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LAND TENURE, LAND TITLING, AND THE ADOPTION OF IMPROVED SOIL MANAGEMENT PRACTICES IN HONDURAS

By

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ABSTRACT

LAND TENURE, LAND TITLING, AND THE ADOPTION OF IMPROVED SOIL MANAGEMENT PRACTICES IN HONDURAS

by

Patricia Bonnard

This research evaluated the link between land tenure, land titling and the adoption of improved soil management practices using Honduras as a case study. Common development wisdom contends that land privatization and titling programs, are prerequisites to investments land. Such improvements are considered to be fundamental to policies directed at improving natural resource management and land productivity.

Titling programs are expensive and extend over a long period while reforms are developed, instituted, challenged and modified, and disputes are finally legally settled. Land reform, by definition, entails a reassignment of rights which often implies significant changes in social welfare. In this light, and given the severe resource constraints of many less-developed countries, the study attempted to determine whether this link exists and the utility of such reforms and programs.

The analysis was based on both informal interviews and formal primary data collection. Observations draw from basic descriptive analysis as well as econometric estimation (i.e., probit analysis). The study was able to contrast usufruct and full fee simple land rights, as well as national and local administration of tenure. The approach was unique in that it incorporated the farmers' perceptions of ownership,

analyzing what constitutes ownership for Honduran farmers, and how this notion compares to formal, legal rights.

The results of the study do not support the contention that individual private land rights and titling promote investments in land. Furthermore, in Honduras, receipt of credit appears to be disassociated from land ownership in many cases. The titling program benefits extend more to larger, wealthier and better informed farmers. Additional costs to the smallest farmers are expected.

Factors positively associated with adoption of improved practices include perceived ownership, the *ejido* tenure system, availability of labor, production of cash crops, the presence of extension agents or land management development projects, and the slope of the land. Farm size, soil quality, planting of coffee, and off-farm employment were inversely related to adoption.

The author acknowledges the diversity and complexity of the issues presented within the study, and cautions others against using standardized and inflexible survey methods and the over-simplifying these relationships.

DEDICATION

This dissertation is dedicated to my mother, Dolores, who got me started on this with her belief that I could do anything with enough perseverance; and to my father, Vicente, who got me through this with the wisdom of his farmer story. Together, they make a phenomenal team. Obrigadão!

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Knowing little of me, Mattias Lundberg and Jane Legg opened their home to me on my first trip back to East Lansing. Their enduring friendship is a warm reminder of their uncommon hospitality. Dr. Douglas Kreiger, Gayle Miller, Jazbo, and Dutchess later took me in. Despite the freezing cold, and because of the hot water bottles, I am eternally grateful. I owe general thanks to all my East Lansing friends for pumping me with coffee, breaking up the grind, and taking down all those messages on the computer room white board.

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LIST OF ABBREVIATIONS:

ACDI	Agencia Canadiense para el Desarrollo Industrial
ACORDE	Asociacion Corrdinadora para el Desarollo
AID	United States Agency for International Development
AMI	Areas de Manejo Integrado
APAP	Agricultural Policy Analysis Project, USAID/Abt
BANADESA	Banco Naciónal de Desarrollo de Agropecurio
BANTRAL	Banco Central de Honduras
CNA	Censo Nacional de Agricultura
COHDEFOR	Corporación Hondureña de Desarrollo Forestal
CRSP	Collaborative Research Support Program
CURLA	Centro Universitario Regional del Litoral Atlantico
DEC	Dirección Ejecutiva del Catastro
FAO	Food and Agriculture Organization
FHIA	Fundacion Hondureña de Investigación Agricola
FSH	Federación Sindical Hondureña
IFPRI	International Food Policy Research Institute
IICA	Instituto Interamericano de Cooperacion para la Agricultura
INA	Instituto Nacional Agrario
INCAFE	Instituto Hondureño del Cafe
LTC	Land Tenure Center, University of Wisconsin, Madison
LUPE	Proyecto de Mejoramiento del Uso y Productividad de la Tierra
MSU	Michigan State University
MRN	Ministerio de Recursos Naturales/Ministry of Natural Resources
NGO	Non-Governmental Organization
NRM	Natural Resource Management Project
OAS	Organization of American States
ODA	Overseas Development Adminstration
OEA	Organization of America States
PCV	Peace Corps Volunteer
PTT	Proyecto de Titulación de Tierras
SECPLAN	Secretaría de Corrdinación, Planificación y Presupuesto
SRN	Secretaría de Recursos Naturales
UNAH	Universidad Nacional Autónoma de Honduras
UNC	Unión Nacional de Campesinos
USAID	United States Agency for International Development
WB	World Bank
Zamorano	Escuela Agrícola Panamericana, at El Zamorano

LIST OF TERMS:

Term	Definition
Cajas de credito rurales	A credit program designed for reform beneficiaries, initiated with government seed money, and managed by the campesinos themselves. Still in the planning stage.
Campesino	Small farmer or peasant.
Coyote	A trader of agricultural commodities generally felt to be exploiting peasants. Often provides informal credit.
Dominio útil	Usufruct title. The bearer can sell all improvements to the land but not the land itself. Often of an indefinite duration.
Dominio pleno	A fee-simple title. Confers complete unattenuated rights.
Ejido	Land surrounding a municipality that the central government granted to municipalities with the aim of issuing usufruct rights to landless peasants within the community. Unlike the Ejido of Mexico, which stems from Aztec law, ownership and administration of Honduran Ejidos are not collective.
Fee simple title	Confers complete unattenuated rights. Bearer is given unconditional use and transfer.
Hacienda	Farm. Usually refers to larger, commercial farm.
Lempira	Honduran currency.
Latifundio	Large farm owned by the latifundista.
Latifundista	Large landowner and rural patron.
Manzana	Local unit of measure equal to 1.7 acres or .69 hectares.
Minifundio	Small farm owned by the minifundista.
Minfundista	Small peasant farmer. The definition in terms of farm size changes over time and among authors.
Postrera	Second agricultural season, December to February.
Primera	Primary agricultural season, May to October.
Proprietary	Individual right which is clearly specified, exclusive, transferable and enforceable.
Pulpero	Owner of a small store. This can vary in size from one who sells tarjitas (chips) out of their house to one who purchases grains and sells agricultural inputs. Often provides informal credit.
Unattenuated	Rights which are clearly specified, exclusive, transferable and enforceable.

CHAPTER ONE

INTRODUCTION

1.1 Problem Statement

The aim of this dissertation research is to evaluate the link between land tenure, land titling and the adoption of soil management practices using Honduras as a case study. Common development wisdom asserts that privatization of land as well as complementary land titling programs are prerequisites to investments in land. Such investments are considered to be fundamental to policy efforts directed at improving natural resource management and land productivity.

Titling programs are generally expensive and extend over long periods of time while reforms are developed, instituted, challenged and modified, and disputes are finally legally settled. More importantly, land reform by definition entails a reassignment of rights which often implies significant changes in social welfare. In this light, and given the severe resource constraints of many less-developed countries, the study will attempt to determine whether this link exists and, if so, how strong is it.

Honduras was chosen as the case study for a number of reasons. It is representative of many poor, agriculturally-based countries struggling with a number of common environmental and socio-economic concerns and tradeoffs. In addition, the country possesses considerable diversity with respect to land tenure despite the fact that for over two decades it has been engaged in a major effort to privatize and

title land.

Honduras is a poor agricultural country. Approximately 60 percent of the population resides in rural areas (Stonich, 1991). Agriculture represents 30 percent of Gross National Product (GNP) and two thirds of total exports (Norsworthy and Barry, 1993; and Ponce, 1986). From 1980 to 1990, Honduras experienced a reduction in per capita agricultural production. The meager average rate of growth in agricultural output of 1.8 percent was superseded by a rapid population growth of 3 percent (World Bank, 1992). With a per capita GNP of $900, Honduras is one of the poorest countries in Latin America (World Bank, 1992). Eighty-six percent of the Honduran population is low income or poor (Abt, 1990). The National Nutritional Survey of 1987 estimated that 38 percent of Hondurans suffer from "wasting," and 44.7 percent from "stunting."

Environmental degradation is a pressing concern for Honduras. Over 60 percent of the population resides in rural areas (Stonich, 1991), and 80 percent of all farms are located on steep fragile hillsides. A report from the Collaborative Research Support Council (CRSP) states that 75 percent of the basic grains produced in Honduras (i.e., maize, beans, and sorghum) are grown by small-scale marginal hillside farmers (CRSP, 1991). Because these small farmers are producing predominantly basic subsistence crops, they can not easily substitute less-erosive perennial crops for these crops. SECPLAN (1993) reports that 29 percent of the annual crop producers have farms which are less than 2.5 ha, 44 percent are less than 5 ha, and 56 percent are less than 10 ha. Perennial growers are more common among the larger farms: 57 percent of those greater than 50 ha, and less than 15 percent of smaller farms. Stonich and others suggest that large expanding livestock

and export producers have been pushing small farmers further up the hillsides or into forested areas (Stonich, 1989). This continued extension of agricultural production onto fragile erodible hillsides intensifies the need to address environmental concerns.

Honduras provides an excellent environment for looking into the more general important issues related to the linkages between land tenure and soil management. Honduras is the only Central American country with a significant amount of national and municipal (i.e. *ejidal*) land remaining: up to 33 percent of total land area as of the late 1970s (Brockett, 1987). Stringer (1989) reported that in 1982 over 75 percent of all Honduran farmers were cultivating national lands without titles or any other type of document. As much as 50 percent of the area cultivated in some departments is in private use on publicly held land (Coles, 1989). Historically, the federal government allocated national land and municipalities allocated *ejidal* lands to local farmers, granting exclusive usufruct rights. More recently, reforms have been altering these land tenure arrangements.

Considerable time and money has been invested in a series of land tenure reforms. The government instituted a titling program in the mid 1970s, which specifically attempted to transform traditional usufruct rights into individual proprietary rights; and more recently a "modernization law," which has been distributing new titles to mostly national lands. While both programs engendered enhancement of land productivity objectives, the modernization law has also incorporated environmental concerns including the creation of a Secretary of the Environment.

Research on the influence of tenure on the adoption of improved soil

management practices is particularly relevant and timely for a country like Honduras which is establishing new and drastic policy reforms predicated on the theoretical benefits of proprietary right, yet, with limited practical knowledge. The preliminary results of the 1993 agriculture census suggests that the distribution of land is still relatively unchanged since 1974 despite the reforms and titling program (SECPLAN, 1993). Approximately 60 percent of all farms are less than 5 ha, 25 percent are between 5 and 20 ha, 12 percent are larger than 20 ha. Even with the efforts to formally institutionalize tenure, many Honduran farmers claim to own the land they cultivate even though they have no documentation, which implies that they may have a different perception of security. Field studies undertaken by the researcher indicate that many farmers without titles have adopted improved soil management practices casting doubt on claims that titles are a prerequisite to investments in land improvements. Coles (1989) concluded from his research in western Honduras that farmers weigh historical precedence when forming perceptions of their land rights, possessing a greater sense of security on *ejidal* relative to national land.

1.2 Objectives of the Study

The study will attempt to determine whether investments in soil management practices are related to land tenure and land titling. For purposes of this study, tenure is defined both by possession of official titles or other documents and by the type of land: national, *ejidal*, and private. Recent modifications in the Honduran land tenure system will be compared to the preexisting or customary system with the aim of identifying contributions of the new reform and the titling program to improved economic performance of the agricultural sector and natural resource

management. Like much of Latin America, the Honduran agriculture sector is said to be dualistic, or perhaps more accurately, pluralistic in nature. As a consequence, many of the attributes assumed to influence a farmer's ability to secure a title, or the farmer's decision to adopt soil management practices, are expected to be associated with farm size. In addition, land reforms by definition involve a reassignment of rights and are accompanied by changes in social welfare. Therefore, results of the study will be presented in such a way as to draw attention to the differences among distinct groups of farmers defined according to farm size. For these reasons, the author decided to stratify most of the analysis according to farm size.

Specific objectives and hypotheses include the following:

1. Describe, for the study area, patterns of adoption of improved soil management practices such as managed maize stubble, fertilizer bean, contour planting, terraces, drainage ditches, live barriers, terraces and stone walls;

2. Test the hypothesis that proprietary tenure is a necessary condition for investment in improved soil management practices in Honduras;

3. Determine the importance of land titles and/or other forms of documentation in the decision to adopt improved soil management practices relative to other biophysical, socioeconomic, and institutional factors;

4. Define what is meant by land "ownership" in the Honduran context;

5. Evaluate the contribution of the 1992 Agriculture Modernization Law and Titling Program with respect to increasing land use security and promoting land investments in the form of improved soil management practices.

The study area was limited to the Departments of El Paraíso, Francisco

Morazan, and Olancho which were felt to be representative of Honduras as a whole. Because development projects and extension agents have been promoting the same group of improved soil management practices and rates of adoption are quite low, it was decided to look at a set of practices rather than focusing on one or two.

This analysis utilized several different types of data, some of which were available from secondary sources. USAID's Land Productivity Enhancement Project (LUPE) provided information on soil management practices as well as criteria for grouping them. The Honduran National Agriculture Census contributed the sampling frame information and maps. Household-level information was derived largely from primary data collection activities undertaken by the researcher in collaboration with a Michigan State University/CRSP researcher and a small enumerator team.

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CHAPTER TWO

BACKGROUND

2.1 Brief Review of the Agricultural Sector

2.1.1 Characterization of the Agricultural Sector

Honduras is 112,100 km^2 (11.2 million hectares) and mountainous. Eighty percent of its land area ranges from 300 to 3000 meters in altitude, and 75 percent of the country has a slope of at least 25 percent (Johnston, et al., 1990). For the most part, the climate is temperate in the mountains and tropical with relatively fertile soils in the lowlands and valleys (Ponce, 1986). Approximately 38 percent of the total land area is suitable for pasture or crop production. There are two agricultural seasons. The *primera*, the primary season, extends from May to September or October, and the *postrera* lasts from December to February. The exact months for each season vary somewhat across different regions of the country. Rains in the *primera* are more intense and plentiful than in the *postrera* (For a map of Honduras see Appendix D.)

Like the rest of Central America, the agricultural sector in Honduras is characterized by dualism with the best lands concentrated in the hands of a few families. There is a majority of resource poor, intensively-managed, subsistence farms on the one hand, and a minority of large, extensively-managed, significantly wealthier farms on the other. These small farms, or *minifundios*, primarily cultivate maize and beans, whereas the larger farms, or *latifundios*, produce commercial

crops and cattle. These two terms are used to refer to either two contrasting socio-economic strata or farm sizes. Because the latter has continually changed over time (see section on land tenure for further details), this study will use these terms to imply a strata and not specific farm sizes.

Table 2.1 illustrates the distribution of farms by farm size. Sixty-four percent of all farms are less than 5 ha, while .2 percent are larger than 500. These two categories of farms represent, respectively, 9 and 22 percent of the total agricultural land in Honduras. Ninety-six percent of all farms are less than 50 ha and collectively account for only 44 percent of the land area. The preliminary results of the 1993 Agricultural Census report different and somewhat conflicting figures, but a similar distribution is observed (see Table 2.2). Again, a much larger percentage of farmers are small: about 64 percent are 3.5 ha or less. Land is concentrated in the

Table 2.1 Distribution of Farms by Farm Size, 1974.

Farm Category	No. of Farms	Percent of Total	Area (in 100,000 ha)	Percent of Total	Ave. Farm Size (ha)
< =5 ha	124,800	64.0	234	9	1.88
>5 ha and < =50 ha	62,650	32.0	9,306	35	14.85
>50 ha and < =500 ha	7,460	3.8	881	34	118.09
>500 ha	445	.2	579	22	1,301.12
Total	195,355	100.0	2,600	100	13.31

Source: Adapted from Ponce, Mario. (1986). "Honduras: Agricultural Policy and Perspectives." In Rosenberg, Mark B. and Philip L. Shepherd. (1986). Honduras Confronts Its Future: Contending Perspectives on Critical Issues. Boulder, Lynne Rienner Publishers, Inc: p. 132.

Table 2.2 Percentage Distribution of Farms and Area Farmed by Farm Size, 1971 and 1993

	Percent of Farms		Percent of Area	
Farm Category	1974	1993	1974	1993
< =3.5 ha	63.9	62.1	9.1	7.9
>3.5 and < =14 ha	24.3	24.1	17.9	15.1
>14 ha and < =70 ha	10.0	11.2	29.0	30.9
>70 ha	1.8	2.6	44.0	46.1

Source: Secretaria de Planificación y Presupuesto. (1993). "IV Censo Naciónal Agropecuario: Resultados Preliminares." Tegucigalpa, SECPLAN. Figures originally reported in local units, manzanas (1 manzana = .7 hectares).

large-farm category as well. Farms of 70 ha or greater represent 1.8 percent of all farms and 44 percent of total agricultural land. This skewed distribution changes little over the period of 1974 to 1993. The larger farms have slightly expanded in number and area, while the area cultivated by smaller farms has somewhat contracted.

Perhaps the most widely discussed issue concerning agriculture in Latin American, and Honduras specifically, is the expansion of large-scale commercial agriculture, particularly cattle ranching, at the expense of small subsistence farmers. This displaced group of small farmers is often faulted for much of the deforestation in the region (Faber, 1993; and Lindarte and Benito, 1993). They convert forests into migratory, or swidden, agriculture land. In addition, they provide the initial force behind forest to pasture conversion by opening the forests, employing inefficient and erosive annual crop production practices that rapidly deplete the soil, and then selling their use rights to their exhausted plots to cattle ranchers. This whole

Table 2.3 Land Use Distribution, 1977 to 1989

Land Use	Area (in 1000 ha)	Percent of Total Area	Percent Change From 1977-89
Crop Land	1,793	14	2.3
Pasture	2,540	21	7.2
Forest	3,420	28	(18.8)
Wilderness	1,126	9	10.0
Other	3,436	28	20.4

NOTE: Negative values are presented in parentheses.
Source: Adapted from World Resource Institute. (1992). World Resources: 1992-93. New York, Oxford University Press. Parentheses indicate a negative rate of growth.

process takes as little as three to four years. In fact, some development project workers feel that this time period could be as short as two years (interviews with Gary Thompson and Rolando Mendosa, 1994).

Table 2.3 reports some recent figures on land use composition in Honduras as well as the rate of change from 1977 to 1989. Pasture has increased more than any other single land use (7.2 percent). Crop land area, which was smaller than pasture in absolute terms in 1977, has been augmented by just 2.3 percent. According to Ruben (1991:20-29), the number of *minifundistas* has increased since 1952, while average farm size decreased 17 percent from 1952 to 1965, and 35 percent from 1965 to 1988. Forest land is the only category that has decreased, and the reduction has been a substantial 18 percent.

It is important to note that a large share of the pasture land listed in Table 2.3 is situated on lowlands and in valleys: the most fertile areas. Much of the 1,793 ha of crop land is located on steep hillsides, particularly that which is cultivated in basic grains.

2.1.2 Characterization of Honduran Farms

Most farmers have three or four small plots frequently less than 1 ha each. These plots are widely scattered around the farmer's homestead, and can take up to two hours to reach by foot. A farmer might have both flat and sloping parcels of land, but given their small size, specific parcels rarely possess mixed slopes (interviews with LUPE, Zamorano, Peace Corps, and World Neighbor staff, 1993 and 1994). Larger farmers also have multiple plots, though the size of each plot is considerably larger.

Small farmers grow mostly annual crops. Although grown in both seasons, maize is the principle crop for the *primera*. Many farmers intercrop maize and beans. Still, beans are more commonly planted, often monocropped, in the *postrera*. Small farmers generally do not produce a sufficient amount of food to last an entire year. Medium-sized farms, between 10 and 50 ha, cultivate a mix of food and commercial crops. They grow more perennials as well. They manage pastures and, to a lesser extent, forests. Farms greater than 50 ha have mostly pasture, forests and a limited amount of annual crops (Ministerio de Recursos Naturales, 1989).

Small farmers employ few inputs. Many will apply small, sometimes ineffective, amounts of chemical fertilizer or pesticides. Some who live in more level areas and nearer to cattle owners rent oxen to till the soil. The remaining agricultural tasks are done by hand. Larger farmers can employ daily wage labor, apply ample quantities of agriculture chemicals, use animal traction, and, in some cases, irrigate. The spectrum of farmers is broad. Nevertheless, resource availability tends to be dualistic: there are few who have and plenty who have not.

The government is currently developing a farmer-managed credit program,

cajas de credito rurales, to administer loans to reform beneficiaries using government seed money. The specifics of the program are not yet finalized. Currently, formal credit is made almost exclusively available to large commercial farmers. The national agriculture bank, BANADESA, does provide some credit to small farmers. Nonetheless, only 2 percent of the agricultural funds of both BANADESA and the central bank, BANTRAL, went to basic grains (Stonich, 1991). An even smaller portion of that amount would have been made available to small farmers. The Ministry of Natural Resources (MRN) reports that 44 percent of farms over 50 ha receive credit compared with only 6 percent for farms of less than 2.5 ha (MRN, 1989). For small farmers, credit is essentially only available at extremely high rates of interests through the informal sector. They acquire credit from local traders (including the *coyotes*), store owners (mostly *pulperos*), neighbors, or their employers if they work as farm laborers. Interviews with key informants and farmers suggest that lenders of informal credit are not interested in small farmers' steep and fragile land as collateral. They prefer use the farmers' indebtedness as a means of controlling their labor force or manipulating input as well as output prices.

Most Honduran farmers sell their produce to private traders at the farm gate. Small farmers sell their produce to local traders, store owners and their neighbors. It was predominantly medium-sized producers who took greater advantage of the earlier purchasing activities of the state-owned grain marketing board, IHMA. Some larger farmers sell their own as well as other farmers' produce at local markets.

Depending on the region and available resources, a small to medium-sized farmer cultivates a small amount of coffee, sugar cane or horticultural products as cash crops. Women may store wealth in pigs and other small animals. Still, many

small farmers rely on the sale of maize and beans for their cash needs. Ruben (1991:25) notes that basic grains represents approximately 85 percent of gross income for farms of less than 5 ha. Off-farm employment is common, although, the returns are limited. Wages are low and job security is minimal. Some household members find seasonal work in banana harvesting or coffee picking. These wage opportunities often require long-distance migration. Both men and women migrate, although, men more often do.

Despite these differences in wealth and available resources, farms of all sizes achieve similar yields. Bean yields range from .46 to .59 tons per hectare. Maize yields are slightly higher for larger farms. They range from 1.08 tons per hectare for farms less than 2.5 ha to 1.84 tons per hectare for farms greater than 50 ha (MRN, 1989). Farms under 50 ha account for 83 percent of both the area and production of maize (Ponce, 1986). The figure is nearly the same for beans. The intensity of livestock management varies inversely with farm size. Ranches less than 20 ha represent 15 percent of the area in pasture and 22 percent of the cattle. Conversely, ranches greater than 400 ha account for 19 percent of the area and 12 percent of the cattle.

2.1.3 Policy Environment

Prior to World War II, Honduras was an isolated country connected to the rest of the world largely through the exportation of bananas. As Stonich points out, change came to Honduras initially through the Alliance for Progress in the 1960s (Stonich, 1991). The main objective behind the Alliance was to stimulate economic growth and democratize politics in order to promote stability within the region

(Perez-Brignoli, 1989; and Faber, 1993). Growth was attained through a massive infusion of foreign capital in the form of aid and private investment, promotion of agricultural exports, and reforms which largely favored expansion and diversification of larger commercial agricultural enterprises. (Details on land reforms are provided in the section entitled "Land Tenure in Honduras.")

From this limited perspective of the Alliance for Progress, the Honduras program was running quite well. Over the following two decades, the U.S. Agency for International Development (UASAID), the World Bank, and other donor organizations pumped billions of dollars into Honduras, the government enacted a series of mild reforms, and the agricultural sector experienced a substantial transformation (Brockett, 1987; Brockett, 1987b; Hefferman, 1988; Stonich, 1989; Murry, 1991; Stonich, 1991; Faber, 1993; and Norsworthy and Barry, 1993). The government instituted credit programs as well as chemical input and export subsidies in order to introduce, and encourage the expansion of, a series of nontraditional exports such as pineapple, coffee, cotton, melons, and sugar cane. It was during these two decades that contract farming was introduced in Honduras, largely for the production of horticultural exports. In addition, some large-scale commercial farmers began producing traditional food crops (e.g., maize, sorghum, and beans).

Unfortunately, from a broader socio-economic perspective, the progress did not look quite as good. In the Choluteca area, the process of land concentration under cotton, and later melon cultivation, was rapid and wide spread. When the cotton market collapsed in the 1980s, many wage laborers lost their jobs and the region experienced dramatic outmigration (Stonich, 1989; and Ruben, 1991). Many

of these migrants are being held responsible for the recent acceleration of tropical moist forest conversion in the northern regions of Honduras.

Food production suffered a marked decline over this period of time as well. Stonich (1989) asserts that per capita production of basic grains plummeted 31 percent between 1950 and 1985, and that Honduras became a net importer of maize, beans and sorghum. Brockett (1987b) notes that the domestically-produced food supply declined 19 percent from 1948 to 1983. Land cultivated in basic grains contracted, while pasture and land in commercial crops increased. Despite local demand, traders exported beans to more lucrative markets in neighboring countries adding more stress on local markets. Moreover, landlessness increased from 26 percent in the mid-1960s to 35 percent by the early 1970s (Stringer, 1989b).

In the late 1980s and early 1990s, the orientation of Honduran economic policy changed. President Callejas embraced the new trends in thinking of USAID and the World Bank, and instituted the Structural Economic Adjustment Law in March 1990 (Johnston, et al., 1990; and Norsworthy and Barry, 1993). The law reduced tariffs, withdrew fiscal exemptions, increased the number and type of taxes, privatized a number of government enterprises, devalued the Lempira, established a flexible exchange rate, and liberalized prices. IHMA and BANADESA were privatized. Whereas IHMA had been purchasing and selling grain, it's new role was restricted to one of advice and extension. In 1992, USAID drafted and the Callejas government enacted the Agriculture Modernization Law. The new law altered a number of the conditions for granting and titling land, and included provisions for technical support and credit. (See the following section on land tenure for more details.)

Stringer (1989) points out two important distinctions between the agrarian history of Honduras and the rest of Central America. First, other Central American countries converted indigenous land to private holdings during the early 1800s whereas Honduras transferred these lands to the public domain. Seventy-five percent of Honduran farmers occupy public lands without titles and 4 out 5 farms are worked by someone other than a the landowner. As such, farmers refer to the ownership of land improvements more often than that of the land itself (Coles, 1989; Stringer, 1989; Norsworthy and Barry, 1994, and discussions with Jolyne Melmed-Sanjak, 1994). Second, the timely formation of national *campesino* organizations exerted sufficient pressure for agrarian reforms. Given the abundance of public land, the government could afford to continually grant new properties to landless and marginal peasants and avoid the disastrous mission of expropriating private property like other unfortunate Central American governments.

2.2 Land Tenure in Honduras

Forms of property and documentation of tenurial rights in Honduras are varied, complicated, and sometimes contradictory. In many instances, dates and details of specific reforms are not consistently reported in the literature. Thus, it is helpful at this point to review and clarify the evolution of different types of property and documents found in Honduras. The author has made her best effort to verify and accurately report historic and current information on land tenure in Honduras.

