-third of their purchasing power over the past twenty-some years (Jansen et al., 2002). Nevertheless and in spite of low market values for basic grains, many small farmers' primary goal (particularly in the hillsides) is still to produce food.

[11] Throughout Central America, the term "basic grains" (*granos básicos*) refers mainly to maize and beans but also includes sorghum and rice.

The decreasing terms of trade for the agricultural sector as a whole and the loss in purchasing power of virtually all sub-sectors have had a strong negative impact on the welfare of the rural population in general and almost certainly have contributed to the increase in the absolute number of rural poor. Figure 3 shows the time trends regarding real purchasing power of the rural population, in Lempiras (Lps) per person per year using the consumer price index as the deflator. Figure 3 also displays the trend in purchasing power of the agricultural sector, again in Lps per person per year but this time using the price index for non-agricultural goods as the deflator. Both trends closely follow each other, showing a rise in the mid-1970s, a collapse in the late 1970s and early 1980s, slow recovery during the late 1980s and early 1990s, and another collapse in the late 1990s. It thus seems that the following conclusion of Barham et al. (2002b) is indeed confirmed: "…..the liberalized agrarian economy of Honduras shows little sign of operating in the pro-poor fashion that some have hypothesized."

Figure 3. Purchasing Power (PP) of the Rural Population and the Agricultural Sector in Honduras, 1971-2000 (Lempiras of 1978/capita/year)



***Source**: based on data in Table A15 in Cotty et al. (2001)*

3. CONCEPTUAL FRAMEWORK

The Asset Base Conceptual Framework

The conceptual framework used in this paper is anchored to an "asset base approach" where the *assets* of a household are broadly defined to include the productive, social and locational assets.[12] Assets, together with the context, determine the opportunity set of options for *livelihood strategies* or ways in which a household puts its assets to use. Household and community decisions regarding asset use determine outcomes such as household well-being, environmental preservation and community prosperity. The welfare-generating potential of assets depends on the asset-context interface. Policy reforms and building of assets need to be considered in tandem. The asset base approach is well suited for understanding and analyzing the Honduran rural economy because of the unequal distribution of assets, high exposure to natural, economic and social risks, and continuing economic, political and institutional reforms.

The asset base conceptual framework (Figure 4) includes the following components: assets (productive, social, locational), the context (policies and risks), household behavior (livelihood strategies), and outcomes (measures of household well-being). The asset base approach underlies the livelihoods approach.[13]

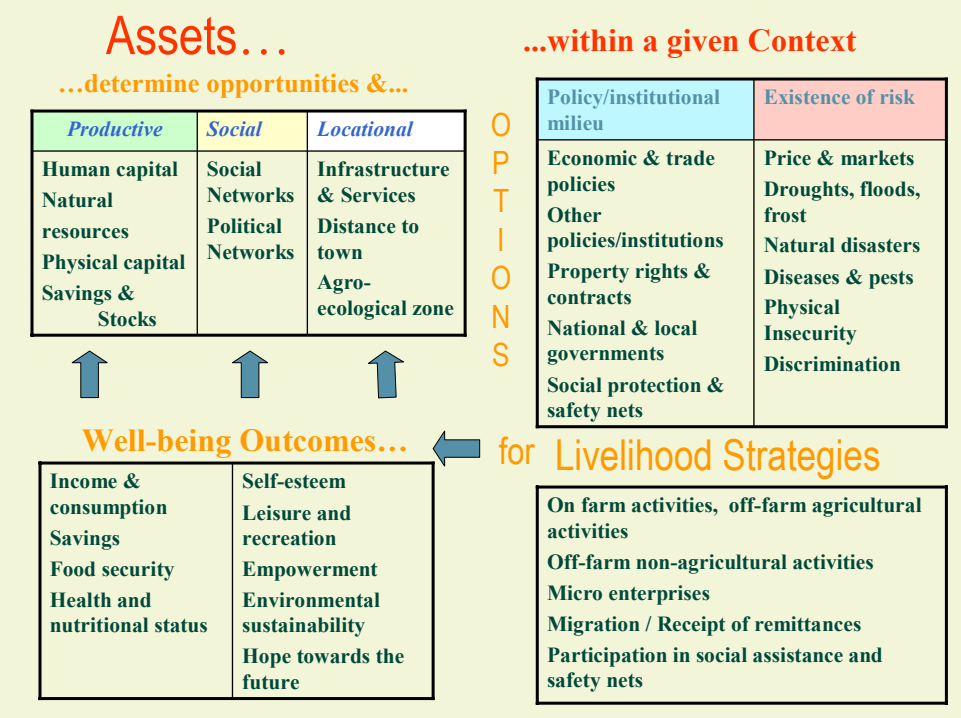
A household's **asset portfolio** consists of the stock of productive, social, and locational resources used to generate well-being (see Moser, 1998; Siegel and Alwang, 1999; Carney et al., 1999; Rakodi, 1999; Winters et al., 2002). Household assets are drawn from individual, household, community, and national and global levels and include natural, physical, human, financial, social/political and locational assets. According to the asset base framework, the poor are defined as being "asset-poor", i.e. they have

[12] For more details on the asset base conceptual framework see Siegel (2004).

[13] We are aware of the many discussions surrounding the livelihoods concept (for good summaries see Carney et al. 1999, DFID 1999, Rakodi 1999 and www.livelihoods.org). In this paper we use the term "livelihood strategies" at the farm household level in order to distinguish between different types of households based on the use of assets. We quantify the livelihoods concept by generating a household typology using statistical cluster analysis techniques. For technical details of our quantitative livelihood approach, see Chapter 5 and Annex 4.

limited assets, hold assets with low income-generating potential, have low returns to their assets, or are otherwise unable to exploit their assets effectively. Given the available information in our household data set and supplementary secondary data sources, we define each asset (or capital) as follows:

Figure 4. Asset Base Approach



- *Natural capital* includes the amount of land owned by the household; climate as defined by rainfall and altitude (as a proxy for temperature); soil water deficits; and soil fertility (as a proxy for land quality);
- *Human capital* includes size and composition of the household, with the latter determining the dependency ratio and, together with farm size, the land-labor ratio; level of formal education of its members; training received; and migration capital;

- *Physical capital* includes non-land physical assets including machinery, equipment and transportation assets; and livestock.
- *Financial capital* includes transfers (remittances and other cash transfers), credit, and savings.
- *Location capital* is determined by the geographical location of the household and includes population density, road density, distance to markets, and access to public services.
- *Social capital* is measured by the household's participation in various types of organizations.

Certain assets are only effective if combined with others, that is, asset complementarity matters. For example, access to high (or low) quality land may have different implications for well-being depending on its location relative to markets and other infrastructure, access to credit and level of education. The latter may have markedly different implications for welfare generation depending on location and the functioning of labor markets. Good transport and market infrastructure is essential for successful adoption of agricultural technology. Other important determinants of asset productivity include regulatory and legal systems, which determine the security and transferability of assets, the existence of means of exclusion, and others. These factors are known as the context.

The **context** in which households operate helps determine the welfare-generating potential of assets and prospects for improved well-being. The political, legal and regulatory contexts affect how households' assets are managed (Zezza and Llambi, 2002). Even though not explicitly addressed in this paper, exposure to risk is also a part of the context.[14] Domestic and international policies, institutions and markets, and forces

[14] Risk has both an intrinsic and instrumental cost. Risk creates fluctuations in consumption and lowers household well-being. The instrumental cost of risk is due to its impact on household responses. The costs of risk management include lower growth due to risk avoidance behavior and risk-reducing activities, and costs associated with coping activities (Siegel and Alwang, 1999).

of nature shape the context. In response, households and allocate their assets and select livelihood strategies to manage risks associated with the prevailing context.

The "opportunity set" for households to achieve different levels of well-being depends on the interface between assets and the prevailing context. Strategic management of a household's asset portfolio defines its behavior or **livelihood strategy** (Chambers and Conway, 1992; Ellis, 1998; Adato and Meizen-Dick, 2002). Livelihood strategies thus refer to the choices that people employ regarding the use of their asset portfolio, in pursuit of income, security, well-being and other productive and reproductive goals. These choices translate into economic activities such as land and labor use decisions, reproductive choices, investments in education, migration, participation in social capital building etc. Choices thus depend to an important extent on asset holdings which determine the ability to undertake a given enterprise and the productivity of resources allocated to that enterprise, while the potential returns depend also on the context. Livelihood strategies include a wide range of on- and off-farm agricultural and non-agricultural activities (Berdegué et al., 2001; Corral and Reardon, 2001). In the asset base approach, asset accumulation and changes in livelihood strategies are important drivers of sustained improvements in well-being.

Ultimately, we are concerned with measures of **outcomes** that reflect household well-being and prospects for growth over time. Even though the focus in this paper is on income, the asset base conceptual framework leads us to consider a variety of measures of household well-being in the qualitative analyses. In addition to income and consumption, poor rural households are concerned about food security, health status, vulnerability in general, empowerment and self-esteem, participation in community affairs, environmental quality, and hopefulness towards the future (Moser, 1998; Narayan et al., 2000). Barrett et al. (2001) argue that assets, livelihoods, and income all have limitations as indicators and therefore should be used in combination.

In Box 6 we present some findings from a survey of rural households impacted by hurricane Mitch. We present this box as an example to illustrate many of the ideas and

terms that will be presented in subsequent chapters, and how they are related to our asset base conceptual framework.

Box 6. Hurricane Mitch and Livelihoods of the Rural Poor in Honduras

A survey of poor and non-poor rural households affected by Hurricane Mitch came to the following observations, conclusions, and implications (based on Morris et al., 2002):

Observations:

a) The rural poor, in particular the poorest of the poor, were severely impacted.
b) The negative impacts on poor rural households spread beyond the areas impacted (due to migration/remittance linkages and out-migration of impacted groups).
c) The storm caused a reduction in current income, a depletion of assets, and other unanticipated costs (e.g., for health care).
d) Despite massive reconstruction efforts, short-term aid in the surveyed areas was extremely limited relative to the losses suffered.

Conclusions:

a) Asset portfolios of the rural poor are not only very limited, but also risky.
b) Crop losses were most devastating in terms of short-term income and food security shortfalls.
c) Physical assets such as livestock and housing are very vulnerable to severe weather.
d) Community level organizations are critical for receiving and distributing disaster aid.

Implications:

a) There is a need for insuring very poor households against weather-related risks, including insurance of crops, livestock and housing.
b) There is a need for self-targeted rapid response safety nets beyond areas hit by natural disasters.
c) The poor should be the major target for disaster assistance, since even a small amount of damage can have devastating implications for their asset portfolios and livelihood strategies.

Analytical Framework: Key Components of the Honduras Case Study

The asset base framework is amenable to a number of analytical techniques. In this paper we employ a number of complementary quantitative and qualitative methods in order to deepen our understanding of the relationship between assets, policy and rural growth potential. We combine mapping techniques, quantitative household analysis, qualitative analyses of household and community assets and livelihoods, and project stocktaking. This combination provides a description of rural space and the distribution of assets over space, representative statistical information on asset ownership and household well-being, and a better understanding of asset quality, perceptions of constraints to adoption of successful livelihood strategies, and the heterogeneity of assets and options in rural areas.

Spatial overview: A spatial overview of Honduras was produced by mapping key location-specific assets across rural space using standard geographic information systems (GIS) techniques. The analysis of geo-referenced data provides broad information about relationships between location-specific assets and household well-being. It is also used to identify areas of high/low economic potential and to increase understanding regarding which types of investments might be appropriate in specific areas.

Household-level analyses: Descriptive statistics and econometric analyses were carried out using household-level survey data (from 2 different surveys carried out during the period 2000-2002 in 12 of Honduras' 18 provinces) to better understand: (i) household characteristics, assets, livelihood strategies and levels of well-being, (ii) assets and asset combinations affecting household well-being, and (iii) impacts of potential policy levers on household well-being.

Community-level analyses: Qualitative livelihoods information at the community level was collected and linked to one of the household surveys, and used to complement the quantitative information at the household level.

Project stocktaking exercises: The asset base approach was used as a framework for examining several ongoing rural development projects using participatory methods. A series of rapid participatory assessments with project stakeholders were carried out in 2003-2004 to better understand the role of assets in generating well-being, perceptions of obstacles to adoption of successful livelihood strategies, and priorities for investments. These rapid assessments attempt to identify missing assets that are constraining project impacts, and to examine how the context of policies, risks and institutions interact with assets to achieve sustainable poverty-reducing growth.

4. SPATIAL OVERVIEW OF RURAL HONDURAS[15]

This chapter presents a spatial overview of rural Honduras, using national GIS data. A number of maps and map overlays are presented; these maps illustrate the distribution of people, economic potential and activities, and well-being outcomes across the rural space. Rural Honduras is characterized by substantial heterogeneity in economic potential and performance of sub-regions. Part of this heterogeneity is due to inherent differences in topography and agro-ecological conditions, and part is due to historical decisions to steer public investments toward more favored areas.

The spatial overview sets the stage for the household analysis in the next Chapter. The analysis begins by showing the spatial distribution of population compared to the distribution of transportation infrastructure. As expected, more densely populated areas are also those areas with better road infrastructure. We compare these distributions with the spatial distribution of agricultural potential and derive zones of economic growth potential. We examine the spatial distribution of outcomes in terms of poverty and food insecurity to understand the spatial relationship between population density, growth potential and these outcomes.[16]

Geography

Honduras is the second largest country in Central America, with a land area of about 112,000 km^2 (Figures 5 and 6). Except for the eastern province of Gracias a Dios, the country is almost entirely mountainous. About 80 percent of the country's land area west of Gracias a Dios consists of hillsides (interior highlands) or hillside areas, with the remaining 20 percent classified as lowland valleys (Figure 7, for terminology see Box 1). Within the interior highlands, numerous flat-floored valleys are mainly used for extensive

[15] This Chapter benefited from a background paper prepared by Alwang and Wooddall-Gainey (2004).

[16] Data for this section's analysis come from a variety of sources, notably the *Sistema Nacional de Información Territorial* (SINIT) and *InfoAgro*, a GIS unit belonging to SAG. These data are supplemented with data from the 1988 and 2001 population censuses, and maps from the vulnerability assessment conducted by the World Food Program (WFP).

livestock operations. Hillside areas are dominated by subsistence agriculture and staple food production and are characterized by small landholdings, low levels of technology, and low productivity.

Figure 5. Map of Honduras

***Source**: University of Texas map collection*

Population

In general, Honduras has a relatively low population density of 58 persons/km^2, but given the mountainous nature of the country, the number or people per unit of arable land tends to be much higher. About half of the population is classified as urban, of which the capital city of Tegucigalpa (about 770,000 inhabitants) together with the

Figure 6. Honduras Provinces and Counties

industrial center of San Pedro Sula (440,000 inhabitants) account for about 40% of urban residents. Other population centers with more than 100,000 inhabitants are only four[17] and are distributed unevenly across the country (Figure 8). This implies that access to urban markets and services, and non-farm employment opportunities are very limited for most inhabitants of the interior hillside areas. The province of Cortés (location of the industrial valley around San Pedro Sula which includes large concentrations of *maquila* operations) has the highest population density (307 persons/km^2) while the province of Gracias a Dios has the lowest (4 persons/km^2).[18] Of the total of about 4 million rural inhabitants, an estimated 80% lives in the hillside areas. The most densely populated hillside areas include the Western border with Guatemala and the Southwestern border

[17] They include Choloma, El Progreso and La Ceiba in the north/northwest of the country, and Choluteca in the south.

[18] Because of lack of data, neither of these two provinces is part of our household analysis.

Figure 7. Honduras Topography

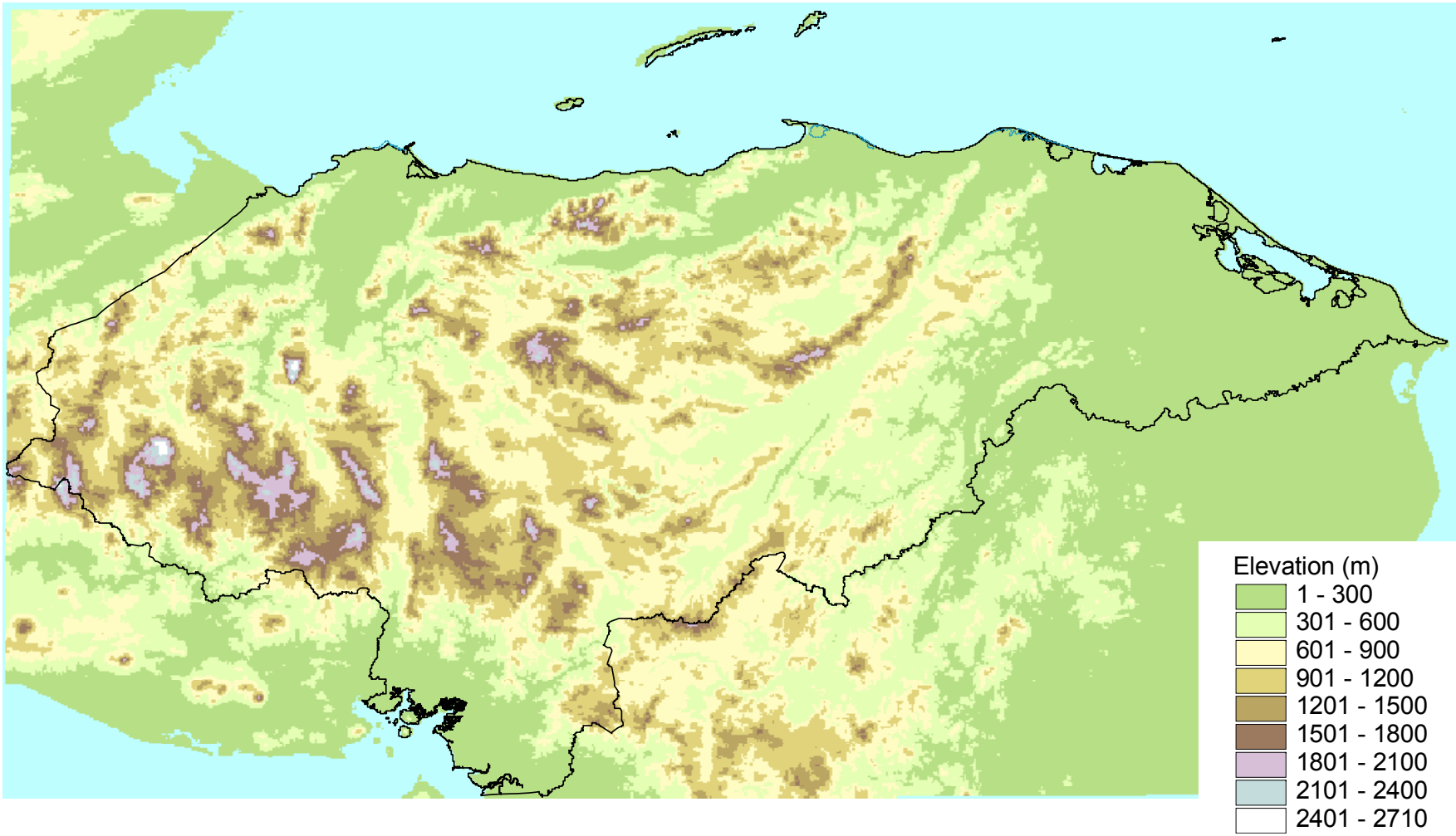
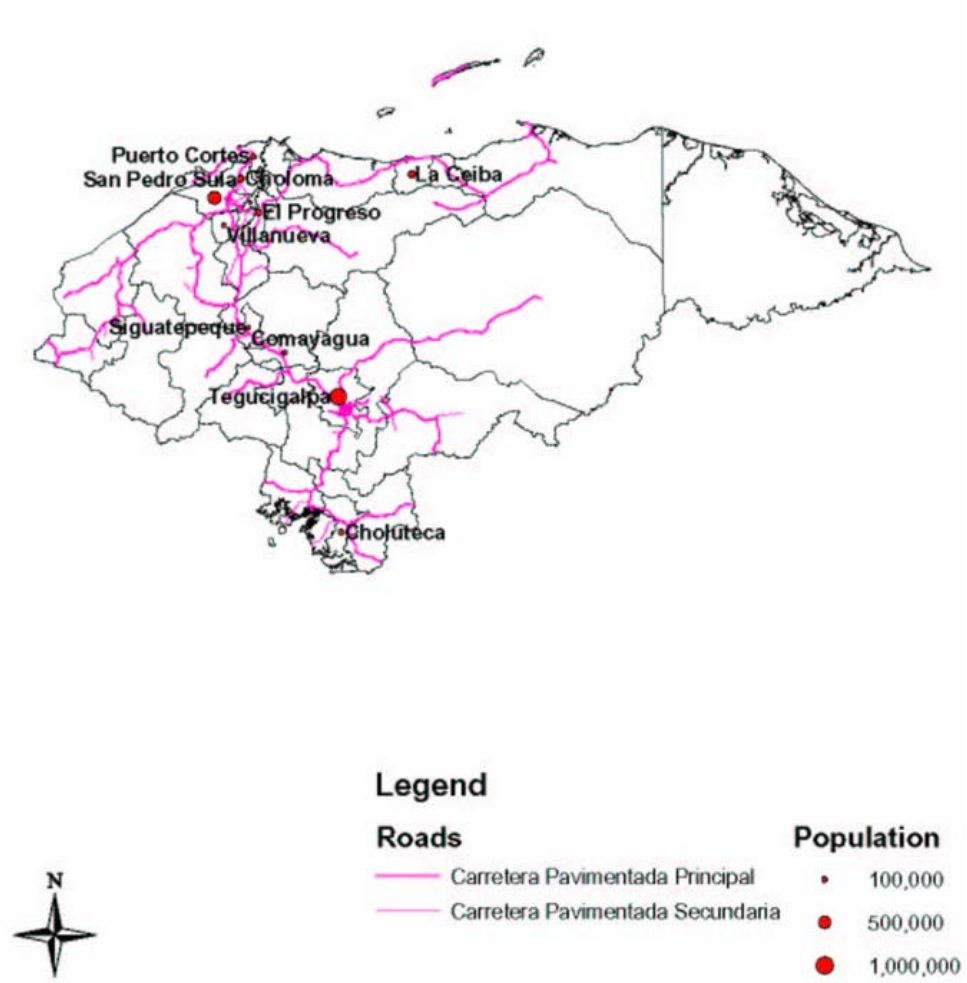


Figure 8. Transportation Infrastructure and Population Centers



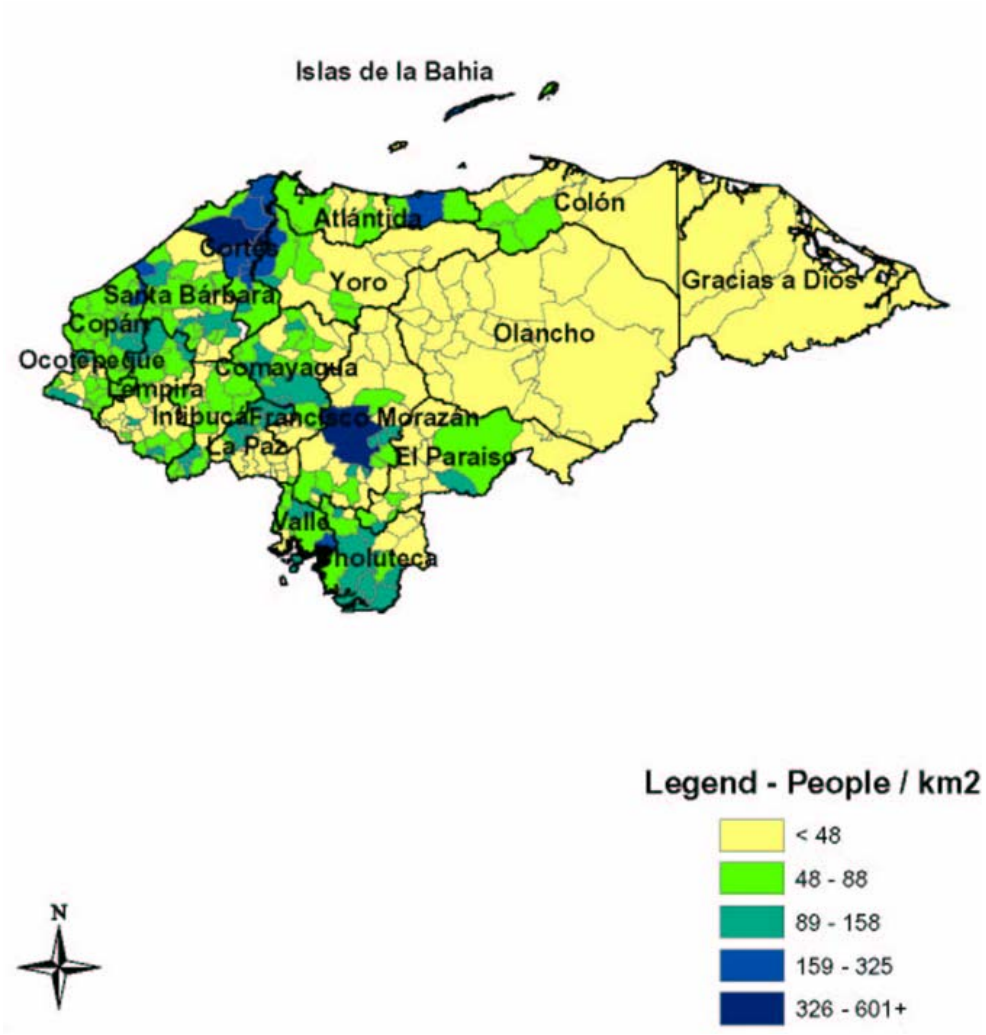
Source: SINIT

with El Salvador (Figure 9), but rural population densities vary enormously across counties and even within individual counties.[19]

Population change between the 1988 and 2001 censuses did not follow a uniform spatial pattern (Table 2 and Figure 10). Urban areas grew faster than rural areas, in particular the areas near Tegucigalpa and San Pedro Sula. But population in most hillside

[19] For example, population densities in the 200 villages of the IFPRI and Wisconsin surveys vary between less than 10 to more than 400 persons/km^2.

Figure 9. Population Density



***Source**: Census of Population and Housing 2001*

areas also increased substantially, by between 1.5 and 4% per year on average during the period 1988 and 2001. On the other hand, some hillside areas with high proportions of landless people experienced much lower population growth or even population decline. For example, some areas in the provinces of Choluteca and Lempira have lost people, mostly due to migration towards the industrial valley in Cortés where population increased most in absolute terms between 1988 and 2001; and to the agricultural frontier in the north-east (Colón and Gracias a Dios) where percentage population growth was

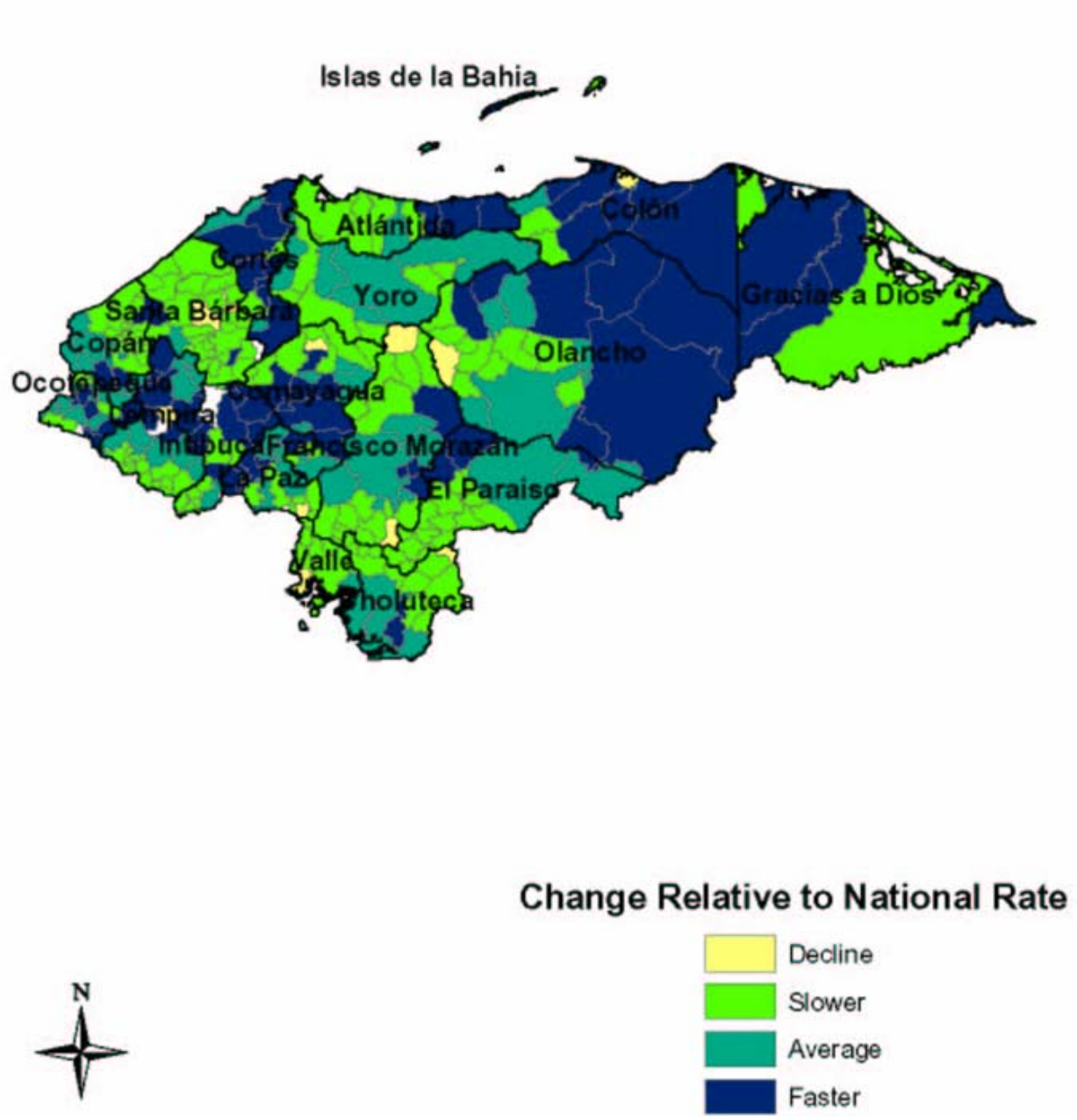
also quite fast in percentage terms, albeit from a low base. Coffee-producing areas near El Paraíso and Francisco Morazán and near the Guatemalan border grew more slowly than the national average, partially due to impacts of the coffee crisis. Internal temporary migration has also historically been an important livelihood strategy in Honduras, with most migrants leaving rural areas in the southwestern parts of the country where land is of poor quality and the supply of basic services limited (World Bank, 1994).

Table 2. Population Change and Density by Province, 1994-2002

Province	Population ('000)		Annual Growth, 1988-2001	Population Density 2001 (persons/km^2)
	1988	2001		
Atlántida	238.7	344.1	2.9	78.7
Colón	149.7	246.7	3.9	29.9
Comayagua	239.9	352.9	3.0	68.9
Copán	219.5	288.8	2.1	89.0
Cortés	662.8	1202.5	4.7	306.5
Choluteca	295.5	390.8	2.2	89.6
El Paraíso	254.3	350.1	2.5	46.7
Francisco Morazán	828.3	1180.7	2.8	137.0
Gracias a Dios	35.0	67.4	5.2	4.0
Intibucá	124.7	179.9	2.9	57.6
Islas de la Bahía	22.1	38.1	4.3	161.4
La Paz	105.9	156.6	3.1	62.0
Lempira	177.1	250.1	2.7	59.2
Ocotepeque	74.3	108.0	2.9	6.6
Olancho	283.9	419.6	3.1	17.6
Santa Bárbara	278.9	342.1	1.6	68.0
Valle	120.0	151.8	1.8	91.2
Yoro	333.5	465.4	2.6	59.8
TOTAL HONDURAS	4443.7	6535.3	3.0	58.0

***Source**: Population Censuses 1988 and 2001; IGN (1996); and own calculations*

Figure 10. Change in Population Densities, 1988 - 2001



***Source**: SINIT & Census of Population and Housing 2001*

Rural Infrastructure

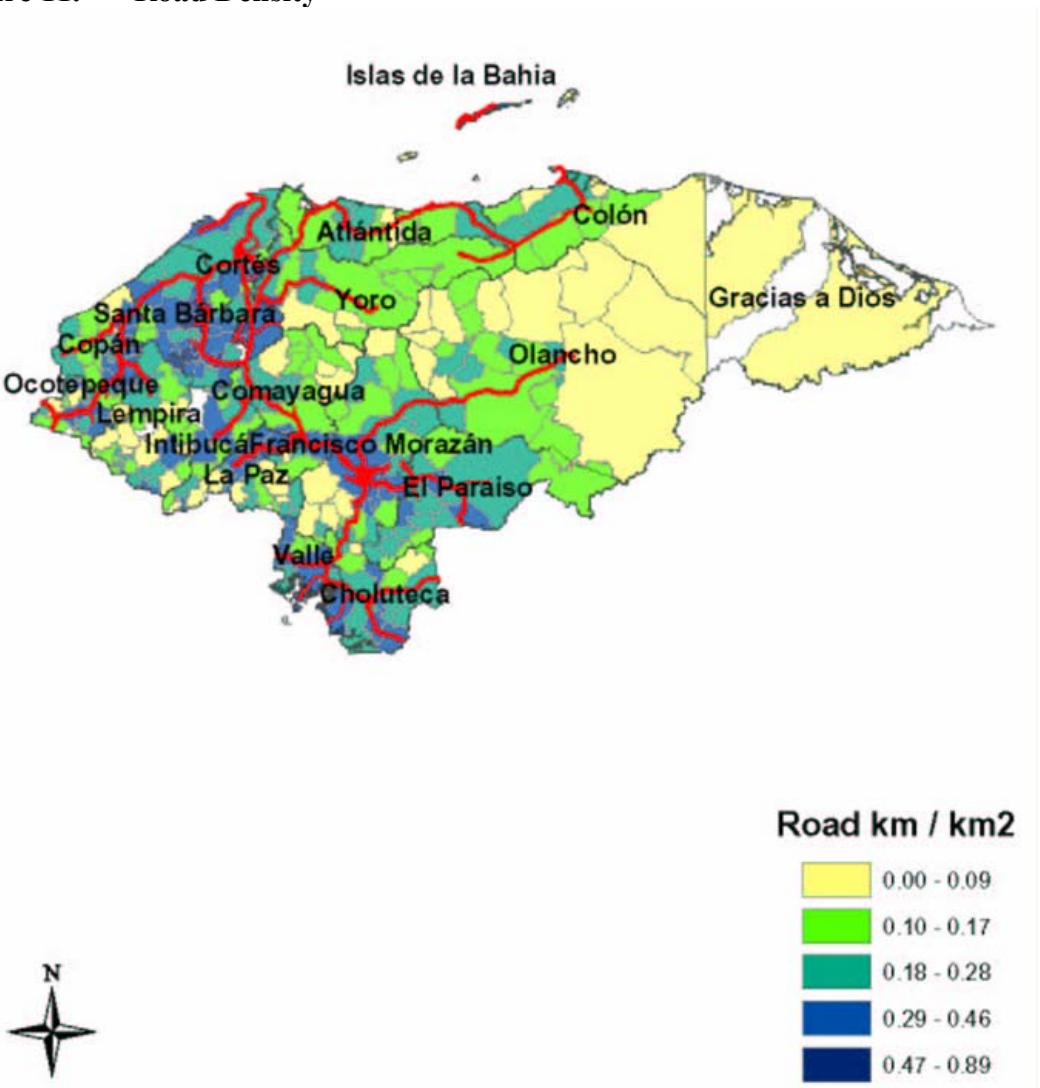
In Honduras, coverage of basic social infrastructure (e.g., schools and clinics) and physical infrastructure (e.g., roads, communication, water and sanitation, electrification) in rural areas expanded significantly in the 1990s, some as part of reconstruction efforts in response to damage caused by hurricane Mitch. However, there remain major gaps in the coverage and access by poor households and communities to infrastructure and public services, especially in hillside areas. Most major roads follow the valleys between Tegucigalpa and San Pedro Sula (Figure 8). Other major road networks head south out of Tegucigalpa to the Gulf of Fonseca near Choluteca; and eastward through the coffee producing areas near El Paraíso. The road network running parallel to the Guatemala border between San Pedro Sula and Santa Rosa de Copán serves the major coffee producing area in the country. A major road running parallel the Caribbean Sea serves the north coast, which contains significant agricultural potential. But many rural communities are isolated from major (primary and secondary) roads and/or are isolated during the rainy season when roads are impassable, especially in the hillside areas where the road network is less well developed than in the valleys. In general terms the eastern half of Honduras has very low road densities while the western half has higher densities (Figure 11). This result mirrors the distribution of population and shows a constraint to growth in the east due to lack of infrastructure; for example, there are no major highways in Gracias a Dios.

While about 70% of the rural population is covered by water and sanitation infrastructure, access and services are not always available. Electricity coverage in rural areas is only 20%, as opposed to 85% in urban areas (Government of Honduras, 2004). The lack of social and physical infrastructure has clear implications for the productivity and competitiveness of agricultural and non-agricultural activities in Honduras, and limits opportunities for poverty-reducing growth.

Agricultural Potential

The majority of Honduras consists of hillside areas, and most of these are not really suitable for intensive agricultural use. The reality is very different, however; despite the absence of a recent land use map, many hillside areas are known to be used for food staple production using unsustainable technologies that have led to increasing degradation of natural resources, particularly soil, forest, and water resources (Kok, 2001; Pender et al., 2001; Jansen et al., 2005).

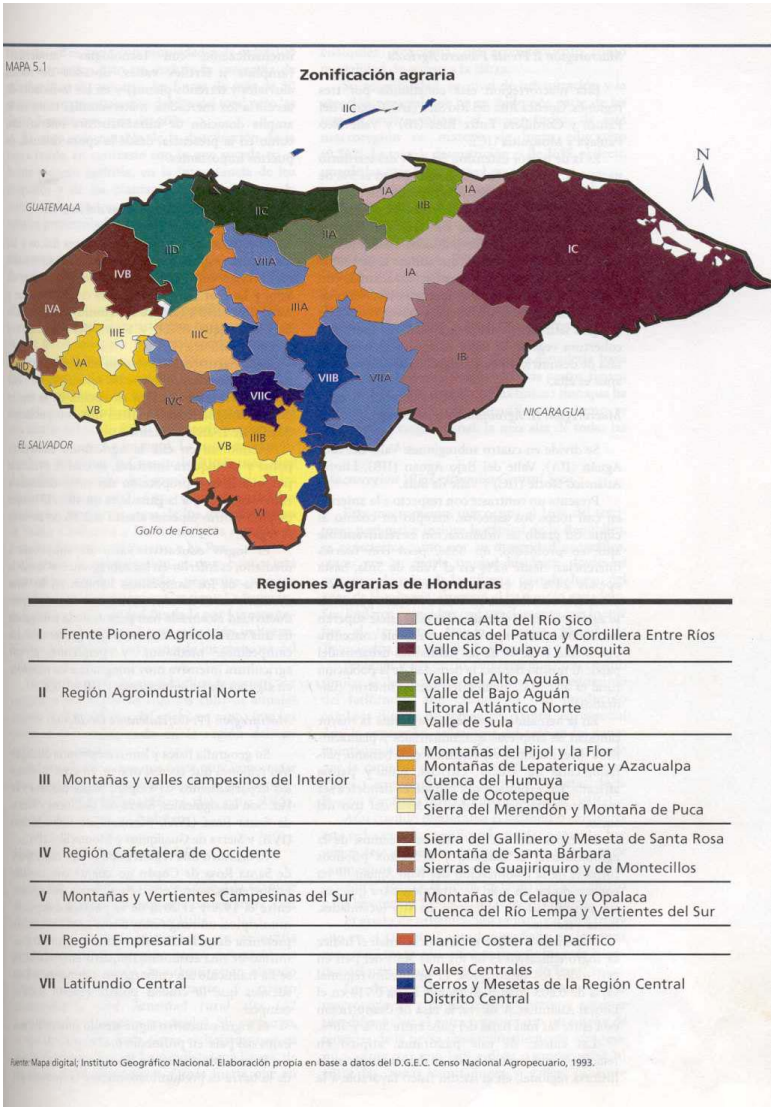
Figure 11. Road Density



***Source**: SINIT & Census of Population and Housing, 2001*

In its 1998 Human Development Report (UNDP, 1998), UNDP divided Honduras into seven agricultural macro regions (Figure 12), each containing characteristics (physical and others) that lead to certain patterns of production. These agro-ecological and land use zones can be useful for conceptualizing agricultural potential and appropriate actions to promote broad-based growth in agriculture. Hillside areas correspond mainly to zones III, IV, V and parts of VII. The seven zones are described in Box 7.

Figure 12. Agricultural Macro-regions



***Source**: UNDP (1998).*

Box 7. Agricultural Macroregions as Delineated by UNDP

Zone I: ***Agricultural frontier***: Represents the east and southeastern regions of the country. This area has very low population density and is underserved by roads. It contains most of the country's biological reserves and is potentially an important area for tourism development. People tend to be very poor (rural poverty is deep) but relatively few (rural poverty is not dense).

Zone II: ***Northern agro-industrial area***. Comprises the northern coastal areas and the valley around San Pedro Sula with high population density and relatively large landholdings. Land use is dominated by plantation agriculture and extensive livestock operations. The *maquila* industry attracts many migrants from rural areas elsewhere in the country. Rural poverty is less deep, but quite dense because of high population densities.

Zone III: ***Mountains and valleys in the central interior***: Areas where small-scale peasant agriculture predominates. Roughly 30 percent of the land is devoted to crops and 40 percent to intensive livestock (small pastures). Both agricultural potential and infrastructure vary considerably in this zone. Rural poverty is deep and dense, particularly in areas with high population density.

Zone IV: ***Western coffee-growing area***. Includes most of Honduras' coffee production, mostly produced on relatively small farms (mostly < 3.5 Ha) that co-exist with larger scale farms. Due to fairly good road infrastructure, producers have relatively good market access, despite the often difficult terrain. Tourism potential, particularly in the Copán area, has not been fully exploited yet. Due to relatively high population densities, rural poverty is dense and has become deeper as a result of the recent coffee crisis.

Zone V: ***Mountains and steep-slope campesinos of the south***. Area largely comprised of very poor small-scale producers of basic grains and small-scale livestock. Poverty and small-scale agriculture are associated with environmental degradation that assumes particular importance as the region contains significant parts of Honduras' four major watersheds. These include Ulua, Chamelecón, Lempa and Choluteca. Rural poverty is both deep and dense.

Zone VI: ***Southern agri-business area***. Includes industrial producers of various scales of production located on the coast of the Gulf of Fonseca who focus on export products such as melons and shrimp. This area, which is relatively urbanized, has relatively favorable access to infrastructure and social-support institutions. As a result, rural poverty is less deep and less dense.

Zone VII: ***Central latifundio***. Area located in the valleys toward the western part of the Nicaraguan border. This area includes Tegucigalpa, occupies about 16 percent of Honduras' land area and is characterized by geographic diversity. Historically, this area was characterized by extensive livestock operations on large holdings. More recent changes have included coffee expansion on mountainous slopes and increased horticulture closer to Tegucigalpa. Landless agricultural workers and producers and smallholdings are found among large-scale landholdings. Rural poverty is both deep and dense.

Box 8. Topography, Agricultural Potential and Market Access

A recent study of western Honduras concludes that: "The most significant finding in this study is that the probability of stable agricultural production is significantly greater at lower elevations, flatter slopes, and in larger patches than in areas of forest cover. Stable agriculture also tends to be found in areas that are relatively more accessible to local markets, but less accessible to regional markets. " (Munroe et al. 2002, p.367).

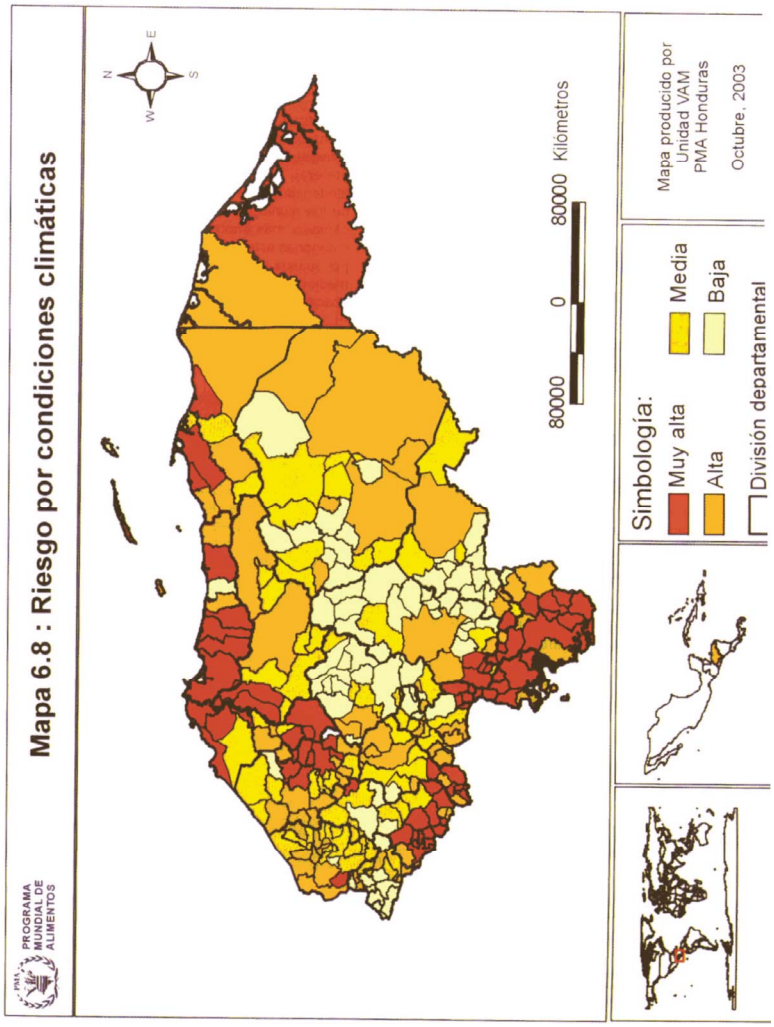
Food (in)security

The World Food Program (WFP), together with the Government of Honduras, has recently published a set of maps that reflect different dimensions of food insecurity (GoH/WFP, 2003). The maps, which were produced using GIS techniques that include overlaying different factors on a single map, reflect different agro-ecological and socio-economic factors that influence the availability and affordability of food for households throughout the country. We present and briefly discuss two of the most relevant of these maps (see also Figures 13 and 14, and Box 8):

a) Vulnerability to food insecurity as a function of economic access: The map in Figure 14 combines 5 factors that influence economic access and the ability of households to deal with risks. The factors and their respective weights are: per capita income (22%), education level (22%), household dependency ratio (22%), road density (16%), gender of household head (14%), and land area under permanent crops (3%). These factors and weights were determined from previous research studies, and are also key factors in our econometric analyses of household level data in Chapter 5. The "T of Development" can be seen quite clearly in this map, as areas represented by low vulnerability to food insecurity and, conversely, high economic access based on a set of critical factors. Hillside areas in the western and central part of the country, and eastern areas are mostly classified as very highly or highly vulnerable to food insecurity because of a combination of lower capita income, low education, high dependency ratio, and low road density.

b) Climatic risk: The map in Figure 15 combines 5 factors of climatic risk which has been identified as an important cause for falling into poverty (Colindres et al., 2004). The factors and their respective weights are: erosion potential from rain (30%), desertification index (25%), vegetative cover (16%), share of population facing flood risk (19%), share of population facing drought risk (13%), and share of population using soil conservation practices (6%). The major parts of this "climatic risk index" are related to droughts, but also includes floods, and factors

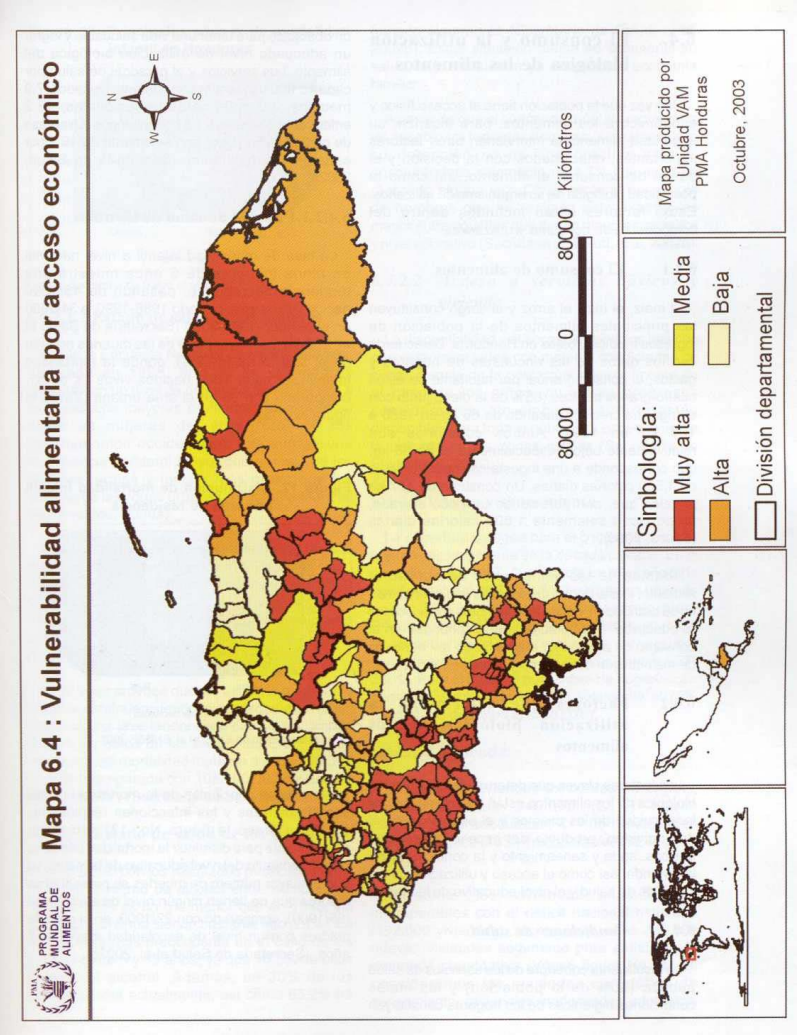
Figure 13. Climatic Risk



such as vegetative cover and conservation practices that can lower vulnerability to climatic risks. Figure 14 shows that most areas of Honduras face very high or high climatic risks. A notable exception is the central part of the country, much of it corresponding to the "T of Development". Hillside areas in the west and south, where poverty density[20] is relatively high contain most of the very high-risk areas.