2.2.1 Land Classification in Honduras

Although land is sometimes classified differently among authors, organizations, and projects working in Honduras, there are essentially three types of property: private, national, and *ejido*. Private property in Honduras is the same as it is nearly anywhere else. The owner has complete individual unattenuated rights. In Honduras, private property has been left essentially untouched by a long and constantly evolving series of land reforms. National land is owned and managed by the central government. *Ejidos* were granted by the central government to municipalities in the 1800s. Each *ejido* was originally approximately 3,036 ha surrounding the municipality. This land was to be allocated under usufruct tenure in lots of 20 ha to landless peasant families most in need of land for subsistence production (Stringer, 1989b). These usufruct rights can be transferred and inherited with authorization from the municipality, but the land can not be sold outright, and can only be used for agricultural and/or forest production. This distinguishes the Honduran *ejidos* from those of Mexico where the community members possess collective choice rights. Nearly all available *ejidal* land was allocated by 1950. *Ejidos* continue to function in the same fashion; although, farm size now varies considerably within and across *ejidos*.

There were previously two other types of land in Honduras. Private municipal land was that which a municipality acquired through purchase, donation, or debt compensation. This did not include the original *ejidos*. Private municipal land was distinct from that which was governed by municipal tenure. The latter was land owned by the central government but administrated by the municipality. These two types of property were eliminated by the 1975 Agrarian Reform. (For more details,

see the sections on land reforms).

As mentioned in the previous section, a significant portion of land is either national or *ejidal*. Coles (1989) notes that more than 50 percent of the area cultivated in some departments is in private use on national or *ejidal* land. In the 8 departments undergoing the greatest transformation to privately-held and titled land, national and *ejidal* land is still 61 percent of the total area (Lopez Tabora, 1993). For Atlántida, one of the more newly settled departments, national and ejidal land comprise 93 percent of the total area.

2.2.2 Reforms in the Twentieth Century

Honduran land reform has been historically, and without exception, directed at public lands. Private land has always been sacrosanct. The first twentieth century reform was the Agrarian Law of 1829 which initiated settlement on public lands (Stringer, 1989). The law was enacted in an effort to bring more land into production. In 1837, the government established *ejidos*. A series of decrees specifying and respecifying the size of a family farm were enacted over the following 100 years. These decrees governed the amount of land to be allocated to rural families seeking to use publicly-held land. The 1924 Agrarian Law stipulated that the family farm unit would be 20 ha, and farmers could be given fee-simple titles (i.e., *dominio pleno*) for national and *ejidal* land (Salgado, et al., 1994). Recall that fee-simple grants the bearer unrestricted use and transfer.

The first *campesino* organization, *Federación Sindical Hondureña* (FSH), was founded in 1929. They aimed to improve the living and working conditions of banana plantation laborers and their families. Acquiring land was one means of

doing so. Through the 1950s, agricultural wage laborers and farmers were permitted to occupy public land as well as areas abandoned by the large fruit companies. Most of this form of settlement took place in the north (Lardizabal, 1986; Posas, 1988; and Norsworthy and Barry, 1993).

2.2.2.1 The 1962 Land Reform and Amendments

In the early 1960s, the Alliance for Progress began to exert its influence over Honduran land tenure making reform a precondition for foreign aid. In the tradition of the Alliance, Honduran reforms were limited to nonprivate lands. The *Instituto Naciónal Agrario* (INA) was established in 1961. The following year, the government enacted an agrarian reform that for the first time provided tenant and landless farmers a means of obtaining land. According to Ericsson (1989), the goals of the reform were: 1) to establish a tenure system that would integrate *campesinos* into the boarder social and economic development of the country, and 2) to stimulate production and enhance productivity.

This was also a time when union and peasant organizations were rapidly forming and spreading throughout the country (Posas, 1987). The communists assisted in the formation of a number of organizations, while the central government, AFL-CIO, and university staff supported the *Asociación Naciónal de Campesinos Auténicos de Honduras*, ANACH. These nascent organizations began to successfully lobby for land for their members: at first illegally, and later legally, occupying land. At this stage, these collective efforts were aimed at securing family plots for individual members. Unfortunately, a military coup in 1963 suppressed the advancement of the reform; although, a law legalizing the organization of farmers

was almost immediately passed. Despite the spotty success of unions and *campesino* groups, Perez-Brignoli (1989) maintains that the only real impact of the 1962 reform was the massive expulsion of the numerous El Salvadoran settlers. Nevertheless, in the following decades, INA would become a powerful institution engaged in the issuance of land titles and promotion of land markets.

After a series of land invasions and peasant demonstrations, Presidential Decree No. 8 was passed in 1972 (Stringer, 1989). Under the decree, the government meekly requested that large landowners merely grant temporary access to the landless. INA was empowered to expropriate and distribute idle or "unproductively used" land, i.e., land planted in anything but perennial crops. *Registro Naciónal de Tierra*, the national registry of property, was created. The decree also set guidelines for establishing reform groups. Reforms now centered on collectives such as cooperatives and associations, although, not to the exclusion of individual families. Generally, the term reform sector refers to these collectives alone, although, individual family farms are officially reform beneficiaries as well. Most statistics on the reform sector include only the former.

These reform collectives unfortunately did not prosper and remain in controversy today. Most Honduran farmers have not liked working in collectives and have resented the government's initiatives. Their complaints are not unlike those of farmers in other parts the world. There are many inefficient farmers and free riders among the members, administrators are dishonest and corrupt, administrative matters are too time consuming, and it is consequently easier and more pleasant to work alone (Barham and Childress, 1992; Parson, 1976; and interviews with key informants, 1993 and 1994).

A significant goal of the decree was to eliminate both *minifundios,* at this point defined as less than 10 ha, and *latifundios* which were larger than 200 ha (Stringer, 1989; Ruben, 1991; and Salgado, et al, 1994). In addition, title applicants had to satisfy the following conditions: 1) be male and over 16 years of age, 2) be principally employed in agriculture, and 3) have peacefully acquired land and continuously worked this land for 10 years (Salgado, et al, 1994). This last condition strongly favored the cultivation of perennial crops.

2.2.2.2 The 1975 Land Reform

Decree No. 170 of 1975 is an important point of reference in the history of Honduran land tenure. Article 21 of the decree stated that all nonprivate land belonging to decentralized government bodies (including municipalities) was to be transferred to the central government and placed under the jurisdiction of INA. This measure substantially increased the area of national land. The reform continued to support the establishment of collectives such as cooperatives, *asentamientos* (comprised of at least 12 members) and *empresas asociativas* (with a minimum of 5 members). In general, like the unions which preceded them, these groups applied for titles collectively but managed their plots independently (Stringer, 1989 and various interviews with group members, 1993).

Titles of *dominio pleno* could now be granted for national land. This is a *fee simple* title implying "..the right to determine the nature of the plot's use; as well as that of its transfer" (Coles-Coghi, 1994). Applicants were awarded provisional titles until the land was completely paid off. The transactional terms included reduced interest rates and payback periods of up to twenty years. Once the land debt was

paid off and the an individual possessed a title of *dominio pleno*, credit could be obtained from state and private banks (Barnes, 1987). Reflecting the ever-increasing land pressures, *minifundio* was once again redefined: this time as farms less than 5 ha (INA, 1978; Falck, 1992; and Stanfield, 1992). Unfortunately, this stipulation still excluded 64 percent of Honduran farmers (refer back to Table 2.1). The upper limit on *latifundios* remained 200 ha (Sierra, 1992). Decree 170 also prohibited the all forms of leasing land (Childress, 1989; and Fandiño, 1993).

Under pressure from strategically important and well-organized coffee growers, Decree No. 78 was enacted in 1981 (Lopez Tabora, 1993). Farms of less than 5 ha could be titled provided that the land was cultivated, in part, with coffee.

2.2.2.3 The Land Titling Project Decree

Another important milestone in the evolution of Honduran land tenure was Decree No. 89 which established the Land Titling Project, *Proyecto de Titulación de Tierras* (PTT) in 1982. The emphasis of reforms from this point on shifted toward the promotion of land markets and away from titling; although, the latter was still an important component of the project and of significant interest to INA as well as many development organizations and donors. In theory, improved land market operations would facilitate the transfer of land to more productive uses. A major objective of the project was to assist in establishing institutional links between INA, the national registry, and the cadastre (Coles, 89; Stringer, 1989b; and Falck, 1992). As a further illustration of the coffee association's clout, project work commenced in 7 of the 18 departments in Honduras: all significant coffee producing areas. Atlántida was added later.

Under the decree, holders of public land between 5 and 50 ha, and less than 5 ha if planted with coffee, could apply directly for a title of *dominio pleno*. Greater emphasis was placed on titles for individuals as opposed to groups, and on the transformation of usufruct rights into a complete set of unattenuated private property rights. It was hoped that such titles would enhance the use of credit and promote investment in agriculture. For the first time, women could apply for titles, but only if they were divorced or single (Barnes, 1987; Nesman and Seligson, 1989; Ruben, 1991; Falck, 1992; and Salgado, et al., 1994).

Despite the stated intention of the project, significant obstacles to improved land transfers persisted. Leasing of land was still prohibited. Even more encumbering, all property of less than 17 ha could not be subdivided and required INA's consent to be bought, sold or otherwise transferred. Larger properties did not need to comply with these conditions (Stringer, 1989b; Stringer, 1989c; and Shearer, Lastarria-Cornhiel, and Mesbah, 1990).

2.2.2.4 The Agricultural Modernization Law of 1992

The Agricultural Modernization Law was drafted by USAID and enacted by the Honduran government in 1992. This remains the current law. The principal objectives of the law were to: 1) eliminate all forms of state intervention in agriculture, 2) limit expropriations of private property considered <u>not</u> to be in "productive" use, and 3) promote foreign and domestic investment in agriculture (Norsworthy and Barry, 1993). Generally, land tenure was streamlined. Reliance on market forces was reemphasized.

The term of continuous use defined under Decree No. 8 was reduced from

10 to 3 years, and owners could leave land idle for up to 24 months with possible extension. Privately-held land could now be leased. The definition of "productive" use was extended beyond perennials to include annuals which provided greater protection from expropriation. *Minifundio* was redefined as property under 1 ha. The Decree stipulates that properties of less than 1 ha should be expropriated, adjoined to other parcels and reallocated in lots of greater than 1 ha. The requirement of INA's consent for land transfers was dropped. Members of reform sector groups were given individual titles for their share of the land. All provisional documents and titles of occupation were eliminated. (For more detail, see the section on titles and documentation.) In order to promote more complete record keeping, the law required that all land transactions be listed at the registry of property within 6 months. The law also created a land fund to provide money for the purchase of up to 10 ha of land per person (Congreso Naciónal, 1992; Falck, 1992; Sandoval Corea, 1992; USAID, 1992; Lopez Tabore, 1993; Norsworthy and Barry, 1993; and Salgado, et al., 1994).

2.2.2.5 Current Land Titles and Documentation

Documentation of land rights is another complicated and confusing issue in Honduras. As indicated above, Honduras has undergone a lengthy series of reforms in a short period of time. Information on reforms and modifications has not travelled quickly. Throughout Honduras, both in the rural areas among *campesinos* and in more urban centers among development workers and administrators, the understanding of current rights and regulations is varied and contradictory. Although only a certain number of documents are currently issued and legally recognized,

Hondurans presently possess a whole range of documents stemming from different stages in the country's tenure evolution.

A paper written by Salgado, et al. (1994) clearly outlines which documents for national and *ejidal* land are currently recognized by INA and the central government. Any number of titles and documents are accepted for private land. A title of *dominio pleno*, or fee-simple title, entails full unattenuated property rights. The proprietor has the right to uniquely determine the use and transfer of the property. With this title, the bearer can obtain credit from a private or public bank and lease his/her property. Originally, fee-simple titles were only issued for private property, now they were issued for national land as well. A *título definitivo* is almost identical to that of *dominio pleno* with the only difference being that, under the modernization law, the latter must be registered within 6 months of completion of the transaction. INA had previously issued the *título definitivo* when the provisional title holder had completely paid for the property in question. A *título de participación individual* is granted to an individual group member for his/her portion of a collective property. The final two documents fall into the category of *documento privado* which designates usufruct rights to national or *ejidal* land, and permits the sale of improvements but not the land itself. These documents are generally drawn up by a lawyer and witnessed; however, they are not listed in the property registry. Banks do not recognize these documents for extending credit. The two most common types of *documentos privados* are: a title of *compra-venta* is issued for national land, *dominio útil* for *ejidos*. In addition, some municipalities have issued *contratos de arrendamiento* which specify 5 year rental agreements for *ejidal* land. At present, INA is attempting to transform all of these documents into titles of

dominio pleno.

Two other types of documents are still in wide circulation; although, neither is presently being distributed (Childress, 1991; Lopez Tabora, 1993; and Salgado, et al, 1994). A *título provisional* was issued by INA to individuals or groups in the process of paying for their property. Lenders have never recognized this form of title. A *garantía de ocupación* is very limited and of little value even at the time of issuance. It was granted to occupants or squatters stating that the military or other landowners could not evict them from the land.

There is a wide range of additional documents found in Honduras. A number of farmers have deeds from the Spanish Crown. Some transactions are recorded on tiny pieces of worn out paper. Others have been drawn up by lawyers, local community secretaries, or just the trading partners themselves. In some areas, a simple verbal agreement is customary (Coles, 1989).

Another complicating factor is that many Hondurans do not seek titles. Only one third of those eligible for titles under the PTT actually applied (Shearer, Lastarria-Cornhiel and Mesbah, 1990). Even when a land transfer is registered, subsequent transactions are not. The simple fact is that obtaining a title requires time, money, information, and knowledge. The average Honduran farmer does not have the time nor the money needed to make several trips to the INA office in the regional center. At one time they had to go all the way to Tegucigalpa (interviews with Mendosa and Jiménez, 1994). Furthermore, most farmers don't have sufficient information and many can't utilize it due to their inadequate education. Yet, despite all of the efforts to formally institutionalize tenure, many Honduran farmers claim to own the land they cultivate even though they do not have any form of

documentation. In sum, ownership is not a simple, straight-forward concept in Honduras, transactions costs associated with land titling are high, and titling procedures favor larger, wealthier farmers .

2.2.3 Land Tenure Summary

Land tenure reform in Honduras has always been restricted to public lands: initially this included only national lands, but more and more the central government has attempted to reform *ejidos* as well. In keeping with the tone of the Alliance for Progress, there has never been a movement to expropriate private property. The objectives of this series of reforms reflect a persistent interest in enhancing agriculture productivity, encouraging investment and modernization, expanding export crop production, privatizing property, and fostering land markets. An implicit objective, also in accordance with the Alliance, was the promotion of political and economic stability. Initially, reforms merely legitimized land occupancy by landless peasants. By mid-1970, the emphasis had switched to the assignment of titles. From the 1980s until now, reforms have stressed land markets and efficiency in land allocation. Reforms had originally assigned rights to individual farm families as members of collectives (e.g., unions, cooperatives, etc.); then focused primarily, although not exclusively, on issuing titles to collectives themselves; and now have been redirected toward granting individual property rights.

Until recently, small farmers had largely been disfavored by the reforms. Minimum farm size requirements and the additional controls that INA and the central government exerted over smaller parcel transfers precluded many small farmers from obtaining titles. Whereas a massive campaign to disseminate information on

land reform is required in a country with undeveloped communications infrastructure like Honduras, the government has made only a minimum effort. Moreover, INA's relatively centralized administration and bureaucratic procedures generate transactions costs that are prohibitive to small farmers.

Generally, evolution of land tenure reform over the past century can be characterized as dynamic, disjointed and convoluted. Many reforms have been quickly overturned and/or overlaid, even before information concerning these reforms was fully disseminated. In the wake of all this activity, are numerous and often contradictory laws and methods of documentation. Very few people can state accurately and with a high degree of certainty what their current rights are.

At the present time, the government recognizes three types of property: private, national, and *ejidal*. However, it is not always clear how a given piece of property should be classified. INA and the central government recognize only a small portion of the documents issued for public property (i.e., national and *ejidal* land). These are *dominio pleno, documento definitivo, dominio útil,* and *compra-venta*. Regardless, farmers with other forms of documentation, or none at all, still claim ownership of parcels of land.

2.3 Soil Management in Honduras

The use of improved soil management practices in Honduras is still quite limited. Farmers traditionally engaged in swidden agriculture with extended fallow and burning to clear fields. With increasing land pressure, the fallow period was substantially reduced and, in some areas, eliminated. Farmers continued to burn their fields; although, massive media and extension campaigns have recently helped

to discourage this practice. With the exception of live fences in western Honduras and the practice of leaving maize stubble in the field, farmers do not have a tradition of employing soil management techniques. Because land grades are steep and initial input levels are low, the incremental benefits from a soil management practices tend to be dramatic (interviews with personnel from LUPE, World Neighbors, and Peace Corps).

2.3.1 Projects Promoting Soil Management

World Neighbors, a nonprofit international development organization, is probably the most influential promoter of soil management practices throughout Honduras. They initiated a collaborative project in Honduras in 1981 with ACORDE and the Ministry of Natural Resources. This project as well as their more recent ones have concentrated on a limited number of areas, but many other projects and programs have adopted their "human farm" philosophy and extension techniques. World Neighbors has activities in the departments of Francisco Morazan, Olancho, El Paraíso, Comayagua, and Choluteca.

The philosophy of the "human farm" was developed by Roland Bunch and is outlined in his book entitled Two Ears of Corn (1982). Extensionists work intensively with farmers discussing problems, accessing available resources, and attempting to place the farmer's production processes in a broader context. Using locally-defined constructs, the extensionist can heighten the farmers awareness and appreciation of environmental issues. The method also fosters the farmer's self-esteem and builds self-confidence which, combined with greater knowledge, increases the farmer's ability to self-actualize, and enhance productivity using

improved and environmentally sound soil management practices.

Bunch has since left World Neighbors to form his own development organization, Cosecha. Elias Sanchez established *Granja Loma Linda*, a training center for all of Latin America, which teaches similar principals. ACORDE, Catholic Relief Service, CIDICCO, PROCONDEMA and the United States Peace Corps all have programs based in the philosophy of the "human farm." Even the traditionally conservative institution Escuela Agrícola Panamericana at El Zamorano (referred to as Zamorano from this point on) has been attempting to incorporate many aspects of this development philosophy into its' teaching and extension work. Their coverage is largely in the departments of Francisco Morazan and El Paraíso, though they provide training courses to projects and programs in other departments and neighboring countries.

The USAID funded Land Use and Productivity Enhancement Project (LUPE) is an extension of their earlier Natural Resource Management Project (NRM). Like its' predecessor, the main objective of LUPE is to increase agricultural productivity on hillsides and in watersheds with the most severe environmental stress. Whereas NRM attempted to enhance productivity through extension of "modern" technologies such as chemical inputs, improved varieties, and some mechanization, LUPE recently reformulated its' approach and now uses elements of the "human farm" philosophy. A review of documents at a number of LUPE's field offices suggests that "modern" technologies are still being encouraged, and that the breadth of soil conservation practices is quite limited. LUPE operates in the departments of Francisco Morazan, El Paraíso, Comayagua, and Choluteca. Until recently, they had been working in Olancho as well (interviews with Flores and

Hern, 1993; and Leonard, 1994).

All of these organizations work predominantly with small farmers. LUPE works with the widest range of farm sizes, including some larger commercial farmers. With regard to their soil management programs, most of these organizations claim to be assisting landowners. In all cases, the farmer's word or perspective is taken as sufficient proof of ownership. Dagen, a member of World Neighbors' staff mentioned that they have also worked with renters in past, particularly in El Paraíso (interview with Dagen, 1994).

2.3.2 Recommended Soil Management Practices

Development organizations and the Ministry of Natural Resources (MRN) recommend a wide range of soil management practices. Some are more common, and this study has been limited to these practices. They include: live barriers, drainage ditches, maize stubble management, manuring, fertilizer beans, contour planting, physical structures (i.e. terraces and stone walls), and minimum tillage. (Diagrams of most of these practices can be found in the Appendix B.) Although the author has attempted to classify these practices according to their expected payback periods, it should be noted that no rigorous analysis of the returns to these practices has been undertaken in Honduras at this time. Such an analysis was beyond the budget and logistical constraints of this study.

2.3.2.1 Live Barriers

Live barriers are contour lines of plants such as *Vitiveria spp.*, king or elephant grass (*Panicum elefantiasis*), lemon grass (*Cymbopogon citratus*), napier

grass (*Pennisetum purpureum*), pineapple (*Ananas comosus*), sugar cane (*Saccharum spp.*), or small leguminous shrubs (mostly *Leucaena spp.* and *Gliricidia sepium*). Mejía (1993) noted that of farmers working with private organizations to establish live barriers, 40 percent used pineapple, 30 percent king grass, and 14 percent lemon grass. King grass is recommended for grades up to 12 percent whereas *Vitiveria spp.* can be effective up to 60 percent. The combined installation and maintenance costs are quite low (World Bank, 1990; LUPE, 1993b; Mejía, 1993; Vietmeyer, 1993; Hesse-Rodríquez, 1994; and LUPE, 1994b). The spacing of barriers depends on the grade. Steeper grades require more barriers and, as a result, claim more of the potential crop area and require more labor inputs. Some plant species are more invasive requiring additional labor for maintenance. However, more abundant vegetation can mean more fodder, green manure, or cash earnings depending on the species selection and availability of markets. Barriers can be established and by-products can be harvested within the first year after installation. They offer a high degree of erosion protection and water retention. Resultant terraces become noticeable within several years, again depending on the grade and rate of soil erosion. The contribution to improving soil fertility depends, in part, on whether cuttings are incorporated into the soil or used in some other way. Because live barriers actually encompasses a wide array of management practices, it is difficult to stipulate a general payback period. Nevertheless, farmers can expect to receive benefits almost immediately with only a moderate amount of labor investment.

2.3.2.2 Managed Maize Stubble

Many farmers manage maize stubble. Methods of managing stubble are extremely variable. Burning stubble is not considered a soil management practice. Instead, the farmer must use the stubble in some productive way. Leaving stubble helps hold soil and moisture in place. Chopping it up and incorporating it into the soil improves the soil fertility. Managing maize stubble is considered a traditional practice in some areas, particularly where livestock is plentiful. However, like the improved practices, traditional management practices vary greatly. While some farmers burn the stubble after the animals are through grazing, others incorporate the organic material into the soil or use it as mulch. Manual incorporation of stubble can be extremely hard work and time consuming. The presence of animal traction greatly reduces the work required for stubble incorporation. Erosion protection is almost immediate; although, the impact on erosion and productivity is less than that of live barriers. If done manually and thoroughly, costs can be high and consequently significantly extend the payback period. In the form of mulch, stubble will effectively hold soil in place for grades of up to 60 percent (LUPE, 1993c; and LUPE, 1994b).

2.3.2.3 Drainage Ditches

The term drainage ditches as defined by the LUPE project includes ditches constructed on both hillsides and flat lands even though they function quite differently on these two terrains. On hillsides, they are installed along the contour. They reduce the velocity of water traveling down the hillside, increase water absorption, and redirect excess water off the parcel. Alternatively, many farmers in

relatively flatter areas use ditches to prevent inundation and remove stagnant water. Regardless of the terrain, drainage ditches are expensive to install and maintain. They need to be checked and cleared after each rain adding considerably to maintenance labor costs. Often, ditches are combined with live barriers. Constructed this way, they are less likely to become blocked or fractured. Still, ditches have an immediate and substantial effect on erosion and water control with respect to the specific parcel. However, hillside drainage ditches can cause considerable off-site erosion problems where water is not controlled beyond the boundaries of the specific plot in question. The effect on soil fertility is minimal. In general, maintaining drainage ditches is considered by farmers to be an arduous task. Investments in drainage ditches would likely have longer payback periods.

2.3.2.4 Manuring and Composting

Manure and compost provide very little protection against soil erosion, but their impact on productivity is significant. Although LUPE claims the costs are low, interviews with farmers suggest that labor costs are prohibitive to many farmers. The effects on soil fertility are immediate. These two practices are not considered long-run investments. Composting requires ample quantities of organic matter, and most farmers do not have a steady supply. Tethered animals are needed to make manuring cost effective. Composting is rare in Honduras, while the application of manure is more common among livestock owners.

2.3.2.5 Green Manure and Fertilizer Bean

Green manure includes clippings as well as ground cover. Mulches are easy to apply and show immediate results. As a consequence, farmers take interest in this practice. Fertilizer bean (*Mucuna spp.* and *Vigna sinensis*) is essentially the only crop cover, and is especially common in the north of the country. Fertilizer bean provides more soil erosion protection and fertility enhancement than live barriers. Erosion control is noted almost immediately; whereas, productivity gains are apparent in two to three years. Vegetative cover also retains moisture and smoothers competing weeds. The beans are edible by both animals and humans. Many farmers make tea from the beans as well. Although the maximum benefits are obtained only after a number of years, fertilizer beans furnish immediate benefits such as nitrogen fixation and other by-products. This tends to reduce the payback period. Farmers complain that it is difficult to find seed. Fertilizer bean cultivation also entails greater managerial complexity and proficiency. In addition, the thick shallow rooting structure disturbs other deeply rooting plants and loosens the soil. On steep slopes this can cause landslides under heavy rain conditions (Nesman and Seligson, 1989; Buckles, Ponce, Sain and Medina, 1992; LUPE, 1994b; and LUPE, 1994e). Overall, fertilizer bean can provide quick moderate results at a relatively low cost. The payback period is generally considered to be short.

2.3.2.6 Contour Planting

Contour planting yields quick but limited results with respect to both erosion control and productivity enhancement. Other practices have a greater impact. Contour planting is applicable to a wide range of grades. It is cheap and relatively

easy for farmers to learn and maintain. Once the contour line is established, the costs are the same as traditional methods. (LUPE, 1993; Mejía, 1993; and LUPE, 1994b. Contour planting is not a long-term investment, and is associated with shorter payback periods.

2.3.2.7 Physical Structures

Physical structures include stone walls, trash lines or dead barriers, and terraces. With the exception of dead barriers, these structures are costly to install. The steeper the slope, the greater the costs. Few farmers use dead barriers. Many of the stone walls found in northern Olancho were established by group efforts. They provide maximum erosion protection and good fertility improvements. Simpler structures such as dead barriers constructed from maize stubble are cheaper and easier to erect, but much less effective. Generally, physical structures are considered long-term investments with significant payback periods. Structures can be used for grades of up to 50 or 60 percent (Mejía, 1993; LUPE, 1994b; and LUPE, 1994c).

2.3.2.8 Conservation Tillage

Conservation tillage techniques are less widely practiced. Since the inter-season vegetative growth is <u>not</u> burnt off, these techniques clash with the typical Honduran farmer's strong cultural preference for clean fields. The farmer plows contour strips under minimum tillage, and sows directly into the accumulated debris under a no-till system. Farmers often confuse these conservation techniques with animal traction. Conservation tillage provides ample erosion protection, is

inexpensive, and furnishes results right away (LUPE, 1994b).

2.3.2.9 Summary of the Expected Economic Performance of Practices

The LUPE project has attempted to assess these selected practices based on theoretic, comparative, and qualitative field observations. As noted previously, no rigorous economic or agronomic evaluations has been conducted as of yet. Table 2.4 summarizes LUPE's assessment of the expected performance of the soil management practices included in this study. Performance indicators include increases in productivity, level of economic costs, and timely provision of benefits. The greater the number of stars, the better the performance with respect to the specific criteria. It should be noted, however, that actual performance varies widely. The information listed on the table was slightly altered by the author for purposes of simplification.