[20] The poverty density is the number of poor per unit of land area. The poverty rate is the number of poor in an area divided by the area's total population.

Figure 14. Vulnerability to Food (In)security



The WFP maps of vulnerability to food insecurity as a function of economic access and climatic risks once again demonstrate the heterogeneity of conditions across Honduras, regarding economic access and climatic risks. However, it is possible to generalize that most of the country is characterized by areas that have low economic access and high exposure to climatic risks.

Population Density, Land Use and Technological Change: Malthus or Boserup?

Kok (2001) analyzed the relationships between agro-ecological factors, land use and population density and growth rates between 1974 and 1993 for different zones in

Honduras. His findings of a constant relationship between population growth and expanding agricultural area, and yield growth lagging behind area growth, are suggestive of a lack of technological development. Kok (2001) therefore concludes that land use changes in Honduras support the theory of Malthus, whereby population growth is coupled with ongoing environmental destruction (e.g., deforestation and soil degradation) and lagging increases in food production (leading to declining food output per capita). Kok's confirmation of Malthus' theory contradicts the Boserup theory of ever-present endogenous technological change. Jansen et al. (2003b) actually find some support for the Boserup theory in hillside areas of Honduras, but only at relatively high population densities. In particular, they found that new technologies (notably improved conservation practices) start to be adopted only once a certain population density threshold is reached (varying between 170 and 270 persons/km^2, depending on the type of conservation practice). Another study by Munroe et al. (2002) examined land use change in western Honduras (the county of La Campa in the province of Lempira) and found a complex relationship of technological development, agricultural intensification, market orientation and deforestation. They found two simultaneous changes taking place as a result of improved infrastructure (e.g., roads and other basic infrastructure and support services such as technical assistance and credit). First, improved infrastructure leads to abandonment of marginal land and new clearings for market-oriented crops. Second, adoption of agricultural intensification techniques has led farmers to establish more permanent crops (notably coffee) on better quality lands and reduce the use of marginal land for maize and beans, with the latter being reforested. With continued population growth and land scarcity, there has also been a decline in communal tenure, and a transition from shifting cultivation and short fallows. The key questions are: a) how can poor rural households in hillside areas escape the Malthusian "doomsday" route to self-destruction? And b) what assets and institutional incentives can stimulate a Boserupian process of technological change and survival? Answers to these questions are critical for many high population density/high poverty hillside areas in Honduras.

5. KEY FINDINGS FROM QUANTITATIVE AND QUALITATIVE ANALYSES

This chapter contains the main analytical results of both the quantitative and qualitative analyses carried out in the study. We first describe our data sets in Section 5.1. To apply our conceptual framework outlined in Chapter 3 and to better understand rural household livelihood strategies, we analyze households' asset portfolios in Section 5.2. In Section 5.3 we use households' asset portfolios and factor and cluster analysis techniques to identify groups of households that pursue similar livelihood strategies. In Section 5.4 we use econometric techniques to isolate the main determinants of these livelihood strategies. We then investigate the main determinants of household income and their linkages with asset endowments and livelihood strategies in Section 5.5. We also draw upon community livelihood studies, to complement the quantitative analyses. Finally, Section 5.6 reports on the "project stock takings" of a limited number of rural development projects carried out, using participatory methods with project beneficiaries, to examine how these projects contribute to growth and poverty reduction, and to identify "missing assets" and "successful" livelihood strategies. The qualitative analyses provide some perspectives on the institutional/policy and risk context, intangible assets such as social capital, and household measures of well-being besides income, and as such complement our quantitative analyses.

5.1. Description of Data Used

Household Survey Data and their Geographical Coverage

In Honduras, there does not exist a household-level data set that is representative for the entire country while also providing sufficient and reliable information that allows the kind of detailed income and asset-based analyses required for this study. For example, while INE's 2003 permanent household survey covers some 8,000 households and is statistically representative at the country level, it has far too little detail to apply to our asset-based approach. Other available household-level data sets, such as those available at the Panamerican College of Agriculture (EAP Zamorano) have very limited

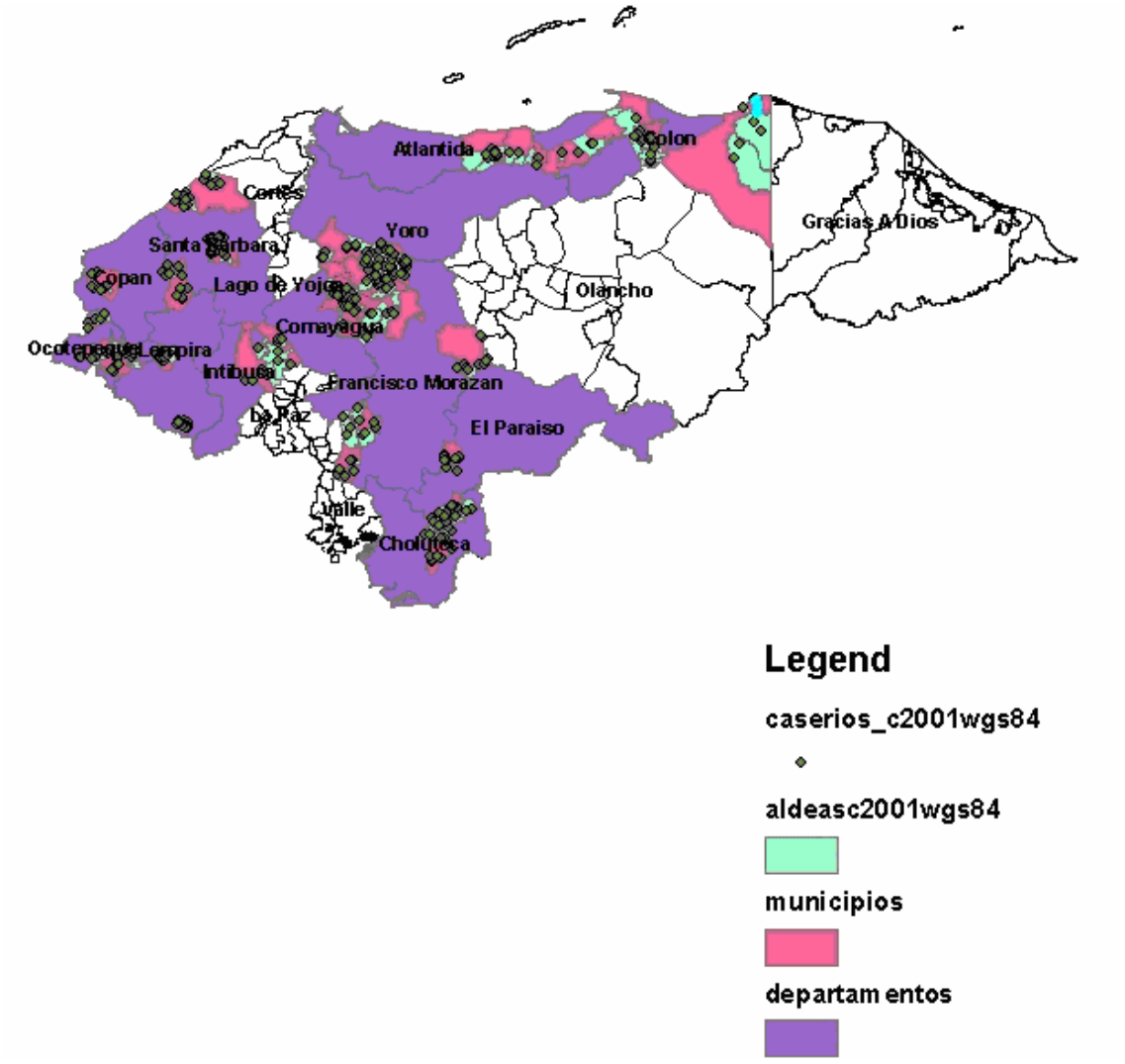
geographical coverage and the data were never properly cleaned. Others, such as farm-level data sets for Lempira province available from the Food and Agriculture Organization of the United Nations (FAO), are of good quality but also short on required economic detail and (especially) geographical coverage.

Consequently, the household-level analyses presented in this paper are based on data from two sub-national surveys that collected similar (though not 100% identical) information and are largely complementary in terms of their geographical coverage. The first survey was carried out in 2000-2001 for a land tenure and rural finance study of the University of Wisconsin at Madison, while the second survey was carried out in 2001-2002 under the auspices of IFPRI (in cooperation with Wageningen University and Research Center (WUR) and the National Program for Sustainable Rural Development (PRONADERS) of the Government of Honduras) for the project "Rural Development Policies and Sustainable Land Use in the Hillsides of Honduras". The IFPRI household survey was carried out in areas classified as hillsides located in hillside areas, whereas the University of Wisconsin survey was carried out in both hillsides and valleys located in hillside areas.[21] Together these surveys cover parts of 12 (out of 18) provinces (*departamentos*), 42 (out of 298) counties (*municipios*), 206 villages (*aldeas*) and 400 hamlets (*caserios*). The total number of households (*hogares*) for the combined surveys is 1,225. Both household surveys were supplemented by adding secondary, mostly geo-referenced information that included (but was not limited to) rainfall, altitude, population density, and road density from various sources.

Figure 15 depicts the geographical coverage of the combined surveys (and see Annex 2 for more details on survey methods and coverage). Note that the combined surveys have virtually no coverage in the eastern part of Honduras where poverty is deep but not dense because of low population densities. However, the combined surveys cover the major populated areas of Honduras.

[21] See Box 1 for an explanation of the terms hillsides and hillside areas.

Figure 15. Geographical Coverage of Combined IFPRI and Wisconsin Household Surveys



Livelihoods Studies and their Geographical Coverage

The IFPRI household survey was accompanied by qualitative diagnostic surveys at the community level in the same 95 communities where the household survey was conducted between May 2001 and March 2002 with the help of local non-governmental organizations (NGOs) with long-term experience in the area. The community-based livelihood studies complement the household surveys and involved the characterization and diagnosis of problems, limitations and opportunities resulting in community profiles. Although highly participatory and informal, structured methods were used in close cooperation with a carefully selected representative group of community stakeholders of about 20 persons in each community. Key elements in each diagnostic included the history of the community, the agricultural production systems, management of natural resources, access to infrastructure, public facilities and services.[22] See Annex 3 for a brief summary of the livelihood studies.

5.2. Distribution of Assets Among Households and Household Income

To apply our asset base approach and better understand household livelihood strategies in rural Honduras, we describe households' asset bases and examine how they differ between poor and less poor households. The descriptive statistics of household assets and incomes presented below are based on the IFPRI and University of Wisconsin household surveys, and are complemented by information on household and community assets from the livelihood studies in IFPRI surveyed communities. Some of the descriptive statistics are presented for both surveys combined, whereas others are presented separately.

[22] Examples of specific information sought include major occupations of the community's inhabitants, dominant land use types, land tenure arrangements; perceptions regarding natural resource degradation, market access, health and education; forms of community-based organization and collective action, and influence of external projects and programs.

Household Assets

Natural Capital

Average landholding size is about 14 ha (or 19.5 manzanas (Mz))[23], but the distribution of land is highly unequal (Table 3). Nearly two-thirds of households work less than 7 ha (10 Mz). Average farm size differs substantially between the IFPRI (hillside) households with 8.6 ha (12.5 Mz) and University of Wisconsin (hillside and valley) households with 15.4 ha (22 Mz). Whereas poverty is widespread throughout rural Honduras, it is particularly severe on small farms where the vast majority of households are not only poor, but also extremely poor.[24] That is, there exists a clear negative correlation between poverty and landholding size. However, 20 percent of households with relatively large landholdings (greater than 14 ha or 20 Mz) also had high rates of poverty and extreme poverty. Thus, more land, in and of itself, is no guaranteed poverty exit strategy.

Land security among hillside households is limited, since fewer than 15 percent of households report owning land with legal title. Whereas receiving land titles is important for smallholders' tenure security, improved land tenure in combination with reforms in the credit market is likely to improve access to credit and stimulate investments in land improvement, thus improving both the level and sustainability of agricultural production.[25] This is likely to be particularly the case where land titles are appropriately registered (López, 1997; Deininger and Chamorro, 2003).

[23] One manzana (Mz) equals 0.7 hectares (Ha).

[24] Following the Honduran National Statistical Institute (*Instituto Nacional de Estadística, INE*), we use income-based definitions of poverty (< US$ 1.50/day/person) and extreme poverty (< US$ 1.00/day/person).

[25] Previous analysis of the IFPRI data (Jansen et al., 2003a) showed that land tenure consistently affects a producer's decision to implement soil conservation measures. Conservation investments are less likely on rented land, while renters are more likely to burn their land.

Table 3. Distribution of Households by Landholding Size and Income

Landholding Size	% Sample Households	% Sub-Sample Households that are Poor	% Sub-sample Households that are Extremely Poor
< 2 Mz	24.5	70.9	66.9
2 to 5 Mz	23.3	59.3	55.8
5 to 10 Mz	17.1	62.2	59.8
10 to 20 Mz	14.8	60.8	54.7
20 to 50 Mz	11.5	59.6	52.5
> 50 Mz	8.8	57.9	52.3

***Source**: Own analysis of IFPRI and Wisconsin household survey data.*

Besides landholding size, agricultural potential is mainly defined by agro-ecological conditions (e.g., elevation, slope, climatic factors). In addition, soil and water conservation investments influence agricultural potential and productivity. Less-poor households tend to have better soils, and are located at lower altitudes, and in higher rainfall areas.[26] Adoption of conservation practices among the survey households is low (Table 4) but higher in communities with agro-ecological conditions favoring horticulture and lower in communities with extensive livestock production (Jansen et al., 2003b). Even the most popular conservation practice (live fences which keep cattle out of fields and also may function as windbreaks) is adopted on less than one out of every five farms. Other conservation practices that require relatively sizeable investments, such as terraces, are even less common. In contrast, more than 50 percent of households burn their fields as a form of land preparation. Lack of knowledge among farmers regarding the need and benefits of soil conservation is widely regarded as a major limitation to the adoption of such practices.

[26] Regarding soil quality and rainfall data, there is detailed soil information for IFPRI households (the IFPRI survey included collection of soil samples from farmers' fields), but not for University of Wisconsin households. Soil quality was approximated by potential maize yields (nutrient-limited but not water-limited) which we calculated using the QUEFTS (QUantitative Evaluation of soil Fertility and response To fertilizerS) model (Janssen, 1990), taking into account nitrogen content, pH, and available potassium and phosphorous. All this information was obtained from laboratory analysis of soil samples as part of the household survey exercise and was used to derive a soil quality index (see also Jansen et al., 2003a).

Table 4. Adoption of Conservation Practices

Type of Conservation Practice	% Wisconsin Households that Have Adopted	% Parcels in IFPRI Survey on which Practice is Adopted
Stone walls	10.4	5.8
Terraces	2.8	n.a.
Wind breaks/live fences	20.6	10.0
Contour planting	9.9	n.a.
Dead fence construction	n.a.	4.8
Fruit tree planting	n.a.	3.4

***Source**: Own analysis of IFPRI and Wisconsin household survey data.*

Human Capital

We consider four types of human capital assets: education, household size and composition, ethnicity, and migration assets.

Average education levels are very low (a little over 4 years, Table 5). Low education levels are consistent with high dropout rates, despite continuing rises in school enrollment. With limited educational progress over time (younger household members tend to have little more schooling than their parents), the human asset base in rural Honduras has virtually stayed stagnant between 1993 and 2003.

On average, households are large with nearly 8 members per household, with relatively high dependency ratio[27] (74%). In combination with low education levels, this limits the income-generating capacity of rural households. One-sixth of all households have at least one member living somewhere else, and on average, households have 1.4 members living outside the community for an average period of seven months per year. Migrants tend to be relatively well educated as suggested by a decline in the proportion of rural residents with secondary education between 1997 and 2003. The vast majority of survey households (95%) do not belong to a distinguishable ethnic minority, which

[27] Dependency ratios were calculated as the number of household members younger than 12 or older than 70 divided by the number of household members between 12 and 70.

makes it difficult to use the survey data to draw any conclusions regarding the influence of ethnicity on income and other indicators of well-being.[28]

Table 5. Education

	Household Head	Household Members Older than 7 years
Education level:	**Frequency (% sample hh)**	**Frequency (% sample hh)**
< 4 years	62.2	47.3
primary, 4-6 years	30.2	36.0
secondary, 7-11 years	3.8	10.1
post-secondary, > 11 years	3.8	1.9
% that can read & write	65.6	
Average yrs of schooling	4.1	4.4

***Source**: Own analysis of IFPRI and Wisconsin household survey data.*

The average level of education also varies considerably among communities. Although the average literacy rate in the 95 IFPRI communities is about 50%, literacy varies from less than 25% to almost 100%.

Physical Capital

Physical assets include fixed agricultural assets such as machinery and equipment, livestock, vehicles, and housing. On average households own about US$ 4750 in physical assets. As in the case of land, the distribution of physical assets is highly skewed. On average, these assets are considerably higher for the Wisconsin than the IFPRI survey households, indicating that the IFPRI survey covered the poorest of the poor in the hillside areas. Less than 20% of the sample communities have electricity, and only 13% have a public telephone. Less than one-third of the communities have a health clinic and about one-third have access to public transportation. Although 80% of the communities have a source of potable water, in general, this service is limited to main settlement centers in the community.

[28] Nationally, defined ethnic minorities account for about 15% of the population, and are thus somewhat underrepresented in the IFPRI and Wisconsin surveys.

Financial Assets

Financial assets include savings, credit, and transfers. Transfers mainly are in the form of remittances, but also include other cash transfers, such as pensions and conditional payments from the *Programa de Asignación Familiar* (PRAF, a conditional cash transfer program). The one-quarter of households that receives remittances (mainly from abroad) receives about US$ 600 per year per household or about US$ 80 per person. Within the rural population, remittances are unevenly distributed: only 15% of all households in the IFPRI sample receive remittances, and on average only US$ 200 per household per year (Box 9).

Box 9. Remittances and Hillside Households

Even though remittances only make a relatively minor contribution to average household income in hillside areas, they are a significant source of income for those households that do receive them. In the IFPRI sample, remittances only account for 5 percent of household income, with an average household receiving 468 Lempiras (equivalent to about US$ 30) per year. But for the 15 percent of households that actually receive remittances, this source of income accounts for one-third of their total income, and for households located around Tegucigalpa this share can be as high as 40 percent. Average annual remittances of families that do receive them are US$ 202. Poor basic grains farmers receive fewer remittances than livestock and coffee farmers.

The majority of households that receive remittances use these funds for food purchases. Remittances are also used to cover health care expenses and schooling costs, but to a much lesser extent. Only 20 percent of households in the IFPRI survey reported *wanting* to spend this income on food, others would have *liked* to have invested this money in buying cattle, fixing up the house, starting a business, buying clothing, or saving. However, many recipient households reported that funds were either insufficient or necessary to buy food, and that these investments could therefore not be realized.

Well over one-half of all rural households do not receive any form of credit (formal or informal, Table 6). Many claim that credit is too expensive and also too risky (danger of losing land), thus preventing them from accessing financial resources for investing in productive activities, as well as a potential safety net for coping with unexpected disasters. Even though just over 10% of households report receiving credit from regulated institutions (mostly banks), such type of credit is almost non-existent in the hillsides. Just over 1 percent of the IFPRI households reported receiving credit from regulated institutions. Formal credit from non-regulated institutions (such as producers' cooperatives, communal banks, NGOs etc.) is more widely accessible: about 12 percent

of rural households reported receiving it with little difference between the IFPRI and the Wisconsin survey households. Informal credit is by far the most popular form of credit used by rural households, with one-quarter of them reporting it. Nearly two-thirds of all households reported keeping some savings (Table 6). The Wisconsin households that have savings hold about US$ 2000 on average. The IFPRI survey did not ask for amounts of savings, but we assume that poor hillside farmers have even lower savings.

Table 6. Financial Capital

TRANSFERS	Average Amount (Lps) per year of Households that Received	% Households that Received
Remittances	9100	44.8
Pension	30586	2.9
School support	528	42.5
Child support	519	20.6
Old age support	519	8.5
Scholarships	997	7.8
Other transfers	2460	6.3
TOTAL TRANSFERS	5710	57.6
CREDIT	**Average Amount (Lps) Borrowed by Households that Received Credit**	**% Households that Received Credit**
Formal credit from regulated institutions	59272	11.8
Formal credit from non-regulated formal institutions	18042	19.3
Informal credit	12034	25.7
Credits that already existed at the beginning of 2000 (only Wisconsin survey)	51148	27.1
TOTAL CREDIT	50738	44.6
SAVINGS	**Average Amount (Lps) of Households that Reported Savings (only Wisconsin Survey)**	**% Households that Reported Savings**
Formal savings	25270	36.3
Informal savings	22911	35.0
TOTAL SAVINGS	32681	61.5
TOTAL FINANCIAL ASSETS	64518	

***Source**: Own analysis of IFPRI and Wisconsin household survey data.*

Social Capital

In general, social capital (which we measured by the degree of participation in organizations active in the community) is limited. Whereas the most popular types of organizations include the church, followed by the '*patronato*', parents' organization and water association, participation in other types of organizations is limited to generally less than 1 in 20 households (Table 7). Perhaps most importantly, the poor have significantly less social capital than the less poor.

Table 7. Participation in Organizations

Type of Organization	Percentage of All Households Participating	Percentage of Poor Households Participating	Percentage of Non-poor Households Participating	Mean Difference Between Non-poor and Poor Households
Agricultural cooperative	2.7	3.0	2.3	-0.7
Producers' association	5.6	5.5	5.9	0.4
Community organization (*patronato*)	14.9	12.4	19.2	6.8
Parents' organization	14.4	10.2	21.7	11.5
Ethnic organization	1.4	0.4	3.2	2.8
Water association	11.6	10.1	14.2	4.1
Political organization	2.6	2.2	3.2	1.0
Church	30.3	20.1	47.9	27.8
Rural savings & loans	5.1	3.4	8.1	4.7
NGO or project	6.1	5.5	7.2	1.7
Women's organization	5.1	4.1	7.2	3.1

***Source**: Own analysis of IFPRI and Wisconsin household survey data.*

Social capital varies greatly among IFPRI communities (Jansen et al., 2003b). The majority of community-based organizations deal with infrastructure, with relatively few of them focusing on agricultural production or environmental protection, both of which seem more the focus of external organizations. The degree of collective action also differs significantly across communities. Collective action focuses mainly on infrastructure works, particularly road maintenance through food-for-work programs and maintenance or construction of other public works such as waterways and school buildings. Compared to infrastructure-related types of collective action, there is much

less collective action linked to protection of natural resources (e.g. reforestation in watersheds, control of forest fires etc.).

Location Assets

The information regarding location assets differs between the IFPRI and the Wisconsin survey to such an extent that it warrants separate analyses. From the Wisconsin data (Table 8), we can conclude that poorer communities tend to be more isolated and have less access to electricity and drinking water. The Permanent Household Surveys (*Encuesta Permanente de Hogares*) carried out regularly by the National Statistical Institute (*INE*), indicate that the proportion of rural residents with access to safe drinking water actually declined by 10% over the period 1993-2003. Access to other public services (health and schooling facilities) is universally difficult and not significantly different between poor and less-poor communities. The IFPRI data for hillside households also provides evidence of generally difficult access to markets and public services, but they do not show a clear-cut correlation with income level (Table 9).

Table 8. Access to Public Infrastructure and Services

Variable	Mean Value	Poor Communities	Non-poor Communities	Mean Difference
Distance to county capital (km)	12.8	13.1	10.9	2.2
Distance to the capital of another (closer) county (km)	12.4	12.3	9.3	3.0
Primary access to the community is a paved road (=1 if yes)	7.2 %	5%	9%	4%
Number of months per year the access road can be used	8.0	8.4	8.9	0.5
Percentage of communities with electricity	28.2	25.7	31.9	6.2
Percentage of communities in which >50% of the households have drinking water	52.8	47.6	58.4	10.8
Percentage of communities in which >50% of the households have sanitary services	2.7	1.7	3.5	1.8
Distance* to daily market, in km	41.5	42.6	43.6	1.0
Distance* to health center, in km	5.4	5.6	4.2	1.4
% communities with secondary school	38.8	37.4	44.0	6.6
Distance to secondary school, in km	6.5	6.6	5.4	1.2
Travel time to secondary school (minutes)	41.4	41.2	38.8	2.4

* If it exists in community, then distance = 0

***Source**: Own analysis of Wisconsin household survey data*

The level of infrastructure development differs significantly across the IFPRI communities. For example, road density varies from less than 0.3 km/km^2 to over 8 km/km^2. Communities in coffee growing areas tend to have a denser road network and better market access. Population density is also generally high in coffee growing areas.

Table 9. Access to Public Infrastructure and Services

Variables (all are travel time in minutes)	Average Value for all HH	Average Value for HH that Earn > $ .00/person/day	Average Value for HH that Earn Between $0.50 & 1.00/person/day	Average Value for HH that Earn < $ .50/person/day
Distance to paved road	74.2	68.7	92.8	72.2
Distance to fuel wood source	43.8	40.2	66.7	40.8
Distance to school	15.1	12.5	10.8	16.1
Distance to health center	66.5	72.3	74.7	64.6
Distance to Farmers' market	73.1	72.1	93.00	70.2
Distance to Non-paved road	34.5	40.2	36.7	33.3

***Source**: Own analysis of IFPRI household survey data*

Household Income

Total household income is defined as the sum of the net value of crop and livestock production (revenues minus costs) and income from off-farm salaried work (either farm or non-farm), own business and transfers. Own production, whether consumed by the household or sold, is included in the calculation of household income. This is in contrast to the INE national permanent household surveys where rural households are only asked about income from sales of agricultural products, thereby not including own-consumption, which is a major imputed part of household income for many rural households in Honduras.[29]

[29] The way in which income is measured in the INE household surveys almost certainly leads to such a serious degree of underreporting of incomes. Despite the many pitfalls caused by the absence thus far of a LSMS survey for Honduras, one advantage of detailed household surveys such as the ones used for this

On average, rural households in Honduras are very poor in terms of per capita income per household member (Table 10). An average per capita daily income of US$ 0.65 translates into a rural poverty rate of 90%. Worse, 94% of the poor (< US$ 1.50 per day) are extremely poor (< US$ 1.00 per day). The IFPRI data confirm that poverty is deepest in the hillsides where there are relatively few non-poor people (as indicated by a relatively low coefficient of variation). The Wisconsin data also contain households located in better-endowed areas (including valleys in hillside areas) and therefore both the average income level and the range of income are higher.

Many participants in the community-based livelihood studies claimed that living conditions have worsened over time. This was confirmed by many participants in the regional dissemination workshops that IFPRI and PRONADERS organized in 2003 (see Jansen, 2005). There was a general perception by many hillside residents that real wages (and purchasing power) in the rural areas have substantially decreased over the past decade, by as much as 30 to 50%.

Table 10. Income-based Indicators of Rural Poverty in Honduras Based on Survey Data

Poverty Indicator	All Household Survey Data	University of Wisconsin Data	IFPRI Data
Poverty rate (% people with < US$ 1.50/person/day)	90.0%	87.6%	95.5%
Extreme poverty rate (% people with < US$ 1.00/person/day)	84.6%	81.4%	91.7%
Average per capita daily income (US$, std error followed by CV in brackets)	0.65 (1.69, 2.57)	0.77 (1.97, 2.56)	0.39 (0.60, 1.52)
Range in per capita daily income (US$)	-3.57 -- 31.89	-3.57 -- 31.89	-2.06 -- 4.37

***Source**: Own analysis of IFPRI and Wisconsin household survey data.*

Less than 15% of all households rely on their own farms as their only source of income, and only one-third of households rely on either farming alone or farming

paper is that they allow for a more precise and generally more reliable calculation of household income. The data of the first LSMS for Honduras are expected to become available in the second half of 2005.

combined with transfers (Table 11). About half the households derive their income from own farming combined with off-farm work, with most of them receiving some transfer payments as well. Less than 1% of all rural households do not engage in farming at all. Despite the low profitability of agricultural production in Honduras, many households stay in farming because of food security reasons (lowering food costs by avoiding market purchases as much as possible) and/or the lack of alternative employment. Persistence in agriculture also reflect the traditions and cultural ties of many rural households in hillside areas, who view themselves as farmers first and foremost. Households with off-farm income, particularly those that manage their own business, are nearly invariably better off than households who stay on their own farm.

Table 11. Household Typology According to Sources of Income

Types of Households	% Households in Combined Sample	Average Household Income (Lempiras/year)
Households that derive income only from farming	14.6	21466
Households that derive income only from salaried work (off-farm)	0.7	29743
Households that derive income only from own business	0.3	26057
Households that derive income only from transfers	0.4	2144
Households that derive income from farming and salaried work (off-farm)	19.1	21828
Households that derive income from farming and own business	3.8	109324
Households that derive income from farming and transfers	19.1	24493
Households that derive income from salaried work (off-farm) and own business	-	-
Households that derive income from salaried work (off-farm) and transfers	0.7	17463
Households that derive income from own business and transfers	-	-
Households that derive income from farming, salaried work (off-farm), own business	3.6	83783
Households that derive income from farming, salaried work (off-farm), transfers	27.2	24141
Households that derive income from farming, own business, transfers	4.2	65113
Households that derive income from salaried work (off-farm), own business, transfers	-	-
Households that derive income from all four sources (farming, salaried work, own business, transfers)	6.3	51274
Total	**100**	

***Source**: Own analysis of IFPRI and Wisconsin household survey data*

5.3. Identification of Key Livelihood Strategies and Household Groups

Clustering households into a limited number of categories that pursue similar livelihood strategies is a useful way to apply the asset base approach. Clustering can provide information to better target interventions towards households with certain common characteristics, thereby increasing the efficiency of targeted policy measures and other incentive structures towards the intended beneficiaries (de Janvry and Sadoulet, 2000b). Consequently, we used factor and cluster analysis techniques to identify and analyze livelihood strategies, separately on the IFPRI and University of Wisconsin household data. Annex 4 provides details on the factor and clustering methods used.

IFPRI Households

The IFPRI households were grouped into seven clusters, each representing a separate livelihood strategy (Table 12). Livelihood strategies in hillside areas mostly revolve around agricultural and small-livestock activities, with relatively few households engaging in higher-return activities such as production of vegetables or non-farm activities. Over one-half of households pursue a livelihood strategy that centers on basic grains production (livelihood clusters #1 and #2), whereas households in other livelihoods groups also tend to produce basic grains. Livestock is also an important livelihood strategy (clusters #1 and #5), and to a lesser degree coffee production (and as coffee laborers).

Below we describe the main characteristics of the various livelihood strategies according to the variables used in the factor and cluster analyses and in terms of outcomes like level and composition of household income. Perhaps surprisingly and certainly shockingly, none of the livelihood strategies in the hillside areas was able to generate an average annual income above the extreme poverty line of US$ 365/capita (US$ 1.00/person/day), let alone above the poverty line of US$ 550/capita annual income (Figure 16). Differences in outcome variables can be regarded as the result of differences in asset endowments that, in turn, are causal factors for differences in livelihood

strategies represented by the clusters. Table 13 provides a summary of the main household characteristics for different livelihood strategies.

Table 12. Livelihood Cluster Groups from IFPRI Household Survey

Livelihoods Cluster Group	Description of Livelihoods Cluster Group	# of Households in Cluster	% Sample Households in Cluster	% Households with Land Title
Cluster # 1	Livestock producers	59	15.6	46
Cluster # 2	Coffee producers	28	7.4	65
Cluster # 3	Basic grains farmers	68	18.1	21
Cluster # 4	Basic grains farmers/farm workers	85	22.6	17
Cluster # 5	Mixed basic grains/ livestock/farm workers	116	30.9	38
Cluster # 6	Permanent crops producers (other than coffee)	12	3.2	67
Cluster # 7	Vegetable producers	8	2.1	69
Total sample		**375**	**100**	**36**

Figure 16. Annual Per Capita Income in US$, by Livelihood Strategy (IFPRI Households)

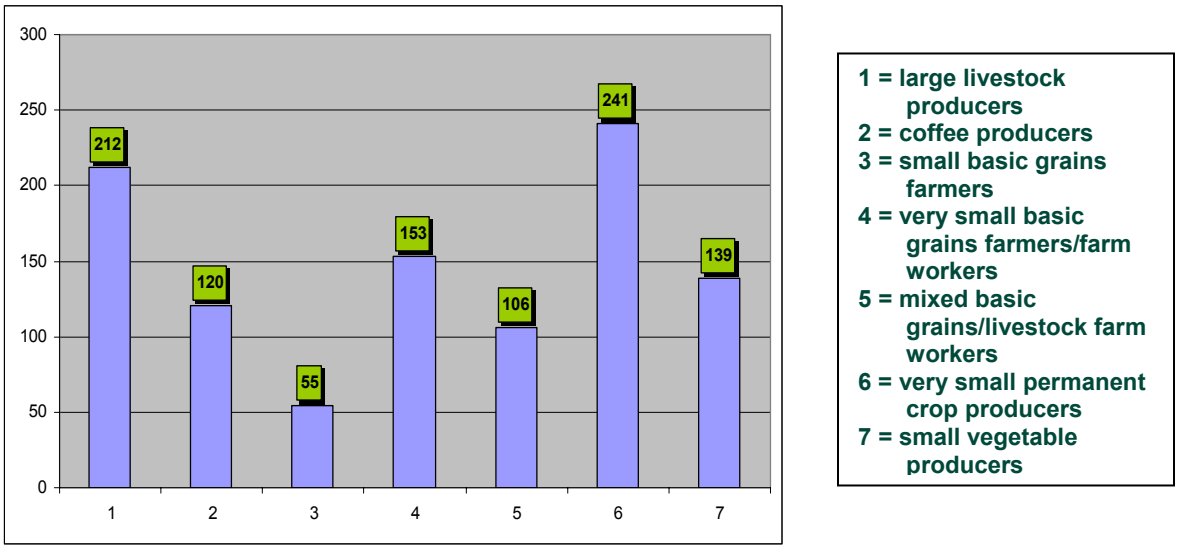


Table 13. Salient Household Characteristics, by Livelihood Strategy (IFPRI Households)

Cluster Group ➔		1	2	3	4	5	6	7
		Livelihood Strategy						
	Total Sample	Livestock Producers	Coffee Producers	Basic Grains Farmers	Basic Grains Farmers/ Farm Workers	Mixed Basic Grains/ Livestock/ Farm Workers	Perma-nent Crops Producers	Annual crops/ Intensive Livestock Producers
Number of households	376	59	28	68	85	116	12	8
Per capita income (US$/day)	0.35	0.58	0.33	0.15	0.42	0.29	0.66	0.38
Farm size (ha)	10.0	32.0	3.5	2.4	1.9	10.7	2.4	4.4
% Households with any titled land	36%	46%	65%	21%	17%	38%	67%	69%
Importance of food security		Medium	Medium	High	High	Medium	Medium	Medium
Degree of market orientation		Medium	High	Low	Low	Low	High	High
Importance of off-farm agricultural labor		Low	Medium	Low	High	Medium	Medium	Low
Importance of off-farm non-agricultural labor		Low	Low	Low	Low	Low	Low	Low
Dependency ratio		Low	Low	High	High	Medium	Medium	Low
Population density		Low	Medium	High	High	Medium	High	Low
Access to markets and public services		Low	Medium	Low	Low	Medium	High	High
Education		High	Low	Medium	Low	Medium	Medium	High
Natural capital		Medium	Low	Low	Medium	Medium	High	High
% poor households[1)]	92.6	77.1	99.1	97.3	94.4	95.8	95.2	86.2
% extremely poor households[2)]	92.3	76.2	100.0	100.0	91.8	96.6	77.0	85.8

[1)] *Percentage of households with less than US $ 1.50/capita/day.*
[2)] *Percentage of households with less than US $ 1.00/capita/day.*

We want to draw special attention to the relationship between livelihood strategies and land titles. All in all, of the sampled households about one-third had title to at least some of their land. As can be observed in Table 12, almost 70% of households in cluster #2 (coffee), cluster #6 (permanent crops), and cluster #7 (vegetable producers) have land title. In contrast, only about 20% of households in clusters #3 and #4 (producers of basic grains) have land title. Somewhere in-between are households in livelihood groups #1 and #5 (livestock producers). Thus, lack of land title seems to be related to livelihood strategies based on annual low-value crops, whereas possession of and title seems to be related to crop/livestock strategies that require investments in land and more security to pursue higher-value permanent crops and or larger livestock operations.

Brief Description of the Livelihood Strategies of the IFPRI Households

The livelihood of households in ***cluster #1*** is based on extensive livestock farming on relatively large farm holdings (32 ha on average). Households in this cluster keep a large portion (65% on average) of their farm in pasture and the average livestock herd is worth nearly US$ 6000. These households allocate the highest proportion of total household labor to their own farms, with most of their time devoted to livestock related activities. They also devote an average of 4 ha to basic grains production for household food security and are mostly located in lower altitude areas with relatively low population densities. In general, education levels are above average. Access to markets and public services is below average, which may explain why these households also produce basic grains for own-consumption. Despite being the second "richest" household group in the IFPRI sample, average daily per capita income is only US$ 0.58. However, the *average* per capita income is somewhat misleading because the poverty rate in this livelihood group is lower than all the other groups. Therefore, there are some households for which this is a poverty-exit livelihood strategy.

Most coffee farms in ***cluster #2*** have relatively small landholdings (average farm size is 3.5 ha) and are located at higher altitudes (> 1000 meters above sea level) where

they tend to farm relatively less fertile soils. Market access and education are average for these households. [30] These farmers rely on basic grains for their subsistence needs: they use about one-third of their farm area and more than one-quarter of their household labor to produce basic grains. The income of coffee producing households is US$ 0.33, just over half of livestock farmers. However, the survey was taken during the period when coffee prices collapsed (falling in 2000-2002 to about half the level of previous years but on the rise again as of 2004).

Households in ***cluster #3*** are the poorest among all livelihood groups, earning an average of only US$ 0.15 per person per day. The explanation may lie in the fact that these households rely nearly exclusively on basic grains production that has low profitability (partially caused by limited natural assets in terms of quantity and quality) and is relatively low-value. These households have small farms (2 ha on average), tend to be located at high elevations and/or steep slopes, and have little in terms of other productive assets. In addition, they are the most geographically isolated households, severely limiting off-farm opportunities. The probability of a female head is highest for this cluster (see also Box 10).

Box 10. Gender in the Hillside Areas

Based on the IFPRI sample, female-headed households (FHH) are different from male-headed households (MHH) in five characteristics: 1) *household income*: on average, FHH have about 30% lower income than MHH; 2) *importance of livestock*: FHH earn 23 percent of their household income from producing and selling livestock and livestock products, as opposed to only 8% for MHH; 3) *proportion of rented land*: while MHH rent in approximately 27 percent of their total farm area, this is only 18 percent for FHH; 4) *the amount of government transfers received*: even though FHH receive levels of remittances that are comparable to MHH, FHH receive less than half the level of government transfers (including pensions, school subsidies, pregnancy support, nutritional support, old-age support, and fellowships) received by MHH; 5) *degree of diversification*: crop diversification is less common in FHH than MHH. FHH do not grow annual crops other than basic grains and very few FHH grow permanent crops. Some of these differences between MHH and FHH can be explained by the many competing demands for female labor.

[30] The market access result is somewhat surprising in view of the investments in roads made by the Honduran Coffee Institute (IHCAFE) in coffee growing areas.

The livelihoods strategy of households in ***cluster #4*** includes basic grains and off-farm employment. This is the second largest livelihood group in the sample with almost one-quarter of all households. These households have the smallest landholdings, with less than 2 ha of farmland of which less than 20% is owned, on average. Thus, they need to rent land, but overall land access is limited. By working off-farm they are able to earn more than double (US$ 0.41 per person per day) the income of cluster #3 households, despite an above-average dependency ratio and below-average education. It seems that limited access to land "pushes" these households to be more entrepreneurial and seek out alternative employment opportunities, in or out of agriculture.

Cluster #5*,* the largest livelihoods group, accounts for 30% of the total sample. On average they have over 10 ha of land, of which nearly two-thirds is kept either fallow or under forest. Their livelihood strategy is similar to households in cluster #4 but with considerably more land, so they hire (rather than sell) labor and devote more time to livestock activities. However, their average daily per capita income of US$ 0.29 is about 30% less than that of households in cluster #4, but higher than households in cluster #3, who just produce basic grains. Apparently by working on-farm, these households have lower incomes than those seeking off-farm employment. On the other hand, these households may be less vulnerable to risks than those in cluster #4, since they have greater wealth and more diversified income sources. Education is slightly above average for this cluster, whereas both physical and natural assets are about average.

Cluster #6 represents a small group of permanent crop producers with small landholdings (2.4 ha on average) whom devote most of their land and labor to intensive tree crop production such as fruits, oil palm etc. These households have the highest average incomes in the sample (US$ 0.66 per capita per day). They have smaller than average household sizes and are located in favorable agro-ecological areas with high population densities, high rainfall and good access to paved roads and public transportation, all of which are important for diversification into higher-value permanent crop production.

Finally, most households in ***cluster #7*** are vegetable producers who allocate most of their labor to working on their own farms. Despite being far from a paved road in areas with low population densities, these households are close to a non-paved road, which gives them a sufficient degree of market access to specialize in vegetable production. Somewhat surprisingly is the fact that their average daily income during the survey year (US$ 0.38 per capita) was only slightly above average despite an average farm size of about 4.5 ha, good market access and the relatively high educational level of the household heads.

To conclude, there are not many households with asset bases and livelihood strategies that are associated with exiting poverty. Having land title seems important, and livelihoods dominated by basic grains production on less than 2 ha is a poverty trap.

Wisconsin Households

The Wisconsin households were clustered into six livelihood strategies (Table 14). About one-quarter of households pursued a diversified livelihood strategy and nearly 30 percent are coffee producers. Basic grain production and livestock production are also important livelihood strategies. In contrast to the IFPRI livelihood strategy group clusters, the Wisconsin sample includes households whose livelihood strategies are dominated by a business or receipt of remittances.

Table 14. Livelihood Cluster Groups from Wisconsin Household Survey

Livelihoods Cluster Group	Description of Livelihoods Cluster Group	# of Households in Cluster	% Sample Households in Cluster	% Households with Land Title
Cluster #1	Households that follow a diversified livelihood strategy	222	26.1	32.9
Cluster # 2	Basic grains farmers/farm workers	115	13.5	7.8
Cluster # 3	Livestock producers	98	11.5	48.0
Cluster # 4	Coffee producers	242	28.4	31.0
Cluster # 5	Own business	58	6.8	32.8
Cluster # 6	Remittances	91	10.7	25.3
Total sample		850	100	29.8

Similar to the IFPRI households, we describe the main characteristics of the various livelihood strategies according to the variables used in the factor and cluster analyses. We then proceed with a discussion of the differences between clusters in terms of outcomes like level and composition of household income. Again differences in outcome variables can be regarded as the result of differences in asset endowments, which in turn are causal factors for differences in the livelihood strategies represented by the clusters. In general terms, the Wisconsin households are considerably less poor than the IFPRI households (Figure 17), mainly due to better asset endowments. However, also in the Wisconsin sample there are distinct differences according to livelihood strategies (Table 15).

Figure 17. Annual Per Capita Income in US$, by Livelihood Strategy (Wisconsin Households)

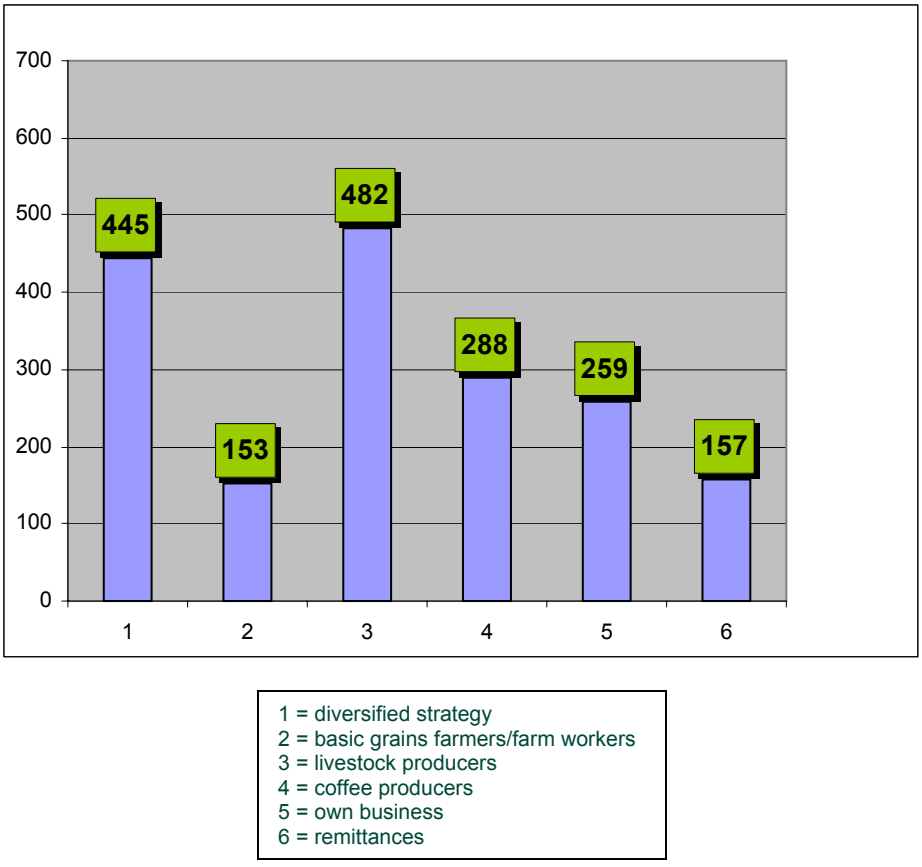


Table 15. Salient Household Characteristics, by Livelihood Strategy (Wisconsin Households)

Cluster Group ➔		**1**	**2**	**3**	**4**	**5**	**6**
		Livelihood Strategy					
	Total Sample	**Diversified Production**	**Basic Grains Farmers/ Farm Workers**	**Livestock Producers**	**Coffee Producers**	**Own Business**	**Remittances**
Number of households	826	222	115	98	242	58	91
Per capita income (US$/day)	0.87	1.22	0.42	1.32	0.79	0.71	0.43
Farm size (ha)	22.1	42.8	1.9	24.6	11.6	38.0	12.0
Importance of food security		Medium	High	Medium	Medium	Low	High
Degree of market orientation		Medium	Low	Medium	High	High	Low
Importance of off-farm agricultural labor		Medium	High	Low	Medium	Low	Low
Importance of off-farm non-agricultural labor		Medium	Low	Low	Low	High	Low
Dependency ratio		Low	High	Medium	Medium	Low	Medium
Population density							
Access to markets and public services		Medium	Medium	Medium	Medium	Medium	Medium
Education		Medium	Low	Medium	Low	High	Medium
Natural capital		Medium	Medium	Medium	Medium	Medium	Medium
% poor households[1)]	86.2	82.9	98.3	77.6	86.0	81.0	92.3
% extremely poor households[2)]	79.7	76.1	94.8	68.4	80.2	70.7	85.7

[1)] Percentage of households with less than US $ 1.50/capita/day.
[2)] Percentage of households with less than US $ 1.00/capita/day.

Brief Description of the Livelihood Strategies of the Wisconsin Households

The livelihood of households in ***cluster #1*** accounted for about one-quarter of the sample and is the most diversified. These households have diversified farm operations and work outside their own farm in both agricultural and non-agricultural occupations. They have relatively high quantities of some productive assets (average farm size is 43 ha, along with sizeable amounts of livestock), but average endowments of other assets. These households obtain about 40% of their total income from the own farm (basic grains, some coffee and livestock); the remainder of their income is from off-farm work (65% from agricultural labor on other farms and 35% from labor outside the agricultural sector). About 10% of their income is from remittances. Average daily per capita income is with US$ 1.22 the second highest in the sample.

Households in ***cluster #2*** are subsistence-type farmers with very little land (average farm size is less than 2 ha and most land is without title), virtually all of which is used for basic grains production for household food security. They have very little other physical capital, low human capital, high dependency ratio, poor access to credit and low social capital. These households generate most of their cash income from off-farm work (about 70% from working on other farms and 30% from work in the non-agricultural sector). Only about 6% of their income consists of conditional transfer payments and remittances. These households belong to the poorest of the poor with an average per capita income of US$ 0.42 per day. These households resemble the ones in cluster # 4 of the IFPRI sample.

Cluster #3 consists of medium-size livestock farmers (average farm size 24.6 ha 50% of which is titled) who do very little off-farm. Their endowment of assets other than livestock is average. Most of their land is used for basic grains and pastures. These households generate virtually all of their income on their own farms and also are the richest households in the sample (income is US$ 1.32/day/person).

Coffee farmers who make up ***cluster #4*** on average farm 11.6 ha and also work a considerable proportion of their time outside their own farm (though not as much as households in cluster # 2). These households tend to have their own means of

transportation but very little livestock. They are located at higher altitudes. Their human capital is average but their social capital (participation in organizations) is above average. They have average savings but better-than-average access to credit. Off-farm work (mostly on other farms) generates nearly 40% of their total income. At just US$ 0.79, average per capita daily is low, though higher than that of coffee farmers in the IFPRI sample.

Cluster #5 consists of households with relatively large landholdings (38 ha on average, a third of which is titled) but average for physical assets. However, they do not depend on their farm for most of their income, because they have their own businesses (shops, trade etc). Education is above average. These households also have relatively high amounts of financial assets (high savings) and above average social capital. This group represents only 7% of the sample but has lower-than-expected average income and higher-than-expected poverty rate. On the other hand, our calculation of average income for this cluster (US$ 0.71 per day per person) is probably an underestimate because our calculated income for these households from farm operations consistently resulted in negative values.