An estimation of the expected payback periods for the different practices is useful for the purposes of evaluating tenure and longer term investments. The payback period is a function of the relative magnitudes of the cost and benefit streams. Generally speaking, higher costs, lower benefits, and more extensive delays in receiving benefits imply longer payback periods. Longer payback periods imply greater emphasis on land use security. Unfortunately, neither LUPE or any other development project have developed such an indicator, nor is it possible to derive a definitive relative qualitative measure from the information contained in Table 2.4. Nevertheless, the assessments provide a helpful means of comparing and grouping practices.

Table 2.4 Estimated Performance of Soil Management Practices

Soil Management Practices	Performance Indicator: Increase in Productivity[a]	Level of Economic Costs[b]	Time Lag for Benefits[c]
Quick, inexpensive, moderate results:			
Contour planting	**	****	*****
Fertilizer bean	***	****	***
Live barriers	**	****	***
Moderately expensive, good results:			
Managed stubble	***	**	***
Minimum tillage	***	***	***
Manure	*****	**	*****
More expensive, longer-run results:			
Drainage ditches	**	**	***
Terraces	***	*	***
Stone walls	***	*	***

NOTE: The more asterisks, the better the performance. ** = very low to none, ** = low, *** = fair, **** = high, ***** = very high. [b]** = very high costs, ** = high costs, *** = moderate, **** = low costs, ***** = very low costs. [c]** = four or more years, *** = two to three years, ***** = within one year.
LUPE. (1994b). "Manual Practico de Manejo de Suelos en Ladera: Modulo 4, Seleccion e Incorporacion de Practicas de Manejo de Suelos." Tegucigalpa, Proyecto LUPE/USAID.

The author attempted to form a classification of these practices based on their expected payback periods. The assessments contained on Table 2.4 combined with discussions with technicians working with LUPE and other projects suggest that live barriers, fertilizer beans and contour planting provide quick results at a low cost, but the effect on productivity is only low to fair. These practices would have a relatively quick payback period. In addition, live barrier provides longer term benefits from the establishment of terraces. Manure, managed stubble, and minimum tillage are more costly with a slightly stronger influence upon productivity. Terraces, stone walls, and drainage ditches are more likely to be associated with longer payback periods. Practices have been grouped this way throughout the analysis. Caution is suggested in interpreting the finding based on these categories given the limited amount of technical information available and the ambiguous nature of this classification scheme.

2.3.3 Farmer Awareness of Land Degradation Issues

To the typical Honduran farmer, land appears to be abundant: it is access which is limited. Farmers are by and large aware of land degradation. Matthew Thorton, a Peace Corps volunteer who had worked in western Honduras noted that farmers comment on the brownish color of streams and river water, and discuss how the water carries all their soil and nutrients to the Sula Valley (interview, 1994). Mejía's study on private organizations working on soil conservation throughout Honduras, found that 66 percent of participating farmers recognized that water washes soil away. A reduction in the number and height of maize stalks is used as an indicator of the diminishing fertility of fields. The change is usually noted

within 2 or 3 years of continuous cultivation. As the soil becomes more depleted, farmers may remark that the soil color is lightening and/or that there are rocks 'growing' in the field (interviews with Leonard, Thompson, and Thorton in 1994). Farmers also comment that the distances to their newer fields are increasing, as is the time necessary for collecting a week's worth of fuelwood. Some farmers claim that the volume and duration of the rains have declined. As a result of extensive media coverage, most farmers are aware of the problems associated with burning their fields. Although many still employ burning, fewer do. Farmers are also more inclined to leave trees in their fields.

Farmers are often aware of soil management practices even if they don't employ them. Nesman and Seligison (1989) commented that in Santa Barbara and Comayagua few farmers who knew of practices used them. They added that some farmers incorporated maize stubble. Mejía (1993) found that his sample of project farmers were well informed. More than 85 percent had heard of live barriers and drainage ditches. Over half knew of green manure, incorporating maize stubble, and structures such as dead barriers and walls.

2.3.4 Existing Knowledge of the Use of Soil Recommended Management Practices in Honduras

Literature on the use of improved soil management practices is limited. Meijá produced a study of private organizations working on soil conservation. In addition, a few development projects have kept records of farmer adoption activity; and fortunately many experienced development workers have formulated, and shared their own impressions with the author (Lopez-Pereira, Sanders, Baker, and Preckel, 1992; Medina, 1992; and Mejía, 1993; and interviews with Flores, Hern, Mejía in

1993; and Thompson, Thorton, Jiménez, and Leonard, 1994).

Mejía found that the most commonly used practices were: live barriers (73 percent), contour planting (72 percent), drainage ditches (66 percent), minimum tillage (61 percent), incorporation of stubble (53 percent), and green manures including fertilizer bean but not compost (45 percent). These figures can be compared to the 44 percent who use inorganic fertilizers. Farmers were more likely to employ conservation practices with maize cultivation. Although projects often promote planting valuable horticultural crops as a means of enhancing the benefit stream from fields where practices are being established, few farmers actually do so.

The pattern of technology adoption tends to be, in part, project and location specific. About a decade ago, stone wall terraces were promoted for village groups in northern Francisco Morazan and Olancho. Fertilizer bean is the single most popular practice in Atlántia, and live fences of *Gliricidia spp.* are a common sight in the west.

Adoption takes place on small to medium sized farms of less than 15 ha. Mejía (1993) found that 83 percent of the individual fields with practices were less 1.4 ha. Normally, farmers have some fields with practices and others without. Adopters tended to be full-time farmers, and, as a group, they had a higher rate of literacy than the overall rural population.

A title of *dominio pleno* is not a perquisite. Of the farmers in Medina's study (1992), 75 percent had clearly defined rights to their land; however, 60 percent of those farmers had titles of *dominio útil* and only 15 percent had *dominio pleno*. Thirty-eight percent of the farmers in Mejía's report (1993) were located on *ejidos*.

Possession of a title is more of an issue where land is strongly disputed such as heavily forested areas. The government forestry agency, COHDEFOR, recently relinquished its' monopoly rights over forests, and is currently officially monitoring, through authorization of management plans, forest reclamation by private individuals and communities. It is here in forested areas that disputes are most prevalent and development workers tend to emphasize land rights issues.

The benefits derived from installing conservation practices are varied. Improved yields mean that farmers do not have to buy so much maize and other basic grains, or they can reduce the area in grains. Parcels can be continuously manage and reduced in number. Farmers can work predominantly on nearby parcels. They can reduce their dependence, and their cash expenditures, on chemical fertilizers. With the new surplus area, improved water management, and more abundant organic matter or chemical fertilizer, farmers can diversify into other crops such as more highly valued horticultural crops. Cash savings can also translate into more income for other important household needs. Live barriers, stubble and fertilizer beans provide fodder and organic fertilizer. Finally, many farmers comment on how attractive their fields look. These benefits were substantiated by others working for various projects in the field.

Farmers remarked that the lack of information and insufficient labor are the most significant constraints to adoption. Where farmers require cash for hired labor to assist in establishing and/or maintaining practices, limited access to credit is an obstacle. The unavailability of seed and other inputs are faulted in some instances, particularly with fertilizer bean.

CHAPTER THREE

LITERATURE REVIEW

3.1 The Causes of Land Degradation

The literature is rich with theories on the causes of land degradation. Although these views originate from different academic disciplines and ideological backgrounds, they share many key elements and relationships. Some theories are neatly contained within an academic discipline, others are multidisciplinary, while still others consist of observations on just one key variable such as price subsidies, taxes, or population growth. The validity and utility of these diverse views is, in part, determined by the specific research context. Aspects of nearly each view provide some degree of clarity for this study.

Malthusians and neo-Malthusians claim that unchecked population growth ultimately pushes a society beyond the carrying capacity of its' available resources and leads to degradation, famine, and other catastrophic events (Harrison, 1987; Randall, 1987; and Nebel, 1990). Land fragmentation, affiliated with rapid population growth, results in an impoverishment of agricultural producers with expansion onto rented, more distant and marginal plots (Clay, 1992).

Conversely, Boserup and others submit that as population pressure increases and resources become constrained, new resource-conserving technologies are developed following signals of relative scarcities in the form of factor prices (Boserup, 1981; Hayami and Ruttan, 1985; Blaikie and Brookfield, 1985; Pingali, Bigot, and Binswanger, 1987; Lele and Stone, 1989; and Belshaw, Blaikie and

Stocking, 1991). Although in agreement with the basic Boserup premise, Binswanger and Pingali (1988) emphasize that this technological evolution requires government intervention to assist and hasten farmer response. As a result, they place greater stress on the role of institutions and government programs. Stonich (1989:271) refers to a number of scholars who claim that "..environmental problems have their basis in the structure of rural poverty rather than in population per se." Clay, Guizlo and Wallace (1993:3) argue that both the Malthus and Boserup perspectives are incomplete because "..they fail to fully incorporate the intermediate linkages both to and from the changing structure of landholdings."

Neo-classical economists claim that private individual property regimes based in the context of competitive markets are the most efficient and lead to appropriate resource management. They blame land degradation on market failures or imperfections. These imperfections could be in the form of inappropriate incentives or policy measures, concentration of market power, substantial transactions costs, etc. Quiggin (1988) refers to this group as the "externality theorists." He states that they are orthodox economists who frequently employ static equilibrium models and individual profit maximization.

There are many examples of studies that draw upon Neo-classical economics to explain degradation. Much has been written about inappropriate tax policies and subsidies that favor livestock expansion into the fragile Amazon (Binswanger, 1989; and Hecht and Cockburn, 1990). Alternatively, holding producer prices artificially low decreases the income stream from farm enterprises. Farmers are unable to pass on to the consumer even a portion of the costs associated with acting in a more socially preferred manner, i.e., installing improved soil management practices. In

addition, reduced benefits filter into lower rates of return which promote shorter-run management practices (Southgate, 1988). Credit and direct fertilizer subsidies are said to promote chemical intensive practices at the expense of soil management and conservation (Blaikie and Brookfield, 1985; and Napier, Napier, Tucker, 1991). Overvalued exchange rates favor imported machinery and chemical inputs over improved soil management practices, and disfavor environmentally less destructive exportable perennials (e.g., coffee, cacao, fruit). Road expansion projects increase erosion by destablizing the landscape and encouraging migration (Napier, Napier, Tucker, 1991; and Bioconsult, 1992). Barrett (1991) analyzed the effects of price policy on soil conservation. He concluded that the effects could go either way: promoting or discouraging conservation. He further claimed that it was unlikely that the effects of pricing policy would be dramatic.

Institutionalists view the problem of resource degradation as one of poorly defined and/or badly enforced property rights. What Quiggin refers to as the "private property school" fits within this group. Although externalities are central to this approach, the emphasis is on the structure of property rights and how they evolve in response to changes in externalities and the need to internalize them (Quiggin, 1988). Scholars and policy makers concerned predominantly with tenure security, irregardless of the connection to specific externalities, are related to this group. Wachter labels the latter the "tenure insecurity approach" (Wachter, 1992).

Approaches such as Ashby's "social ecology," Wachter's "agrarian structure," Blaikie's "regional political ecology" and later "resource-access model," and what Stonich refers to as "human systems ecology" place greater emphasis on the political-economy filter through which population pressure, among other factors,

must work itself out (Ashby, 1985; Wachter, 1992; Blaikie and Brookfield, 1987; Blaikie, 1989; and Stonich, 1986). Political conflict may result in land degradation. It depends on the strength of the various actors within the political economy. Hecht and Cockburn (1990), Thiesenhusen (1991) Tucker (1992), and Faber (1993) all argue that livestock and export operations expand at the expense of traditional agriculture in Central America, and lead to land concentration on the part of large holders together with displacement and marginalization of small farmers. In Latin America, 1.3 percent of the land owners possess 72 percent of the land under cultivation. (Thampapillai and Anderson, 1991:215). The result of this increasing concentration is a progressive encroachment onto marginal lands by the politically and economically marginalized farmers and increasing land degradation. In contrast to the Latin American scenario, conflicts between livestock herders and settled farmers have lead to improved land-use management in a number of instances in Africa (Harrison, 1987; and Pereira, 1989).

Lastly, poverty itself is considered to be the driving force behind land degradation. Poor farmers have limited cash income or surplus, high marginal time preferences for money, low levels of education, minimal knowledge of soil management practices, and few as well as expensive sources of credit. Many conservation issues are very similar to those related to poverty (Larson and Bromley, 1990; and Belshaw, Blaikie and Stocking, 1991). Generally, these characteristics of poverty act as constraints upon the implementation of soil management practices as well.

3.2 Property and Theories on Land Tenure

A review of the literature on land tenure and land reform by way of titling and registration requires some prior clarification of terms. For the purposes of this study land tenure and property rights are taken to be synonymous. A basic definition of tenure would be: the set of rules and regulations accepted by a group of people that govern the ownership, use, and transfer of property as well as the enforcement of these rules and regulations.

3.2.1 Open-Access and Common Property

Property is generally labelled open-access, common or private. Bromley (1989b) claims that there is nothing inherent in the resource, but rather it is the form of governance, which determines how the resource is categorized. Others argue that there are inherent attributes as is the case with common-pool resources which have high exclusion costs. These attributes suggest certain kinds of property rights (Ostrom, 1990 and Schmid, 1994).

Open-access resources are defined by the lack of governance. Bromley (1989b) refers to them as "nonproperty." Many individuals have access to the resource; yet, there are no rules dictating management, use, or exclusion. Although he used the term "commons," it was actually open-access property that Hardin (1968) referred to in his famous study "Tragedy of the Commons." Briefly, he argued that where demand for an open-access resource is significant, opportunistic behavior invariably results in serious resource degradation.

Common property is defined several different ways in the literature.

Southgate and Runge (1990) distinguish common property from open-access based upon the presence of cooperation among individual users defined by a set of rules that specify joint use rights. Larson and Bromley (1990) expand this definition to include restrictions on group size. Bromley (1989b) claimed that there are two requisite conditions of common property: 1) there must be a "management group" or owners who have the right to exclude others, who, in turn, have to abide by the rules of exclusion; and 2) the individual members of the management group have certain rights and obligations governing their use and the maintenance of the resource. He later modified this view through his work with Larson (1990) stating that common property need not be communally owned. Schlager and Ostrom (1992) characterize common property according to two types of rights: 1) the "operational-level" rights which pertain to access to the resource as well as withdrawal of product, and 2) the "collective choice" rights whereby one can participate in the decisions that regulate management, exclusion, and alienation. These rights are said to evolve rather than remain static. Using Honduras as an example, national and *ejidal* land are associated with operational-level, but not collective choice rights. The rural community as a whole does not share in decisions concerning the establishment and modification of rights. It is strictly within the jurisdiction of the municipality. The basic shared thread among these views of common property is that there are always multiple users bound by a set of rules which govern management, use, exclusion, and alienation. Lawry (1990) suggests that there is a "minimum definition" of common resources. At a minimum, the rules define users and those excluded from use. "Internal governance," or user rules, would be necessary only where demand exceeds supply.

According to Gibbs and Bromley, in order for any property regime to be efficient, stable, resilient, and equitable it must possess the following four attributes:

1) to be efficient, a minimum of disputes and limited effort necessary to maintain compliance;
2) to be stable, the capacity to cope with progressive changes through adaptation;
3) to be resilient, the capacity to accommodate surprise or sudden shock;
4) to be equitable, a shared perception of fairness among the members with respect to inputs and outcomes (Gibbs and Bromley, 1989:26).

Larson and Bromley have identified two axioms that underlie the performance of any property regime. The "composition axiom" states that "..complete control of a resource must be vested in a well-defined group for socially efficient use." The "authority axiom" asserts that this group "..must also act with unified purpose." (Larson and Bromley, 1990:241). Lawry points out, that there are two basic problems related satisfying these axioms under a common-property regime. First, the "problem of incentives" states that individual members of a group often have insufficient incentives to participate in community-based management. Second, the "problem of authority" refers to the difficulties a community faces in establishing rules and regulations for use and maintenance. Lawry (1989) maintains that many communities in less developed countries are unable to promote the necessary cooperation and enforce rules. In sum, community members have difficulty cooperating and policing individual member's behavior.

3.2.2 Rationalization of Private Property

Private property is seen as the alternative to common property. In the literature, private property is generally treated as synonymous with private individual property. Moreover, the most common depiction of individual private property is what is referred to as unattenuated or proprietary rights. The set of conditions underlying these rights are that they must be: 1) completely specified with respect to ownership, restrictions on ownership, and penalties for violation; 2) exclusive in that rewards and penalties accrue directly to the owner; 3) transferable; and 4) enforceable and completely enforced (Randall, 1987:177-178).

Ault and Rutman (1979) claim that land tenure systems evolve according to economic efficiency and toward individual private property. Boserup, Cohen and others assert that tenure evolves naturally from traditional communal systems to private individual regimes due to population pressure and the resultant need to intensify agricultural land use (Cohen, 1980; Boserup, 1981; Binswanger and McIntire, 1987; Dorner, 1992; Wachter, 1992; and Place and Hazell, 1993). Similarly, Feder and Noronha (1987:146) proclaim that "..customary tenure rights evolve toward stronger, more alienable individual rights as population pressure on land increases, technologies change, and agriculture becomes more commercialized." Researchers and policy makers who adhere to the doctrine of neo-classical economics contend that in a well-functioning market economy, unattenuated property rights are necessary for the efficient allocation of resources (Tietenberg, 1992; and Clay, Guizlo and Wallace, 1993). Moreover, many analysts and policy makers maintain that even where market imperfections exist, the competitive market solution is preferred. Quiggin (1988:109) would refer to this

group as the "externality theorists."

These and other scholars see indigenous tenure as constraints on agricultural development. They argue that indigenous systems are inflexible and outmoded. Referring back to Larson and Bromley's two axioms of property rights (i.e., composition and authority), the argument for individual private property claims that the most unified group is that which is comprised of one individual, and that groups are not able to act in a socially preferred manner.

Much of the literature on land titling and registration is limited to titles of ownership, either individual or group, and ignores the possibility of titling usufruct rights. As a result, the following arguments for establishing greater security of rights through titling are somewhat erroneously tied to ownership. Green (1987) summarizes well the basic reasons behind individual land titling and registration. Such a system is expected to increase land tenure security. This enhanced security stimulates investment in land. A dynamic land market ensues and encourages a reallocation of land to its' most productive use. She notes that registration can also provide a data base from which a system of land taxes can be instituted. Ault and Rutman (1979) add that individualization of property rights reduces the costs of litigation over land disputes.

Feder and a number of his associates contend that land titles are necessary for use as collateral in acquiring loans for much needed investment (Feder, Ochan, Chalawong, and Hongladarom, 1986; Feder and Norohna, 1987; Feder, 1987; and Feder and Feeny, 1991). In fact, Feder and Noronha (1987) say that it is not security of use that matters but rather security to alienate and transfer land. Finally, Migot-Adolla, Hazell, Blarel, and Place (1991) contend that land registration

programs would be worthwhile where indigenous tenure systems are absent or weak, where land disputes are numerous, and where there are plans for a substantial development project.

With respect to the influence of tenure on investment decisions, transactions costs economics would explain the advantages of private individual property rights in the following manner. Insecurity of ownership increases the costs of clarifying the status of a given property and adds an element of uncertainty, diminishing the value of the investment and increasing risk. Furthermore, lenders provide less credit at a higher cost to the borrower (i.e., a higher rate of interest with a shorter payback period). From the borrower's perspective, the lower gross benefits combined with both a higher rate of interest and an additional risk factor further reduce the present value of, and internal rate of return on, the investment. The net result is greater inefficiency and a bias toward shorter-term investments (Barrows and Roth, 1990; Williamson, 1985; Schmid, 1987; and Johnson, 1972). It is argued that land titling and registration would reduce these transactions costs and consequently increase efficiency.

3.2.3 Criticisms of Private Titles and Registration Programs

There is considerable skepticism in the literature concerning the merits of programs that: 1) promote the transformation from traditional communal usufruct property systems to new private ownership regimes, 2) institute land registration, and/or 3) assist in the development of land markets. First of all, titling programs and land registries are expensive to establish and maintain. Properties need to be delineated, located on topographical maps, and assigned unique identification

numbers. In addition, a system must be installed in order to track ownership transfers and property redefinitions (Schweigert, 1989).

There are also difficult decisions as to who will bare the costs. Stanfield evaluated some of these costs for Honduras, Ecuador and St. Lucia. Costs for delineation and mapping ranged from $41 to $96 per parcel, and from $89 to $118 for titling (Stanfield, 1990:23). Although he feels these costs are minor, for a small farmer they are substantial: a small Honduran farmer may have 3 or 4 parcels of land, and an annual income well below the national average of $900. Wachter (1992) notes that the costs may vary indirectly according to farmer income. Wealthier farmers have larger plots making titling less expensive when costs are viewed on an area basis.

Many natural resource policies in Latin America take the form of credit assistance, subsidized inputs, extension, and/or tax breaks linked to land ownership. In this case, property confers privilege. Consequently, the price of land is bid up, creating a larger gap between the land prices and the return a small farmer can expect from his/her subsistence enterprises. When titling programs are established concurrently with these types of programs, there may be some serious indirect social welfare issues that are overlooked.

From a practical point of view, the theoretic argument that unattenuated individual rights are more efficient is dubious. Many game theorists using a "prisoner's dilemma" game structure claim a strict dominance of individual strategies (private individual rights) over cooperation (common property). However, these conclusions are based on two conditions which are rarely met: 1) the objective functions of all members are independent of one another (i.e., separable),

and 2) each member can ignore all external costs to others.

A more likely scenario, particularly in less developed countries, would be that markets are not perfect, (Hecht, 1985; and Anderson and Thampapillai, 1987), land is heterogenous, buyers and sellers can influence price, bureaucratic procedures abound, information is imperfect, and there are barriers to entry in land markets (Shearer, Lastarria-Cornhiel, and Mesbah, 1990). This model is certainly more indicative of Honduras.

The distinction between the assignment and security of land tenure constitutes another issue of debate within literature. Many researchers argue that it is not the title or the type of tenure which is important but rather the security of that tenure (Blaikie and Brookfield, 1985; Bruce, 1985; Atwood, 1990; Bromley and Cernea, 1990). From Bromley and Cernea's standpoint, many researchers and policy makers simply confuse policy objectives such as land security with policy instruments i.e., property ownership and titles (Bromley and Cernea, 1990). Roth and Barrows purport that it is not the assignment of ownership which is critical to establishing security, but rather the clarity and enforceability of rights. They state that a clear definition of property requires that rights: 1) are allocated to specific individuals or groups, 2) are easy to identify and verify, and 3) have legal recourse and certainty (Roth and Barrows, 1988:5).

Unfortunately, even those researchers supposedly studying land tenure security typically measure or equate security with the possession of certain types of rights and documents (e.g., titles, registries) without accounting for enforceability. It is also important to recognize that the extent or duration of land tenure security need only be long enough to guarantee the expected payback. Therefore, the

required level of land tenure security is, in part, dependent on the type of investment.

Supporters of individual private property argue that enforcement is easier under private property as compared to common-pool regimes; yet, their rationale is rarely explicitly expressed, nor is it particularly obvious. Research findings suggest that the actual performance of newly established land markets has been disappointing. Coles (1989), Stringer (1989), Stanfield (1990) and Schweigert (1989), citing from independent studies on Latin America, and Green, making observations on Africa, all conclude that land transfers after the initiation of titling programs did not increase significantly, if at all.

The provision of credit is a common justification for titling programs. Various studies have concluded that land titles are a prerequisite to investments in land while failing to evaluate the combined effect of titles and credit which is tied to land as a form of collateral (Feder, Ochan, and Hongladarom, 1986; Southgate and Runge, 1990; Blarel, Hazell, Place, and Quiggin, 1992; and Place and Hazell, 1993). Moreover, these conclusions favoring titling may be erroneous given the presence of selectivity bias. Under a voluntary land registration system (i.e., where registration results from farmer initiative), many of the farmers seeking titles will be those who are more apt to make investments in the first place (Carter, Wiebe and Blarel, 1990). Titling may be just providing these farmers with an additional avenue for acquiring credit.

Invalidating the title/credit link, are banks and money lenders who do not accept marginal land as collateral and many farmers will not use their land as collateral after acquiring title for fear that they could loose it (Green, 1987; and the

author's field experience). Furthermore, the interest rate in most less developed countries, especially in the informal credit sector, can easily be upward of 40 percent, as can the marginal time preference of money for poor farmers. Bromley and Cernea (1991) suggest that with a discount rate of 10 percent benefits accruing beyond 20 to 25 years are essentially valued at zero in today's dollars. High interest rates and time preferences favor short-term investments regardless of tenure.

There are many alternative types of credit schemes using animals, houses, and production as collateral. Titling land is not the only option. Accurately specifying what is the true relationship between these factors and investment is critical to the decision concerning the appropriate orientation of development programs, i.e., titling, revision of credit institutions, or both.

Finally, Fandiño (1993) asserts that land titling programs in Latin America, including Honduras, do not take into account the semiproletariat role of small farmers, i.e., engaging in subsistence agricultural production as a means to supplement insufficient earnings from labor force participation. The elimination of rent and sharecropping arrangements as well as the establishment a minimum farm size, both common complementary policy tools, ignores this wage/farming link. Green (1987) further contends that titling programs enhance the power of the outside authority administrating the program and concentrates the power in the hands of the educated elite.

3.3 Definitions and Theories of Technology Adoption

There are several significant differences between decisions to adopt soil conservation practices as opposed to improved annual crop varieties or mechanization. Like mechanization, the initial installation of some soil conservation practices can be costly. Unlike mechanization, the costs of soil conservation practices can not be lessened through rental agreements. In addition, the effect of a given practice on soil erosion or indirectly crop yields tends to emerge over time, not in one agricultural season. Incorporating practices which render some form of short-run soil fertility enhancement or by-products from trees, shrubs, and grasses can speed up and enlarge the stream of returns.

The benefits of improved soil conservation or management practices may be hard to observe and quantify. They may be in the form of mitigating progressive degradation rather than improving yields per se. They may be measured in environmental quality improvements instead of economic returns. In some instances, community cooperation is necessary for conservation measures to be effective. These differences distinguish adoption of conservation practices from the broader study of technology adoption. However, the two could be viewed as intersecting sets with some important shared attributes.

3.3.1 Aggregate Verses Individual Adoption

Theories on technology adoption are numerous and varied. This stems partly from the multitude of definitions there are of adoption. One major distinction is that of adoption in the aggregate verses adoption on an individual farm. Researchers who study adoption in the aggregate are concerned with the number of farmers

adopting, the total land area under the new practices, how the innovation spreads throughout a region, and the aggregate commodity supply shifts based on the overall rates of adoption (Lockeretz, 1990; Dinar and Yaron, 1991; and Feder, Just and Zilberman, 1985). Generally, aggregate adoption studies are commodity specific dealing with a single innovation or package of innovations such hybrid annual crop varieties and complementary inputs. Agricultural mechanization and irrigation have also been studied in the aggregate.