Finally, households in ***cluster #6*** live mostly off remittances. Despite the fact that some of these households do have considerable landholdings (12 ha on average) they have very little other physical capital and belong to the poorest in the sample (average income only US$ 0.43/day/person). They often have a female household head and work very little outside their own farms.

Combining the IFPRI and Wisconsin Livelihood Strategies

Combining the results of the two cluster analyses, we identify eight livelihood strategies in rural Honduras:

1. **Pure basic grains farmers**. These households, have small land holdings (usually less than 2 ha) and few other assets. They are found mostly in the IFPRI sample. They engage in minimal off-farm work and earn very low incomes (average of $0.15/person/day). A relatively large proportion

of these households have a female head. This livelihood strategy is associated with deep and persistent poverty.

2. **Basic grains and off-farm work**. Households pursuing this strategy have even smaller land holdings than pure basic grains farmers and, like the latter, have very few other assets. However, they earn somewhat higher incomes by working a large proportion of their time off-farm (mostly in agriculture). But these households also belong to the poorest of the poor, earning less than $0.50/person/day.

3. **Diversified households**. These households represent a considerable proportion of both surveys. While the diversified households in the Wisconsin survey have relatively large farms, medium endowments of most assets, and few missing assets, the IFPRI diversifiers are much more poorly endowed. As a result, diversified households in the Wisconsin survey are far more diversified than the IFPRI households. They earn significantly higher incomes as well.

4. **Extensive livestock farmers**. These households are present in both samples. They have relatively large farms and cattle holdings, but average levels of other assets. They tend to stay on their own farms. For many (but not all) of them, this livelihood is a poverty exit strategy.

5. **Coffee farmers**. These are mostly found in the Wisconsin sample, and coffee growers in the Wisconsin sample have considerably more land than those in the IFPRI sample. They also earn higher incomes. The collapse in coffee prices has pushed many coffee growers below the poverty line, even though they are relatively well-endowed with assets. Some have a financial buffer, which allows them to survive. Coffee prices were at all-time lows during the time when the surveys were executed and have recovered somewhat since.

6. **Small-scale vegetable farmers, permanent crop producers, and intensive livestock farmers**. These households are relatively few. They earn higher incomes than basic grains farmers, but many of them are still poor. Because of their small numbers, households pursuing these strategies are not included in the econometric analyses in the next section.

7. **Households that have their own business**. These households are relatively few and present only in the Wisconsin sample. They are generally better endowed in terms of land holdings, education, and financial capital. Most of these households are above the poverty line.

8. **Finally, a small group of households lives virtually exclusively off remittances.** These households are found only in the Wisconsin sample and most belong to the poorest of the poor.

5.4. Determinants of Livelihood Strategies: Multinomial Logit Models

Econometric Analyses of Livelihood Strategies of IFPRI Households and Communities

Multinomial logit models[31] were used to explain a household's choice of livelihood strategy using data from the household surveys. The econometric results can be found in Annex 5. A similar model was also applied to analyze primary data obtained from the more qualitative community-level livelihood studies[32] combined with secondary data obtained from various sources.

Analysis of Livelihood Strategies Based on Household Data

The results of the multinomial logit model combined with previous analysis of the IFPRI household survey data allow us to derive the following conclusions:

[31] A multinomial logit model (Greene, 1990) is appropriate when the dependent variable consists of multiple categories (e.g. livelihood strategies) and in our case relates the probability that a household (or community) chooses a certain livelihood strategy over another livelihood strategy, given the household's (or community's) asset endowment.

[32] The quantification of qualitative data for econometric analyses is a new analytical approach. Given the qualitative and subjective nature of the data used, results of these models should be considered more suggestive than definitive. They do, however, complement the more traditional econometric analyses of household survey data.

1) ***Rural poverty***: The poorest households (represented by livelihood strategy cluster #3, basic grains farmers) live in high population density areas with poor market access, and agriculture is often limited to one season (due to relatively poor second-season rainfall). The poorest households are more likely to have a female head[33] and have significantly less migration assets (i.e., are less likely to have one or more household members who practice temporary migration). They have also less social capital and less access to credit, despite the fact that credit organizations often focus on these households. A high dependency ratio ("more mouths to be fed") and little land force many of these households to adopt livelihood strategy #3. Many of these households seem to be locked into a vicious cycle of producing basic grains (mainly for self-consumption and using traditional production technologies with low returns to land ad labor), blocking the transition to other income-earning strategies that would possibly be more profitable. These factors, in combination with little land and other complementary assets, strongly associate pure basic grains farming with poverty.

2) ***Land tenure***: Households with a larger share of titled land are more likely to grow coffee (livelihood strategy #2). For all other livelihood strategies, land rental is a common and widespread practice with many households renting in 50% or more of their operated land.

3) ***Landholding size:*** People with larger farms tend to use most of their surplus land (i.e. land left after satisfying the household's basic grains needs) for livestock. That is, larger farms tend to be livestock operations with more physical assets. But livestock technologies are extensive (low returns to land) and often result in land degradation. Appropriate

[33] Households headed by single women are not the only ones included among the extremely poor, but they do have fewer options, a factor that can generate families of extremely poor people among the children raised in these families. See Colindres et al. (2004).

incentives and technologies are needed to deal with these problems associated with under-utilization and degradation of land resources, in order to raise the profitability and sustainability of livestock-based livelihood strategies (see also Jansen et al., 1997).

4) ***Food security***: Households that have enough land to be food secure tend to work more on their own farms and less off-farm. This reflects both the traditions and cultural ties of many rural households in hillside areas to farming, and a relatively high degree of risk aversion (attempting to avoid food purchases as much as possible).

5) ***Off-farm work:*** Households with little or no land are "pushed" to look for off-farm work. For asset-poor households with little land and no access to improved technologies, off-farm work is often more remunerative than on-farm work. So income from off-farm work is a critical source of income for smallholder families living in the hillsides.

6) ***Natural assets***: Agro-ecological conditions affect livelihood strategies. Lower altitudes favor livestock rearing, while higher altitudes favor coffee growing. Even though the corresponding variable is not significant in our multinomial logit model, we know from experience in the field and soil sample results that coffee farms tend to have relatively fertile soils, whereas large extensive livestock operations tend to be on less fertile soil.

7) ***Family planning***: Households with a lower dependency ratio are more likely to be coffee growers or large livestock farmers, which generally are more remunerative livelihoods than basic grains farming.

8) ***Ethnicity***: Ethnic minorities are less likely to be livestock farmers or coffee growers (this result is derived from an alternative specification of the multinomial model that is not reported here).

Analysis of Livelihood Strategies Based on Community Studies

The main conclusions that can be drawn from results of the multinomial logit model using IFPRI community livelihoods study data[34] largely confirm the results from the logit model based on the IFPRI household data:

1) ***Comparative advantage***: The major household livelihood strategies in a community depend on a range of asset-related variables that jointly determine its comparative advantage.

2) ***Natural assets***: A relatively high altitude increases the probability that a community specializes in the production of coffee or horticultural crops (vegetables in particular) instead of a focus on basic grains and livestock production. Favorable rainfall lowers the probability that a community's income-earning strategy focuses on off-farm work, possibly because it makes agricultural on-farm production more profitable.[35]

3) ***Population pressure***: Livelihood strategies based on primary agricultural production are limited in scope and incomes relatively low in the high population density areas, where landholdings tend to be smaller and more fragmented. Communities in high population density areas tend to specialize in basic grains and small-scale livestock production to achieve food security objectives. These activities have relatively low economic returns, especially low levels of land and labor productivity. High population densities are therefore associated with poverty because many households in high population density areas seem to be locked into a vicious cycle of producing basic grains and livestock (mainly for own consumption and using traditional production technologies), blocking the transition to other (possibly more profitable) income-earning strategies.

[34] See Table A3.1 in Annex 3 and Jansen et al. (2003b).

[35] For example, since only two out of the 95 IFPRI communities reported having significant irrigation facilities, sufficient rainfall in the secondary season is crucial for successful off-season vegetable production.

4) ***Access to markets***: Market access, defined as the time needed to reach the nearest urban center from the community (accounting for distance, road quality and slope) is a critical determinant of livelihood strategies. All other factors being equal, favorable market access increases the probability that a community will specialize in coffee or vegetables.[36] Good access to urban centers is also associated with more off-farm work.

5) ***Land tenure***: A higher percentage of people without their own land in the community "pushes" households into livelihood strategies that focus on off-farm agricultural and non-agricultural work.

6) ***Social capital***: Market-oriented production is stimulated by organizations external to the community that help identify new technologies, markets, or enterprises with comparative advantage.

We can conclude that, even though we presented the household and community findings separately, the clear overlaps between the main findings from these quantitative and qualitative analyses reinforce our general conclusions.

Econometric Analyses of Livelihood Strategies of Wisconsin Households

Household-level multinomial models were also used to explain the livelihood choices of the Wisconsin households. Their specification is similar to the logit models used on the IFPRI data, with the exception of a few minor differences due to data availability. Detailed estimation results can be found in Annex 5, and we can draw the following conclusions:

1) ***Rural poverty***: Similar to our findings for the IFPRI households, the poorest households in the Wisconsin sample (represented by livelihood strategy #3, basic grains farmers/farm workers) are more likely to live in remote areas with lower population density (less market opportunities).

[36] In the case of coffee there may be reverse causality, i.e. IHCAFE has a long history of investing in road construction in many coffee-growing areas.

These households farm little land and are less likely to own the land that they work.

2) ***Diversification***: A sufficient level of annual rainfall, access to land, a somewhat older household head (more experience) and a relatively high population density increase the probability that a household will follow a diversified household strategy (livelihood #1).

3) ***Own business***: Households that own land, have higher education, take part in a savings and loan organization and live in areas with higher population densities, are more likely to have a business (livelihood #5).

4) ***Coffee:*** Coffee farmers tend to be in higher elevation areas, relatively farther from a county capital but closer to another market. They have older household heads but also are more likely to receive credit.

5) ***Migration and remittances***: Households that rely mainly on remittances tend to own their land and have land titles; have an older household head that is more often female; and have fewer household members living outside the household. Whereas the latter may sound contradictory, apparently the remittance payments on which these households subsist come from people that are no longer considered part of the household.

6) ***Roads:*** Lower road densities increase the probability that a households concentrate on livestock rearing, coffee or running a business.

5.5. Determinants of Household Income: Least-Squares Regression Models

IFPRI Households

Household income was hypothesized to depend on the household's livelihood strategy and asset portfolio. In addition to the effects on income of individual assets, we investigated a number of interaction effects, in order to identify possible synergies and/or substitution between pairs of assets. These interaction effects included land ownership and credit, farm size and market access, farm size and education, market access and

education, and land ownership and soil fertility. The detailed model results are reported in Annex 6 and we draw the following main conclusions for hillside households:

1) ***Off-farm work***: A livelihood strategy based on basic grains production combined with off-farm work results in significantly higher incomes than basic grains farming alone.

2) ***Access to markets***: Better market access has a significant positive effect on income (and see also results 6 and 7 below).

3) ***Non-land physical assets***: The amount of non-land physical assets owned by the household (machinery, equipment, transportation) has a positive (but small) effect on income, most likely because it increases labor productivity.

4) ***Household size and composition:*** Larger households have higher income but households with high dependency ratios have lower income. Households with older household heads have lower income. Households with more migration assets have higher income.

5) ***Education and training****:* Even though our regression model fails to detect a statistically significant effect of formal education, households that have participated in training programs over the past 10 years have higher incomes. Other research suggests that in Honduras every year of additional education increases income by about 10%, with upper secondary education having the highest returns.[37] Acquiring professional skills (agriculture-related or not) allow people to sell their labor at a higher price.

6) ***Farm size and market access***: The interaction between size of the farm holding and market access has a positive effect on income. Since the

[37] Source: Presentation by Guillermo Perry and Felipe Jaramillo at the Third Regional Conference on Central America "Economic Growth and Issues in Bank Resolution" sponsored by The Central American Monetary Council and the International Monetary Fund and hosted by the Central Bank of Honduras on July 8-9, 2004 in San Pedro Sula.

market access variable is essentially a measure of travel time (meaning that the larger the variable's value, the poorer is market access), this result suggests that good market access can, to some extent, compensate for small farm size.

7) ***Education and market access***: The positive interaction effect between the education and market access variables suggests that, in terms of their effect on household income, good market access can also compensate for less education.

8) ***Social capital***: The reduced form of the income regression (not reported) also shows a positive impact of household participation in external organizations (NGOs etc) on income.

9) ***Ethnicity:*** Earlier versions of the income regression that included a ethnicity dummy variable (not reported) showed no significant effect of ethnicity on household income.

Wisconsin Households

Just as we did for the multinomial logit models, we tried to keep as large a consistency as possible between the income regressions for the IFPRI and for the Wisconsin samples. Again, however, the specifications of the income models differ a bit between the IFPRI and the Wisconsin households, due to differences in data availability. The estimation results are again reported in Annex 6 and we can draw the following main conclusions:

1) ***Rural poverty***: Households whose livelihood strategy consists of basic grains production on small landholdings combined with off-farm agricultural work earn the lowest incomes. All other livelihood strategies (with the exception of households that are mostly dependent on remittances but including coffee producers) earn significantly higher

incomes, which allow them to rise above the extreme poverty line (but not above the poverty line).

2) ***Land titling***: Households that own at least some titled land earn significantly higher incomes than households that don't.

3) ***Household size and composition***: Larger households have higher incomes (but this may not be so in per capita terms). But households with older household heads have lower incomes.

4) ***Roads***: Households that live in higher road density areas have higher incomes than households that live in areas with lower road densities.

5) ***Land ownership and credit***: The interaction between the amount of land owned by the household and access to credit exerts a positive effect on income. This implies the existence of a synergy effect between owned land and credit, i.e. land ownership (physical capital) and credit (financial capital) are complementary assets.

6) ***Farm size and schooling***: The interaction between the amount of land farmed by the household and the average level of formal schooling of its members (> 12 years of age) exerts a positive effect on income. This suggests the existence of a synergy effect between size of the farm and formal education, i.e. education helps in translating the benefits of physical capital (in this case land) into higher income.

5.6. Stocktakings of Rural Development Projects

Stocktakings of a number rural development projects in Honduras were undertaken in late 2003 and early 2004 to examine how these projects (Box 11) contribute to sustainable rural growth and poverty reduction, and to help identify "missing assets" and "successful" livelihood strategies. Since the current study was commissioned and financed by the World Bank, the stocktaking exercise was limited to four Bank-supported field projects that fall under the responsibility of the

Environmentally and Socially Sustainable Development Department and the Central American Department in the Latin America and Caribbean Region (CA ESSD) of the World Bank. The project stocktakings applied rapid appraisal methods anchored in the asset base approach to understand changes in household assets, the institutional and risk context, livelihood strategies and well-being outcomes.

Participatory workshops with stakeholders (including project coordinators and staff, beneficiaries and some local government officials) were carried out. Two sets of workshops were held. First, preparatory workshops were conducted in different locations for the respective projects during the months of November and December 2003. Subsequently, regional workshops were held in February 2004 in the city of Comayagua, Department of Comayagua. Visualization techniques, charts/boards, etc. were used to enhance the possibility of eliciting views from the participants at the workshops. The number of participants at the workshops was 30-35, including men and women.

Box 11. Description of CA ESSD Projects Subjected to Stocktaking Exercises

PAAR-CMAT. Objectives of the Modernization and Administration of Lands (CMAT) component of the Honduras Rural Land Management (PAAR) project are to: a) modernize the land titling system; b) modernize the property registry and land cadastre; c) improve land tenure security; and d) promote the sustainable use of land.

PAAR-FPPL. Objectives of the Fund for Producers in Mountain Slopes (FPPL) component of the PAAR project are to: a) increase the transfer of technology to improve agricultural, livestock and forestry practices for farmers located in hillside areas; b) reduce deforestation, soil erosion, and depletion of soil fertility in hillside areas; c) improve the incomes and welfare of poor farmers and residents in hillside areas; and d) establish a financial mechanism whereby hillside farmers can access technical assistance and training over the long-term. See section 5.6.1 for results of the stocktaking exercise.

PACTA. Objectives of the Project Access to Land (PACTA) project are to: a) facilitate access to land for landless households through the land market; and b) promote the development of sustainable rural enterprises. The target population consists of landless households. See section 5.6.2 for results of the stocktaking exercise.

PROBAP. Objectives of the Biodiversity and Priority Areas Project (PROBAP) are: a) capacity building at the institutional level to help better manage national parks; b) more and better involvement of adjacent communities in the protection and management of protected areas; c) improved management in buffer zones between communities and protected areas; and d) capacity building for biological monitoring activities.

In this section, we present the key findings from two of the project stocktaking exercises (one for the PAAR-FPPL project and one for the PACTA project) that

particularly complement the household and community level quantitative and qualitative analyses of the IFPRI and Wisconsin studies. The stocktaking annex (Annex 7) provides methodological details that apply to the entire project stocktaking exercise.

Key Findings from Stocktaking of the PAAR-FPPL Project

The target population of PAAR-FPPL is subsistence farmers with less than 5 ha of land in hillside areas, which grow maize, beans, coffee, raise small farm animals and/or practice small-scale horticulture. Most of these farmers farm communal lands and do not have land titles. PAAR-FPPL is involved in the following activities: a) improve research services to generate appropriate technologies for agriculture, cattle raising and forest management in the project area; b) improve training and capacity building services to teach farmers sustainable technologies, c) improve technical and capacity building services for municipalities to manage watersheds; and d) train technical assistance providers to transfer technology for agriculture, livestock, and forestry.

Workshop participants included beneficiaries (men and women) from 6 community groups from the provinces of Yoro and Olancho. Before participating in the PAAR-FPPL project, beneficiary farmers derived most of their income from growing maize and beans, coffee, and from off-farm wage labor on coffee plantations. Compared to the past, project participants now tend to devote more time to on-farm activities and less to off-farm wage labor activities.

Project beneficiaries indicated having made the following progress: a) increased productivity of traditional subsistence crops (mainly maize and beans) and coffee, b) increased surplus production to sell in markets and for household consumption, and c) adoption of new crops with higher returns such as vegetables, fruits and forestry in fallow lands and through improved crop rotations. These changes in livelihood strategies are directly linked with project activities including: technical assistance and capacity building, improved community organization; distribution of high yielding seed varieties and improved plant materials, distribution of agricultural inputs, and improved practices of soil conservation.

The project has not been able to help farmers reduce risks from droughts and flooding, but has made progress in helping farmers reduce risks from pests and disease in crops and humans. However, surplus production has created new risks associated with post-harvest losses, price variations and market uncertainty. Farmers perceive market-related risk as their most important risk.

Regarding household well-being, beneficiaries consider that the increase in farm production has improved their food security. Nevertheless, their monetary income seems to have changed little, although the sources of income have changed. That is, although they have more surplus production, prices for agricultural products have fallen, whereas they are working less off the farm. Before the project they derived about 50 percent of their income from farm production; after the project this proportion has gone up to 90 percent. Farmers believe the new agricultural practices they have been using have increased their productivity, and have helped protect their soils, water sources and have also improved the natural environment. In general, farmers feel the project helped develop a more positive attitude toward entrepreneurship and that now they are headed for improved well-being and quality of life. Thus, they feel their asset bases and livelihood options have improved and are more optimistic about the future, but are concerned with the policy and institutional context (e.g., trade reforms) and increased exposure to market risks.

Farmers in the project have prioritized the need for strengthening of short-term credit and also are interested in obtaining investment capital. During the workshops they also mentioned the importance of skills and knowledge for increasing farm productivity as well as for group organization with productive and commercial objectives. To complement technical assistance (which respondents said needs improvement), farmers said they would like micro-irrigation systems, housing improvements, more education and high yielding varieties. In sum, farmers are demanding continuing help for financing, technical assistance and capacity building. The second phase of the project (the recently approved Forests and Rural Productivity Project) includes credit provision as part of the assistance package provided to farmers.

Key Findings from Stocktaking of the PACTA Project

The target population of the PACTA project is landless households, and the project provides the following services: a) technical services to support beneficiaries develop business plans; b) technical assistance to obtain long-term credit from commercial sources for purchasing land; c) non-reimbursable grant funds for productive investments; and d) technical services to help beneficiaries consolidate their enterprises during the initial phase.

Workshop participants included PACTA beneficiaries (both men and women) from the provinces of Yoro, Colón, Copán and Comayagua. Before the project, most participants derived their incomes from salaried work and commerce (especially women), and a smaller proportion of income from growing maize, beans, rice, coffee, potatoes and raising small farm animals in rented or communal lands.

Livelihood strategies of these households have changed significantly since forming enterprises on their newly acquired lands (although they often do not live on these properties and must travel from their homes). Labor on the farms is carried out collectively or individually, depending on the type of enterprise, group preferences and the types of enterprises. Enterprises include cattle raising and dairy production, oil palm, horticulture, coffee, and forestry, along with the ubiquitous production of basic grains for food security. Most beneficiaries are dedicated full-time to work on the newly acquired lands and/or associated enterprises, and seem to have adopted an entrepreneurial perspective. Thus, the need to work on other people's farms has been reduced.

Although previous to PACTA, most of the households received some type of technical assistance or credit, their asset base was limited mostly to own (low education and skill) labor and some work tools. Now, their asset bases have expanded to include land, financial assets, livestock, equipment and machinery, and improved human and social capital (training and technical assistance, group organization).

The combination ("package") of land tenure security, physical assets, production credit, and technical assistance for enterprise development, is perceived by households as

an incentive to introduce new productive activities such as cattle raising, dairy production and commerce, and also as a way to consolidate their livelihood strategies.

On the other hand, households face new risks inherent to a more complex portfolio of productive activities, including the uncertainty related to markets and prices, and the debt burden from purchasing land. Additionally, some conflicts have arisen among members of the same enterprise given some uncertain legal and judicial rights. This makes the new enterprises vulnerable to dissolution and to lost efforts. Nevertheless, the training and technical assistance received by these households have helped them mange other risks like market access, price variation, pests and diseases.

Regarding well-being, households believe it has increased significantly along with food security, even though they do not perceive an increase in monetary income. Self-esteem, motivation, willingness to work and respect among neighbors have also increased notably. Family ties have been strengthened because more members of the family engage in the enterprise, including women, developing an entrepreneurial attitude in the household. Even though they are preoccupied with their debt obligations, they are hopeful they can repay by making the necessary sacrifices, enabling them to bequeath their investment to their children.

The most immediate additional demands that beneficiaries perceive need to be addressed are: housing, technical assistance and training (production and marketing), and infrastructure (roads, electricity and irrigation).

Conclusions from the Project Stocktakings

The following conclusions of the project stocktaking exercises (for all four CA ESSD projects) are based on: a) perceptions of workshop participants; and b) reflections by the project stocktaking team.[38]

[38] The project stocktaking team included Ricardo Arias (consultant, Honduras), Paul Siegel, Jorge Caballero (FAO) and Benjamin Bustamante (consultant, Honduras).

Food, land and housing security. There is a strong correlation between households' demands for food security, land security and housing security. Taken together they are the basis for encouraging a more market-oriented perspective for their livelihood activities and asset accumulation strategies.

Land tenure security and housing security should be viewed as an integrated package in that together they add more economic value than if they are achieved separately (e.g., they should be considered as complementary assets), taking into account minimum requirement of land size and quality of housing. This is because as a package land tenure security and housing security provide households with greater overall security and encourages savings for food security; facilitate the establishment of micro-enterprises in or outside the homestead; and provide legal rights to demand water, electricity and other public services, and also help in accessing credit.

PACTA promotes access to secure land through titles but it does not provide funding for construction or improvements in housing. PAAR-CMAT creates the conditions necessary for land tenure security in lands where beneficiaries are already settled and with some type of housing. Land titles that legally recognize household land plots and residences are still lacking.

Improvements in combined food-land-housing security require actions to improve policies, laws and institutions, including implementation and enforcement in order to confer greater value to households' assets, combined with activities oriented to augment and protect assets. Why is this essential? Because they guarantee property rights and allow mortgaging or renting of lands. Appropriate policies and regulations also can help generate new business and employment opportunities, and they are critical to capitalizing land values.

PACTA provides alliances with the public sector and banks to access land and technical assistance services. PROBAP helps communities organize to access the institutional and legal frameworks, infrastructure, alliances among public, private and other organizations. PAAR-CMAT helps improve the legal and institutional context

through the provision of land titles and granting legal rights that increase property values. These factors also have the capacity of generating increased income and welfare, even though this is not necessarily reflected in market value of land.

Physical infrastructure such as transport and communications, marketing opportunities, electrification, and water for consumption and irrigation, are considered important complements that add value to poor household's assets, whether they are tangible or not (like human and social capital). One case in point is PROBAP's infrastructure projects for roads and eco-tourism. PACTA is also considering funding productive infrastructure projects.

Technical assistance and training to improve human and social capital. The rural poor without legal rights over land can still benefit from technical assistance and training to improve their production and ensure food security and introduce new crops. In recognition of this "process" of change, the PAAR-FPPL project offers technical assistance, training and inputs to intensify traditional agriculture and promote crop diversification.

Technical assistance and training are highly valued by households. These investments in human capital contribute to change the social and environmental contexts, and also open doors to markets, and gives way to acknowledgement and respect for the laws and promotes the approval of new norms and policies. However, the private sector provision of technical assistance needs to be improved. The public sector could provide more capacity building for private providers of technical assistance, and have some system for quality control.

Availability of financial services is one of the most underserved demands. New alternatives to credit, savings and insurance schemes must be found, when the formal financial market is absent. None of the four projects currently grants direct access to credit, but some credit institutions have already been identified in the region. See Box 12 for an example of an attempt to address the lack of financial services in rural areas using a community-based approach.

Box 12. Community-Led Asset Building: The *Nuestras Raíces* Program

Although not part of the project stocktakings, the *Nuestras Raíces* (NR) Program is a CA ESSD project that is an interesting example of a community driven development that attempts to apply a more integrated approach. The NR Program is specifically geared towards members of officially designated ethnic groups. The main objectives of the project are to build human capital, social and cultural assets, and promote gender equity. NR finances small-scale social and productive infrastructure projects identified, selected and implemented by community groups. To deal with the lack of rural finance, NR provides community groups with knowledge and funds to create, manage, administer and monitor their own community banks. This type of capacity building is also provided for small-scale infrastructure projects. Needs assessments carried out before the project indicated a high demand for small-scale projects such as bridges and paths, housing, health-related projects, water conservation, communal storage places, etc. (see Traa-Valarezo and Rodríguez, 2003).

6. CONCLUSIONS AND RECOMMENDATIONS

In this paper we developed and applied an appropriate conceptual and analytical framework to better understand how prospects for growth and poverty reduction can be stimulated in rural Honduras. Anchored in an asset-base approach, our framework uses a combination of quantitative and qualitative methods to generate a number of key findings with important strategic implications. Our conclusions and recommendations are mainly focused on hillsides and hillside areas[39] since the majority of our data is for these areas.

Rural areas and households in Honduras are characterized by significant heterogeneity in terms of their endowments of natural and other types of assets. This heterogeneity is particularly stark in hillside areas. Natural assets define agricultural potential and absolute advantage of a given area, and together with socio-economic conditions determine its comparative advantage. Economic potential is thus determined by the interaction between natural assets and other asset types. As a result of this heterogeneity across space and households, economic potential has a strong spatial pattern in Honduras, with most high potential areas located close to the main cities and along the Northern Coast. Public investments in human and physical assets in Honduras have been skewed towards the so-called "T of Development" which comprises 55 counties located along the fertile north coast and the central corridor area, connecting the cities of Tegucigalpa in the south and San Pedro Sula in the north. Outside the "T", public investments (particularly road networks and other infrastructure) have been concentrated where agro-ecological conditions are favorable for export agriculture such as coffee (concentrated on small and medium-sized farms in the west) and bananas (mostly on large plantations in the northern valleys). Most other rural areas have been relatively excluded from public investments. This, together with highly heterogeneous conditions in rural areas, has resulted in poverty being highest and deepest in the hillsides and hillside areas.

[39] 'Hillsides' are areas with slopes of more than 12%. 'Hillside areas' also include flat-floored valleys, 300 to 900 meters in elevation, which are scattered throughout the interior hillsides.

Hillsides and hillside areas account for the majority of land area and often have agro-ecological constraints that make them less suitable for agriculture. The rural poor tend to have small and fragmented land plots. Production is often limited to a single rain-fed growing season. The poorest of the rural poor live in areas with high population density and high population growth, further increasing pressure on the declining natural resource base of such areas. These factors constrain potential gains from adopting improved technologies and limit opportunities to diversify agricultural production systems. As a result, many people are locked into strategies based on production of basic grains and small livestock for subsistence needs in areas that are not suited for such strategies. Under these circumstances, achieving sustainable agricultural growth is challenging.

But rural poverty can be high even in areas with relatively favorable biophysical and socio-economic conditions. For example, hillside areas along the Guatemalan and Salvadoran borders in western and southwestern Honduras have relatively good access to infrastructure (e.g., relatively well-developed road infrastructure in coffee producing areas), favorable bio-physical conditions and good economic potential, but also high rates of poverty. In particular, the Copán area has substantial tourism potential, but despite good locational conditions, measures of well being are lagging far behind potential. Persistent high rates of poverty show that this potential is not being realized -- and the extent to which it is being realized, the poor are not participating. Most hillside households have limited assets on which to base their livelihood strategies. Moreover, high inequalities in asset distribution constrain how the asset-poor can share in the benefits of growth, even under appropriate policy regimes. In the specific example of the counties bordering Guatemala and El Salvador, lack of feeder roads within these mountainous counties increases transaction costs and makes it difficult for poor households to participate in the market economy. These households also lack the minimum skills and education needed to obtain employment outside agriculture (e.g. in the tourism sector). Poor or no access to credit also limits off-farm agricultural and non-agricultural employment opportunities. Thus, public investments are needed to

strengthen the asset bases of the poor before they can benefit from growth-related spillovers.

Based on our analyses in the previous chapters, we offer the following conclusions and policy recommendations:

1. Hillsides and hillside areas should be a major target of national rural poverty reduction strategies

In Chapter 2 we show that most of the poor are found in rural areas and that some 80 percent of all rural poor live in areas classified as hillsides or hillside areas. The analysis in Chapter 5 reveals that most rural poor in these areas are also extremely poor. This should make hillsides and hillside areas a natural target of national rural poverty reduction strategies.

2. Within the hillsides and hillside areas, public investments should focus on high poverty rate-high poverty density areas since investments there should reach significant proportions of the country's rural poor

Based on our geographical analysis in Chapter 4, we determined that many hillsides and hillside areas in Honduras show both high rates of poverty and high population densities (leading to high poverty densities). For example, the western areas around Copán, the southern areas in Valle and Choluteca, and the Province of Comayagua have both high poverty rates and high poverty densities. By targeting these areas, significant proportions of the rural poor can be reached. The problem of leakages to the non-poor in these areas will be minimized because of high poverty rates. The geographic correspondence between high poverty rates and high poverty density means that there is little tradeoff in targeting high poverty areas for poverty-reducing interventions. Since several of these areas have relatively good-quality infrastructure and access to markets, they make good candidates for poverty-reducing investments.[40]

[40] On the other hand, low population densities in the eastern part of the country lead to much lower poverty densities and a tradeoff between poverty rates and poverty densities. Even though these areas were not part of our study, it is likely that because of the high poverty rates in some of these areas, investments need not have a complicated explicit targeting mechanism; leakages to the non-poor are reduced in areas with higher

3. Agriculture-based growth should form an integral part of the rural development strategy for hillsides and hillside areas

In Chapter 2 we showed that over the past 25 years, agriculture has not been a strong engine of growth in rural Honduras. In Chapter 5 we found that land and labor productivity are particularly low in the hillsides and hillside areas and that off-farm work (even if it is mostly limited to agriculture-related work) is more remunerative than primary production of basic grains on the own farm. While showing the extremely low profitability of basic grains production in hillsides and hillside areas, this result points towards the critical importance of income from off-farm work for many households in hillsides and hillside areas that have insufficient land to meet their basic food security needs given their use of traditional production technologies. On the other hand, households with a certain minimum landholding size tend to stay on their farms. The emphasis on food security of most hillside households combined with low land and labor productivity locks these households into a cycle of poverty. Breaking this cycle, freeing up more labor for off-farm work and achieving broad-based agricultural growth require substantial increases in the productivity of both land and labor. The analysis in Chapter 5 suggests that labor productivity can be increased through the provision of physical assets such as agricultural tools and machinery. Land productivity will have to be raised through increased adoption of improved land-saving production technologies. The econometric analysis in Chapter 5 also shows the importance of agricultural training for increasing labor productivity and incomes.

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rates of poverty. On the other hand, because population densities are low, investments should be spatially targeted to specific population clusters, or the types of investments should be selected based on low per unit costs of delivery over space. For example, investments like health-related services should obviously be targeted to population clusters. Others, such as education should be located to guarantee a reasonable degree of access, even in low population density areas.

4. Public investments in access to land alone have limited impact on household income and therefore should be combined with investments in human and financial capital

In Chapter 5 we showed that more land in and of itself is no guaranteed poverty exit strategy. But we also showed that access to land combined with access to credit and/or more education has a significant and positive effect on household income; and that households with land titles are more likely to follow more remunerative livelihood strategies that are not basic grains-based and therefore earn higher incomes. Therefore, efforts to facilitate access to land need to include titling programs and be combined with investments aimed at improving the financial and human asset bases of rural households.

5. Investments in infrastructure are urgently needed in the hillsides and hillside areas

Livelihood strategies based primarily on agriculture will not be adequate for many households in hillside areas. However, non-agricultural activities are relatively rare in rural Honduras because of the physical distances from urban centers and towns and the lack of good road infrastructure and transport services. Our econometric analyses in Chapter 5 show that better market access and higher road densities enable households to follow more diversified livelihood strategies and therefore earn higher incomes. The same analyses also show that, to a certain extent, improved market access can compensate for lack of land or low levels of education. Investments in rural infrastructure therefore deserve high priority in Honduras' rural development strategy. Besides as complements to land access programs (see previous conclusion), our results in Chapter 5 also show the importance of credit and education for a self-employment-based livelihood strategy. Finally, we found evidence of a positive and statistically significant link between education and the likelihood that households follow a relatively profitable livelihood strategy based on their own business.

6. Need to capitalize on the full potential of the migration phenomenon

Temporary and permanent migration within Honduras and abroad are part of the

livelihood strategies of rural households in hillside areas. The primary causes of migration are poverty and land degradation, not lack of land access per se. For example, people from hillside areas in the west and south–where soils have been exhausted and eroded – frequently migrate to the north and northeast regions. Our results in Chapter 5 indicate that migration is significantly less common among low-income households that follow livelihood strategies based on basic grains production. We also found evidence that households with more migration assets have higher income (all other factors equal) but that only small percentage of hillside households receive remittances. A major question therefore is: how to capitalize on the full potential of the migration phenomenon? Currently remittances mostly serve as a source of finance for food and other goods which can be expected given that poverty is deep among hillside households. But remittances are a potential source of finance for market-oriented productive activities and household diversification. To maximize returns from migration, the Government should consider providing basic training to assist prospective migrants, assist community-based initiatives aimed at investing remittances in a productive way, and improving financial systems to lower the transaction costs and risks associated with remittances.

7. Stimulating the formation of social capital is important for increasing the welfare of rural households

Even though our econometric analysis in Chapter 5 did not detect a significant direct effect of social capital on household income, participation in community organizations increases the likelihood of a household following a more remunerative livelihood strategy. Moreover, our community-level analysis confirmed that in the absence of formal institutions in isolated rural areas, these organizations can fill a critical role and are a potentially important factor in stimulating more remunerative, market-oriented production activities.

8. Efforts to curtail rural population growth are important

Our analysis in Chapter 5 indicates that households with higher dependency ratios earn lower incomes. Public programs aimed at reducing fertility rates in rural areas

therefore seem important.

9. Move from geographically untargeted investments in single assets to a more integrated and geographically based approach of asset enhancement with proper complementarities

In our final conclusion and recommendation we argue that while some public investments in household assets programs should be national in nature (such as education and health), others (such as investments in infrastructure, and productive and social capital assets) require more local adaptation and must be carried out in tandem, according to specific needs of regions and households. Household-level heterogeneity limits the appropriateness of "cookie-cutter approaches" to policies and programs designed to foster broad-based growth (see also Box 13). Investment strategies should be formulated on broad regional bases, but options within regions should be tailored to local asset bases and other conditions.

Box 13. The Need for Differentiated Strategies by Household Assets and Livelihood Strategies

The need for a household differentiated approach is not new for Honduras. In an analysis of the relationships between land assets, land use and poverty, Stonich (1992, p. 396) divided rural households into two groups: a) landless households and those with access to 5 ha or less, and b) medium farms with more than 5 ha of land. She then concludes that for households with less than 5 ha: "Merely increasing agricultural productivity is not an adequate solution for households which tend to be headed by land renters rather than owners and who earn most of their income from off-farm sources. Strategies aimed at reducing poverty in this group must incorporate issues of access to land but also those of employment creation and off-farm wages. Such efforts should be focused at the household level and should fit the labor demands dictated by multiple income-generating activities. Envisioned technological innovations must be evaluated in relation to the risks they present and the opportunity costs of lost wages if family members are restricted from participating in seasonal labor markets." For that latter group, Stonich proposes: "It is for this group that projects aimed directly at increasing agricultural productivity and improving degraded lands are most appropriate. ….. Development efforts should emphasize augmenting production through improved cropping and animal systems (including nontraditional commodities where appropriate), and better post harvest processing and storage systems, and enhanced marketing arrangements including information and credit."

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ANNEX 1. COMPARISON OF INCOME ESTIMATES FROM INE AND THE IFPRI AND UNIVERSITY OF WISCONSIN SURVEYS

The National Statistical Institute (INE) of the Government of Honduras recently produced a poverty map based on an application of a statistical relationship between household income and a number of welfare indicators obtained from the regularly-excecuted permanent household survey (*Encuesta Permanente de Hogares de Propósitos Múltiples*). This relationship was then applied to the 2001 population census data (which does not contain information regarding income). The resulting estimates regarding average per capita daily income at the county level range from US$ 0.08 and 0.26, substantially below our own estimates and with a much narrower range as well (Table A1.1).

The fact that the INE national permanent household surveys do not consider own-consumption as part of total household income almost certainly leads to a serious degree of underreporting of incomes. In the analysis of the IFPRI and Wisconsin survey data we defined total household income as the sum of the net value of crop and livestock production (revenues minus costs), off-farm salaried work (either farm or non-farm), own business and transfers. Own production, whether consumed by the household or sold, is included in the calculation of household income.

A disadvantage of our household survey data is their partial coverage which does not allow the construction of a representative poverty map. On the other hand, their advantage is that they allow for a more precise and much more reliable calculation of household income.

Table A1.1. Comparison Between Income Estimates (US$/capita/day)

Department	Municipio	Income estimate Based on IFPRI and Wisconsin Surveys	Income Estimate Based on INE
Atlantida	La Ceiba	0.58	0.18
Atlantida	Jutiapa	0.45	0.15
Colon	Trujillo	0.59	0.20
Colon	Iriona	0.40	0.17
Colon	Sonaguera	1.03	0.15
Colon	Bonito Oriental	0.71	0.14
Comayagua	Esquías	0.75	0.19
Comayagua	La Libertad	0.52	0.17
Comayagua	Minas de Oro	0.81	0.17
Comayagua	Ojos de Agua	0.32	0.16
Comayagua	San Jerónimo	1.36	0.20
Comayagua	S. José del Potrero	3.09	0.19
Comayagua	San Luis	0.40	0.22
Comayagua	Las Lajas	1.80	0.17
Copan	Santa Rita	0.26	0.13
Choluteca	Apacilagua	0.75	0.08
Choluteca	El Corpus	0.31	0.10
Choluteca	Morolica	0.49	0.08
El Paraiso	Guinope	0.44	0.26
Fco. Morazan	Curaren	0.30	0.20
Fco. Morazan	Guaimaca	0.23	0.18
Fco. Morazan	Lepaterique	0.44	0.24
Intibucá	Intibucá	0.72	0.10
Intibucá	Jesús de Otoro	0.54	0.13
Intibucá	Masaguara	0.16	0.15
Lempira	Candelaria	0.24	0.13
Lempira	Lepaera	0.39	0.08
Lempira	S. Manuel Colohete	0.24	0.08
Ocotepeque	La Encarnación	1.17	0.25
Ocotepeque	La Labor	0.52	0.18
Ocotepeque	S. Fco. del Valle	0.97	0.17
Ocotepeque	San Jorge	0.41	0.22
Ocotepeque	San Marcos	1.22	0.14
Ocotepeque	Sensenti	1.75	0.18
Ocotepeque	Sinuapa	1.48	0.20
St Barbara	Azacualpa	1.65	0.11
St Barbara	Naranjito	0.23	0.08
St Barbara	Quimistán	0.15	0.13
St Barbara	S. José de Colinas	0.38	0.14
Yoro	Sulaco	0.28	0.11
Yoro	Victoria	0.40	0.12
Yoro	Yorito	0.28	0.12

***Sources**: Own income estimates based on IFPRI and Wisconsin household survey data;and INE (2003).*

ANNEX 2. BRIEF DESCRIPTION OF HOUSEHOLD DATA FROM IFPRI AND UNIVERSITY OF WISCONSIN SURVEYS

IFPRI Household Survey

This survey was carried out in 2001-2002 under the auspices of IFPRI (in cooperation with Wageningen University and Research Center (WUR) and the National Program for Sustainable Rural Development (PRONADERS)) as part of the project "Rural Development Policies and Sustainable Land Use in the Hillsides of Honduras". The IFPRI survey interviewed hillside households in 9 provinces (*departamentos*) and 19 counties (*municipios*). The latter were selected purposively based on several criteria including agro-ecological conditions (largely synonymous with agricultural potential), dominant land use, population density, market access, and the presence of projects and programs. In addition, the importance of a number of counties in the northeast of the country as recipient areas of migrants (extending the agricultural frontier) warranted their inclusion in the study. The remainder of the sampling process in the IFPRI survey was done in a fully randomized manner: five villages (*aldeas*) in each county, two hamlets (*caserios*) in each village, and two households (*hogares*) in each hamlet.

The IFPRI sample contains a total of 375 farms, 1,066 parcels (defined on the basis of tenure type) and 2,143 plots (defined on the basis of land use). Key socio-economic elements of the survey at the household level included household composition, education, asset ownership, labor use, sources of income, sales of crop and livestock products, participation in credit markets, membership of organizations, participation in training and extension, collective action etc. Since an important goal of the IFPRI survey was to analyze the adoption of conservation practices and policies for sustainable land use, information was collected at the parcel and plot level as well and included land tenure, cropping patterns, crop yields, technology use including use of inputs, and conservation practices and investments. Finally, the IFPRI survey also collected detailed biophysical data for a (randomly drawn) sample of two plots on each farm including landscape attributes, plot size, type of soil parent material, erosion status, and presence of physical conservation structures. Soil samples were also taken and analyzed in a soil

laboratory resulting in data regarding pH, nutrient content, organic matter content and texture. These data were mainly used for the calculation of water availability, soil fertility and erosion risk which together served as a basis for soil suitability ratings (Wielemaker, 2002).

University of Wisconsin Household Survey

This survey was carried out in 2000-2001 under the auspices of the University of Wisconsin for a study on land tenure and rural finance, and covers 850 households in 6 provinces and 26 counties. Information was collected at the household level without entering down to the individual parcel or plot levels. The Wisconsin survey sample consists of two parts: the first is a non-random panel survey of 500 households most of which had been surveyed previously in 1994 in the context of a USAID-sponsored land tenure survey. The second part consists of 350 households that were part of a baseline sample for a European Union (EU) sponsored land access project. As in the IFPRI survey, in the second part of the Wisconsin survey counties were selected purposively but thereafter the sample was done randomly.

Observations on the Two Surveys

Together these surveys cover households in 12 (out of 18) provinces, 42 (out of 298) counties, 206 villages, 400 hamlets, and 1,225 households (Table A2.1). Unlike the IFPRI survey, the Wisconsin survey not only includes households located in hillside areas but also in areas characterized as valleys (Box 1 in Chapter 1 for terminology).

From a purely statistical point of view the IFPRI survey is representative for the 19 counties where it was conducted. On the other hand, statistical representativity was never of much concern in the sampling of the University of Wisconsin survey households. As a result, only the part of the Wisconsin survey that corresponds to the EU project can be said to be representative at the level of the county.

In both cases, household survey data were supplemented by adding secondary, mostly geo-referenced information that included (but was not limited to) rainfall, altitude, population density, and road density from various sources.

Table A2.1. List of Provinces and Counties Covered by the Household Surveys

Province code	Province Name	County Code	County Name
01	Atlantida	0101	La Ceiba
		0104	Jutiapa
02	Colon	0201	Trujillo
		0203	Iriona
		0208	Sonaguera
		0210	Bonito Oriental
03	Comayagua	0304	Esquias
		0306	La Libertad
		0311	Minas de Oro
		0312	Ojo de Agua
		0313	San Jeronimo
		0315	San Jose del Potrero
		0316	San Luis
		0320	Lajas
04	Copan	0421	Santa Rita
06	Choluteca	0602	Apacilagua
		0605	El Corpus
		0608	Morolica
07	El Paraiso	0705	Guinope
08	Fco. Morazan	0804	Curaren
		0806	Guaimaca
		0809	Lepaterique
10	Intibuca	1006	Intibuca
		1007	Jesus de Otoro
		1009	Masaguara
13	Lempira	1303	Candelaria
		1313	Lepaera
		1319	S. Manuel Colohete
14	Ocotepeque	1406	La Encarnacion
		1407	La Labor
		1411	S. Fco. Del Valle
		1412	San Jorge
		1413	San Marcos
		1415	Sensenti
		1416	Sinuapa
16	Santa Barbara	1604	Azacualpa
		1613	Naranjito
		1617	Quimistan
		1619	S. Jose de Colinas
18	Yoro	1809	Sulaco
		1810	Victoria
		1811	Yorito

ANNEX 3. BRIEF DESCRIPTION OF LIVELIHOOD STUDIES

The IFPRI household survey was accompanied by qualitative diagnostic surveys at the community level in the same 95 randomly selected communities where the household survey was conducted. These diagnostic surveys were carried out between May 2001 and March 2002 with the help of local non-governmental organizations (NGOs) with long-term experience in the area.[41] They involved characterization and diagnosis of problems, limitations and opportunities, resulting in community profiles. Highly participatory, informal but structured methods were used in close cooperation with a carefully selected, representative group of community stakeholders of about 20 persons in each community. Key elements in each diagnostic included the history of the community, the agricultural production environment, management of natural resources, access to public facilities and services, infrastructure development etc. Examples of specific information sought include major occupations of the community's inhabitants, dominant land use types, land tenure arrangements; perceptions regarding natural resource degradation, market access, health and education; forms of community-based organization and collective action, influence of external projects and programs, etc. For each community, a document was produced that contains a full description of the community based on the information collected. In addition, those parts of the collected information that could be quantified were coded and stored in a database in Access and complemented by additional data from secondary sources including elevation, rainfall, population density road density, market access and literacy rates. Finally, after the analysis of the community-level information was completed, a series of four regional workshops was conducted (one each in Tegucigalpa, Santa Rosa de Copán, Yoro and La Ceiba) for county mayors and other county officials, community leaders, NGOs, field project leaders and farmer organizations, in order to obtain feedback regarding the main results of the community-level analysis (and also present preliminary results of the household analysis) (Jansen, 2005).

[41] Before carrying out the diagnostic surveys, each NGO was given the appropriate amount of training by staff from IFPRI and PRONADERS.

Compared to the clustering of households by assets carried out with the household survey data, major livelihood activities at the community level were used to group communities. We hypothesized that just like livelihood strategies, income-earning strategies at the community level are largely defined by a limited number of biophysical factors and socio-economic conditions which together make up the asset portfolio of a community. Whereas biophysical factors define agricultural potential and absolute advantage as determined by local climate, soil quality, topography, and other biophysical factors (mainly natural capital), socio-economic conditions determine the comparative advantage of a community, and may include such diverse factors as access to roads and markets, and population density (location capital); average education levels in the community (human capital); land tenure situation (physical capital); and social capital, including presence and effectiveness of organizations and the ability of communities to organize successfully for appropriate collective action. Examples of the latter are the organization and management of productive activities or micro-enterprises, and management of common natural resources.

Classification of Sample Communities

Even though people in hillside communities in Honduras typically engage in a wide range of income-earning activities, there exist clear differences between communities with respect to their dominant activities. Therefore we categorized the 95 communities according to the dominant income-earning occupations of their inhabitants. This was done in a fully qualitative manner by the study team and involved reviewing each of the 95 community reports to identify the primary, secondary and tertiary livelihood strategies and income earning activities. The livelihood groups were identified as:

- Income strategy # 1: coffee + basic grains (19 communities)
- Income strategy # 2: basic grains + livestock (12 communities)
- Income strategy # 3: basic grains + forestry (6 communities)

- Income strategy # 4: basic grains + off-farm work[42] + coffee (7 communities)
- Income strategy # 5: basic grains + off-farm work + livestock (19 communities)
- Income strategy # 6: basic grains + off-farm work + horticulture (fruits and vegetables) (21 communities)
- Income strategy # 7: basic grains + horticulture (9 communities)
- Income strategy # 8: fisheries + commerce + horticulture (2 communities).

Strategy # 8 involves only two communities in the municipality of Iriona (Colón province) and is different from the other strategies because of the importance of fishing and handicrafts in these communities. Unlike in other communities where there is a strong focus on maize and bean cultivation, agriculture in these two communities mainly involves crops such as cassava, plantain and banana (and some rice as well).

Consistent with the results from the IFPRI household survey, a common characteristic of all strategies is the dominance of basic grains production and rearing of minor livestock (pigs and poultry), mainly for own consumption. Analysis of secondary community level data revealed clear differences between communities that belong to different income-earning groups with respect to biophysical characteristics (elevation, rainfall) and economic characteristics (population density, infrastructure development). ANOVA analysis confirmed the statistical significance of these differences for most of these variables for most pairs of income-strategies.

Table A3.1 provides the results of the multinomial logit model used to identify the main determinants of community-level income earning strategies. Detailed results of the community livelihood analysis can be found in Jansen et al. (2003b).