3.3.2 Definitions of Adoption at the Individual Farm Level

Even within the body of micro or individual farm studies, the definition of adoption varies. It can be defined as whether a farmer adopts a complete package of practices or just one or more components. Studies taking this approach generally measure the likelihood that farmers with given characteristics will adopt. Innovation can also be specified by intensity, which is often measured by the number of new practices (Hanson, Erbaugh and Napier, 1987; and Lynne and Rola, 1988). For these types of studies, the most common specifications of adoption are a dichotomous (i.e., two possible outcomes) or multinomial (i.e., series of possible outcomes) dependent variable. (Lee and Stewart, 1983; Lynne and Rola, 1988; Lynne, Schokwiler, and Rola, 1988; Londhe, Pascual, VanWagner, Gabunada, and Pomeroy, 1989; and Lin, 1991).

For other researchers, adoption is dynamic rather than a dichotomous choice. (Duff, Stonehouse, Blackburn, and Hilts, 1992). Ervin and Ervin (1982) defined two distinct aspects to the adoption process: 1) the decision to use one or more soil conservation practices, and 2) "effort" which they defined by the difference

between the before and after erosion rate. The greater the change, the greater the effort. Igodan, Ohaji and Ekpere (1988) created "adoption scores" which imputed a degree of difficulty based on the percentage of adopters in the area. An individual household's adoption decision was weighted accordingly. Effort has also been interpreted as the dollar amount of investment in land (Place and Hazell, 1993).

Innovation can refer to extent, meaning the area over which the farmer installs the practice. Such studies measure the influence of a set of variables on the spread of innovation throughout the whole farm. Some studies distinguish between early adopters, or the real innovators, and late adopters (Bultena and Hoiberg, 1983; Taylor and Miller, 1978; and Duff, Stonehouse, Blackburn and Hilts, 1992). Finally, adoption can be defined by a time interval, implying that the farmer has gone beyond the experimental stage and committed him/herself to the use of the innovation (Rogers, 1962; and Feder, Just, and Zilberman, 1985).

3.3.3 Theories on Adoption

There are several good reviews of the soil conservation adoption literature. Duff, Stonehouse, Blackburn and Hilts (1992) identify four main classes of approaches: 1) traditional diffusion, 2) economic constraint, 3) revised diffusion, and 4) their alternative structural model. The traditional diffusion model is a restatement of Roger's work (1968). Roger contended that an individual passes through five stages in the adoption process: persuasion, decision, implementation, and confirmation. Extension is a critical factor according the diffusion theorists. Economic constraint models are rooted in a constrained profit or utility maximizing framework. Motivations of the individual, household or corporation are implicitly

assumed. The revised diffusion approach asserts that there are differences between environmental and commercial innovation. Analyses combine economic, institutional and behavioral variables. Finally, the alternative structural model, focuses on agricultural institutions more so than individual attitudes, motivations, and decisions. Attention is given to property rights, policy measures, programs, and other institutions. This last approach can be viewed as a combination, and an extension, of the other three.

Hansen, Erbaugh and Napier (1987) assert that there are two alternative approaches to adoption. The first is Roger's diffusion model which utilizes variables that capture both the farmer's access to support service and his/her attitudes. The second is the farm-structure model which downplays these variables and concentrates on socioeconomic characteristics of the farm family. The authors maintain that a more accurate and powerful framework results from combining these two approaches.

Lockeretz's (1990) review provides a good background on soil conservation research. He notes that most studies can be classified into the following three views on adoption: 1) economics is the main consideration for innovation, 2) conservation adoption decisions are essentially the same as all other adoption decisions, and 3) conservation practices are concerned with environmental quality and not economic returns. He argues that the variables which have commonly appealed to researchers can be classified into five groups: 1) personal characteristics including age, education, etc; 2) farmer institutional connections; 3) attitudes; 4) farm characteristics such as ownership, size, indebtedness, cropping pattern, etc; and 5) physical potential for erosion defined largely by the universal soil loss equation.

It should be noted that scholars in the fields of forestry and agroforestry would argue that it is not land tenure but rather tree tenure which is important with respect to soil management practices utilizing trees. Holding other factors constant, if a tree has valuable product other than enhancing soil fertility and reducing soil erosion, secure tree tenure alone should be a sufficient incentive for adoption (Raintree, 1987; and Rocheleau, Weber, and Field-Juma, 1988).

A number of researchers suggest reasons why the adoption of soil conservation or management practices have been in many instances minimal. Farmers tend to be reluctant to alter their farming activities in a way which enhances risk. Poor communication systems; unreliable input delivery systems; insufficiently explained, overly expensive, or inappropriately designed practices; unfavorable policy-induced market distortions, and opportunity costs to labor all constrain a farmer's judgement and ability to act (Sanders, 1990; Napier, Napier, and Tucker, 1991; Fujisaka, 1992; Reardon, 1994).

3.4 Applied Research on Tenure and Technology Adoption

Most aggregate analyses of technology adoption have employed estimations of production or supply equations, whereas micro studies more commonly utilize basic descriptive statistics; Pearson correlation coefficients; discriminant analysis; or dichotomous choice models such as probit, logit or tobit functional forms. In contrast to aggregate studies, most micro analyses measure probabilities or likelihoods of an outcome. In the aggregate, it makes sense to evaluate the resultant change in one factor based on a change in another. For example, it would be interesting to determine how many new farmers would adopt, or how much

additional area would come under a given practice, if extension was increased a certain amount or an institutional variables were altered in some specific way. Farmers and land area are essentially continuous variables in the aggregate. Conversely, these types of relationships make less intuitive sense on at the farm level. Because of the lumpiness of some conservation investments, estimating relationships such as the percentage change in the area of a farm under a particular practice due to a percentage change in income, or an increase in numbers of conservation practices given an increase in credit, is unlikely to provide meaningful or statistically significant results. For this reason, micro or individual studies tend to employ methods which evaluate the likelihood of a farmer adopting one or a number of practices.

Although there is significant overlap, studies have tended to focus on one of the following sets of explanatory variables: socioeconomic, biophysical, attitudinal, or institutional. Despite the contradictions and variation in the literature, some relationships have been repeatedly hypothesized and tested. Factors which have been found to have an inverse relation to adoption of soil conservation are: the opportunity costs of labor, discount rate, risk aversion, farmer age and experience, costs of conservation inputs, indebtedness, and depth of soil (Taylor and Miller, 1978; Lee, 1980; Seitz and Swanson, 1980; Walker, 1981; Norris and Batie, 1987; Southgate, 1988; Pagoulatos, Debertom, and Sjarkowi, 1989; Lynne, 1988; Fujisaka, 1992; Kerr and Sanghi, 1992; and Medina, 1992). These relationships are summarized on Table 3.1.

It should be noted that a number of researchers came to opposite conclusions. Earle, Rose, and Brownlea (1979) reported a weak but positive

Table 3.1 Factors Influencing Farmers' Decision to Adopt Soil Conservation As Identified in the Literature

Factors Exhibiting an Inverse Relationship (-)	Factors Exhibiting a Direct Relationship (+)
Opportunity cost of labor	Ownership, type
Discount rate	Ownership, security
Risk aversion	Income or Economic Status
Indebtedness	Awareness of practices
Soil Depth	Length of slope
Age	Steepness of slope
Experience in farming	Credit availability
Cost of soil conservation practice	Returns to soil conservation investment
	Farm size
	Extension
	Management time-horizon
	Level of education
	Attitudes toward land stewardship

relationship between interest rate and soil conservation without giving an explanation. Lynne, Shonkwiler, and Rola (1988) emphasized the role of attitudes and beliefs in their study of Florida farmers. While views supporting the preservation of nonrenewable resources and the need to reduce off-site effects of farming activities where positively correlated with conservation investments, the variables for profit and technology orientation had significant negative coefficients.

Although there are a number of studies where the results were either inconclusive or contradictory to the list which follows, the list represents the general findings reported in the literature (see Table 3.1 for a quick reference).

Factors with a positive relationship to adoption of soil conservation practices include: land ownership or security, returns to the specific practice, management time-horizon, income and economic status, awareness of degradation problems, steepness and length of slope, credit availability, level of education, farm size, and extension (Bultena and Hoiberg, 1983; Montanez, 1985; Feder and Ohchan, 1987; Nesman and Seligson, 1987; Igodan, Ohaji, and Ekpere, 1988; Lynne and Rola, 1988; Lynne, Shonkwiler, and Rola, 1988; Londhe, Pascual, VanWagner, Gabunada, and Pomeroy, 1989; Nesman and Seligson, 1989; Bentley and Melora, 1991; Migot-Adholla, Hazell, Blarel and Place, 1991; Clay, 1992; Kerr and Sanghi, 1992; Rivas, 1992; Yaron, Dinar and Voet, 1992; and Place and Hazell, 1993).

It should be noted that significant coefficients on tenure were reported for some, but not all, of the regions or separate equations included in several studies mentioned above (Feder, Ochan, Hongladarom, 1986; Feder and Ochan, 1987; and Migot-Adholla, Hazell, Blarel and Place, 1991). There are a number of instances where the coefficient on the tenure variable was insignificant but possessed the expected sign given the researchers' underlying framework (Barbier, 1990; Cashman, 1990; Medina, 1992; and White and Runge, 1992). In some cases where credit and extension were not explicitly specified, the correlation of tenure might have been confounded with that of the latter two variables. Several studies have suggested that modern tenure systems can increase insecurity (Hardy, 1991; and Barrantes, 1993). For example, Meyers (1990) noted that women's tenure security had been undermined by the new system instituted in Southern Nigeria.

Land tenure is most commonly specified as exogenous. Case studies often make the distinction between land tenure and security of land tenure. Quantitative

analyses usually do not. Most tenure specifications are limited to titled verses untitled, or ownership verses rented. Roth (1990) proposed indicators of land tenure security, while Place and Hazell (1993) attempted to operationalize this important distinction. They defined security as the combination of use and transfer rights, which ranged from most secure (a complete set of rights) to least secure (with limited transfer). There was no indication of reliability of enforcement (i.e., tenure security).

Tenurial relationships are most often evaluated at the farm, rather than plot, level. These studies do not actually assess the relationship between ownership and investment in situations where farmers have multiple parcels with varying forms of tenure. In one case, farmers were classified as owners if they possessed a title for any one or more of their many plots. This judgement was based on the farmers ability to acquire investment credit for an untitled parcel using a titled parcel for collateral. The analysis did not peg investments to specific parcels (Feder, Ochan, Chalamwong, and Hongladarom, 1988). This notion confuses credit access with a secure payback period. Why would a farmer rationally wager a titled parcel against an investment on an insecure parcel? Place and Hazell construct a structural model based on plot-level data. They found that generally land rights were not significant determinants of investments in land (Place and Hazell, 1993).

The use of farm size in econometric modelling has frequently yielded inconclusive or contradictory results (Medina, 1992; Yaron, Dinar and Voet, 1992). This appears to be more often the case for studies in Latin America. Researchers postulate that poor farmers who can not expand their land under cultivation, and who have had to reduce their dependence on swidden agricultural traditions, have

opted to invest whatever excess labor they have available in establishing and maintaining soil conservation and management practices. In contrast, large farmers have expansive tracks of lands managed under nonintensive systems with sufficient area available for fallow. They do not perceive the urgent need for conservation.

Ladewig and Garibay (1983) found that soil and water quality, increasing production costs, and availability of information drove the decision to invest in conservation. Hansen, Erbaugh, and Napier (1987) argue that socioeconomic variables are not good indicators of the likelihood of adoption. Variables related to the process of diffusion and other support services have greater predictive power. In one case, producer price was reported to be directly correlated with innovation (Pagoulatos, Debertin, and Sjarkowi, 1989). Wollenberg (1991) found that access and allocation of production inputs as well as market integration influenced conservation innovation.

Clay (1992) evaluated the effects of land fragmentation measured by the distance from the homestead to the plot. He found that the more distant rented plots were more productive. Clay rationalizes these seemingly counterintuitive findings stating that poor farmers would own relatively low quality land and rent supplemental better quality land that was often located at some distance from their homes. Regardless of the additional investments in their own land, the rented plots still preformed better.

3.5 Departures of this Study

This study makes a number of departures from the body of literature reviewed above. In Honduras, property governed nationally, locally and privately can

be found within the same community. It is not uncommon to find farmers who cultivate a number of plots that are governed under different property right regimes. For example, a farm may own one private parcel and in addition cultivate parcels of national and/or *ejidal* land. In some cases, a single plot can be divided among more than one form of property rights. This study links investments and tenurial rights to the specific parcel. It allows for a comparison of parcels with usufruct rights to those with fee simple rights.

Using the various sets of attributes for preferred property rights regimes presented in the literature, the study compares the existing or customary tenure regime with that instituted under the 1992 Modernization Law and the land titling program. This analysis illuminates the utility as well as the social costs and benefits of such an expensive transformation of land tenure in Honduras.

The study will also test for the Honduran case a number of the hypotheses developed in the literature concerning land tenure and adoption of improved soil management practices. Researchers and field workers in Honduras have formed a number of hypotheses specifically relevant to Honduras. For example, off-farm income is invested back into agriculture and thus has a positive relation to adoption, farm size is inversely related to productivity and innovation, and titles do not automatically translate to greater access to credit. These views on Honduran farmer behavior were presented in greater detail in the background section.

Some specific questions to be addressed for the Honduran case include the following. Does the right to transfer land make a difference in Honduran farmers' adoption decisions? In Honduras, does having a title assist a farmer in acquiring credit? Do farmers actually want to use their land as collateral for loans? Does

possession of a title affect the price of land? Finally, this study provides a description of soil management adoption in part of Honduras which is generally less-well studied.

CHAPTER FOUR

METHODS

4.1 Field Research

This research is based on information gathered from a number of sources. The researcher conducted many informal interviews with key informants during two separate trips to Honduras: first while working as a Research Analyst for the International Food Policy Research Institute, and second in the capacity of an independent doctoral candidate responsible for designing and supervising primary data collection. The author undertook primary data collection activities in collaboration with a Michigan State University/CRSP researcher and a small enumerator team. Land tenure and soil management questions specific to this dissertation research were incorporated into a MSU/CRSP study of bean production and marketing. Staff at the National Agricultural Census (CNA) supplied data, topographical map interpretation, and computer programming for all stages of the sampling procedures. David Leonard of the LUPE project furnished information on returns to improved soil management practices as well as ideas on criteria for grouping soil conservation practices. Jolyne Melmed-Sanjak, a consultant with Chemonics International Consulting Firm, provided valuable literature and data related to land tenure, and critiqued the tenure component of the questionnaire.

4.1.1 Sampling Design and Area Sampled

The sample was restricted to the major bean producing areas of the departments of Francisco Morazan, El Paraíso, and Olancho because of their relevance to the MSU/CRSP project. In and of itself, this restriction did not compromise the author's research since the departments are representative of Honduras. However, results of the analysis of soil management practices would likely have been strengthened had the study utilized sampling techniques structured to include more adopters of these practices.

4.1.1.1 Sampling Design

The CNA subdivides municipalities into segments which, based on the population density and terrain, represent an estimated targeted number of labor hours required for complete enumeration of an area. Using CNA data, segments located within this region were eliminated if less than 30 percent of the farmers produced beans. Due to budget and logistical constraints, a number of remote and inaccessible segments were also removed from the sampling frame. Topographical maps of the remaining area were eyeballed in order to characterize the segments as either hilly or flat. An equal number of each type of segment were then randomly selected. Developed for the purposes of the bean study, the latter procedure had the unfortunate consequence of reducing the number of hillside farmers, those who were more relevant to this specific study.

For these sampled segments, the CNA provided a list of all producers ordered by size. A final stratified random sample of 230 farms was drawn equally from each type of segment using three ranges of farm size as stratifiers: less than 2

ha, from 2 to 10 ha, and greater than 10 ha. An equal number of farms were selected from each strata. This study was particularly interested in highlighting those farms that fall below the minimum size requirements defined by the various land reforms and decrees, i.e., 1 and 5 ha, and comparing them to those of the "preferred" size. This procedure unfavorably altered the sampling probabilities of these groups of farmers.

Finally, a number of households with improved soil management practices were purposively added to the sample while the survey work was in progress. Prior to sampling, there was no information on whether households used soil management practices. The responses to the one soil conservation question contained within the 1993 census questionnaire (i.e., the sampling frame) proved to be unreliable, and thus inappropriate as an ex-anti stratifier. Since use of these practices is a scarce phenomena in Honduras, the survey team made an extra effort to include communities and individual households that used practices. As a consequence, statistics concerning Honduras as a whole can not be derived from this sample.

4.1.1.2 Characteristics of the Area Sampled

The sample covered four or five municipalities from each department. Francisco Morazan included Cedros, Guaimaca, Marale, Orica, and Talanga. From El Paraíso there was Danli, Jacaleapa, San Lucas, and Teupasenti. And, the sample from Olancho included Guarizama, Guayape, Juticalpa, Mangulile, and Silca. Overall, the area of the study is representative of Honduras; however, there are some noteworthy differences among the departments. Table 4.1 contains

Table 4.1 Basic Land Characteristics of Sampled Departments

Characteristic	El Paraíso	Fr. Morazan	Olancho
Area in Ag. (including livestock), 1993[a]	514,826	285,175	783,296
Percent Change in Area in Ag., 1974-1993	48%	8%	138%
Agricultural Households, 1993[a]	25,186	23,904	28,085
Percent Change in Households 1974-1993	77%	36%	104%
Average area per Household (ha), 1993	14	8	19
Percent of Area Forested[b]	30-60%	30-60%	>60%
Percent of Farmers with Strictly Private Tenure[c]	40%	54%	31%
Percent of Farmers with Strictly National or Ejidal Tenure[c]	25%	14%	46%

[a]SECPLAN. (1993d). Cuarto Censo Nacional Agropecuario: Resultados Preliminares. Tegucigalpa, Secretaria de Planificacion, Coordinacion y Presupuesto/Secretaria de Recursos Naturales. [b]Jones, Jeffery and Alfonso Pérez. (1982). "Diagnostico Socio-Economico Sobre el Consumo y Produccion de Leña en Honduras." Turrialba, CATIE, Departamento de Recursos Naturales Renovables. [c]Does not include farms with mixed tenure. Data provided by the CNA from the 1993 Census.

information on a number of characteristics such as land area, agricultural population density, and tenure. Olancho is clearly the largest department and has undergone a rapid population influx and accompanying land-use transformation over the past 20 years. Despite this dramatic change, a greater proportion of the land area remains public (64 percent). In contrast, Francisco Morazan has the highest population density and proportion of private land. In this way, the table does suggest a direct relationship between population density and area under private tenure.

Tables 4.2 and 4.3 illustrate the distribution of land tenure by area and farms

respectively. "Mixed" tenure refers to farms that possessed parcels of land under a variety of tenure arrangements. CNA has not disaggregated this portion of the census data. The "dominant form" columns included on both tables evaluate non-mixed tenure only. It should be viewed as a rough assessment given the magnitudes of mixed tenure in some instances, both in terms of area and farm percentages (e.g., 46 percent of farms in Marale are under mixed tenure). In terms of area, public lands are significant in number of municipalities of all three departments. Jacaleapa (73 percent), San Ignacio (91 percent), Guarizama (85 percent), and Juticalpa (88 percent) have predominately private land, whereas Mangulile (80 percent) and San Lucas (60 percent) are characterized by mostly public land.

The results change when looking at the percentages of farms. The percentage of farmers with private holdings is only 41 percent in Jacaleapa. Although the area in Silca is mostly private (46 percent), farms are mostly public (63 percent). This suggests that land may be highly concentrated in a few private hands. Juticalpa, on the hand, is predominantly private both in terms of area and number of farms.

Francisco Morazan is more centrally located with respect to the rest of the country and possesses a relatively good network of roads. There are more urban and market centers such as Tegucigalpa, Talanga, and Guaimaca. As a result, there is more higher-valued commercial horticulture production. Tomatoes were introduced to the region three or four years ago. Tomato growing is a lucrative enterprise which provides considerable employment opportunities. The relatively

Table 4.2 Percentage Distribution of Tenure According to Area by Sampled Municipalities

	Type of Tenure					
Municipality	Mixed	Private	Public	Rented	Other	Dominant form
El Paraíso:						
Danli (%)	15	66	16	2	1	pub
Guinope (%)	36	28	34	1	0	pub/priv
Jacaleapa (%)	6	73	18	2	1	priv
San Lucas (%)	23	12	60	6	0	pub
Teupasenti (%)	63	32	3	1	0	priv
Fr. Morazan:						
Cedros (%)	14	74	9	2	0	priv
Marale (%)	43	17	39	1	0	pub
Orica (%)	33	11	41	2	13	pub
San Ignacio (%)	6	91	1	2	0	priv
Olancho:						
Concordia (%)	16	48	32	4	1	pub/priv
Guarizama (%)	11	85	3	1	0	priv
Guayape (%)	51	14	25	10	1	pub
Juticalpa (%)	7	88	4	0	0	priv
Mangulile (%)	14	5	80	1	0	pub
Silca (%)	22	46	28	3	0	priv

SOURCE: IV Censo Nacional Agropecuario 1993, Tegucigalpa.
NOTE: no figures were available for the municipality of Distrito Central of Francisco Morazan.

higher level of infrastructure development unfortunately fosters greater deforestation as well. Although not always legal, commercial fuelwood and lumber extraction is conspicuous in this area. Nevertheless, a number of sawmills provide steady employment for some communities.

Table 4.3 Percentage Distribution of Tenure According to Number of Farms by Sampled Municipalities

	Type of Tenure					
Municipality	Mixed	Private	Public	Rented	Other	Dominant form
El Paraíso:						
Danli (%)	12	40	22	16	10	pub\priv
Guinope (%)	25	19	48	6	2	pub
Jacaleapa (%)	12	41	24	14	9	priv
San Lucas (%)	27	10	44	19	0	pub
Teupasenti (%)	23	35	32	6	5	pub/priv
Fr. Morazan:						
Cedros (%)	18	55	13	11	3	priv
Marale (%)	25	16	54	2	2	pub
Orica (%)	13	14	55	6	12	pub
San Ignacio (%)	4	82	1	9	3	priv
Olancho:						
Concordia (%)	4	25	56	14	2	pub
Guarizama (%)	17	73	1	7	2	priv
Guayape (%)	33	14	30	21	2	pub/rent
Juticalpa (%)	5	85	5	4	0	priv
Mangulile (%)	12	3	80	5	0	pub
Silca (%)	14	15	63	8	0	pub

SOURCE: IV Censo Nacional Agropecuario 1993, Tegucigalpa.
NOTE: no figures were available for the municipality of Distrito Central of Francisco Morazan.

According to LUPE's evaluation of their project areas within Francisco Morazan, average annual rainfall ranges from 890 to 1240 mm. Most farms are between 1.5 and 3.5 ha with slopes of 30 to 50 percent, and the average household is comprised of approximately 5 people. Urban centers are rapidly growing, and cattle is managed under a forest grazing scheme (LUPE, 1988).

ACORDE, COSECHA, IHCAFE, LUPE and MRN are some of the organizations operating in the area. Cooperatives and unions are relatively active here as well.

El Paraíso appears to have a harsher climate than Francisco Morazan. The terrain is extremely mountainous and steep. Average annual rainfall is only 980 mm; soils are poor and degraded; and, in many areas, hillsides are completely denuded of trees. Although there are a number of broad fertile valleys in El Paraíso, the surrounding mountains appear barren. Roads are in terrible condition due, in part, to difficult and time consuming.

LUPE claims that 70 percent of the land in their project areas in El Paraíso is ejidal or national. Informal interviews suggest that renting of land is more common here than in the other two departments. El Paraíso is a major coffee producing area, and the entry point of international trade from Nicaragua. IHCAFE, LUPE, MRN, World Neighbors, and Zamorano work in El Paraíso.

Olancho is a newly settled department. It is best known for expansive latifundio livestock operations, and the "law of the machete." In Olancho, it is not uncommon to see gun toting cowboys or to hear of violent confrontations. Over 50 percent of the land is occupied untitled national land (Faber, 1991). Olancho has experienced a rapid influx of migrants from the south and west as well as both legal and clandestine logging interests. There are fewer development activities than there are in the other two departments. The seat of most projects tend to be in one of the larger urban centers such as Guayape, Juticalpa, or Catacamas with their sphere of influence extending to a few satellite communities. Many of these projects promote commercial agriculture and agribusiness that is expected to supply the larger, more distant markets of Tegucigalpa, Comayagua, and San Pedro Sula.

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4.1.2 Survey Design

The survey team was comprised of two supervisors, six enumerators, and a driver. Due to budget and logistical constraints, the team travelled together working concurrently in several nearby villages. A formal questionnaire was administered once just prior to the onset of planting for the *primera* season. The author also conducted informal interviews with farmers to ascertain more qualitative and subtle information on tenure and soil management issues. Excluding pre-tests and training, the field work took between two and three months to complete.

The recall for production, wage earnings, sales, and purchases extended back an entire year. It is recognized that such a lengthy recall period implies some inaccuracy in the data; however, for the purposes of this study, the researcher is more interested in relative magnitudes than in absolute figures. There were serious problems in collecting data on the costs of improved soil management practices since many farmers had established their practices a number of years ago.

Each enumerator carried diagrams depicting different improved soil management practices (see Appendix C) in order that they could more clearly communicate with the farmers. The enumerators had little prior knowledge of the subject. Many farmers used local or inaccurate names for practices they had seen or installed. This technique proved to be invaluable for both clarifying terms and promoting greater dialogue.

4.1.3 Questionnaire Design

The questionnaire design was greatly influenced by the fact that this study was added onto another already extensive questionnaire. All information was

collected directly from respondents, i.e., the individual responsible for a specific activity. There was no direct measurement. Through informal interviews with key informants, indicator variables for land scarcity and degradation were developed. Unfortunately, a number of questions designed to ascertain the farmer's notion of land tenure security had to be dropped in order to reduce the length of the questionnaire and individual interviews. For further simplification, questions elicited categorical, rather than continuous, data for land attributes and the use of improved soil management practices. Since the use of improved soil management practices is quite limited, questions were devised to capture not only the farmer's use of a given practice but also his/her knowledge of, and interest in, the practice.

4.1.4 Definition of Terms

Terms which have been defined a number of ways in the literature are clarified here in an attempt to reduce confusion for the reader. Adoption was defined a number of ways for comparative purposes, but one definition was preferred. Results of analyses based on alternative definitions are provided in Appendix E. In most cases, and for the all tables, "adoption" refers to a binary choice: a farmer adopts or doesn't adopt. The parcel is the level of analysis for econometric modelling and for most tables. Exceptions are noted on the tables and described in the text.

Alternatively, adoption was evaluated as a continuous choice: the farmer adopts from zero to whatever number innovations. The latter formulation was an attempt to ascertain how extensive or intensive was the farmer's innovation effort. It was also employed to establish the strength of the econometric results. Models

estimated with a continuous choice variable for adoption preformed less than satisfactory, and are included in Appendix E for the reader's interest and further inspection.

Tenure is based on both the type of land (private, national or *ejidal*) a farmer occupies and his/her possession of a document (official INA title, any other document, or none). Technically, rights associated with national and *ejidal* land are usufruct, while with private land they are fee-simple. The distinction between the two types of public land is of interest because of the difference in governing body. The federal government administers national land, and the local municipality governs *ejidos*. For this reason, the expression "type of land" is used throughout this study. The meaning of "ownership" is elusive in Honduras. The survey team was instructed to record however the farmer responded to the question: 'do you own the plot?' Chapter Five includes an evaluation of Honduran farmers' perspective on ownership based on the survey results. This study did not look closely at rental property because until enactment of the 1992 Modernization Law rentals were illegal. Rentals did exist illegally, but it was felt that any information collected from farmers on this topic would not be reliable. Since this is such a new phenomena, little can be concluded at this point about rental behavior.