[42] Most off-farm work consists of wage labor on other farms. Consistent with findings by others (see, e.g., Ruben and van den Berg, 2001), non-farm rural activities in our sample communities turned out to be relatively minor.

Table A3.1. Principal Determinants of Income-Earning Strategies in Hillside Communities in Honduras

No. of obs = 78, Pseudo R^2 = 0.52, Log probability = -68.07 Multinomial Logit Regression [1)]

Explanatory Variables [2)]										Diagnostics		
Income-earning strategy	**Altitude (m above sea level)**	**Rainfall first season (mm during May-Sept)**	**Rainfall second season (mm during Oct-Jan)**	**Population density (persons per km^2)**	**Market access[3)]**	**Index of community-based organizations [4)]**	**Percentage of people with land**	**Number of external organizations**	**Illiteracy rate**	**Mean predicted probability**	**Proportion of observations**	**Difference (%)**
Coffee and basic grains	**0.008****	0.001	0.004	**-0.023*****	-0.282	-0.027	-0.039	0.433	**0.065***	0.241	0.288	16.5
Standard error	*0.003*	*0.003*	*0.004*	*0.008*	*0.182*	*0.124*	*0.026*	*0.335*	*0.037*			
P-value	*0.011*	*0.668*	*0.291*	*0.007*	*0.121*	*0.827*	*0.138*	*0.196*	*0.083*			
Basic grains and forestry	0.008	**0.009***	0.003	-0.030	-0.028	0.137	-0.008	-0.056	-0.201	0.044	0.042	-5.9
Standard error	*0.005*	*0.005*	*0.004*	*0.040*	*0.114*	*0.187*	*0.026*	*0.267*	*0.178*			
P-value	*0.108*	*0.064*	*0.472*	*0.450*	*0.803*	*0.464*	*0.775*	*0.834*	*0.259*			
Basic grains, off-farm work and coffee	**0.009****	0.002	-0.008	**-0.011****	**-0.990****	**0.400****	**-0.055***	**1.265*****	**0.097***	0.134	0.114	-17.1
Standard error	*0.004*	*0.002*	*0.006*	*0.005*	*0.425*	*0.191*	*0.032*	*0.475*	*0.052*			
P-value	*0.029*	*0.390*	*0.139*	*0.044*	*0.020*	*0.038*	*0.086*	*0.008*	*0.066*			
Basic grains, off-farm work and livest.	-0.004	**0.005****	**-0.011****	**-0.027*****	-0.157	**0.175***	**-0.076*****	-0.117	0.189	0.152	0.137	11.1
Standard error	*0.003*	*0.003*	*0.005*	*0.010*	*0.123*	*0.095*	*0.029*	*0.297*	*0.031*			
P-value	*0.226*	*0.097*	*0.027*	*0.005*	*0.200*	*0.067*	*0.009*	*0.693*	*0.544*			
Basic grains, off-farm work and horticul.	-0.000	**0.006****	0.003	**-0.025*****	**-0.143****	0.083	**-0.066****	-0.307	0.039	0.219	0.210	-4.2
Standard error	*0.002*	*0.002*	*0.002*	*0.008*	*0.062*	*0.089*	*0.026*	*0.254*	*0.030*			
P-value	*0.903*	*0.016*	*0.210*	*0.001*	*0.021*	*0.351*	*0.012*	*0.227*	*0.194*			
Basic grains and horticulture	**0.013*****	0.001	**0.022*****	**-0.023*****	**-1.762*****	**-0.310***	0.078	**1.567*****	**0.120****	0.106	0.083	28.0
Standard error	*0.005*	*0.003*	*0.008*	*0.007*	*0.645*	*0.167*	*0.075*	*0.518*	*0.047*			
P-value	*0.009*	*0.767*	*0.006*	*0.001*	*0.006*	*0.065*	*0.295*	*0.002*	*0.011*			

[1)] Left-out income-earning strategy is "Basic grains and livestock"

[2)] *,**, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

[3)] Travel time between the center of the community and the nearest urban market, adjusted for road type and slope.

[4)] Number of community-based organizations multiplied by an average performance indicator (1=poor, 2=average, 3=good).

ANNEX 4. CONCEPTUAL FRAMEWORK AND STATISTICAL METHODS USED FOR CLUSTERING OF HOUSEHOLDS

Conceptual Framework

The existing literature contains a number of attempts at quantifying livelihood strategies and related concepts, using various methods. Pender et al. (2001) used data on primary and secondary occupation and land use changes over time to determine community development pathways. Common pathways were then grouped and used as units of analysis to explore conservation and cropping practices. Jansen et al. (2003b, 2005) used a similar approach but primarily used qualitative information and expert knowledge to group rural communities in Honduras according to income-earning strategy. Birch-Thomsen et al. (2001) used indices to weigh the importance of different sources of household income. Different types of income were allocated points based on their source, such as income from natural resources, business, rents etc. Groups were then formed based on the frequency distribution of income sources. Lambin (2003), in a study on land cover changes in a protected area in Kenya, used clustering techniques to group farmers on the basis of their physical capital as expressed in their land use. Adato and Meinzen-Dick (2002) implemented the livelihoods framework using qualitative methods using four case studies to assess the impact of agricultural technology and research on people's lives.

Given the debate in the literature regarding appropriate methods to implement the livelihood strategy framework, we considered several methods for clustering households based on previous work done in this area, and the information available from our household surveys and other data. Use of income shares (as in Birch-Thomsen et al., 2001) was considered as a means to conceptualize livelihood strategies. However, unless income composition is available over time, using income shares from one year presents several specific problems when attempting to define a farm household's livelihood strategy. A household's income for a single year is not only an outcome of a household's use of assets, but may also be influenced by random events such as weather conditions, which often are particularly variable in less-favored areas. As such a household's income

in a particular year reflects its short-term coping mechanism rather than a long-term livelihood strategy.

We decided to use the time allocation of a household on different types of productive activities, and the household's land use pattern as the starting points for determining and defining a household's livelihood strategy. Time allocation and land use largely reflect the way in which the household puts its main assets (labor and land) to use. However, whereas the IFPRI household survey contains information on both land use and time allocation, the Wisconsin household survey lacks information regarding the latter. Therefore, we used factor analysis and cluster analysis to group the IFPRI farm households with similar time allocation and land use patterns. The Wisconsin households were factored and clustered on the basis of similar land use patterns and income shares, despite the above-mentioned potential problems with the latter. Clustering based on the basis of land use patterns only would overlook livelihood strategies based on off-farm work and own business. Analysis of land use patterns, income shares and (in the case of the IFPRI survey) average time allocation in each of the clusters was subsequently performed to help defining livelihood strategies.

Statistical Methods

To lay the foundations for the factor analysis, we captured the households' (1) land use patterns in terms of the proportions of the farm used for basic grains, other annual crops, coffee, other permanent crops, pastures, and forest plus fallow; (2) household patterns of time allocation, in terms of the proportion of time spent by its members on the following five categories: annual crops, including basic grains and other annual crops (e.g. vegetables), permanent crops, including coffee and other permanent crops (e.g. plantain, fruit trees), livestock activities, off-farm agricultural work (working on other people's farms), and off-farm non-agricultural work (only in the case of the IFPRI households); (3) shares in total household income of income from own farm, salaried off-farm work (either ag or non-ag), own business, and transfer payments (Wisconsin households only). Factor analysis is a data reduction method that looks for

linear combinations within the correlation matrix for the labor- and land-related variables that we hypothesize are closely linked to households' livelihood strategies. Basically it tries to represent these variables with a smaller set of "derived" variables, or common factors. We used the principal factor (pf) method in STATA to analyze the correlation matrix of the variables. The common factors are computed using the squared multiple correlations as estimates of the communality.

The results of the factor analysis served as input into a cluster analysis, which was used to categorize and assign each household to previously undefined groups or clusters. Cluster analysis is a technique used to identify meaningful, mutually exclusive subgroups of observations from a larger aggregate group of observations (Hair et al., 1998). A cluster analysis that is preceded by a factor analysis usually results in a much more clear-cut delineation of clusters than a straight stand-alone cluster analysis. Based on the results of the factor analysis, the cluster analysis methodology explained below was used to determine both the number and composition of the clusters present in the sample.

The first step in the cluster analysis process is an agglomerative hierarchical clustering to inspect the number of natural groups or clusters that exist in the data.[43] Dendograms, based on the hierarchical clustering procedure were drawn to visually inspect groups within the data and indicated the presence of seven primary groups or clusters.[44]

Using results from the hierarchical cluster analysis, k-means cluster analysis, a non-hierarchical clustering method, was implemented. Agglomerative hierarchical cluster analysis, used in the first step, efficiently grouped households together. However, hierarchical clustering can give rise to misclassification of observations at the boundaries between clusters (Wishart, 1999). Using k-means analysis corrects for this problem. K-means cluster analysis is an iterative process that allows for starting points and their

[43] ClustanGraphics, a computer software specifically designed for cluster analysis, was used to implement all cluster analysis procedures (ClustanGraphics, 2002).

[44] Increase in sum of squares was used in the hierarchical cluster procedure. Increase in sum of squares assumes that cases can be represented by points in Euclidean space and uses a proximity matrix of squared Euclidean distances to determine the similarity between two observations or two clusters (Wishart, 1999).

means to be set at the beginning of the process. We used the groups and group averages (as identified through hierarchical cluster analysis for each of the cluster variables) as starting centers for the k-means analysis. Observations were then assigned to groups that they are "closest" to. Based on the addition of each subsequent observation, cluster centers were recalculated and progressively calibrated through successive iterations. This process was repeated until all observations were assigned across groups.

ANNEX 5. RESULTS OF THE MULTINOMIAL LOGIT MODELS

Explanatory variables of both the biophysical and socio-economic type were used in multinomial logit models to identify the main determinants of households' livelihood strategies. This was done separately for the IFPRI and the Wisconsin household samples. Together the explanatory variables used in the multinomial logit models constitute a fair representation of the households' asset base (Tables A5.1 and A5.2). We present the results of both the full and the reduced form models (Tables A5.3 and A5.4 for the IFPRI sample, and Tables A5.5 and A5.6 for the Wisconsin sample). Whereas the full models investigate the influence of all types of capital on households' livelihood strategy decisions, the reduced forms only take natural, human and physical capital into account, based on the possibly endogeneity and/or reverse causality of locational, financial and social capital-related explanatory variables. For example, a household's participation in organizations (social capital) may be partially determined by the particular type of livelihood strategy pursued by that household, rather than the other way around.

IFPRI Households

The estimated coefficients are relative to livelihood strategy #3 (basic grains producers) and significant variables should be interpreted as increasing or decreasing the probability that a given household follows the corresponding strategy rather than strategy # 3. That is, the magnitude of the coefficients has no clear interpretation, but their direction does. Because of limited number of observations, livelihood strategies # 6 and # 7 do not form part of the models.

Wisconsin Households

The estimated coefficients are relative to livelihood strategy #2 (basic grains producers/farm workers). Just like in the IFPRI models, significant variables should be interpreted as increasing or decreasing the probability that a given Wisconsin household follows the corresponding strategy rather than the comparison strategy (strategy # 2).

Again the reduced form (Table A5.6) leaves out all potentially endogenous variables whose influence may often stem from reverse causality.

Table A5.1. Explanatory Variables Used in Multinomial Logit Model, by Livelihood Strategy, IFPRI Sample

			Cluster number													
	Total sample		**1**		**2**		**3**		**4**		**5**		**6***		**7***	
Number of households	**376**		**59**		**28**		**68**		**85**		**116**		**12**		**8**	
Independent variables	Mean	Std error	Mean	Std error	Mean	Std error	Mean	Std error	Mean	Std error	Mean	Std error	Mean	Std error	Mean	Std error
NATURAL CAPITAL																
Summer rainfall[1)]	1005	17	943	37	917	41	976	41	1058	45	1008	25	1576	74	1060	53
Rainfall deficit second season[2)]	14	3	18	7	1	1	33	11	11	4	6	2	9	4	9	10
Altitude[3)]	2231	127	1220	198	3845	169	2009	265	2412	232	2569	240	1661	182	734	111
Soil fertility[4)]	2846	67	2834	159	2572	171	2806	166	2939	94	2835	140	2935	183	3315	263
PHYSICAL CAPITAL																
Area of land owned[5)]	7.4	1.6	22.7	6.9	3.2	0.8	1.2	0.6	0.5	0.3	9.3	3.5	1.9	0.5	0.5	0.2
% HH with at least some titled land	29.4	4.1	36.9	8.9	56.7	12.1	18.5	7.9	14.8	9.2	34.6	8.5	58.4	15.8	6.7	2.5
Value of non-land physical assets[6)]	3,698	631	6,023	1,113	6,590	3,612	2,884	947	422	159	4,757	1,527	1,726	930	671	144
Value of livestock[6)]	19,703	5,077	87,336	23,146	4,029	848	4,105	1,148	1,994	660	10,394	3,097	892	371	5,547	1,076
HUMAN CAPITAL																
Household size (# of HH members)	6.1	0.2	6.1	0.5	6.2	0.6	5.7	0.4	5.9	0.4	6.4	0.3	4.6	0.5	7.1	0.9
Age of head of HH[7)]	47.2	1.4	46.3	2.4	40.7	3.4	43.9	3.6	45.3	3.5	52.3	2.5	49.9	6.7	47.9	1.5
Migration time[8)]	7.6%	2.0%	21.2%	7.54%	17.3%	13.4%	2.2%	1.5%	3.42%	1.9%	4.7%	1.4%	0.3%	0.3%	0.1%	0.10%
Education[9)]	2.8	0.2	3.4	0.3	1.9	0.3	2.9	0.5	2.3	0.3	3.0	0.2	2.5	0.8	2.5	0.4
Training dummy[10)]	0.33	0.05	0.17	0.07	0.39	0.14	0.31	0.10	0.22	0.09	0.47	0.10	0.68	0.18	0.13	0.13
Extension dummy[11)]	0.13	0.02	0.09	0.04	0.04	0.03	0.13	0.08	0.07	0.03	0.12	0.05	0.56	0.20	0.01	0.01
Dependency ratio[12)]	0.9	0.1	0.6	0.1	0.7	0.2	1.1	0.2	1.2	0.2	0.9	0.1	0.9	0.2	0.5	0.2
Female headed HH dummy[13)]	9.4	3.0	14.8	7.1	1.4	1.5	17.7	9.4	12.9	9.7	2.2	1.3	0.0	0.0	3.2	4.1
% female adults in the HH[14)]	49.7	1.3	44.7	2.1	51.4	5.1	50.4	3.2	46.2	1.9	52.4	2.4	60.7	3.3	56.3	3.0
LOCATION CAPITAL																
Population density[15)]	104	12	51	9	81	10	132	28	125	33	99	23	263	103	52	9
Distance to input market by foot[16)]	53.6	5.4	72.9	15.8	68.5	16.4	33.4	8.0	53.8	12.2	54.9	8.9	74.5	75.7	11.3	7.3
Distance to input market by vehicle[16)]	14.8	3.4	22.4	9.6	16.2	8.8	20.7	10.8	6.3	3.8	11.2	4.6	24.7	25.9	14.8	16.8
Road density[17)]	4.0	0.3	2.1	0.3	5.7	0.4	4.0	0.4	4.8	0.6	4.3	0.5	3.3	0.2	2.0	0.2
FINANCIAL CAPITAL																
Credit availability dummy[18)]	0.37	0.05	0.31	0.09	0.27	0.11	0.19	0.06	0.49	0.13	0.47	0.10	0.61	0.20	0.00	0.01
SOCIAL CAPITAL																
Agricultural organizations[19)]	0.09	0.04	0.17	0.08	0.18	0.07	0.01	0.01	0.01	0.01	0.14	0.11	0.26	0.22	0.00	0.00
Community organizations[20)]	0.869	0.03	0.75	0.10	0.93	0.04	0.87	0.05	0.87	0.05	0.90	0.03	0.99	0.01	0.8	0.14
Savings and credit organizations[21)]	0.08	0.02	0.00	0.00	0.21	0.14	0.14	0.06	0.06	0.03	0.08	0.03	0.00	0.00	0.11	0.13
External organizations[22)]	0.82	0.05	0.94	0.03	0.90	0.07	0.85	0.06	0.67	0.15	0.83	0.11	0.79	0.17	0.87	0.14

***** Not part of the multinomial logit regression.

[1)] In mm for the period May-September. Own calculations based on information from CIAT (2001).

[2] Measured as maize water deficit for the period Oct-January (average for sampled plots in mm). The IFPRI survey collected detailed biophysical data and soil samples on a (randomly drawn) sample of two plots on each farm. These samples were analyzed in a local soil laboratory resulting in data regarding pH, nutrient content, organic matter content and texture. These data were mainly used for the calculation of water availability and soil fertility. Water deficits were calculated on the basis of data for monthly temperature, effective rainfall (taking runoff into account as determined mainly by slope, slope direction, contour curvature, profile curvature and position on slope), evapotranspiration, and soil characteristics including depth, texture and organic matter content. Only moisture availability for the second season (*postrera*) was included in the model since the data indicated very few cases of main season (*primera*) water deficits.
[3] Average altitude of sampled plots in feet above sea level (data from household survey).
[4] Soil fertility was approximated by potential maize yields (nutrient-limited but not water-limited) as determined by the QUEFTS (QUantitative Evaluation of soil Fertility and response To Fertilizers) model (Janssen, 1990), taking into account nitrogen content, pH, and available potassium and phosphorous. Units are kgs.
[5] In manzanas (1 Mz = 0.7 ha), data from household survey.
[6] Value of machinery, equipment & transportation in Lps, data from household survey.
[7] In years, data from household survey.
[8] Total number of months lived outside the household by adult HH members in 2000, divided by the number of adult in the HH x 12 and multiplied by 100.
Data from household survey.
[9] Median years of schooling of household members older than 7 years, data from household survey.
[10] Dummy variable (=1 if HH has received training, 0 if not) , data from household survey.
[11] Dummy variable (=1 if HH has received extension visits, 0 if not) , data from household survey.
[12] Ratio defined as follows: (# of HH members < 12 and > 70 yrs) / (# of HH members between 12 and 70 yrs) , data from household survey.
[13] 1=female head of household, data from household survey.
[14] Females > 12 yrs of age as a % of total household size, data from household survey.
[15] # of persons per km^2 in the community, data from SINIT/CIAT.
[16] Average travel time to the nearest input market from the homestead, data from household survey. Logit models (Tables 5 and 6) use ordinal market access index variable that takes into account geographical distance, road quality and slope. Index developed by CIAT.
[17] Km of roads/km^2 in the community, data from SINIT/CIAT.
[18] Dummy variable (1=HH has access to any form of credit, 0 otherwise), data from household survey.
[19] Dummy variable (1 = household participates in the organization, 0 = household does not participate in the organization). Includes agricultural cooperatives, producer associations, unions and private enterprises engaged in agricultural services etc. Data from household survey.
[20] Dummy variable (1 = household participates in the organization, 0 = household does not participate in the organization). Includes villagers' association, parent organization, ethnic council, water users' group, religious organizations, women's organizations. Data from household survey.
[21] Dummy variable (1 = household participates in the organization, 0 = household does not participate in the organization). Includes savings and loans type operations.
[22] Dummy variable (1=household participates, 0 = household does not participate). Includes NGOs delivering mainly technical assistance in the areas of agricultural production and/or marketing. Data from household survey.

Table A5.2. Explanatory Variables Used in Multinomial Logit Model, by Livelihood Strategy, Wisconsin Sample

			Cluster Number											
	Total sample		**1**		**2**		**3**		**4**		**5**		**6***	
Number of households	**826**		**222**		**115**		**98**		**242**		**58**		**91**	
Independent variables	Mean	Std error	Mean	Std error	Mean	Std error	Mean	Std error	Mean	Std error	Mean	Std error	Mean	Std error
NATURAL CAPITAL														
Annual rainfall[1)]	1497.7	9.1	1502.8	19.6	1546.3	25.0	1481.0	26.9	1473.3	13.8	1447.7	33.9	1541.2	31.1
Summer rainfall[1)]	984.8	7.0	979.5	15.4	986.5	21.7	988.7	21.6	997.9	9.6	936.5	23.5	985.3	23.3
Altitude[2)]	929.5	18.6	857.0	37.8	918.3	61.3	881.0	60.7	1072.0	25.3	803.5	63.3	850.2	54.1
PHYSICAL CAPITAL														
Area of land owned[3)]	22.1	2.8	42.8	9.3	1.9	0.2	24.7	4.7	11.6	1.4	38.0	10.2	12.0	2.5
% HH with at least some titled land	29.8	1.6	32.9	3.2	7.8	2.5	48.0	5.1	31.0	3.0	32.8	6.2	25.3	4.6
Value of other non-land physical assets[4)]	5823	2230	9671	6343	0	0	0	0	9330	4799	4704	3571	1454	1352
Value of livestock[4)]	18752	8615	52457	31857	1618	441	15194	3508	3417	879	15428	8301	4915	1909
HUMAN CAPITAL														
Household size (# of HH members)	8.7	0.1	9.2	0.3	8.0	0.3	8.7	0.4	8.2	0.2	9.2	0.6	9.4	0.4
Age of household head[5)]	52.2	0.6	53.6	1.0	45.7	1.5	53.3	1.6	51.3	1.0	53.2	1.9	57.9	2.0
Migration time[6)]	2.4	0.2	2.1	0.3	3.1	0.7	1.9	0.5	2.6	0.5	3.6	1.1	1.4	0.4
Average education[7)]	5.0	0.1	5.2	0.2	3.8	0.2	5.0	0.2	4.9	0.1	6.4	0.4	5.3	0.3
Dependency ratio[8)]	0.6	0.02	0.5	0.04	0.8	0.1	0.6	0.1	0.6	0.04	0.5	0.1	0.6	0.1
% Female headed HH[9)]	12.4	1.2	11.7	2.2	15.7	3.4	6.1	2.4	9.5	1.9	10.3	4.0	25.3	4.6
% female adults in the HH[10)]	38.2	0.5	38.0	1.0	34.3	1.3	39.2	1.7	38.3	1.0	41.2	2.0	40.1	1.7
LOCATION CAPITAL														
Population density[11)]	107.2	4.5	114.6	9.6	78.2	7.0	136.0	14.2	100.8	8.1	126.9	19.0	99.7	13.5
Road density[12)]	1.8	0.1	2.0	0.2	1.9	0.2	2.3	0.3	1.5	0.1	1.7	0.3	1.7	0.3
Distance between community and county capital or capital of another county (if closer) [13)]	15.9	0.7	12.3	1.4	17.5	2.3	12.3	2.3	21.2	1.2	14.3	2.5	13.2	1.8
Distance to daily market[13)]	40.1	1.6	48.3	3.7	36.5	4.2	46.2	5.0	32.1	2.3	43.0	6.5	37.6	4.5
FINANCIAL CAPITAL														
Credit availability dummy[14)]	47.1	1.7	40.5	3.3	40.9	4.6	48.0	5.1	58.7	3.2	50.0	6.6	37.4	5.1
SOCIAL CAPITAL														
Agricultural organizations[15)]	10.2	1.1	9.0	1.9	2.6	1.5	10.2	3.1	14.1	2.2	15.5	4.8	8.8	3.0
Community organizations[16)]	36.9	1.7	35.6	3.2	39.1	4.6	34.7	4.8	39.7	3.2	37.9	6.4	31.9	4.9
Savings and credit organizations[17)]	3.9	0.7	4.5	1.4	2.6	1.5	4.1	2.0	1.7	0.8	8.6	3.7	6.6	2.6
External organizations[18)]	5.3	0.8	3.2	1.2	5.2	2.1	5.1	2.2	6.2	1.6	3.5	2.4	9.9	3.2

* Not part of the multinomial logit regression.

[1)] In mm for the period May-September. Own calculations based on information from SINIT/CIAT.

[2] In meters above sea level; own calculations based on information from SINIT/CIAT.

[3)] In manzanas (1 Mz = 0.7 ha).

[4] Value of machinery, equipment & transportation in Lps, data from household survey.
[5] In years, data from household survey.
[6] Total number of man-months spent outside the household by household members. Data from household survey.
[7] Median years of schooling of household members older than 7 years, data from household survey.
[8] Ratio defined as follows: (# of HH members < 12 and > 70 yrs) / (# of HH members between 12 and 70 yrs). Data from household survey.
[9] 1=female head of household, data from household survey.
[10] Females > 12 yrs of age as a % of total household size, data from household survey.
[11] # of persons per km^2 in the community, data from SINIT/CIAT.
[12] Km of roads/km^2 in the community, data from SINIT/CIAT.
[13] In km, data from household survey.
[14] Dummy variable (1=HH has access to any form of credit, 0 otherwise). Data from household survey.
[15] Dummy variable (1 = household participates in the organization, 0 = household does not participate in the organization). Includes agricultural cooperatives and producer associations. Data from household survey.
[16] Dummy variable (1 = household participates in the organization, 0 = household does not participate in the organization). Includes villagers' association, parent organization, ethnic council, water users' group, religious organizations, political organizations, women's organizations. Data from household survey.
[17] Dummy variable (1 = household participates in the organization, 0 = household does not participate in the organization). Includes community banks etc.
[18] Dummy variable (1=household participates, 0 = household does not participate). Includes NGOs and other projects. Data from household survey.