A household or farm family was defined as all those individuals who live on the farm for most of the year and share the same food. Excluded from the household figures are family members who reside away from the farm regardless of whether they send remittances or receive assistance.

4.2 Data Analysis

4.2.1 Data Limitations

There are some notable problems with the sample data which constrain the range of possible statistical and econometric analysis. The sample was drawn with another set of objectives in mind, i.e., those of the bean study. Collection of plot-specific data was limited to a few physical attributes such as size, slope, soil quality and the existence of improved soil management practices. Information on inputs and credit apply to the overall farm, not specific parcels. As such, it is difficult to evaluate the affects of tenure on the adoption of practices relative to these other factors. A comparison of different components of the questionnaire suggest that not all practices were recorded at the plot level. While a number of farmers stated that they adopted certain practices, a review of the plot-specific data indicates that this information was not always recorded. These errors are attributed to the length and complexity of the questionnaire as well as the technical sophistication of the enumerators. Finally, there is tremendous variation in the data regarding the practices and the inputs involved in the installation and maintenance. Farmers had a difficult time recalling levels of inputs for practices they had either established many years ago or had completed in stages over an extended period of time. Different farmers had their personal views of what constituted a specific practice and how best to establish and maintain it. Due to their inexperience with soil management and the limitations of the survey tool, the enumerators were understandably unable to discern and account for these differences.

4.2.2 Descriptives

This chapter relies almost exclusively on the survey data. Sources noted on the table indicate otherwise. Much of the analysis was based on correlations, crosstabs, and simple anovas. For household-level as opposed to parcel-level analyses, it was difficult to determine the statistical significance of some crosstabs because the number of cases was often quite small. Tables were constructed using the number of farmers who responded to the specific questions associated with a given table or the number of parcels for which data was sussessfully collected. Missing information varies widely across survey questions. As a result, the sample size varies among the tables according to the completeness of the data set. This procedure was selected in order to retain and present as much information possible. Unfortunately, there was no procedure to record the causes for missing data such as distinguishing between whether the respondent did not wish to respond or did not know the answer.

4.2.3 Reason for Stratifying the Analysis

Most of the results are stratified by farm size. As the background chapter indicates, the agriculture sector of Honduras is much like the rest of Central America and is dualistic in nature. Farms that tend to share important characteristics concerning demographic composition, land tenure status, production systems, investment opportunities, and market activities can be loosely classified according to farm size. The placement of farms into four size strata is expected to assist in clarifying how important adoption variables affect the opportunities and behaviors of these different sized farms. The stratification procedure also helps to

test for the possible asymmetric distribution of reform and program impacts. Four strata were primarily selected to capture the effects of changes in the minimum farm size requirement of the titling procedures (i.e., first 5 ha and later 1 ha), but also to identify and emphasize salient difference across farm types.

The *minifundistas* were chosen as the base for two reasons. These are the farms which remain excluded from the land reform and titling process as defined in the most recent reform, the 1992 Modernization Law. As such, the study will emphasize policy impacts on this group. In addition, it is the author's view that the presentation of results is clearer and more logical when using of this strata as the reference point because the strata is more homogenous than the others and *minifundistas* represent an important and vulnerable extreme on the subsistence to commercial farming continuum.

4.2.4 Econometric Models

Econometric models were added to the analysis in order to assist in evaluating expected outcomes of land reform and titling by explicitly holding other variables constant. Land titles contribute to the enhancement of land productivity in two interdependent ways. First, titles cultivate the farmer's sense of land security, and facilitate the acquisition of credit. Both security and credit accessibility encourage adoption of land improvements and consequently increase productivity. Second, titles improve the efficiency of land markets. By clarifying rights, they reduce the costs to the purchaser of acquiring information and limiting the uncertainty associated with the transaction. Land markets are stimulated by the efficiency gain, and encourage a smoother reallocation of land to its' most

productive use. The econometric models presented below are developed in order to statistically test the existence and importance these two proposed roles of land titles.

A land price model was estimated in order to determine whether documentation of land parcels, and in particular official INA titles, increases the price of land through the reduction of transactions costs (see section 4.2.4.2 for further discussion of the relationship between titles and transactions costs). Second, a set of models of adoption of improved soil management practices is specified and estimated. Through the estimation of these models, the effects of land tenure and documentation can be evaluated holding a number of alternative important adoption determinants constant. The estimation results will also allow for a comparison of the relative importance of tenure and other non-tenure factors.

Available data were not sufficiently rich to allow for concise specification of some key variables. In addition, there are questions as to the accuracy of some of the information collected (see section 4.2.1, Data Limitations, for further discussion). Given these two limitations, it is not surprising that the models are not very robust with respect to several explanatory variables. Nevertheless, there are a number of useful and meaningful results.

4.2.4.1 Adoption of Land Management Practices Model

A number of explanatory variables were expected to possess positive coefficients. Investments in longer-term land improvements are directly related to the farmer's perceive security of land tenure. Security can be inferred from several variables. It was hypothesized that farmers who considered themselves owners, and

who had some form of documentation, would be more likely to adopt soil management practices. An outsider may presume that official titles give security when, in fact, farmers may be taking their cues from other factors. To explore this, farmers were directly asked whether they considered themselves owners. Furthermore, those who had an official INA title would have a greater sense of land tenure security and be even more likely to adopt. Given the greater stability in the administration of *ejidal* as compared to national land, it is expected that adoption is positively related to the former while negatively related to the latter. Not only has national land been the subject of numerous decrees reassigning transfer and use rights (see section 2.2.2), but informal interviews with farmers and development workers indicate that land disputes are more common on national, as opposed to private or *ejidal*, lands.

There are non-institutional factors which influence adoption as well. Adoption is expected to be directly related to the slope of the parcel. The greater the slope, the greater the need for erosion mitigating practices. Since labor is the predominant input employed in establishing and maintaining these improved practices, the number of family members working on the farm and the availability of hired labor are expected to be positively associated with adoption. The ability to secure loans, as measured by whether the farmer was able to acquire credit from any source within the past five years, contributes to the adoption of those practices for which the farmer might seek to hire labor to assist in the installation and maintenance.

It was further hypothesized that farmers with poor soils, and who purchase fertilizer and/or basic grains would install practices in an effort to boost performance

and lessen their dependence on cash income in an effort to minimize cash expenditures. Those marketing higher value cash crops, as opposed to basic grains, would have an incentive to adopt because the returns would higher and could exceed the marginal costs of labor required to install and maintain practices.

A smaller number of explanatory variables were expected to have negative coefficients. Adoption would be less on distant parcels. Farmers would prefer to invest in parcels that are easier to supervise and maintain. Distance was measured in terms of minutes required to walk from the homestead to the parcel. Since homesteads in Honduras are generally located nearby roads, this variable also loosely captured accessibility to roads and markets. Consequently, the argument for a negative relationship between distance and adoption is made stronger. Parcels planted to coffee would not be in as much need of improved practices since the establishment of coffee trees mitigates erosion.

Those households with wage earning opportunities (i.e., higher opportunity costs) would tend to allocate their time to wage activities as opposed to installing and maintaining improved soil management investments. This suggests a negative relationship between wage employment and adoption. Development workers in Honduras would argue that this relationship is direct or, in other words, positive. The general model specification is the following:

ADOPT = f(CONSTANT,SOIL,SLOPE,DISTANCE,OWNER,EJIDO,
NATIONAL,INA,OTHERDOC,STRATA2,STRATA3,
STRATA4,LABORFAM,LABORHIRE,OFFFARM,
FERTILIZER,MACHINE,COFFEE,CASHCROP,
SELLCROP,BUYGRAIN,YEARS,CREDIT,EXTENSION
PROJECT,VISIT)

where:

ADOPT = binary parcel-level variable where 1 is adopted one or more practices;
SOIL = categorical parcel-level variable where 1 is poorer soil;
SLOPE = categorical parcel-level variable where 0 is flat, 1 is slightly sloped, 3 is hilly, and 4 is extremely hilly;
DISTANCE = binary parcel-level variable where 0 is under 25 minute walk from homestead to plot and 1 is a walk of 25 minutes or more;
OWNER = binary parcel-level variable where 1 is the farmer perceives him/herself to the owner;
EJIDO = binary parcel-level variable where 1 is a ejidal land;
NATIONAL = binary parcel-level variable where 1 is national land;
INA = binary parcel-level variable where 1 is possession of an official INA title;
OTHERDOC = binary parcel-level variable where 1 is possession of any other document;
STRATA2 = binary household-level variable where 1 is the second farm size strata;
STRATA3 = binary household-level variable where 1 is the third farm size strata;
STRATA4 = binary household-level variable where 1 is the fourth farm size strata;
LABORFAM = number of family agricultural laborers;
LABORHIRE = binary household-level variable where 1 is hires labor;
OFFFARM = number of family members working off the farm;
FERTILIZER = binary household-level variable where 1 is uses fertilizer on the farm;
MACHINE = binary household-level variable where 1 is uses machinery or animal traction on the farm;
COFFEE = binary parcel-level variable where 1 is parcel is planted at least in part to coffee;
CASHCROP = binary parcel-level variable where 1 is parcel planted to cash crop;
SELLCROP = binary household-level variable where 1 is sold crop other than maize or beans during last agricultural year;
BUYGRAIN = binary household-level variable where 1 is bought maize or beans within last agricultural year;
YEARS = number of years working the parcel;
CREDIT = binary household-level variable where 1 is received credit from any source within last five years;
EXTENSION = binary household-level variable where 1 is extension working in the area;
PROJECT = binary household-level variable where 1 is land management development project present in municipality;
VISIT = binary household-level variable where 1 is farmer visited by extension agent within last five years.

This model was estimated twice using a probit procedure on parcel-level data. Information on several variables were collected at the household and replicated for the parcel-level analysis. These include extension, project, visit, fertilizer, machinery, all labor data, and credit. The first estimation included all improved soil management practices while the second excluded managed maize stubble. As indicated earlier in section 2.3.3.2, managed stubble is a traditional practice which is appropriate even for flat parcels. However, as one single practice, it is not well defined and includes a variety of alternative new and improved methods of incorporating the stubble. As such, managed stubble is an improved practice for some farmers, and not for others. This creates some confusion in specifying what is considered adoption of strictly improved practices, and in making simple comparisons across the two models. In the absence of better information, it is, nonetheless, useful to note the differences in performance of the model based on this distinction.

4.2.4.2 Land Price Model

A land price model was specified and then estimated using an ordinary least squares procedure. The unit of analysis was the land parcel. Data on land prices were collected by asking the farmer at what price s(he) could sell the parcel today? These prices were not necessarily actual prices. As a number of theoretical articles and research studies included in the literature review argue, the high transactions costs associated with poorly specified land rights results in discounted land prices. The price model evaluates this supposition.Land prices were expected to be a function of the physical characteristics of the land such as the slope and soil

quality. The greater the slope, the lower the price. The coefficient on slope should be negative. Recall that both characteristics were subjectively evaluated by farmers and not directly measured. Plots located close to the village were thought to be valued higher than those at a distance. Therefore, the coefficient on the distance variable was expected to be negative. Generally, larger plots would be more desirable than smaller ones. They are easier to manage than several small spatially-separated plots. Larger parcels of land also allow for more sub-divisions in the inheritance process, are conducive to a wider range of productive activities, and permit greater autonomy from the rest of the community. Land titles and other documents as well as the installation of soil management practices were expected to have a direct relationship to land prices. Signs on the coefficients of these last three variables are expected to be positive. A number of alternative models were estimated but the results were unsatisfactory. The land price model was specified in the following manner:

PRICE = f(CONSTANT,SOIL,SLOPE,DISTANCE,
INA TITLE,PARCEL SIZE,IMPROVED PRACTICE)

where:

PRICE	= price of land in lempira per hectare,
CONSTANT	= constant term,
SOIL	= binary variable where 1 is better quality soil,
SLOPE	= binary variable where 0 is flat or slightly sloped land and 1 is steep or very steep,
DISTANCE	= binary variable where 0 is under 25 minute walk from homestead to plot and 1 is a walk of 25 minutes and more,
INA TITLE	= binary variable where 0 is no official INA document and 1 is possession of such document,
PARCEL SIZE	= area plot in hectares,
IMPROVED PRACTICE	= presence of any one or more practices.

The model was estimated twice: once including both flat and sloping land, and once excluding flat land. The estimation on all parcels illustrates the relative importance each selected explanatory variable in determining the price of land, holding all other variables constant. The equation on hillside parcels helps to illustrate how factors, other than slope, behave somewhat differently given that land is sloping. The combined outcomes of these two estimation procedures provides a measure of the relative importance of explanatory variables on price determination for potentially degradable hillsides specifically as compared to land in general. Estimates are provided in section 5.2.2.3, entitled "Distribution of Benefits From Titling," in Chapter Five.

CHAPTER FIVE

RESULTS

5.1 Introduction

This chapter presents the results of the sample data analyses. First, general patterns of adoption of improved soil management are presented and compared to those discussed in the literature. Patterns are defined according to the distribution of important land tenure and socio-economic attributes. This procedure should help elicit whether Honduras fits the general pattern and common wisdom concerning land privatization, land titling, and investments in land improvements (i.e., adoption of improved soil management practices). It should also provide a starting point for a more generalized discussion of these issues. Econometric analysis then used to explain the variation in adoption and identify which factors are influential in the decision to adopt improved soil management practices. These factors are then inspected more closely by their explanatory power for different farm size strata. This final procedure should elicit the incentives and constraints of groups of farmers, based on size, and suggest the potential distribution of benefits from the reform and titling program.

5.1.1 Demographics and Land Tenure

Analysis of the survey data produced interesting results concerning land tenure and adoption of soil management practices. Tables 5.1 and 5.2 present basic

Table 5.1 Average Sample Household Land Tenure Characteristics by Department

Average Household Characteristic (% of land area)	Department			
	El Paraíso	Fr. Morazan	Olancho	Total Sample
Owned (%)[a]	81	79	86	82
Hillside (%)	55	53	58	56
TYPE OF LAND:				
Private (%)	53	45	35	44
National (%)	32	25	52	37
Ejidal (%)	16	30	13	18
DOCUMENTATION:				
With INA document (%)[b]	25	2	3	12
With any document (%)[c]	67	37	33	47
METHOD OF ACQUISITION:				
Purchased (%)	48	39	36	42
Adjudicated	5	8	6	6
Inherited or given (%)	26	21	34	28
Borrowed (%)	9	7	4	7
Rented (%)	5	5	2	4
Occupied without permission	<1	<1	2	1
Number of parcels	329	211	309	849
Number of households	109	66	87	262

[a]The only criteria for ownership is that the respondent claims to be the owner. [b]An INA document is a title of dominio pleno issued by the Instituto Nacional Agrario. [c]This category includes any form of documentation: public or private, registered or unregistered.

demographic and land tenure information for the average farm for each of the three departments included in the sample.

Public land comprised more than half of the area of the average farm in each of the departments. In Olancho, national land alone represented 52 percent of the

Table 5.2 Sample Household Demographics by Department

Characteristic	Department			
	El Paraíso	Fr. Morazan	Olancho	Overall
	(Household Averages)			
Household size	6.15	5.94	6.31	6.15
Average farm size (ha)	19.21	7.97	10.03	13.27
Area/capita (ha)	3.66	1.94	2.00	2.68
Adult equivalents[a]	4.73	4.25	4.77	4.63
Age of household head	49	50	52	50
Number of literate household members	1.93	2.26	2.21	2.10
Number of members working in agriculture on the farm	2.95	2.65	2.57	2.75
Number of salaried workers[b]	.83	.91	.54	.83
Number of self-employed	.51	.54	.32	.46
	(Percentage of Households)			
Households with literate head (%)	21	28	25	24
Households with at least one literate member (%)	75	80	82	78
Households selling maize and/or beans (%)	62	73	56	63
Households selling other agricultural products (%)	80	79	84	81
Households with at least one salaried worker (%)[b]	48	62	41	49
Households with at least one member self-employed (%)	34	46	28	35
Number of households	109	66	87	262

[a] All household members over 14 years old are given a weight of 1. Children from 7 to 14 are given a weight of .75, and less than 7 are weighted 0. [b] Salaried workers are mostly seasonal workers although permanent workers are included as well.
NOTE: Special attention is given to the head of household because in the area studied in Honduras, the head of household is nearly always the individual in charge of field crops.

average farm's land holdings. Ejidal land was most common in Francisco Morazan (30 percent). Farmers considered themselves owners of more than three quarters of their land area in all three departments even when only one third of that area was documented (see Table 5.1). El Paraíso had the highest percentage of area with INA titles and any form of documentation. This was anticipated since El Paraíso, unlike the other two departments, was included in the initial stages of the titling program (see Chapter Two for further details).

The demographic statistics for three departments look similar with few notable differences. Farms in Francisco Morazan are smaller. They have more salaried and self-employed household members than the other two departments. They also sell more basic grains. This is as expected. Francisco Morazan is relatively more densely populated and commercially developed, especially in the areas sampled. Still, all of the departments have approximately 80 percent of the sampled households selling agricultural products other than basic grains (i.e., crops other than maize and beans).

5.1.2 Perception of Improved Soil Management Practices

Before relating tenure to adoption, it will be useful to consider farmers' perceptions, knowledge, and interest in improved soil management practices. The results of this study generally support Meija's work in the western and central departments of Honduras as presented in Chapter Two. Farmers included in this study, like those of western and central Honduras, were aware of land degradation (refer to Table 5.3). They had considerable knowledge of, even though

Table 5.3 Perceived Farmer Awareness of Land Degradation

Indicator of land degradation (% of farms)	Yes (%)	No (%)	Number of respondents
Maize stalk height decreasing	51	49	249
Soil color deteriorating	46	54	247
Gullies present	47	53	253
Rocks in soil more prevalent	45	55	256
Reduced burning of fields*	56	30	257
Leave trees in fields	46	54	257

* The percentages do not sum to 100 since 14 percent of the farmers reported that they never used burning to prepare their fields.
NOTE: The results reported in this table are consistent over farm size strata and portion of cultivated land on hillsides. The percentage of affirmative responses increased slightly for farms with a higher portion of sloping land.

few adopted, practices other than managed maize stubble (see Table 5.4). Preferences for specific soil management practices were also similar; although, the adoption rates were much lower for the areas included in this study. Managed maize stubble is an exception, but this can be partly accounted for by the fact that Meija's study defined this practice strictly in terms of incorporating stubble into the soil as opposed to leaving it for animal feed or burning it, while this study had difficulties making the distinction in the field.

Some farmers had as many as 7 different soil management practices established throughout their farm. However, intensive employment of practices was not the norm. Of the farmers who adopted at least one practice on at least one parcel, 62 percent adopted only one practice and 63 percent installed their practice(s) on just one parcel. These results are consistent with those of Meija.

Table 5.4 Percentage of Farms With Knowledge of, Use of, and Interest in a Given Improved Soil Management Practice.

Practice (% of Farms)	Know of practice	Use practice: whole sample	Use practice: adopters only	Have interest in practice
Quick, inexpensive, moderate results:				
Contour Planting (%)	61	17	21	10
Fertilizer Beans (%)	66	8	21	25
Live Barriers (%)	68	17	12	14
Moderately expensive, good results:				
Managed corn stubble (%)	83	65	82	4
Minimum Tillage (%)	45	10	11	10
Manure (%)	64	18	22	19
More expensive, longer-run results:				
Drainage (%)	67	16	18	15
Terraces (%)	55	10	12	12
Stone Walls (%)	24	6	7	3
Any Practice (%)	95	78	100	51
Number of respondents	259	259	206	207

NOTE:The figures increase only slightly when farms with mostly flat land are removed from the analysis. Interest refers to introducing or expanding a practice.

5.1.3 Improved Soil Management Practices and Tenure

The adoption of soil management practices was not limited to parcels with clearly documented private property rights as was Meija's study (see section 2.3.4).

Table 5.5 Distribution of Farms With and Without Practices* by Tenure and Document Status

Tenure Attribute of Parcel (% of parcels)	Without Practice	With Practice	Number of Parcels
TYPE OF LAND:			
Ejidal (%)	57	43	146
National (%)	66	34	299
Private (%)	60	40	357
All parcels (%)	62	38	802
TYPE OF DOCUMENT:			
No document (%)	64	34	481
Document other than INA title (%)	62	38	301
INA title (%)	58	42	100
Any document (%)	63	37	401

*Practice refers to any of the nine practices included in the study

Table 5.5 demonstrates that farmers on public lands (i.e., national or *ejidal*) as well as undocumented parcels were, in general, using any improved soil management practice. The table includes all practices. In the author's judgement, the variation in rates of adoption within the types of land and types of document remained essentially the same when an evaluation was made of only those practices with longer expected pay back periods and greater capital costs, and for which security would be expected to have greater importance (i.e., drainage ditches, terraces and stone walls). The specific rates of adoption were much lower for these long-term practices, and difference between the three categories of documentation disappears

completely. Some caution is warranted in the interpretation of these results. Because the information on costs of and returns for each practice was limited, there was considerable ambiguity concerning how each practice should be classified according to payback periods.

5.1.4 Improved Soil Management Practices and Slope

It is expected that the installation of improved soil management practices is directly related to the slope of the parcel. In addition, certain practices are better suited for specific topography and the choice of practice is, consequently, dependent on slope. Table 5.6 suggests that the steepest parcels were less likely to possess a practice, while the flat lands were just as likely to have some kind of practice as those that were slightly sloped or steep (note that these grades of steepness refer to the subjective categories listed on the questionnaire presented in Appendix A). There are some differences depending on the practice. Terraces, contour planting, and live barriers are found more on sloping land which is to be expected. Similarly, managed stubble is not likely to be encountered on the steepest slopes. The generally heavy concentration of most types of practices on flat land was probably due to the higher economic returns and to both the sampling procedure which was designed for the bean study and aimed to capture relatively equal numbers of valley and hillside farmers, and the bias in perception which suggests that land appears comparatively flat in mountainous regions when it is, in fact, sloping. Of course, the converse of this subjective evaluation is also true, but less likely in the case of Honduras.

Table 5.6 Percentage of Fields With Improved Soil Management Practices by Field Slope

	Slope				
Practices (% of fields)	Flat	Slightly slopped	Steep	Very steep	Total sample
No practice	62	63	58	80	63
Contour planting (%)	2	<1	4	6	2
Fertilizer bean (%)	0	2	2	2	1
Live fences (%)	1	3	2	2	2
Managed stubble (%)	28	27	23	2	25
Minimum tillage (%)	1	1	2	0	1
Manure (%)	4	3	1	2	3
Drainage (%)	2	<1	4	4	2
Terraces (%)	1	1	4	4	2
Stone walls (%)	<1	1	0	0	<1
Any practice (%)	38	37	42	20	37
Number of parcels	383	246	179	55	863

NOTE: Columns may sum to greater than 100% because parcels can possess more than one practice. "No practice" and "Any practice" sum to 100%.

5.2 Adoption of Improved Soil Management Practices Model

5.2.1 Introduction

The adoption model was specified in a number of ways because it was felt that not all of the data were well defined and free of measurement error. Comparing specifications would help capture the robustness of the outcomes. There were two parcel-level ordinary least squares (OLS) models: one with a more extensive set of explanatory variables than the other. Two household-level models compared specifying adoption as a binary choice in one case and a continuous choice in the other. And, two parcel-level binary choice models were specified: one included all

improved soil management practices, the other consisted of all but managed maize stubble.

The overall performance of the econometric models was weak, but as expected given the data limitations. The models using an OLS procedure had very low R^2s indicating that the model explained only a small portion of the variation in the dependent variable, i.e., the number of practices adopted per parcel. Only a small portion of farmers adopted multiple practices and even fewer installed more than one practice on a given parcel. As such, these continuous choice OLS models as well as the tobit model were estimated on a dependent variable with limited variability. Changing the explanatory variables included in the model changed the signs and significance of other important variables such as possession of an official INA title. A review of these models found in Appendix E illustrates these two points. The two models estimated at the household level are also included in the appendix. The signs of coefficients were not as expected and not readily explained. Few estimated coefficients are significant at a significance level of .05. In addition, the predictive power of the alternative probit specification was quite low. Using this model instead of the naive assumption that all farmers are adopters, actually results in few correct predictions. The computer printouts for all these various models are included in the appendix in order to demonstrate some of the difficulties in interpreting the results. A variable key is provided to assist the reader in perusing the results. Despite these problems the set of models viewed collectively did provide some meaningful information which are largely consistent with those reported in the literature (see sections 3.3 and 3.4 and Table 3.1), and discussed in the chapter on methods (see 4.2.2.1). It is also worth noting that a number of

variables perform consistently throughout the modelling exercise. The results with respect to these variable are more robust.

5.2.2 Parcel-level Binary Choice Models of Adoption

Two parcel-level models are presented here within the body of the study: one probit estimation on adoption of any practice, and another on any practice other than managed maize stubble. These two specifications are largely consistent with the rest of the analysis and presentation of this study in a number of ways. The models define adoption as a binary choice: adoption or no adoption. Estimated at the parcel level, the two models presented here directly link land tenure, documentation, and the presence of an improved practice.

The estimation results are contained on Table 5.7. This includes coefficients, significance level, and the frequency with which predicted and actual outcomes matched. Coefficients are interpreted as the change in the probability that a farmer will adopt a practice given a one unit change in the explanatory variable. A coefficient is said to be significant if the significance level of is less than or equal to .05. The selection of this level is according to convention, and does not take into account the costs of Type I or Type II errors for this specific research problem. Because the author had insufficient information and authority to evaluate the costs of these potential errors and to assess policy makers' decision criteria, she has opted to use convention. Computer printouts containing greater detail are included in Appendix E.

The model suggests that perception of ownership (OWNER) and possession of documents, either an official INA title any other form of documentation, are not

Table 5.7 Results of Adoption of Improved Soil Management Practices Model Estimation: All Practices and Practices Other Than Managed Maize Stubble (Parcel level)

	All Practices		Practices Excluding Managed Maize Stubble	
Variable	Coeff	sig. level	Coeff	sag. level
Constant	-.8333	.018	-1.117	.004
INA Title	.0023	.985	-.1272	.353
Other document	.0034	.971	-.0445	.674
National land	-.1120	.222	-.2643	.0132
Ejidal land	.0931	.392	.2268	.0532
Perceived ownership	.0140	.913	.2099	.162
Years farming parcel	.0009	.144	.0005	.477
Soil quality	-.0140	.019	-.0007	.057
Slope	.0038	.899	.1444	.0083
Strata (> =1 and <5 ha)	-.3757	.189	-.5125	.099
Strata (> =5 and <10 ha)	-.4445	.158	-.4698	.171
Strata (<10 ha)	-.8016	.008	-.6894	.039
Fertilizer	.1029	.992	.1593	.198
Machinery/animal traction	.2311	.110	-.0608	.704
Number of family farm laborers	.1064	.0003	.1052	.0005
Hired labor	.0647	.596	-.2971	.027
Off-farm workers	-.1433	.0037	-.1035	.0007
Planted w/coffee	-.6524	.019	-.1286	.6601
Planted w/cash crop	.5365	.0233	.4268	.0912
Sales of crops other than maize and beans	.1624	.1296	.1074	.379
Credit received	.0735	.447	.0635	.563
Purchased grain	.0627	.534	-.0148	.897
Project within municipality	.5062	.0000	.4516	.0023
Extension in area	.0005	.0005	.0008	.0000
Visited by extension agent	.00001	.049	.0003	.0357
Nonadopters correctly predicted (%)		87		98
Adopters correctly predicted (%)		33		18

related to the adoption of improved soil management practices. Although the coefficients on both document variables are unexpectedly negative, the significance levels are quite low. While the model does not conclusively reject the hypothesis that titles are necessary condition for investments in land, it does suggest further investigation of this claim.

The coefficients on national and *ejidal* land are negative and positive respectively suggesting that farmers are more inclined to make land investments on *ejidal* land. Removing managed maize stubble from the model increases both the size and significance of coefficients. All other factors being equal, farmers have more confidence in the *ejidal* tenure system. Recall that *ejidos* are locally governed. This form of administration has remained essentially unchanged since the early 1800s so a farmer can be expected to feel secure with this institution. This is contrasted with the fickle nature of the central government's administration of national lands (see background chapter for further details on reforms). Although there are large *ejidal* land holdings, it remains less concentrated with fewer large-holders than on national land. The initial version of the questionnaire, which was administered only in El Paraíso, included several questions about land disputes in the respondents immediate geographic area. Respondents recalled that most disputes occurred over national land, although, none of these recorded examples resulted in farmers loosing land.

The coefficient on credit was also insignificant and extremely small. This variable was collected at the household as opposed to parcel level. Consequently, it was not expected to provide conclusive results in the form of highly significant coefficients. Nevertheless, the result casts doubt on the argument that the

unavailability of capital is an critical constraint on farmer's decision to adopt improved management practices in Honduras. The literature further suggests that issuance of titles and creation of new and alternative credit sources would promote adoption. Outcomes of this model dispute this argument.

The positive and significant coefficients on the soil quality in the first equation and slope in the second indicate that improved soil management practices provide a means by which a farmer can offset the negative impacts on productivity of poor quality land. However, these coefficients are small. The slope coefficient is logically larger for the model excluding managed maize stubble. This is expected since the most of the remaining practices are more narrowly tailored to hillside environments than is managed stubble. The reader is reminded that soil quality was defined to be a binary variable with a value of zero implying good soil quality and a value of one representing poorer soil quality. The planting of coffee tree, viewed as an erosion mitigating production option, limits the probability that the farmer will install other improved soil management practices.

The availability of household farm labor is positively related to adoption: one additional family farm laborer increased the probability of adoption by 10 percent. Hired labor on the other hand was negatively associated with adoption. It was the larger farms which tended to hire labor and were less likely to install improved soil management practices (see the coefficients on the set of farm size strata dummy variables). Hired labor was employed in other productive activities, e.g., land preparation and harvesting. Unfortunately, this study was unable to definitively ascertain what those activities were.

Farm size is inversely related to adoption of improved soil management

practices. For each successive farm size strata the probability of adoption diminishes further. The coefficient on the largest farm size strata is significant at the .05 level.

The number of household salaried laborers is negatively associated with adoption. Most of the improved soil management practices are essentially labor-intensive technologies. Consequently, adoption is dependent on the availability of labor as well as the opportunity costs. The results suggest that the greater the opportunity cost for labor, the less likely a farmer will adopt improved soil management practices. The household can get more income from additional member working in an activity other than installing and maintaining soil improvements. It should be that this variable measures the number of wage earning household members and not the actual income earned, as normally specified in the literature. It was, unfortunately, impossible to ascertain the labor constraints of specific sampled farms given the cost and logical constraints on the type of data collected.

On the reverse side of labor allocation equation, cash crop production is positively associated with adoption. Higher value crops increases the marginal productivity of land and labor engaged in agricultural relative to off-farm activities. This assumes that markets are available for subsistence as well as cash crops, and that all farmers have access to them. With relatively predictable markets, farmers can chose a self-reliant as opposed to self-sufficient basic needs strategy. In this case, farmers can respond to the higher returns to labor from cash crops, increasing their net benefits of soil management investments and reducing their capital rationing problem. For the net consumers of basic grains (i.e., producers who must still purchase to meet subsistence needs), the increased output resulting from the

installation of practices would help reduce the household's cash expenditures and dependence on their extremely limited and unpredictable cash income.

The results of the model indicate that the presence of a development project that promotes improved soil and natural resource management within the municipality has a pronounced direct affect on the probability that a farmer will adopt improved practices. While the coefficients on the presence of extension agents and being visited by an agent within the past five years are positive and significant, they are quite small: much smaller than those for development projects. This could imply that development project staff are more effective at promoting change than the extension staff of the Ministry of Natural Resources (MRN).

5.3 Distribution of Tenure and Other Socio-Economic Factors Influencing Adoption

Results of the previous section bring into question the argument that well-documented, individual private land rights are prerequisites to adoption of improved soil management practices. Although not conclusive, the findings are provocative. As previously mentioned, the author was unable to collect sufficiently detailed data on alternative factors to conduct a rigorous analysis of determinants of adoption due to budget and logistical constraints. The econometric analysis was, nonetheless, able to show that a number of other factors play an important role. The remainder of the analysis of adoption behavior borrows heavily from informal field observations, the theory and research covered in the literature review chapter and relies on qualitative analysis to supplement the more rigorous statistical analysis of these alternative factors.

It is often claimed that the rural sector of Honduras, like that of Central

America in general, is dualistic in nature (see sections 2.1.1 and 2.1.2). Resources and socio-economic opportunities concentrate according to farm size. Many of the important socio-economic factors related to adoption follow a similar pattern. In fact, the farm size strata dummy variables were all strongly significant. As a consequence, it was felt that Honduran farmer behavior concerning land tenure and adoption of soil management practices would not be well understood using a socio-economic model that only looked at the average farm. Instead, an analysis which distinguished between different size farms would be better able to identify unique incentives and constraints. The following discussion of alternative determinants of adoption is therefore stratified according to farm size.

One stratification procedure was employed for the sampling procedure, as discussed in Chapter Four; yet, a different stratification was used in the analysis. Although not a preferred procedure in principle, it was felt that this particular stratification would better suit an analysis of land tenure. The stratification procedure used in the analysis was also defined according to farm size, but it was felt that these strata provide a better opportunity to evaluate the various groups of farms singled out by successive land reforms. Recall that the original titling program limited titling to farms no less than 5 ha unless part of the land was planted to coffee, and the 1992 Modernization Law reduced this minimum to 1 ha. The sample was broken down in the following way: 1) less than one hectare, 2) one to less than five hectares, 3) five to less than ten hectares, and 4) ten hectares and greater. The distribution of the sample over the strata is presented on Table 5.8. Unfortunately, the sample turned out to be highly concentrated in the second strata, and the first strata was undesirablely small. The variance within the strata suggests

that the number of observations is too small to justify inferences. However, the author's own experience in the field is consistent with these results. In sum, it was felt that this pattern of sample stratification would be more revealing of the factors at work. The reader is cautioned when making comparisons to the *minifundistas*. The rationale behind the definition of strata is provided below in the initial paragraph for each strata.

5.3.1 Minifundios, Farms less than one hectare

The new modernization law (agrarian reform) labels all farms less than one hectare as *minifundios*. As discussed in the background chapter, the law forbids the granting of titles to *minifundistas*. Under the law, these properties are expected to be gradually aggregated with other properties less than one hectare, and reallocated. The 1993 Census reports that for the municipalities included in the sample, farms of less than one hectare comprise between 9 and 28 percent of the total number of farms (see Table 5.9). The portion is highest in El Paraíso, ranging

Table 5.8 Distribution of Farms Among Farm Size Strata

Strata	Number	Percentage
Less than 1 ha	14	5
Greater than or equal to 1 ha and less than 5 ha	132	50
Greater than or equal to 5 ha and less than 10 ha	38	14
Greater than or equal to 10 ha	78	30
Total	262	100

Table 5.9 Farm Size Distribution by Municipality

Municipality (% of farms)	Farm size strata < 1 ha	1 to <5 ha	5 to <10 ha	> 10 ha	Total sample
El Paraíso:					
Danli (%)	22	43	11	24	100
Guinope (%)	25	51	10	14	100
Jacalepa (%)	19	44	8	29	100
San Lucas (%)	28	56	8	8	100
Teupasenti (%)	18	47	14	21	100
Fr. Morazan:					
Cedros (%)	24	55	8	13	100
Marale (%)	10	60	18	12	100
Orica (%)	21	59	10	10	100
San Ignacio (%)	23	56	8	13	100
Olancho:					
Concordia (%)	26	55	11	8	100
Guarizama (%)	9	51	17	23	100
Guayape (%)	17	67	11	5	100
Juticalpa (%)	16	45	11	28	100
Manguille (%)	12	56	17	15	100
Silca (%)	13	50	15	22	100

SOURCE: IV Censo Nacional Agropecuario 1993, Tegucigalpa.
NOTE: no figures were available for the municipality of Districto Central in Francisco Morazan.

from 18 percent in Teupasenti to 28 percent in San Lucas. Olancho has the fewest (between 9 and 26 percent, with most municipalities around 15 percent). In short, the number of *minifundios* is not at all insignificant. As it turns out, these farmers are very different from those of other strata. It is conjectured that a number of

these differences in socioeconomic characteristics significantly contribute asymmetric outcomes from the implementation of the Modernization Law and the Land Titling Program. Social welfare concerns strengthen the argument for the making the farm size distinction. For these reasons, it was deemed important to maintain a separate category of analysis for these farmers.

5.3.1.1 Household Demographics

As indicated on Table 5.10, farms within this group had the fewest number of household members and family agricultural laborers (1.2), the youngest heads of household (45 years old), and lowest literacy rates (although not much different from other strata). On average, they have resided in the current location, and cultivated their various plots for the shortest period of time: 34 and 10 years respectively. One interpretation of these data is that the strata represent stages in the life cycle of a Honduran farm. The younger farmers have only begun to slowly acquire land, their families are smaller with lower adult equivalents, and they have been at the current residence for less time. As they get older, they move through the different strata.

These farms had the greatest number of wage laborers (1.6). These workers tended to work for a larger portion of the year. One third of those with jobs worked the entire year while the rest engaged in seasonal agricultural activities for two to three months. Eighty percent or more of the employed household members worked only a portion of any given month, usually two weeks. Seventy-one percent of the heads of household were engaged in salaried employment, mostly on local *haciendas*, as compared to 30 percent overall and 8 percent for the largest strata.

Table 5.10 Average Household Characteristics by Farm Size Strata

Characteristic	Farm Size Strata				
	<1 ha	1 ha to <5 ha	5 ha to <10 ha	>10 ha	Total sample
Household size	4.6	6.3	6.2	6.1	6.1
Area/capita (ha)	.25	.48	1.33	7.48	2.68
Adult equivalents[a]	3.2	4.6	4.5	4.9	4.6
Age of household head	45	48	48	55	50
Number of members working in agriculture on the farm	1.9	2.8	2.6	2.9	2.8
Number of salaried workers[b]	1.6	1.1	.6	.4	.8
Number of self-employed	.43	.43	.46	.49	.46
Years residing at current residence	34	42	43	47	44
Households with literate head (%)	21	19	32	28	24
Households with a least one literate member (%)	71	79	73	82	79
Households with at least one salaried worker (%)[b]	79	61	40	28	49
Households with at least one member self-employed (%)	29	33	40	38	35
Households receiving remittances	7	15	19	15	15

n = 262 households or the entire sample.
[a] All household members over 14 years old are given a weight of 1. Children from 7 to 14 are given a weight of .75, and less than 7 are weighted 0. [b]Salaried workers are predominantly seasonal although permanent workers are included as well.
NOTE: Special attention is given to the head of household because in the area studied in Honduras, the head of household is nearly always the individual in charge of field crops.

5.3.1.2 Land Characteristics and Land Tenure

In the sample, *minifundistas* occupy mostly private land (54 percent): the highest percentage across the four strata. The remaining portion is nearly equally distributed between national and *ejidal* lands (see Table 5.11). This strata of farmers

Table 5.11 Physical and Tenurial Characteristics of the Land by Farm Size Strata

	Farm Size Strata				
Characteristic	<1 ha	1 ha to <5 ha	5 ha to <10 ha	>10 ha	Total sample
	(Average Household)				
Farm size (ha)	.66	2.51	6.81	36.51	4.35
Number of plots	1.6	2.8	3.7	4.4	3.4
Area of farm cultivated					
in primera (%)	80	50	27	16	37
in postrera (%)	88	45	29	16	36
Area of farm					
on hillsides (%)	58	57	73	69	63
on national land (%)	25	34	34	31	32
on ejidos (%)	21	14	20	16	16
on private land (%)	54	40	39	47	43
Years cultivating a field	10	17	17	21	16
	(Percentage of Households)				
Households with at least one sloping field (%)	64	70	92	87	78
Households with a least one field with poor soil (%)	14	19	30	29	23
Number in sample	14	132	37	79	262

NOTE: Percentages of area on national, ejidal and private do not sum to 100 due to missing values: farmers were not always certain of the type of land.

has the highest proportion renting: 14 percent compared to an overall 5 percent (Table 5.12). In Honduras, it is not uncommon for small farmers to encroach upon larger property owners and cultivate small plots without permission. It should be noted that some farmers, who are occupying land without permission, prefer to state that they are "borrowing" the land. Thirty-three percent of the *minifundistas* say they borrow land. This is much higher than any other strata.

Minifundistas are less likely to have any form of documentation for their parcels. Although half say they own the land they cultivate, only 1 percent of their parcels have INA documents, and only 17 percent have any type of document at all. These percentages are compared to overall figures of 12 and 45 percent

Table 5.12 Average Household Method of Land Acquisition by Farm Size Strata

	Farm Size Strata				
Characteristic	<1 ha	1 ha to <5 ha	5 ha to <10 ha	>10 ha	Total sample
Owned (%)[a]	51	68	84	90	76
With INA document (%)[b]	1	9	18	17	12
With any document (%)[c]	17	34	56	64	45
Purchased (%)	30	25	40	54	36
Inherited or given (%)	16	30	28	22	26
Borrowed (%)	33	12	4	1	8
Rented (%)	14	7	<1	2	5
Occupied without permission	0	1	1	<1	1

n = 262 or the sample of households.
[a]The only criteria for ownership is that the respondent claims to be the owner. [b]An INA document is a title of dominio pleno issued by the Instituto Nacional Agrario. [c]This category includes any form of documentation: public or private, registered or unregistered.

respectively (Table 5.12). Just 19 percent of the land area of the average farm in this strata has some form of documentation. Figures for the third and fourth strata are 56 and 64 percent respectively. Twenty-two percent of all of the land included the first strata is documented, while 71 percent is for the largest strata.

It is surprising that, in the sample, the smallest farms were not all located on steep slopes with soil they considered of poor quality. They have fewer hillside plots, but the percentage of area on hillsides is the same as the next larger strata. Still, a larger percentage of these farmers possess only flat parcels: 36 percent compared to 22 percent for the overall sample. (Note that these last figures were derived by subtracting the percentages of households with at least one sloping parcel from 100.) This finding contradicts the more popular view for Honduras and Central America as a whole which argues that small marginalized farmers have been pushed up the hillsides and onto marginal land.

5.3.1.3 Agricultural Production

Although all of the sampled farms were similar in terms of crop choices, there were some notable differences in the production systems. *Minifundistas*, on average, had only 1.5 plots while larger farmers of other strata had between 3 and 4. Farms of less than one hectare cultivated at least 80 percent of their land in both seasons: primera and postrera. This is much higher than any other strata or the sample average of approximately 35 percent (refer to Table 5.11). With a land area per capita ratio of just .25, compared to 2.68 overall, the intensity of cultivation is not surprising. They grow only maize and beans. A small percentage of farms of all other strata grow coffee as well as a number of other subsistence or cash crops and

cattle. Only two of the fourteen *minifundistas* own cattle.

Minifundistas are less inclined to use fertilizer, insecticides, machinery and particularly hired labor. Only 29 percent hire farm labor compared to 69 percent for the overall sample (see Table 5.13). They have fewer household members working in the fields and fewer fields. These factors can, in part, explain why their yields of and postrera bean yields are the lowest (refer to Table 5.14). The F-statistic calculated from the analysis of variance on maize yields is significant at the .10 level. Average yields for *minifundistas* are 1169 kg/ha while the sample average is 1385 kg/ha. The lack of risk-mitigating inputs also suggests that output levels would be more uncertain. Based on the coefficient of variation, maize yield variability is greatest for this group. There is less variation in bean yields for the *primera* but not the *postrera*. Although not conclusive, these results indicating that larger farmers are more productive based on yield figures, contradict the common opinion of development workers in Honduras. They claim that small farmers are more productive per worker per hectare.

Table 5.13 Input Use by Farm Size Strata

	Farm Size Strata				
Input (% of households)	<1 ha	1 ha to <5 ha	5 ha to <10 ha	>10 ha	Total sample
Fertilizer (%)	36	49	57	66	55
Machinery/animal traction (%)	71	80	81	89	82
Hired labor (%)	29	61	87	81	69
One of more soil conservation practices (%)	86	82	86	78	82
Number in sample	14	132	37	79	262

Table 5.14 Maize and Bean Yields by Farm Size Strata

Yield (kg/hectare)	Farm Size Strata <1 ha	1 ha to <5 ha	5 ha to <10 ha	>10 ha	Total Sample	sag of F-stat[a]
MAIZE						
Primera						
Monocropped						
Mean	1169	1221	1503	1564	1385	.070
Coef. of Var.	1.06	.85	.66	.82	.82	
n	13	158	49	122	342	
BEANS						
Primera						
Monocropped						
Mean	693	527	498	528	525	.938
Coef. of Var.	.47	1.03	1.05	.87	.95	
n	8	57	27	46	138	
Postrera						
Monocropped						
Mean	454	523	587	475	511	.441
Coef. of Var.	.71	.76	.66	.69	.72	
n	12	125	34	95	265	

[a]sig of F-stat is the level at which the F-statistic derived from an analysis of variance for the four strata is significant.

5.3.1.4 Improved Soil Management Practices

In this section, both the adoption of practices and the farmers' perception of benefits will be analyzed by farm size strata. The analysis is presented first at the parcel level and then at the household level. Both adoption, and the benefits derived from the adoption of improved soil management practices, vary across farm size strata. First, consider adoption. A slightly higher percentage of *minifundistas'* as compared to the other stratas' plots have some form of soil management practices (refer to Table 5.15). Looking at nontraditional practices (i.e., all practices except managed maize stubble) and hillside parcels only, this distinction becomes more dramatic (see Table 5.16). The difference is most striking between the smallest and

Table 5.15 Percentage of Fields With Improved Soil Management Practices by Farm Size Strata

	Farm Size Strata				
Practices (% of fields)	< 1 ha	1 ha and < 5 ha	5 ha and <10 ha	> 10 ha	Total sample
Managed stubble (%)	36	31	26	22	27
Drainage ditches (%)	0	6	4	4	5
Manure (%)	9	5	4	7	6
Fertilizer bean (%)	4	2	4	1	2
Live barriers (%)	14	7	5	6	6
Contour planting (%)	4	5	13	4	6
Minimum tillage (%)	9	3	4	1	3
Terraces (%)	4	4	5	3	4
Stone walls (%)	4	2	2	1	2
Any practice (%)	50	40	41	33	38
Number of parcels	22	372	133	345	872

Table 5.16 Percentage of Households With Nontraditional Practices on Hillsides by Farm Size Strata

	Farm Size Strata				
Adoption (% of households)	<1 ha	1 ha to <5 ha	5 ha to <10 ha	>10 ha	Total sample
Any soil management practice on any plot (%)	50	40	41	33	38
Any soil management practice on sloping land only (%)	70	43	39	28	37
Any practice except management of maize stubble and sloping land only (%)	60	26	30	20	25
Number of parcels	22	372	133	346	873
Number of sloping parcels	10	199	77	194	480

largest farm strata, but also apparent between the mid-size farms and the largest. This is an interesting outcome given the higher percentage of flatter plots with better soil quality, and the fact that these farmers tend to have less knowledge of soil management practices. The smallest farmers are generally less aware of the different practices; however, 93 percent knew of at least one practice. For all farmers, extension agents were the most common source of improved soil management information. Unfortunately, *minifundistas* were unlikely to be visited by extension agents. Neighbors, and to a lesser extent family members and development projects, were cited as additional sources. Development projects tended to focus on farmers of the two middle strata.

Shifting the level of analysis from the parcel to the household, one can

observation that all practices, with the exception of drainage ditches, are adopted by at least one member of the smallest farm strata. The most common practices were managing maize stubble and manuring, both of which better reflect the averagephysical attributes of the land than the socioeconomic characteristics of the household in that they are technically appropriate for flat to only slightly sloping parcels. Approximately one quarter of the *minifundistas* installed live barriers. Close to 80 percent of all farmers within each strata used at least one soil management practice (including the traditional managed maize stubble) on at least one plot (Table 5.17).

Table 5.17 Percentage of Households With Improved Soil Management Practices by Farm Size Strata

	Farm Size Strata				
Practices (% of farms)	< 1 ha	1 ha and < 5 ha	5 ha and <10 ha	> 10 ha	Total sample
Managed stubble (%)	57	65	64	67	65
Drainage ditches (%)	0	20	11	15	16
Manure (%)	21	13	11	28	18
Fertilizer bean (%)	7	5	11	6	8
Live barriers (%)	21	18	17	15	17
Contour planting (%)	7	14	36	15	17
Minimum tillage (%)	14	11	11	6	10
Terraces (%)	7	8	14	9	9
Stone walls (%)	7	5	8	5	6
Any practice (%)	79	78	83	78	79
Number responding	14	132	37	79	262

Table 5.18 Farmer Opinion of Benefits From Soil Management Practices by Farm Size Strata

Benefit (percent of households)	Farm Size Strata <1 ha	1 ha to <5 ha	5 ha to <10 ha	>10 ha	Total sample
MOST IMPORTANT BENEFIT[a]					
Land produces more (%)	44	70	59	62	66
Fewer plots needed (%)	11	2	0	2	2
Use less fertilizer (%)	12	9	3	8	7
More food for animals (%)	0	3	7	4	4
Improved soil moisture[b] (%)	11	8	14	10	10
Reduces erosion (%)	0	7	7	8	6
Other (%)	22	0	10	6	5
Total (%)	100	100	100	100	100
OVERALL BENEFITS[c]					
Land produces more (%)	67	87	79	81	83
Fewer plots needed (%)	11	7	14	9	9
Use less fertilizer (%)	33	47	34	28	39
More food for animals (%)	0	28	24	40	29
Improved soil moisture[b] (%)	33	20	21	28	23
Reduces erosion (%)	0	10	21	14	12
Other (%)	22	8	12	9	9
Number of respondents	9	98	29	58	194

[a] primary benefit refers to the most important benefit as expressed by the respondent. [b] improved soil moisture refers to both drainage of excess water on flatter parcels and retention of water on hillsides. [c] overall benefits includes all of the one to up to three benefits listed by the respondent without accounting for the farmers prioritization of those benefits.

Almost all farmers identified several benefits from the use of improved soil management practices. Although farmers of all four strata perceived the increase in produce as the most important benefit, there were also some differences among

strata (refer to Table 5.18). *Minifundistas* noted that they could reduce the number of plots cultivated and the amount of fertilizer used. Unlike, farmers of the other strata, they did not use by-products such as fodder for animals and, therefore, one of them listed it as a fodder. It is interesting to note that improved soil moisture was generally felt to be more important than soil erosion control. In fact, the improvement in soil moisture was listed as a benefit for approximately one quarter of the sampled farmers and as much as one third of the *minifundistas*. While the application of fertilizer can partially compensate for decreases in the fertility of some eroded soils and consequently postpone the decision to invest in soil management practices, there is no substitute for water during low-rainfall periods. In addition, farmers note that beans are particularly sensitive to excessive moisture. One farmer in Los Marquitos stated that he preferred live barriers to drainage ditches (in the case of hillside, drainage ditches collect and redirect the flow of water) because the former retained water for draught periods whereas the latter simply redirected it as it fell. Looking at the overall benefits, i.e., not accounting for the farmers' stated benefit priority, reducing the need for fertilizer was noted to be a benefit for 30 percent or more of all farmers from all strata.

The most common reason reported by all farmers for why a given soil management practice was not adopted was that there was no problem with soil erosion. In a number of these cases, the farmer may not have been aware that a problem existed. *Minifundistas* also frequently listed the lack of requisite inputs (e.g. fertilizer bean seed) as a deterrent to adoption. Also mentioned was the fact that the land was rented. A group of small farmers in the municipality of Danli

complained that large land owners rented parcels for only one year. It seems that by cultivating rented plots, these small farmers formed the preliminary step in developing larger land owners' pasture lands. Each year they had to familiarize themselves with a new plot with its distinct agroecological conditions. This system would tend to eliminate the potential productivity gains expected to arise from cumulative practical experience. In addition, the tenants had no incentive to protect or build the soil.

5.3.1.5 Generation of Cash Income

The smallest farms only grow subsistence crops, and over three quarters are net consumers of maize and beans (see Table 5.19). The need to purchase basic foods implies that there is no surplus for cash needs. Just 7 percent of these

Table 5.19 Market Behavior by Farm Size Strata

	Farm Size Strata				
Market Activity (% of households)	<1 ha	1 ha to <5 ha	5 ha to <10 ha	>10 ha	Total sample
Bought grain (%)	79	62	40	47	55
Sold grain (%)	57	57	57	77	63
Bought or sold grain (%)	43	30	14	28	28
Sold other agricultural products (%)	0	31	62	63	44
Sold any agricultural product (%)	57	72	87	98	81
Number in sample	14	132	37	79	262

farmers receive cash remittances from others living off the farm. As such, the smallest farmers have to choose between marketing either subsistence crops or their own labor in order to purchase fertilizer, pesticides, and household items as well as afford machinery rentals. Seventy-nine percent of the households have at least one salaried worker while the overall figure for the sample is just 49 percent. Still, farmers might choose to sell some of their output and go hungry. Tragically,this is not an uncommon phenomena in Honduras.

5.3.1.6 Credit

Sources of cash are very limited for the *minifundistas*. Fifty-seven percent rely on the neighbors, friends and family to obtain loans. Twenty-nine percent sell produce and/or their labor (see Table 5.20). A comparison of these figures to those of the other three strata illustrates the minifundistas greater cash constraints and reliance on their community.

Some of the farmers within this group said that they borrowed from the informal sector. None of them borrowed from a bank. Nor did any of the farmers receive loans from projects or cooperatives (refer to Table 5.21). These organizations tend to concentrate their efforts on slightly larger farmers. One farmer in the municipality of San Lucas revealed that he preferred to deal with local lenders because, unlike an impersonal banker, the lenders knew him, understood his circumstances should he be unable to repay the loan on time, and were more likely

Table 5.20 Source of Cash by Farm Size Strata

Source of cash (% of households)	Farm Size Strata <1 ha	1 ha to <5 ha	5 ha to <10 ha	>10 ha	Total sample
Own account (%)	29	47	43	46	45
Borrow[a] (%)	14	25	35	37	30
Friends/family (%)	57	23	11	8	18
Cooperatives and projects (%)	0	5	11	9	7
Number responding	14	131	37	78	260

[a] Borrowing includes bank and informal lenders.