Table A5.3. Determinants of Livelihood Strategies (Full Multinomial Logit Model), IFPRI sample (Livelihood Strategy #3 is Comparison Group)

Cluster	1 Livestock Producers			2 Coffee Producers			4 Basic Grains Farmers/ Farm Workers			5 Mixed Basic Grains/ Livestock Producers/ Farm Workers		
No of HH in each Cluster	58	28	85	116								
VARIABLE [1)]	Estimate	Std. error	p-value	Estimate	Std. Error	p-value	Estimate	Std. error	p-value	Estimate	Std. error	p-value
Summer rainfall	-0.002	0.002	0.429	-0.005	0.003	0.155	-0.0002	0.001	0.876	0.002	0.001	0.103
Rain deficit 2nd season	-0.010	0.008	0.231	-0.017	0.017	0.304	**-0.018**	0.006	0.003	**-0.026**	0.009	0.005
Altitude	-0.0005	0.001	0.762	**0.004**	0.001	0.002	-0.0002	0.001	0.863	0.001	0.001	0.242
Soil fertility	0.0002	0.0005	0.660	-0.001	0.001	0.384	0.00004	0.000	0.240	0.000	0.000	0.890
Area of owned land	0.068	0.062	0.279	-0.051	0.130	0.693	-0.417	0.308	0.178	0.089	0.061	0.147
Titled land dummy	**1.760**	1.004	0.081	**3.199**	1.282	0.013	1.228	1.551	0.429	0.402	0.840	0.633
Value of other non-land physical assets	**0.00009**	0.00005	0.061	0.000	0.000	0.385	**-0.001**	0.000	0.063	-.000	0.000	0.174
Value of livestock	**0.0001**	0.00004	0.001	0.000	0.000	0.556	0.000	0.000	0.978	**0.0001**	0.000	0.055
HH size (# of members)	0.075	0.126	0.550	0.070	0.158	0.660	-0.056	0.124	0.650	-0.059	0.115	0.607
Age of HH head	-0.001	0.027	0.964	-0.007	0.028	0.790	0.029	0.019	0.143	**0.067**	0.018	0.000
Migration time	**6.551**	3.017	0.031	**8.041**	3.190	0.012	5.565	3.400	0.103	4.059	2.770	0.144
Education	-0.201	0.309	0.515	**-0.544**	0.183	0.003	-0.220	0.163	0.180	0.024	0.153	0.875
Training dummy	-0.311	0.830	0.708	0.665	0.823	0.419	0.203	0.717	0.777	0.814	0.684	0.235
Extension dummy	-1.722	1.460	0.239	-1.551	1.651	0.348	0.367	0.857	0.669	-0.546	0.784	0.487
Dependency ratio	-0.504	0.669	0.452	**-1.559**	0.655	0.018	-0.392	0.435	0.368	0.342	0.420	0.416
Female headed HH dummy	-1.223	1.236	0.323	**-4.018**	2.214	0.070	-0.933	0.892	0.296	**-4.211**	1.025	0.000
% female adults in HH	**-4.333**	2.300	0.060	-1.320	3.758	0.726	-2.871	1.743	0.101	2.258	2.254	0.317
Population density	-0.012	0.009	0.213	**-0.026**	0.007	0.001	-0.005	0.004	0.199	**-0.016**	0.004	0.000
Market access index	**0.125**	0.072	0.083	0.056	0.107	0.599	**0.092**	0.048	0.055	0.117	0.055	0.035
Road density	-0.052	0.325	0.872	0.543	0.377	0.151	0.383	0.248	0.123	0.165	0.238	0.488
Credit availability dummy	**2.586**	0.839	0.002	-0.086	0.990	0.930	2.158	0.613	0.000	**1.833**	0.734	0.013
Agricultural organizations dummy	**5.558**	1.314	0.000	**4.432**	1.541	0.004	1.069	1.509	0.479	2.329	1.215	0.056
Community organizations dummy	-1.465	0.945	0.122	0.593	1.124	0.598	-0.943	0.650	0.148	-1.258	0.782	0.109
Credit organizations dummy	**-3.383**	1.657	0.042	**-1.960**	1.123	0.082	**-2.092**	0.916	0.023	-2.177	0.896	0.016
External organizations dummy	0.890	1.364	0.514	-0.249	1.086	0.819	-0.425	0.757	0.955	0.238	0.875	0.785
% of community that participates in any org	15.642	11.750	0.184	7.253	12.040	0.547	8.377	8.629	0.332	**17.648**	9.460	0.063
Constant	-2.728	5.185	0.599	1.963	3.255	0.549	-0.064	2.386	0.979	-7.524	2.911	0.010
Diagnostics of Fit	Mean predicted probability	Actual Proportion	% Difference	Mean predicted probability	Actual Proportion	% Difference	Mean predicted probability	Actual Proportion	% Difference	Mean predicted probability	Actual Proportion	% Difference
	0.159	0.166	-0.007	0.097	0.078	0.018	0.217	0.238	-0.022	0.343	0.325	0.017

[1)] Table A5.1 for an explanation of the variables.

Table A5.4. Reduced Form of the Multinomial Logit Model, IFPRI sample (Livelihood Strategy #3 is Comparison Group)

Cluster	1 Livestock Producers			2 Coffee Producers			4 Basic Grains Farmers/ Farm Workers			5 Mixed Basic Grains/ Livestock Producers/ Farm Workers		
No of HH in each Cluster			58			28			85			116
VARIABLE [1)]	Estimate	Std. error	p-value	Estimate	Std. Error	p-value	Estimate	Std. error	p-value	Estimate	Std. error	p-value
No of HH in each Cluster	58	28	85	116								
VARIABLE[1)]	Estimate	Std. error	p-value	Estimate	Std. error	p-value	Estimate	Std. error	p-value	Estimate	Std. error	p-value
Summer rainfall	0.002	0.001	0.207	0.002	0.002	0.339	0.001	0.001	0.199	0.002	0.001	0.147
Rain deficit in 2nd season	**-0.018**	0.006	0.007	-0.033	0.026	0.204	**-0.019**	0.07	0.008	**-0.029**	0.008	0.000
Altitude	**0.003**	0.001	0.018	**0.003**	0.001	0.001	0.0002	0.001	0.817	0.0007	0.001	0.454
Soil fertility	0.0004	0.0005	0.462	0.0003	0.001	0.596	0.0007	0.0004	0.064	0.0004	0.0005	0.347
Area of owned land	**0.219**	0.052	0.000	0.041	0.094	0.662	**-0.516**	0.277	0.063	**0.206**	0.053	0.000
Titled land dummy	-1.341	1.203	0.266	**2.189**	1.061	0.040	1.263	1.251	0.313	-0.618	0.936	0.510
HH size	0.102	0.132	0.439	0.068	0.142	0.634	-0.064	0.111	0.560	-0.015	0.108	0.894
Age of HH head	0.0004	0.023	0.985	-0.007	0.024	0.766	0.030	0.021	0.154	**0.068**	0.018	0.000
Average education	0.030	0.228	0.896	**-0.395**	0.205	0.054	-0.232	0.184	0.210	0.177	0.190	0.353
Dependency ratio	**-1.581**	0.666	0.018	**-1.316**	0.568	0.021	-0.180	0.501	0.724	0.232	0.450	0.606
Female headed HH	-0.146	0.893	0.870	**-4.099**	1.522	0.007	-0.994	0.940	0.291	**-3.900**	1.032	0.000
% female adults in HH	0.570	2.073	0.784	1.478	2.640	0.576	-2.222	1.935	0.252	**4.863**	2.217	0.029
Population density	**-0.018**	0.007	0.006	**-0.025**	0.010	0.009	0.002	0.004	0.540	**-0.015**	0.004	0.001
Constant	-0.063	2.664	0.981	1.861	2.733	0.496	-1.596	2.102	0.448	-7.750	2.784	0.006
Diagnostics of Fit	Mean predicted probability	Actual Proportion	% Difference	Mean predicted probability	Actual Proportion	% Difference	Mean predicted probability	Actual Proportion	% Difference	Mean predicted probability	Actual Proportion	% Difference
	0.179	0.165	-0.085	0.085	0.078	-0.084	0.214	0.238	0.100	0.323	0.325	0.006

[1)] Table A5.1 for an explanation of the variables.

Table A5.5. Determinants of Livelihood Strategies (Full Multinomial Logit Model), Wisconsin sample (Livelihood Strategy #2 is Comparison Group)

Cluster	1 Diversified producers			3 Livestock producers			4 Coffee producers			5 Own business			6 Remittances		
No of HH in each Cluster			222			98			242			58			91
VARIABLE [1)]	Estimate	Std. error	p-value	Estimate	Std. error	p-value	Estimate	Std. error	p-value	Estimate	Std. error	p-value	Estimate	Std. error	p-value
Annual rainfall	0.001	0.001	0.200	0.002	0.001	0.117	-0.0003	0.001	0.744	0.0003	0.001	0.838	0.002	0.001	0.147
Summer rainfall	-0.00003	0.001	0.981	-0.0001	0.001	0.924	0.001	0.001	0.303	0.0002	0.002	0.907	0.0003	0.001	0.794
Altitude	0.0002	0.001	0.757	0.0003	0.001	0.679	0.0008	0.0005	0.119	-0.0006	0.0008	0.440	-0.0001	0.0006	0.886
Area of owned land	**0.421**	0.080	0.000	**0.420**	0.080	0.000	**0.389**	0.080	0.000	**0.419**	0.080	0.000	**0.386**	0. 081	0.000
% HH with titled land	**1.174**	0.503	0.020	**1.887**	0.543	0.001	0.486	0.505	0.335	0.839	0.618	0.174	**0.975**	0.559	0.081
Value of other non-land physical assets	0.001	0.203	0.997	-0.0001	0.204	1.000	0.0009	0.203	0.997	0.001	0.203	0.997	0.001	0.203	0.997
Value of livestock	-0.00003	0.00002	0.126	-0.00003	0.00002	0.128	**-0.00006**	0.00002	0.022	-0.00003	0.00002	0.127	-0.00003	0.00002	0.189
HH size	0.034	0.055	0.541	-0.063	0.064	0.322	-0.065	0.055	0.232	0.053	0.0745	0.478	0.018	0.064	0.776
Age of HH head	0.015	0.014	0.280	0.019	0.015	0.203	**0.029**	0.013	0.026	-0.0002	0.019	0.993	**0.038**	0.015	0.014
Migration time	-0.026	0.0273	0.332	-0.013	0.032	0.682	0.014	0.024	0.567	0.012	0.030	0.693	**-0.132**	0.054	0.014
Average education	-0.038	0.103	0.715	-0.088	0.115	0.444	0.137	0.100	0.169	0.169	0.128	0.186	**0.258**	0.113	0.022
Dependency ratio	-0.087	0.350	0.803	-0.015	0.411	0.972	0.099	0.335	0.768	0-.047	0.533	0.930	0.188	0.375	0.615
Female HH head dummy	0.425	0.518	0.412	-0.082	0.644	0.898	0.049	0.530	0.926	0.326	0.724	0.652	1.431	0.543	0.008
% female adults in HH	-0.011	0.015	0.483	0.011	0.017	0.530	-0.001	0.015	0.930	-0.010	0.021	0.644	-0.019	0.017	0.275
Population density	**0.007**	0.003	0.022	**0.011**	0.004	0.002	**0.011**	0.003	0.001	**0.012**	0.005	0.013	0.005	0.004	0.167
Road density	-0.102	0.098	0.299	**-0.288**	0.136	0.034	**-0.578**	0.114	0.000	**-0.369**	0.177	0.037	-0.118	0.118	0.313
Distance to county capital	-0.002	.008	0.841	-0.002	0.010	0.808	**0.019**	0.008	0.020	0.003	0.013	0.846	0.006	0.010	0.519
Distance to daily market	-0.003	0.005	0.556	-0.001	0.005	0.807	**-0.013**	0.005	0.004	-0.010	0.006	0.134	-0.007	0.006	0.229
Credit availability dummy	-0.492	0.355	0.165	0.305	0.406	0.452	**0.810**	0.339	0.017	-0.115	0.495	0.816	-0.133	0.416	0.749
Agricultural organizations	-0.177	0.900	0.844	-0.146	0.932	0.876	0.899	0.861	0.296	0.457	0.968	0.637	0.403	0.953	0.673
Community organizations	-0.340	.0350	0.333	-0575	0.412	0.162	-0.490	.334	0.149	-0.232	0.485	0.633	0.689	0.424	0.105
Credit organizations	1.357	0.947	0.152	1.040	1.162	0.371	0.118	1.021	0.908	**2.563**	1.068	0.016	1.216	1.077	0.259
External organizations	-0.040	0.793	0.960	0.712	0.812	0.380	0.266	0.692	0.701	-0.398	1.222	0.745	**1.533**	0.762	0.044
Constant	-3.675	1.945	0.059	-5.843	2.281	0.010	-3.812	1.865	0.041	-3.833	2.604	0.141	-7.076	2.286	0.002
Diagnostics of Fit	Mean predicted prob.	Actual prop.	% Diff.	Mean predicted prob.	Actual prop.	% Diff.	Mean predicted prob.	Actual prop.	% Diff.	Mean predicted prob.	Actual prop.	% Diff.	Mean predicted prob.	Actual prop.	% Diff.
	0.252	0.269	0.062	0.123	0.119	-0.037	0.293	0.293	0.000	0.066	0.070	0.060	0.109	0.110	0.009

[1)] Table A5.2 for an explanation of the variables.

Table A5.6. Reduced Form of the Multinomial Logit Model, Wisconsin sample (Livelihood Strategy #2 is Comparison Group)

Cluster	1 Diversified Producers			3 Livestock Producers			4 Coffee Producers			5 Own Business			6 Remittances		
No of HH in each Cluster	222			98			242			58			91		
VARIABLE [1)]	Estimate	Std. error	p-value	Estimate	Std. error	p-value	Estimate	Std. error	p-value	Estimate	Std. error	p-value	Estimate	Std. error	p-value
Annual rainfall	0.001	0.001	0.091	0.001	0.001	0.340	0.0008	0.0007	0.253	0.0005	0.0009	0.604	0.002	0.001	0.026
Summer rainfall	-0.0001	0.0010	0.879	0.0002	0.001	0.892	-0.001	0.001	0.355	-0.001	0.001	0.500	-0.0003	0.001	0.801
Altitude	0.0002	0.0004	0.688	-0.0002	0.0005	0.618	0.001	0.0004	0.004	-0.0003	0.0006	0.604	0.0002	0.0005	0.722
Area of owned land	0.379	0.072	0.000	0.376	0.072	0.000	0.354	0.072	0.000	0.376	0.072	0.000	0.343	0.073	0.000
% HH with titled land	1.031	0.475	0.030	1.80	0.506	0.000	0.884	0.463	0.056	0.681	0.578	0.239	0.940	0.524	0.073
Population density	0.004	0.002	0.048	0.004	0.002	0.057	0.001	0.002	0.567	0.004	0.003	0.066	0.002	0.002	0.273
HH size	0.017	0.052	0.744	-0.068	0.061	0.259	-0.080	0.051	0.113	0.041	0.070	0.556	0.002	0.060	0.977
Age of HH head	0.021	0.012	0.096	0.020	0.014	0.148	0.027	0.012	0.025	0.0002	0.017	0.991	0.043	0.014	0.002
Migration time	-0.019	0.028	0.483	-0.011	0.034	0.754	0.022	0.022	0.320	0.029	0.027	0.280	-0.120	0.053	0.024
Average education	-0.046	0.095	0.628	-0.083	0.106	0.434	0.098	0.0901	0.279	0.228	0.114	0.045	0.243	0.105	0.021
Dependency ratio	-0.062	0.330	0.850	-0.021	0.386	0.957	0.043	0.306	0.888	0.097	0.482	0.841	0.192	0.361	0.595
Female headed HH	0.318	0.490	0.517	-0.206	.612	0.737	-0.166	0.492	0.735	-0.099	0.691	0.886	1.117	0.510	0.029
% female adults in HH	-0.010	0.015	0.498	0.009	0.0167	0.599	-0.004	0.014	0.782	0.003	0.019	0.883	-0.021	.0168	0.221
Constant	-4.075	1.576	0.010	-4.110	1.827	0.024	-3.199	1.490	0.032	-4.192	2.156	0.052	-7.329	1.863	0.000
Diagnostics of Fit	Mean predicted prob.	Actual prop.	% Diff.	Mean predicted prob.	Actual prop.	% Diff.	Mean predicted prob.	Actual prop.	% Diff.	Mean predicted prob.	Actual prop.	% Diff.	Mean predicted prob.	Actual prop.	% Diff.
	0.254	0.269	0.056	0.121	0.119	-0.017	0.295	0.293	-0.007	0.071	0.070	-0.014	0.108	0.110	0.018

[1)] Table A5.2 for an explanation of the variables.

ANNEX 6. INCOME REGRESSION RESULTS

In order to find out to what extent livelihood strategies and asset endowments impact on household income, two OLS (Ordinary Least Squares) income regressions were run, one each for the IFPRI and the Wisconsin household samples. The dependent variable in both income regressions is the natural logarithm of total annual household income, measured in Lps. The explanatory variables include the following:

- livelihood strategies (except one to avoid perfect collinearity);
- natural assets: summer rainfall, second season rainfall deficit (IFPRI households only), annual rainfall (Wisconsin households only), soil fertility (IFPRI households only), elevation, amount of owned land, share of land holdings that has title;
- location assets: population density, market access;
- physical assets: value of livestock holdings, value of machinery, equipment and transportation; human assets: household size, dependency ratio, age of household head, sex of the household head, median education, migration, % of female adults, training received (IFPRI households only), extension received (IFPRI households only);
- financial assets: access to credit;
- social assets: participation in community organizations, credit organizations, external organizations, participation in any other organization;
- interaction variables: (owned land *x* credit), (farm size *x* education), (farm size *x* market access), (education *x* market access), and, only for the IFPRI households, (owned land *x* soil fertility).

The decision whether or not to use the log transformation of the independent variables depended on their respective distributions across the sample. The results, shown in Tables A6.1 and A6.2, are discussed in Section 5.5.

Table A6.1. Determinants of Household Income, IFPRI Households[1)]

Dependent variable: ln (Total Annual HH income), N=315	
Explanatory variables [3)]	**Estimated coefficient**[2)]
Livelihood strategy 2[4)]	0.292
Livelihood strategy 3[4)]	-0.091
Livelihood strategy 4[4)]	0.829*
Livelihood strategy 5[4)]	0.160
Altitude	0.000
ln (Summer rainfall)	-0.388
Second season rainfall deficit	0.000
ln (Soil fertility)	0.000
Amount of land owned	-0.011
Titled land	0.307
ln (Population density)	-0.016
ln (Market access)	-0.613*
Value of livestock holdings	0.000
Value of non-land physical assets	0.00001**
Household size	0.237**
Dependency ratio	-0.297*
ln (Age of household head)	-0.776*
Female household head	0.443
Average education	0.033
Migration	1.188*
% female adults	-0.008
Training dummy	0.365*
Extension dummy	-0.161
Credit dummy	-0.018
Agricultural organizations dummy	-0.184
Community organizations dummy	-0.249
Savings and credit organizations dummy	-0.344
External organizations dummy	-0.254
Any other organization dummy	2.323
Owned land * credit dummy	-0.003
ln (Farm size * market access)	0.352*
Farm size * education	-0.001
Education * market access	0.010*
Owned land * soil fertility	0.000
Constant	12.576
R2	0.547

[1)] Only households with positive total income.
[2)] *,** indicate statistical significance at the 5%, and 1% level, respectively.
[3)] Table A5.1 for an explanation of the variables.
[4)] Predicted values from the multinomial logit regression were used.

Table A6.2. Determinants of Household Income, Wisconsin Households[1)]

Dependent variable: ln (Total Annual HH income), N=527	
Explanatory variables [3)]	**Estimated coefficient**[2)]
Livelihood strategy 1[4)]	0.246
Livelihood strategy 3[4)]	0.623**
Livelihood strategy 4[4)]	0.586**
Livelihood strategy 5[4)]	0.574*
ln (Summer rainfall)	-0.681
Altitude	-0.0003
Amount of land owned	-0.001
Titled land	0.323*
Value of livestock holdings	1.62e-06
Value of non-land physical assets	-2.87e-06*
Household size	0.089**
ln (Age of household head)	-0.530*
Migration	-0.002
Average education	0.020
Dependency ratio	-0.148
Female household head dummy	-0.090
% female adults in the HH	-0.006
ln (Population density)	-0.040
Road density	0.100**
Distance to county capital	-0.003
Distance to daily market	-0.004
Credit dummy	-0.032
Agricultural organizations dummy	0.215
Community organizations dummy	-0.015
Savings and credit organizations dummy	0.543
External organizations dummy	0.224
Owned land * credit dummy	0.009**
ln (Farm size * distance to daily market)	-0.015
Farm size * education	0.032**
Education * distance to daily market	0.001
Constant	15.110
R2	0.294

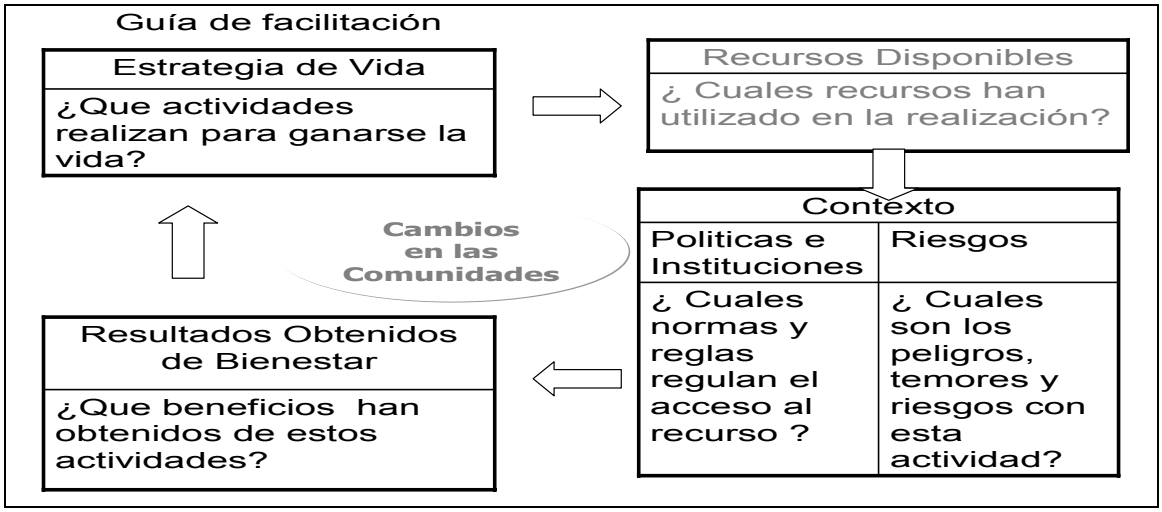
[1)] Only households with positive total income.
[2)] *,** indicate statistical significance at the 5%, and 1% level, respectively.
[3)] Table A5.2 for an explanation of the variables.
[4)] Predicted values from the multinomial logit regression were used.

ANNEX 7. PROJECT STOCKTAKING EXERCISES

In an attempt to link the results of our study to actual project experience in the field, a number of project stocktakings of World Bank-sponsored rural development projects in Honduras were undertaken. The principal objectives of these exercises were to: a) identify key assets for growth and poverty reduction, b) better understand the complementarity of key assets, c) examine links between assets and livelihood strategies, and d) identify priority investments and actions to enhance households' asset portfolios.

The project stocktaking exercises are an important complement to the quantitative analyses. These qualitative analyses help "ground-truth" results from the quantitative analyses and also provide insights into the institutional and risk context, and intangible assets such as certain elements of social capital that are not easily measured using standard quantitative methods.

After explaining the conceptual framework (assets-context-behavior-outcomes, see also Figure 4 in Chapter 3 and the figure below), discussions were organized around a set of standard and simple questions about livelihood strategies, assets, risks, outcomes, opportunities before and after the projects, and limitations of the different projects. Visualization techniques, charts/boards, etc. were used to enhance the possibility of eliciting views from the participants at the workshops. Approximately the number of participants at the workshops was 30-35 including women.



The following main questions were presented to workshop participants:

1) What are your current (with the project) livelihood strategies?

2) What are the most important livelihood strategies in terms of time and income?

3) Which assets are used for these livelihood strategies?

4) What are the institutional and risks that influence assets and livelihood strategies?

5) What are the well-being outcomes from current livelihood strategies?

6) What were the livelihood strategies, assets, institutional and risk context and well-being before the project?

7) What are the "missing assets" from the project that could improve livelihoods and outcomes?

8) What are the priorities to improve livelihoods and outcome?

LIST OF DISCUSSION PAPERS

No. 01 "Market Opportunities for African Agriculture: An Examination of Demand-Side Constraints on Agricultural Growth" by Xinshen Diao, Paul Dorosh, and Shaikh Mahfuzur Rahman with Siet Meijer, Mark Rosegrant, Yukitsugu Yanoma, and Weibo Li (September 2003)

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No. 17 "Achieving Regional Growth Dynamics in African Agriculture" by Awudu Abdulai, Xinshen Diao and Michael Johnson (January 2005)

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