Table 5.21 Source of Most Recent Loan by Farm Size Strata

Source of Loan (% of households)	Farm Size Strata <1 ha	1 ha to <5 ha	5 ha to <10 ha	>10 ha	Total sample
BANADESA (%)	0	31	52	66	46
Work Place (%)	0	6	0	3	4
Informal Sector (%)	80	19	21	7	17
Family (%)	20	14	3	5	9
Cooperative (%)	0	5	70	7	4
Project (%)	0	20	14	8	6
Other (%)	0	5	3	3	14
Number responding	10	80	29	59	178

to renegotiate terms if need be.

Minifundistas reliance on personal relations and their stock of social capital is also manifested in their typical type of loans from family and friends. The only form of collateral used was personal references from other people, including local agriculture cooperatives (see Table 5.22). This suggests that while cooperatives are not giving loans to very small farmers, they support the farmer's efforts in acquiring them through other sources. Only 36 percent were willing to pledge their land as collateral in the future (Table 5.23). *Minifundistas* felt that providing collateral for loans was too expensive (probably referring to the option to use expected harvests as collateral), risky, or they had nothing to use.

Table 5.22 Collateral Used in Acquiring Most Recent Loan

	Farm Size Strata				
Type of Collateral (% of households)	<1 ha	1 ha to <5 ha	5 ha to <10 ha	>10 ha	Total sample
Land (%)	0	9	16	14	11
Animals (%)	0	21	20	51	30
House (%)	0	5	0	2	3
Harvest (%)	0	14	20	7	12
Friend or Cooperative Reference (%)	100	46	33	21	37
Land and animals (%)	0	3	10	4	4
Land and harvest (%)	0	0	0	2	<1
Other	0	3	7	0	2
Number responding	6	77	30	57	170
Number in sample	14	132	38	78	262

Table 5.23 Use of Land as Collateral by Farm Size Strata

	Farm Size Strata				
Use of land as Collateral	<1 ha	1 ha to <5 ha	5 ha to <10 ha	>10 ha	Total sample
Used land as collateral to acquire most recent loan (%)	0	9	16	44	11
number responding	6	77	30	57	170
Has used land as collateral (%)	0	9	16	14	11
number responding	13	129	38	77	257
Would use land as collateral in the future (%)	36	59	56	25	49
number responding	14	99	25	36	174
Has or would use land as collateral for a loan (%)	36	63	63	36	55
number responding	14	99	25	36	174
number in sample	14	132	38	78	262

Like all farmers in the study, *minifundistas* commonly took loans for purchasing fertilizer, pesticides and inputs other than machinery rentals and hired labor. What distinguishes the *minifundistas* is the higher proportion of loans acquired for machinery rentals, land improvements, and consumption (see Table 5.24). None of these farmers owned equipment. Animal traction and chemical spray pumps had to be rented. No loans were acquired for hiring labor. They relied strictly on family for their agricultural labor needs.

Table 5.24 Use of Most Recent Loan by Farm Size Strata

	Farm Size Strata				
Use of loan (% of households)	<1 ha	1 ha to <5 ha	5 ha to <10 ha	>10 ha	Total sample
Consumption (%)	17	14	10	5	10
Hired labor (%)	0	4	3	4	4
Inputs (%)	50	56	55	62	59
Machinery Rental (%)	17	5	3	0	4
Land improvements (%)	16	6	3	2	4
Inputs and labor (%)	0	6	0	2	9
Inputs and machinery (%)	0	5	10	12	7
Inputs and land improvements (%)	0	1	13	13	2
Other (%)	0	3	3	0	0
Total (%)	100	100	100	100	100
Number responding	6	79	31	56	172

5.3.2. Farms Greater Than or Equal to One Hectare and Less Than Five Hectares:

While the Modernization Law of 1992 permits official titling (an INA title of *dominio pleno*) for parcels less than 5 hectares, the previous reform sanctioned the titling of such parcels only if they were planted, at least in part, with coffee. In essence, these farmers were excluded from acquiring a title for the entire initial phase of the USAID titling program. According to the 1993 Census, farms of this size represent over 50 percent of all farms within the municipalities included in this study (refer back to Table 5.12). With these two issues in mind, a distinct strata was defined in order to give special attention to this group of farmers. In addition, this strata represents one stage of the transition between very small, food-insecure,

subsistence-based *minifundios* to larger, more food-secure and commercially-oriented farms. Generally, these farms are more diverse than *minifundios*, but conspicuously less commercial than the larger farms.

As with the *minifundistas*, it is more likely that the head of household is illiterate and that at least one member of the household is engaged in salaried activities (recall Table 5.10). However, the categories of salaried positions are more diversified and include jobs in urban areas. These farms are more like the farms of the bigger strata with respect to the household size (6.3), number of agricultural workers (2.8), and years residing in the area (43) and in cultivating individual plots (17).

This strata of farmers possess mostly private (40 percent) and national (34 percent) lands (Table 5.11). Farmers claim to be the "owner" of 68 percent of the plots they cultivate, which is higher than the *minifundistas* but still below the overall average. They have a higher portion of land with INA and other documents, but this is still considerably lower than the larger two strata: 34 percent compared to 56 and 64 percent (Table 5.12). The most common means of acquiring land is through inheritance. Only 25 percent purchase land. This is the lowest rate among the different strata. This may be indicative of typical farm size shrinkage of multigenerational divisions due to population growth and inheritance.

With an average land per capita ratio of only .48 ha, farmers of the second strata intensively cultivate, using roughly half of the total area in each season (refer back to Table 5.10). Their use of fertilizers, insecticides, machinery, and hired labor inputs resembles the larger farms: 80 percent apply fertilizers and 61 percent hire labor (Table 5.13). As a result, both maize and bean yields are better than those

achieved by *minifundistas* (see Table 5.14). Nevertheless, these farmers are still net purchasers of basic grains.

As is true for all of the farms in the sample, maize and beans are the most important crops for both consumption and sales. However, unlike the *minifundistas*, these households grow other commodities such as coffee, horticultural crops, fruit trees, sugar cane, and sorghum. Coffee and horticultural crops are important income earners, though second still to maize and beans. One third of the households market an agricultural product other than maize and beans (recall Table 5.19). As such, their cash sources are more diverse.

Farmers in this strata were more familiar with soil management practices than were *minifundistas*. As with all farmers, managed stubble is most commonly employed. No other practice seems to dominate for this group. However, they do appear to be less inclined to adopt terraces and stone walls, which is not unlike the sample as a whole (see Table 5.17). Farmers expressed interest in practices which enhance soil fertility such as fertilizer beans, manuring, and live barriers. Besides claiming that there was no problem with soil erosion, these farmers said that it was the lack of knowledge which prevented them from implementing practices.

Like the *minifundistas*, these farmers also rely on friends and family for their cash needs. However, a quarter of them also borrowed from banks and the informal sector (Table 5.20). Of those acquiring loans within the last 5 years, 31 and 20 percent were arranged through BANADESA and development projects respectively (see Table 5.21). As with the larger farms, sales of produce and/or labor was quite common. The majority of farms still used references as collateral, but some also used animals, their pending harvest, and land (Table 5.22). These farmers were the

most willing to use their land as collateral. Nearly 90 percent said that they had or were willing to use their land as collateral (refer to Table 5.23). Loans were predominantly for inputs, although some were acquired for hired labor and consumption needs (Table 5.24).

5.3.3 Farms Greater Than or Equal to Five Hectares and Less Than Ten Hectares:

This group represents between 8 and 18 percent of the farms within the municipalities included in the study. This strata is not very distinct but rather a point on the continuum between small marginal subsistence farmers and larger commercially oriented farmers. Tables contained in the sections covering the first two farm strata illustrate this tendency. For this reason, there is little detailed description provided here.

In general, these farmers most resemble the farms of the largest strata. The percentage of cultivated land is much lower than the two smaller strata: one quarter to a third in either the *primera* or *postrera* (Table 5.11). Rates of land documentation (18 percent with an INA title and 56 percent with any document) and perceived ownership (84 percent) are much higher; yet, they are lower than those for the largest strata (see Table 5.12).

Nearly all of the farmers in this strata (92 percent) are likely to possess at least one hillside parcel. Eighty-six percent have adopted at least one improved soil management practice on at least one parcel (Table 5.13). Managed stubble and contour planting are the most common (Table 5.18). Farmers of this strata also tend to use fertilizer, insecticide, machinery, and hired labor.

As is the case with the larger strata, these farmers satisfy their cash through

crop and animals sales, employment, and/or borrowing (refer back to Table 5.20). They also use animals to secure loans (20 percent). However, like the smaller farmers, they rely mostly on personal references (33 percent) and expected harvests (20 percent). Although similar to the larger farmers in that they tend to borrow from banks and informal lenders, they also have access to project loans (Table 5.21).

5.3.4 Farms Greater Than or Equal to Ten Hectares:

According to the 1993 Census, farms greater than or equal to ten hectares collectively represent between 5 and 29 percent of all the farms in the municipalities included in the sample. This strata is the broadest in terms of farm size: the smallest being 10 ha, the largest 688 ha. The average farm size is 36 ha and per capita land area is 7.48 ha, much higher than the other three strata (Table 5.10).

Although different in size, these farms are essentially homogenous with respect to the farm characteristics presented in this chapter. The strata was broken down further into narrower ranges and compared. Differences in the substrata generally reinforced trends illustrated on a number of tables. For example, the percentage of farms acquiring bank credit, selling agricultural products other than maize and beans, owning animals, and possessing documents all increased with the farm size substrata. Because of this tendency and the desire to simplify the analysis, the author chose to lump all of the larger farms into one strata.

As Table 5.10 indicates, farms of this strata have the oldest heads of households (55), the greatest number of family laborers (2.9), and the fewest number of salaried workers (.4). A higher portion of the salaried workers is

employed in urban areas. Only 8 percent of the heads of households engage in salaried activities. This is much lower than the sample average of 30 percent. These households have been residing in the area and cultivating their fields for the longest period of time: 47 and 21 years respectively (Table 5.11).

Like all of the other strata, about 50 percent of the land is private. National lands comprise, on average, 31 percent of the land. Surprisingly, these farmers have as high a percentage land on hillsides (87 percent) and with poor quality soil (29 percent) as do smaller farmers.

Large farmers do not intensively cultivate their land. Only 16 percent of the area was cultivated in either the primera or postrera (note that the area in coffee production was included in this calculation). Over three quarters of these farms use machinery or animal traction, hire labor, and apply fertilizer (Table 5.13). They have the highest yields of maize and beans with the smallest variability in maize yields (Table 5.14). In general, coefficients of variation for both crops in both seasons are among the lowest.

Like all other strata, nearly 80 percent of the farmers employ some form of improved soil management, most commonly managed maize stubble (see Table 5.17). However, according to Table 5.15, the largest farms have the lowest percent of their cultivated fields with practices, 33 percent. The higher percent of farms using manure reflects the greater accessibility of inputs through the ownership of cattle. Lack of knowledge was a common reason given for not adopting a practice. Many large farmers felt that animal traction was mutually exclusive from management of maize stubble and minimum tillage, and they preferred the former.

Although beans are the most important cash crop among all farms, large

farmers also sell cattle, livestock products, and coffee. To a lesser extent, they sell horticultural products. Ninety-eight percent sold some agricultural product and 63 percent sold something other than maize and beans (Table 5.19). These farmers are less preoccupied with providing for their subsistence than *minifundistas*. With more land, higher yields, and more diversity in production, they are less inclined to fall short of their household's subsistence needs. With more marketable surplus and greater purchasing power, they are able to meet shortfalls in their basic food supply through market purchases. The main objective of these farmers is to maximize profits and reduce drudgery.

Large farmers either sold produce or borrowed cash when needed. Over the last 5 years, 66 percent of their loans were arranged through BANADESA. They received less assistance from projects than farms ranging between 1 and 10 ha (Table 5.21). The most common form of collateral was animals, even in cases where loans were granted by BANADESA. One quarter of the large farmers secured loans using personal references, while only 14 percent used land (refer to Table 5.22). Those who wouldn't use land for collateral were afraid that they would lose it. Even for large farmers, using land as collateral is not very common.

5.3.5 Effect of Infrastructure on Adoption

A number of additional factors which influence the adoption of soil management practices stem from the context in which the farmer lives, and help to explain why adopters seem to concentrate in some municipalities or villages and not others. Such factors include: 1) the extent of extension and development project activities, 2) the presence of local institutions and organizations (e.g., cooperatives,

credit associations, women's groups, etc.) which facilitate individuals or groups to innovate, 3) the degree of market integration, and 4) situations which afford economic gains in excess of own-farm opportunities. Because only a few farmers were included from each of the villages or caserios in the survey, it is difficult to rigorously characterize the farmers' communities. Nevertheless, first-hand experience and anecdotal information assist in clarifying the roles of these factors.

Soil management practices were relatively common in the municipality of San Lucas. Farmers had come to know of the new practices through attending local seminars presented by MNR extension agents. World Vision and LUPE were also active in the area. Although appearing extremely remote, farmers produced vegetables, peanuts, and coffee for markets in Tegucigalpa and abroad. They talked about the benefits of green manure when applied to their horticultural crops, and the complementarity of cash crops and soil management techniques professed by the LUPE project. Lomas Limpias and Guinope, also in El Paraíso, were similar to San Lucus. Like San Lucus the areas are largely comprised of *ejidal* land, and the use of soil management practices was immediately evident from the road leading into the villages. Guinope has a large regional market which is assessable to Lomas Limpias residents as well. LUPE, World Neighbors, Zamorano and a number of commodity specific projects work in Guinope. Cooperatives and a number of community organizations are active here as well. Although high up on top of a mountain outside the immediate range of development projects, the people of Lomas Limpias seemed to compensate for the lack project assistance with active community involvement. The school was well maintained, and water pipes were being installed in a local cooperative effort. They people appeared enthusiastic

about their accomplishments and strongly committed to their farms. When asked what they would do with additional time if they had it, farmers unanimously said invest it in the farm.

In contrast, the use of soil management practices did not spread in Santa Cruz, Olancho. In clear view, at the entrance to the town, were the strikingly green fields of a local man who was trained as a demonstration farmer by a development project more than eight years ago. No development workers had been there since. Nevertheless, he had maintained his live barriers which had successfully transformed into terraces. He had drainage ditches and incorporated into the soil both the maize stubble and barrier cuttings. According to the farmer, his neighbors' indifference toward his success was attributed to their laziness as well as the abundant wage opportunities on local commercial farms. Most recently, new and expanding tomato farms have been providing substantial employment in the region.

5.4 Land Tenure Issues Not Strictly Related to Adoption

5.4.1 The Question of "Ownership" in Honduras

Historically, ownership was commonly defined in the literature as possession of a title of unattenuated individual land rights (see section 2.4 of Chapter Two). The results of this study suggest a different perspective in Honduras. Eighty-three percent of the sampled farmers described themselves as owners. Farmers have the impression that they are de facto owners even when they do not have an official INA title or other document, even when they have just usufruct rights to national and *ejidal* land, and even when they are merely borrowers of land or squatters. Table (Table 5.25) illustrates that farmers claiming to be owners occupy all types of

Table 5.25 Tenure Attributes of Parcels of Those Perceiving Themselves as Owners and Non-owners

Attribute of Parcel (% of parcels by owner/non owner)	Owner	Non Owner
TYPE OF LAND:		
Ejidal (%)	18	19
National (%)	38	32
Private (%)	44	49
TYPE OF DOCUMENT:		
No document	53	90
Any document (%)	47	10
Document other than INA title (%)	32	5
INA title (%)	15	5
Total (%)	100	100
METHOD OF ACQUISITION:		
Purchased (%)	50	1
Given/Inherited (%)	31	13
Other (%)	19	86
Total (%)	100	100
OTHER ATTRIBUTES:		
Years cultivating field (yrs)	17	8
Soil Management practice on field (%)	40	40
Planted trees (%)	42	28
Number of fields	696	148

land, including those governed by a usufruct system. Less than half of the plots perceived as owned actually have accompanying documents.

The responses of farmers suggest that there are a number of parcel-level attributes which imply ownership; although, some farmers who do not possess

these attributes still consider themselves owners. These attributes include: 1) using a plot for an extended period of time; 2) purchasing or inheriting a plot regardless of the type of land; 3) possessing some form of documentation; and 4) installing fences or planting trees, both of which imply the farmer has expectations of long-term land use. Of the plots with INA titles, 90 percent were identified as being owned. Farmers also maintain that they own over 90 percent of the parcels that are purchased, individually adjudicated, or inherited (note that these last figures are not presented in the tables). In other words, possess of these attributes implies ownership, but a farmer may perceive themselves to be owners without possessing these attributes. The prevalence of this form of de facto ownership my be a reflection of rural Hondurans continued reliance on traditional institutions in place of legal, formal and external institutions introduced through the titling program.

5.4.2 Contributions of Land Titling

The rationale behind instituting individual private property rights through the conferment of land titles is predicated on the notion that unattenuated individual property rights provide investment incentives and encourage efficient allocation of land. Briefly, this translates into awarding documented rights that are clearly specified, exclusive, transferable, and enforceable. In theory, land titling programs are instituted under such conditions. In practice these conditions are not always met. And, even when met, they may not achieve any more than can be achieved by other means. In a number of instances (see Chapter Three), these functions were carried out prior to, and without the need of, a titling program.

5.4.2.1 Land Prices and Documentation

In the preceeding discussion, the relationship of titles to adoption of improved soil management practices was explored. The forward link from these practices to increased productivity can be tested by the relationship of tiles to land values. A price ordinary least squares (OLS) model was estimated in order to test whether possession of an INA official document had an effect on the price of land. As noted in Chapter Three, documentation of land rights is expected to reduce transactions costs and increase security of investment expectations, and consequently, increase price. The point of this analysis is not to predict the land values as such, but to see if titles and documents are factors in the determination of productivity enhancement, which itself might be expected to be reflected in land prices.

The price model estimation results are recorded on Table 5.25. The basic models were introduced in section 4.2.4.2 of Chapter Four. The results are as expected. Possession of an official INA title (INA TITLE), holding all other factors in the model constant, added to the price of land. However, the beta coefficient indicates that its' influence is somewhat less than other the factors such as area, distance from the homestead, and quality of the soil. The larger INA title coefficient in the equation using all parcels as compared to that using just hillside plots suggests that the greater demand for land located in the valley translates into more benefits derived from securing ownership through official titling.

In both cases, the price of land (PRICE) is negatively related to the slop and the distance that the parcel is from the homestead. Generally, in Honduras, homesteads are located at the side of road so distance to the homestead provides a

Table 5.26 Results of Land Price Model Estimation

HILLSIDE PARCELS ONLY*					
Variable		Coeff	Beta Coeff	t-stat	sag level
CONSTANT		5276	-	1.59	.1151
SOIL QUALITY		9211	.2841	3.34	.0012
SLOPE		-4783	-.1470	-1.68	.0953
PARCEL SIZE		887	.4211	4.81	.0000
DISTANCE		-6998	-.2091	-2.47	.0153
INA TITLE		5332	.1562	1.85	.0680
IMPROVED PRACTICE		5599	.1701	2.02	.0464
adjusted R^2	.32				
number of observations	104				
d.f.	97				
FLAT AND HILLSIDE PARCELS					
Variable		Coeff	Beta Coeff	t-stat	sag level
CONSTANT		5943	-	1.93	.0554
SOIL QUALITY		7213	.2007	2.70	.0077
SLOPE		-2359	-.0638	-.85	.3977
PARCEL SIZE		599	.2879	3.97	.0001
DISTANCE		-6564	-.1735	-2.41	.0170
INA TITLE		7748	.2048	2.84	.0052
IMPROVED PRACTICE		1987	.0549	.769	.4430
adjusted R^2	.23				
number of observations	161				
d.f.	154				

*The only flat land parcels were excluded from this model.

proxy for accessibility. The larger the parcel (PARCEL SIZE) and the better the soil quality (SOIL QUALITY), the higher the price. The existence of an improved soil management practice (IMPROVED PRACTICE) had a direct effect on price, but only for the model estimating hillside plots. This is consistent with the impression of farmers from Los Marquitos, San Lucas, and Lomas Limpias who felt that a parcel with soil management practices would command a higher price. The effect of slope and improved soil management practice are less for the equation including flat parcels. This is because the slope and existence of improved practices is more indicative of the productivity of hillside parcels.

The adjusted R^2 in both equations is low, however, not out of line with other studies of land markets in less developed countries where substantial market imperfections exist. As mentioned in Chapter Three, land markets in Honduras are imperfect, land is heterogenous, buyers and sellers can influence price, bureaucratic procedures abound, and information is imperfect. Under these market conditions, it is unlikely that the a portion of the variation in land prices would be explained by such models. Measurement error and significant missing variables, especially when soil quality is measured by a dummy variable, also account for the low R^2s. Population densities and the level of infrastructure development such as roads and markets are expected to contribute to the variation in land prices. Unfortunately, data were not available to test the role of these variables and the hypotheses concerning the roles they play. So, while offical INA titles was significant in the total sampled parcel model, more comprehensive conclusions require better data.

5.4.2.2 Nominal Verses de Facto Property Rights

Section 2.2.2 of Chapter Two clearly illustrates the lack of specificity in the delineation of Honduran property rights, particularly for national lands. Numerous reforms and decrees, along with the dramatic shifts in CODHEFOR's mandate over forested lands, have created confusion and suspicion among the rural population, including government agents. The government's inability to disseminate information only exacerbates the situation. Ninety percent of the farmers included in this 1994 study had not heard of the 1992 Agriculture Modernization Law. Of the 26 farmers who said that they did hear of the it, about one third either misunderstood the law or were mistakenly referring to the previous reform. Of the remaining respondents, most had negative expectations and complained that only the bigger and wealthier land owners would benefit.

Exclusion as well as enforcement are less of an issue on agricultural, as opposed to forest, land in Honduras. Owners of private land and those who have been granted usufruct rights over national and ejidal agricultural land have had exclusive use rights. This is well understood, even by those *campesinos* who borrow or without permission occupy land. Although technically a violation of the exclusion principle, in most cases there is a tacit agreement between the large absentee landowners and local *campesinos* whereby the latter cultivates the periphery of the property without permission and relinquishes it upon the former's request.

In the study area, land security, in the sense of longevity of expected use, did not necessitate documentation or unattenuated individual private rights. The lack of either or both did not inhibit the planting of trees or installing of soil

Table 5.27 Characteristics of Land of Different Tenure Systems

Attribute of Parcel (% of parcels by land type)	National	Ejidal	Private	Overall
Perceived ownership (%)	86	84	82	84
TYPE OF DOCUMENT:				
INA title (%)	12	7	14	12
Other document (%)	17	27	37	28
Any document (%)	29	34	51	40
METHOD OF ACQUISITION:				
Purchased (%)	36	37	48	42
Given/Inherited (%)	29	25	30	29
Inherited and Purchased (%)	21	19	10	13
OTHER ATTRIBUTES:				
Years cultivating field (%)	16	17	16	16
Soil Management practice on field (%)	34	43	40	38
Planted trees (%)	37	44	39	40
Number of plots	299	146	357	802

management practices, both generally considered actions predicated by a greater degree of land security (see Tables 5.27, 5.28 and 5.29). In addition, the fact that 55 percent of inherited land had no accompanying documents, and only 14 percent had an official title, suggests that extended security and perceived ownership are possible without documentation. In general, farmers do not worry that their cultivated land will be taken away so long as they install a fence or indicate in some other way that they are in current possession of a specific parcel. Apparently, other local farmers respect these claims of their neighbors. Community forested areas, however, are more often subject to illegal clearcuts. Here clear connection of a

particular area with a particular person is not established.

Claims of ownership were just as high on national and *ejidal* land as they were on private land: all over 80 percent (see Table 5.27). Yet, the extent of documentation did vary across land types. Private property had the highest incidence of titling (51 percent). INA titles have been acquired for 12 percent of the national land. Unlike *ejidos*, there is no local or customary alternative title for national land. The government no longer issues the other types of documents listed in section 3.2.2.5 of Chapter Two. As Cole-Coghi (1994) points out, INA titles are appreciated as the sole means of legally providing greater security of access to national land. In contrast, there are few INA titles granted to *Ejidos*. The latter observation is due to the availability of documents other than INA titles. It is also a manifestation of municipalities' reluctance to relinquish their authority over *ejidos* to the national government. Local people and small, less educated and poorer farmers may loose out when the administration shifts to the national level. While this group may give up security, the new claimant will gain. The issue the new reform and titling program provide security for whom: the long-term local user or the new claimant.

The lack of documentation or unattenuated rights did not prevent the transfer of land in the study area. Just slightly more than half of the sample plots had some form of documentation, and only 14 percent had INA titles (see Table 5.28). Yet, the lack of title did not appear to have inhibited the purchase or inheritance of land: respectively 28 and 55 percent of these plots were without documentation. Nor did the type of land or tenure regime (i.e., usufruct or full ownership rights) restrict the transfer of land. Recall, national and ejidal lands are

Table 5.28 Proxies of Land Security Distributed Across the Document Status of Land

Document Status of Parcel				
Attribute (% of parcels)	No document	Other document	INA title	Number of fields
Land inherited (%)	55	31	14	232
purchased (%)	28	58	14	348
inherited & purchased (%)	90	4	6	107
owned (%)	45	41	13	693
Trees planted in field (%)	51	38	11	328
Conservation practice on the field (%)	50	38	12	314

formally associated with usufruct rights whereas private land is individually owned. According to Table 5.27, all three types of land were purchased and inherited. But, in practice rights are exchanged.

Another suggested benefit of the land transferability is its use as collateral for loans, especially involving non-local parties. Land must be alienable in order to function as a liquid asset to secure a loan. The results of this study indicate that this is less of an issue in Honduras under current conditions. As was noted in the previous section, few farmers usedland as collateral in any case. Large farmers more frequently used animals, and mid-sized farmers used a portion of their expected harvest; animals; or, like *minifundistas*, personal references. Even in rich countries, land is not used as collateral for production credit to create soil management practices.

Table 5.29 Proxies of Land Security Given the Document Status of Land

	Document Status of Parcel			
Attribute	INA	Other document	No document	Overall
Land inherited (%)	32	22	30	28
purchased (%)	49	70	23	41
owner (%)	93	96	74	83
Years field cultivated (yrs)	20	17	15	16
Trees planted in field (%)	17	26	28	26
Conservation practice on the field (%)	39	39	37	38
Number in sample	100	301	430	831

Table 5.30 Collateral Used by Source Granting Loan

	Source of Loan					
Collateral	BANADESA	At Work	Informal Sector	Family	Co-op	Project
Land (%)	10	0	0	0	0	29
Animals (%)	56	0	0	0	0	25
House (%)	1	0	0	0	11	13
Harvest (%)	9	14	34	6	11	8
Reference (%)	14	72	68	88	56	25
Land and animals (%)	9	0	0	0	0	0
land and harvest (%)	0	0	0	0	11	0
Other (%)	1	14	0	6	11	0
Number responding	80	7	27	16	9	24

Informal interviews with development workers revealed that banks and informal lenders discourage the use of land as collateral because assessing the value and selling the property upon default of the loan is expensive. They prefer more readily marketable items. Table 5.30 presents the type of collateral used for loans arranged through a number of institutions. Land was most commonly used with development project loans. Access to loans is not greatly constrained by lack of documentation for land. There appears to be no relationship between those who have documents and those who receive loans.

5.4.2.3 Distribution of Benefits From Titling

A substantial problem with the land titling program in Honduras is the asymmetric coverage. Larger farmers take advantage of titling property. There are a number of reasons for this. The experience of the small farmer is more local than that of larger farmers. They are most familiar and comfortable with local customary procedures.

The application process for an official INA document is complex, lengthy, and costly. Applicants are required to travel, sometimes numerous times, to the regional INA office located in an often distant urban center. In addition, the law requires that land transfers be executed with the assistance of lawyers. Small farmers can't afford such services. Many less-educated *campesinos* have trouble understanding the procedures. On a number of occasions, respondents exhibited for the survey team documents they believed to be titles which, in fact, had nothing to do with land at all. Coles-Coghi (1994:179) found that farmers in his study believed that their applications to INA would ultimately be denied. In general, it is felt that

titling is not worth the cost or the extensive wait. The fact that INA authorization is required for any subsequent sale of registered property only serves to reinforce this perception. Coles-Coghi (1994) concluded that the Honduran land titling program in the Western and Central regions that "..*campesino* land rights continue to be based primarily on customary practices and personal trust." In sum, for the small farmer, INA land titling provides few incentives and entails substantial transactions costs itself, thus mitigating any transaction costs savings between buyers and sellers.

Since the acquisition of an official INA title was found to increase the price of a given parcel of land (see section 5.1.3 and Table 5.7), and one group of farmers can more easily avail themselves of the titling procedures, the program disproportionately favors the appreciation of land for that group. Recall that the acquisition of a title is directly related to farm size.

In addition, the rise in the price of land implies greater certainty in ownership or usufruct rights. While buyers and lenders from outside the community can be more confident that there will be no unexpected legal claims on the land. This is more important for the locals. Where loans are tied to the value of land as collateral, increases in the value of land imply greater access to credit.

Increases in the price of land due to titling could also filter into higher rents. Landlords (perhaps absentee landlords in particular) would seek to extract more rent now that their rights have been clarified and reinforced. The absolute increase, of course, would depend on the bargaining strength of both parties. Regardless of the outcome, the change in price may not reflect an increase in productivity if the only effect is one transactions costs and not via an impact on productivity enhancing investments. To the renter, the price increase represents a rise in costs. This implies

that a titling program could affect a reduction in the social welfare of the renter. As the output of the study suggests, renters in Honduras are largely *minifundistas*. As confirmed by study, although not conclusive, the titling program could be redistributing wealth from the poorest to wealthier farmers and absentee landlords.

CHAPTER SIX

CONCLUSIONS

6.1 Summary and Conclusions

While unable to conclusively resolve all of the questions initially raised here, the results of this research have provided a number of meaningful observations relevant to the debate surrounding the use of land privatization and titling as a means to improve natural resource management and economic performance. Also, some important areas for further research will be highlighted.

6.1.1 Importance of Distinguishing Farms by Size

This study illustrated the importance of distinguishing farms by size. For example, it showed that the impact of land reforms, titling and extension efforts vary according to farm size (see section 5.3). In the case of Honduras, the smaller the farm, the less likely that land will be titled, that farmers can secure loans, and farms will be visited by extension agents. During the past five years, no *minifundista* was visited by an extension agent or received credit from a development project or bank. They had fewer titles and documents for their land and less technical and financial assistance; yet, they were the most prone to adopt improved soil management practices. This outcome is clearly counter common wisdom found in the literature.

As shown in section 5.3.1.3, the *minifundistas* were subsistence farmers producing only maize and beans, and annual crops generally considered to be land erosive. They cultivated upwards of 80 percent of their holdings, while larger farms could leave the most erodible area idle. The largest farmers, although producing some horticultural crops, tended to diversify into cattle production. Without employing improved pasture techniques, this production choice is also erosive. Only 16 percent of the average large farm holding was cultivated. Mid-sized farms were more inclined than the other two strata to establish a mix of coffee and horticulture. Coffee production is less erosive. Cultivating, on average, between 27 and 50 percent of their total land area, the mid-sized farmers could fallow a portion of their land at any given time. Not surprising, the use of chemical inputs, and hired labor increased with farm size. Both the econometric models of adoption and section 5.3.1.4 demonstrated that adoption of improved soil management practices decreased as farm size increases. Identifying these differences clarifies how objectives and constraints vary dramatically throughout the farming population, and helps to explain the variation in responses to government initiatives. Policies and programs need be designed to reflect these salient differences.

The study exposed an asymmetrical distribution of benefits from land reforms and the titling program (section 5.3.1.2 and 5.4.2.3). There is a pronounced positive relationship between farm size and securing documents or official INA titles specifically. According to the results of this study, government and development programs have excluded or overlooked *minifundistas*. The initial phase of the titling program issued titles to farms no less than five hectares unless some portion was planted in coffee. The 1992 Modernization Law lowered the

program minimum land requirement to one hectare with the explicit intention of eliminating land holdings less than one hectare in size. None of the *minifundistas* in the sample had contact with extension agents, nor was there any indication that development programs were providing them with assistance. Furthermore, not one *minifundista* had ever received a loan from BANADESA. Given the limited information available at this time, this study was unable to discern how the proposed *cajas de credito rurales* program, designed to assist reform beneficiaries (i.e., those registering for titles), would correct for this bias.

Neglected and disadvantaged *minifundistas* are more often than farmers of other strata extremely marginal farmers whose families go hungry over the period of food scarcity just before planting. They also contribute to the problem of deforestation as they seek more land to clear for agriculture purposes. These results should sound a whistle to policy makers struggling with the persistent multipronged problem of increasing agricultural productivity, improving natural resource management, and alleviating rural poverty.

6.1.2 What is "Ownership" of Land?

Clarification of land ownership and land use security is important to policy makers, development workers, and researchers who attempt to identify who are the potential investors in, and/or stewards of, land. Until recently, the conventional wisdom was to assume that an owner was someone with individual unattenuated rights, usually documented. Researchers typically ask farmers if they owned or rented, had or didn't have titles, and proceed to conduct their analyses according to responses to these simple and inflexible questions. Many researchers and

development agents also assume that those with such rights would be most inclined to invest in their land and safeguard its' productive value. More recently, there has been some discussion in the literature about what ownership and land use security is, and what aspects of ownership are important given these types of investment and land stewardship policy objectives (see section 3.2). Honduras calls into question the conventional wisdom.

This study shows that those who consider themselves owners of land in Honduras do not necessarily hold titles or other documents for the land they cultivate. Many who perceive themselves as owners are situated on national and *ejidal* land and possess usufruct as opposed to full, fee simple rights. Crosstabulation of the data suggests that those who consider themselves to be owners, with or without land documents, invest in improved soil management practices more readily than those classifying themselves as nonowners (section 5.4.1). Unfortunately, the econometric analysis could not further support these findings. The effects of perceived ownership and possession of either an official INA title or any other land document were found to be small and insignificant (see section 5.2.2). These results, in contrast to the crosstabulations, generally do not support the hypothesis that perceived ownership and/or documentation are important determinants of investments in improved soil management practices. Given the weak results of the econometric analysis and data limitations, the topic remains a subject for further study. It is possible to conclude, however, that the possession of documented fee simple rights is not a necessary precondition to investing in longer-term land improvements.

The research did show that there are a number of parcel-level attributes

which imply ownership to farmers but they were not exclusive, i.e., some farmers whose land did not possess these attributes still considered themselves owners. These attributes included: 1) using a plot for an extended period of time, 2) purchasing or inheriting a plot regardless of the type of land or tenure, 3) possessing some form of documentation, and 4) installing fences or planting trees, both of which signify permanency. This set of attributes connotes exclusivity and longevity in use. It suggests that a sense of ownership stems from de facto land use security. It does not appear to be dependent on nominal fee simple rights. While documentation of rights was shown to be important, it is not a necessary condition.

6.1.3. Contributions of Land Titling in Honduras

The results of this study challenge both the rationale and methods of recent Honduran land reforms as well as the land titling program, especially in their efforts to encroach on *ejidos*. While the objective of strengthening local land tenure institutions and procedures for land transfer is laudable, the approach taken is ill-conceived and may, as a consequence, undermine the more basic objective of improving natural resource management and economic performance and provide less security to recover land improvement investments rather than move.

Well-defined property rights possess specificity, exclusivity, transferability, and enforceability. Results of this research suggest that local traditional or customary systems of tenure in Honduras, such as *ejidos*, exhibit these attributes in practice. Land use rights are clearly specified, exclusive, and generally enforceable under the *ejido* system. Land can also be bequeathed and land improvements can be sold. The longevity of the system inspires confidence and a sense of land use

security. The was manifested by the estimation of a significant positive relation between *ejidal* land and adoption. In contrast, land rights are less clearly defined for national lands. Honduran land reform over the past century can be characterized as dynamic, disjointed and convoluted. Many reforms have been quickly overturned and/or overlaid, even before information concerning these reforms has been fully disseminated. These numerous reforms and decrees, along with the dramatic shifts in CODHEFOR's mandate over forested lands, have created confusion and suspicion among the rural population, including government agents. In such a sitution, titling may be an occasion of insecurity for traditional users of the land.

The study was able to differentiate the farmer's sense of land security with respect to different tenurial systems or types of land. The econometric results suggest that farmers are inclined to adopt on *ejidal* land and not adopt on national land. Farmers recalled more disputes arising over national land. While it seems certain that the difference in the sense of security exists, it is not possible to determine its' magnitude. Nonetheless, the fact that the authority of the central government has been encroaching on that of the municipalities suggests that there will likely be increasing uncertainty with regard to the definition and administration of the *ejido* system. It is also likely that farmers' confidence in the *ejido* system and other customary practices will erode, and be replaced by suspicion similar to that which they now have for the administration of national lands. Perhaps the recent land reform and the titling program could have taken advantage of the customary tenure regime and institutions and worked to strengthen them as opposed to reinventing a new and unfamiliar system.

Leaving aside the distinction between *ejidos* and national land, the results

indicate that usufruct rights governing both types of public land provide a degree of land use security that is at least equal to that of full fee simple rights associated with private property. This security is expressed in the fact that land under all forms of tenure (i.e., usufruct or fee simple) remains in the possession of a given farmer for extended periods of time and can be bequeathed to future generations or sold to others in the community if not to a distant buyer (see section 5.4.2.2). In addition, farmers found public land equally suitable for investments in land improvements. Many factors other than the type of ownership affect adoption of improved soil management practices.

One objective the study was to evaluate the claim that establishing individual private rights is a prerequisite to promoting more efficient allocation of land and greater use of credit for investments in land. Against this background, the study made a comparison in the transfer of property governed by usufruct rights or with limited or no documentation and property which was privately held and/or documented. Section 5.4 illustrated that the lack of documentation or unattenuated private rights did not prevent the transfer of land. All three types of land were purchased, rented, and inherited, as were both documented an undocumented parcels. Farmers were apparently confident that the sale of land would indeed capture the value of any improvements.

The shift from usufruct to fee simple rights has an important implication for land use patterns. Under usufruct tenure, a farmer is constrained to agricultural or forest activities. A fee simple title has no constraints on the type of use. The land does not have to remain in agriculture, but this is of little consequence in rural Honduras.

With respect to the use of land as collateral for loans, Honduran farmers and local lenders were found to prefer alternatives such as cattle, a share of expected output, or simply personal references (see section 5.3.2.6 and tables 5.22 through 5.24). BANADESA and the development projects were the only lenders extending loans based on collateral in the form of land. The study concluded that documentation and access to credit were directly related to farm size. Small farmers were much less likely than larger farmers to possess a title or document of any kind. Even when they possessed a title for their land, the smallest farmers did not have access to credit from BANADESA or a development project. Informal interviews revealed that banks and informal lenders discouraged the use of land because assessing the value and selling the property upon default of the loan is expensive and time consuming. They preferred more readily marketable items like animals and a portion of the harvest. All of this implies that titling is not closely linked to production credit allocation. If this were the only rationale for an expensive, long-term program such as the Honduran land titling program, certainly an alternative credit scheme would be warranted. The econometric results suggest, although not conclusively, that credit does not contribute the likelihood that a farmer will adopt an improved practice.

The lack of credit may constrain farmers' technology choice, but it is not apparent that titling helps close that gap. Section 5.3.1.6 demonstrated that farmers in Honduras generally do not use their land as collateral, and with the exception of the second strata of farmers (i.e., those greater than or equal to 1 ha and less than 5 ha), many are unwilling to do so in the future.

Although the study did not attempt to specifically assess INA and the land

titling program's performance with regard to increasing the efficiency of land markets, some serious shortcomings in the design of the titling process were identified. The application process for an official INA document is complex, lengthy, and costly. Generally, farmers express a high degree of uncertainty concerning their current rights. Applicants are required to travel, sometimes numerous times, to the regional INA office located in an often distant urban center. In addition, the law requires that land transfers be executed with the assistance of lawyers. Many less-educated *campesinos* have trouble understanding the procedures. It is difficult for farmers to remain current on the subject of land rights since the government has been enable to adequately disseminate information on new decrees including the modernization law. Less than ten percent of the sample farmers had heard of it.

In general, farmers felt that titling was not worth the cost or the extensive wait. The fact that INA authorization is required for any subsequent sale of registered property only serves to reinforce this perception. In brief, INA land titling provides few incentives and entails substantial transactions costs, particularly for small farmers. So the transactions cost savings to the buyer and seller is offset by the increased transactions cost between the government and farmer. It is no wonder that most farmers are inclined to rely on local, customary institutions.

These observations on the problems associated with the 1992 Modernization Law and the land titling program provide a number of valuable lessons in establishing land policy reforms. First, there should be universal access for designated beneficiaries. If the law states that all farmers can acquire titles, then the institutions charged with the administration of such rights need to be structured in a way which provides reasonable assurance that all groups within the target

community have access, regardless of the relevant distinguishable characteristic. This implies effectively disseminating information, simplifying procedures, and minimizing the costs, both in terms of time and money. Second, the program should instill confidence of its' beneficiaries. The reform should be well conceived with little need for subsequent revisions. Again, the information needs to be broadly disseminated and sufficiently clarified. Third, reforms should be conceived with full knowledge of preexisting viable institutions or organizations, and avail themselves of the services of these institutions. Not only do new organizations often unnecessarily ignore the valuable knowledge and memory of older customary institutions, they breed suspicion and insecurity, particularly in more traditional communities.

6.1.3 Titles, Soil Management Practices and the Price of Land

The land price model showed that the presence of documents and improved soil management practices appeared to be significantly and positively related to the price of land. In the case of documents, the rise in the price of land implies greater certainty in ownership or usufruct rights. Buyers and lenders can be more confident that there will be no unexpected legal claims on the land.

By the same token, landlords would seek to extract more rent now that their rights have been clarified and reinforced. The absolute increase, of course, would depend on the bargaining strength of both parties (i.e, renters and landlords). Regardless of the outcome, the change in price would not need to reflect an increase in productivity. To the renter, the price increase represents a rise in costs. This implies that a titling program could result in a substantial change in social

welfare. Since renters in Honduras are largely *minifundistas*. The titling program could be redistributing wealth from the poorest to wealthier farmers and absentee landlords.

The increase in land prices due to installation of soil management practices implies an expected improvement in the quality of land and a consequent gain in productivity. While an increase in rent would still entail additional costs, these costs would be accompanied by a gain in productivity. In addition, The value of land as collateral increases, and farmers can acquire larger loans.

6.1.4 Adoption of Improved Soil Management Practices

The possession of documents was not associated with the adoption of improved soil management practices. However, there are questions concerning the strength and robustness of the econometric models. It is interesting to note, however, that the farmers who are more inclined to acquire titles, i.e, large farmers, are also much less likely to adopt. They have the ability to postpone coming to terms with soil degradation. One aim of the 1992 modernization law is to aggregate parcels creating larger farms. This study suggests that this action could have a negative impact on national resource management objectives. Large farmers are less likely to adopt improved practices and more inclined to establish land-extensive livestock operations.

Other factors that were found to be positively associated with adoption were the slope of land, availability of household labor, cash crop production, *ejidos*, extension, and the presence of development projects. *Ejidos* seem to provide a secure environment for investment. Although extension is highly significant, the

magnitude of it's effect on adoption is small unlike that of development projects. The results of the adoption model suggest that introducing a development project increases the probability of adoption by 50 percent.

The results imply that farmers are interested in improved practices more as a means to revitalize their poor land rather than to further improve more highly productive lands. This could mean that there are higher marginal returns to improved soil management investments on poor as opposed to better quality land. Wage employment is a disincentive to adoption and implies that farmers see off-farm income generating opportunities as a better use of their time. However, most small farmers in Honduras could not meet their household subsistence needs through wage employment alone. It must be stressed that employment opportunities in Honduras are severely limited and unstable. It would be dangerously naive to assume that poor, inefficient farmers could find work once they relinquished or lost their rights to cultivate their land or the land became unproductive. A more likely scenario is that these farmers would migrate and open new land: an outcome at odds with natural resource management objectives since newly opened land is likely to increase deforestation and to be highly erodible as well.

The results of this study generally support the research of others working in Honduras. Farmers were aware of land degradation. It is interesting to note that farmers were more concerned with water management than soil erosion in areas of scarce or poorly distributed rainfall. They had considerable knowledge of practices even though few adopted them. Although they were aware of the practices and had seen them on others fields, many farmers did not know how to install and maintain them. Half of the sampled farmers expressed interest in at least one of the nine

practices included in this study. There is a need for extension and field demonstrations. Farmers often cited the unavailability of inputs, most notable in the case of fertilizer beans and manure, as the major constraint to adoption. This suggests a need to develop and improve input distribution (see sections 5.1 and 5.3.1.4).

Some farmers had as many as seven different soil management practices established throughout their farm land. However, intensive employment of practices was not the norm. Farmers tended to adopt just one practice on only one of their parcels. Management of maize stubble, live barriers, contour planting, drainage ditches and manuring were the most commonly adopted practices.

Although this study did not permit measurement of the profitability of improved soil management practices, only one farmer claimed to have eliminated a practice, indicating that it required too much work to maintain. Given that approximately two thirds of the practices have been established and maintained for four or more years and most farmers stated they were either satisfied or very satisfied with the results, it can be assumed that these practices provide some meaningful returns to the farmer.

Farmers installed practices on public lands and parcels without documents. The pattern of adoption remained essentially the same when an evaluation was made of only those practices with longer expected pay back periods (i.e., drainage ditches, terraces and stone walls). Given the data constraints it was impossible to conclusively determine whether formal individual private unattenuated rights are not a perquisite for the adoption of improved soil management practices in Honduras. The crosstabulations and informal interview do, however, indicate a sense of

ownership is important. As mentioned earlier, ownership for the Honduran farmer implies exclusivity and longevity in use.

6.2 Improving the Study and Recommendations for Further Studies

One of the most obvious ways in which this dissertation research could be improved is to conduct independent field work with similar objectives. As it was mentioned in the introduction, the field work for this study was added to another MSU/CRSP research project. While this option was logistically and financially attractive, it did constrain the type and depth of analysis. Given that adoption of improved soil management practices is uncommon in Honduras, it would have been preferable to employ a sampling frame and method that would have increased the probability of selecting adopters, e.g., inclusion of areas with higher rates of adoption. Similarly, the stratification by flat and sloping land was both unnecessary and a hinderance to this study. It substantially reduced the number of hillside parcels included in the study whereas Honduras is, in fact, predominantly mountainous. An increase in the number of hillside plots would add more robust information on farmers' perceptions of land degradation problems and on their motivations and ability to adopt improved practices. More rigorous and conclusive analysis would have been possible.

Limiting the survey to one research topic would have provided more opportunity to ask questions more uniquely relevant to land titling, tenure security, and adoption. This shortfall was more pronounced for the former two items. What are the determinant factors in establishing a sense of ownership and land security remains unclear, and it is necessary to clarify this process in order to understand

farmers perspectives and decisions concerning investments in land. A number of questions concerning tenure security had to be dropped from the final draft of the questionnaire in order to reduce the length. The MSU/CRSP bean study was undoubtedly affected in a similar manner.

The diversity in farmers' perspectives on improved practices as well as how to best install and manage them made it difficult to create a functional formal questionnaire. As the field research progressed, it became apparent that using a more informal approach, alone or in conjunction with the formal survey, could have provided more illustrative information. Collecting useful information on perceptions and how they are formed requires that several probing questions be included in the survey tool, as opposed to the one used here, and some that anthropological or sociological methods be incorporated. Unfortunately, such an approach would require more time and a more highly trained survey team. Interviewers would need more knowledge on the technical aspects of the practices as well as have a basic foundation in the theory of survey methods. Alternatively, the study could have concentrated on one or two improved soil management practices. This, of course, would considerably reduce the likelihood of finding a sufficient number of adopters.

Current research on the technical efficiency and economic profitability of improved soil management practices in Honduras is extremely limited. There is a need for such studies. It should be noted that farmers themselves are more interested in improved water management than in reducing soil erosion. As such, an evaluation of the changes in the rates of soil erosion with the use of these practices would not be the most appropriate way to conceptualize the research problem.

One interesting study stemming from this research would be an evaluation of

local and municipal organizations affiliated with land tenure and land transfer. This would include an analysis of whether these organizations could provide a viable alternative to the current centralized system overseen by INA.

APPENDICES

APPENDIX A

Soil Management Questionnaire for Honduras

INFORMATION ABOUT THE RESPONDENT

Respondent's name . . . . . _____

Household number . . . . . _____

Department . . . . . _____

Municipality . . . . . _____

Segment number . . . . . _____

Village . . . . . _____

Caserio . . . . . _____

Altitude (meters) . . . . . _____

INFORMATION ABOUT THE ENUMBERATOR

Name . . . . . _____

Date . . . . . _____

Time the interview began . . . . . _____

Time the interview ended . . . . . _____

FARM MAP

Make a map of all of the fields that were worked during the "primera" and "postrera" last year.

INSTRUCTIONS: FIRST, draw the producer's house and points of reference like the principal road. SECOND, a) draw all the fields that the family has (including land rented out and fallow land) and b) all the land that the family rented or borrowed during the past "primera" and "postrera", including land around the house. THIRD, number all the fields. FOURTH, write the size of each fild. FIFTH, write the down the principal crops planted in "primera" and "postrera" last year for each field, indicating if they were planted in association or not. SIXTH, if the family has land in another village or municipality, ask the producer where it is located and record the information on the map.

NORTH

CHECK LIST:
1) did you include the house, points of referentce and principal roads?
2) did you include all the fields?
3) did you number of all fields?
4) did you indicate the principal crops for both the primera and postrera?
5) did you indentify the fields located outside the village?
6) did you indicate fields planted in association and monocropped?

I. INVENTORY OF LAND/FIELDS

We would like to ask you some questions about each of the fields that you had worked.

Table I. Field characteristics

Field #	Who works this field? (enter the name)	how much time does it take to reach the field? (minutes)	mode of transport 1 foot 2 animal 3 car 4 other (esp)	Area of the field		slope 1 flat 2 rolling 3 steep 4 very steep	soil quality 1 very good 2 good 3 regular 4 bad	are there trees in this field? 0 none 1 planted 2 natural 3 both	for how long have you had this field? (years)
				AREAQ	AREAUN				
TERR	MEMB	I1	I2	AREAQ	AREAUN	SLOPE	SOIL	TREE	LANDYR
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

II. CROP PRODUCTION IN PRIMERA
FIELDS WITH CROPS IN ASSOCIATION/INTERCROPPED IN PRIMERA, 1993

INSTRUCTION: Use the map which contains the fields worked to answer question H1, and table V.

H1.	Did you plant crops in association in any field during the primera last year? 0 no (--> H2 NEXT PAGE) 1 yes	

INSTRUCTION: In the following table use one line for each crop in association and write the field number. Each crops should go on a separte line, one below the other.

I would like to ask some questions concerning the fields with INTERCROPPING DURING PRIMERA LAST YEAR. We only want to talk about the area of the field in which there are crops grown in association.

table II. Production during the primera in incropped fields

field #	Crop intercropped 1 maize 2 beans 3 sorghum 4 coffee 5 horticulture 6 other	was the crop grow in association in the entire field or just a part? 1 all 2 only a part	area intercropped		Production	
			quantity	unit 1 manzana 2 tarea 3 ha 4 other	quantity 0 no production -99 don't know	unit 1 lb 2 arroba 3 quintal 4 carga 5 saco/sack 6 other (esp) -99 don't know
TERR	CROP	I11	AREAQ	AREAUN	PRODQ	PRODUN

LAND WITH MONOCROPPING EN LA PRIMERA, 1993

INSTRUCTION: Use the production map to answer the question H2, and table 3.

H2.	During the primera last year, did you monocrop in any of your fields (or part of a field)? 0 no (--> **H3 PROXIMA PAGINA**) 1 yes	

Now I would like to ask some questions about each field where there is monoculture during the primera. Begin with those fields that are only partially planted in crops in association as indicated in the previous table. In this case, lets talk about only that part monocropped.

table III. **Production during primera in fields with monocropping**

field #	Area		Production	
	quantity	unit 1 manzana 2 tarea 3 ha 4 other (esp)	quantity	unit 1 lb 2 arroba 3 quintal 4 carga 5 sacos 6 other (esp)
TERR	AREAQ	AREAUN	PRODQ	PRODUN

CROP PRODUCTION IN THE POSTRERA
FIELDS WITH INTERCROPPING DURING POSTRERA LAST YEAR

INSTRUCTION: Use the map to for question H3, and table IV.

H3.	Did you plant any crops in association in any of your fields during the postrera last year? 0 no (--> H4 NEXT PAGE) 1 yes	

INSTRUCTION: In the following table use one line for each intercropped crop and write the corresponding field number. Each crop in association should go on a separate line, one after the other.

I would like to ask some questions about the fields you have intercropped DURING THE PREVIOUS POSTRERA. We only want to talk about the area that is intercropped.

INSTRUCTION: Use one line for each crop and write the corresponding field number.

table IV. Production during the postrera in intercropped fields

field #	intercropped crops 1 maize 2 beans 3 sorghum 4 coffee 5 horticulture 6 other	was all or only part of the area intercropped? 1 all 2 only a part	Area intercropped		Production	
			quantity	unit 1 manzana 2 tarea 3 ha 4 other	quantity 0 no production 99 don't know	Unit 1 lb 2 arroba 3 quintal 4 carga 5 saco 6 other (esp) 99 don't know
TERR	CROP	VII3	AREAQ	AREAUN	PRODQ	PRODUN

Now we would like to ask some questions about each field where there was monocropping during the previous postrera. We will start with those listed in the previous table that were only partially intercropped. In this case, include only the portion not intercropped..

table V. Production during the postrera in fields not intercropped

field #	Crop 1 maize 2 beans 3 sorghum 4 coffee 5 horticulture 6 other (esp)	Area		Production	
		Quantity	Unit 1 manzana 2 tarea 3 ha 4 other (esp)	Quantity	Unit 1 lb 2 arroba 3 quintal 4 carga 5 sacos 6 other (esp)
TERR	CROP	AREAQ	AREAUN	PRODQ	PRODUN

In some places quintales and the manzanas are different sizes. In order that we can better understand, we would like you to tell us:

H5.	How many tareas are in a manzana?	
H6.	How many lbs are in a quintal?	
H7.	How many lbs are in a carga?	
H8.	How many lbs are in a saco?	
H9.	Other units of measures?	

XIII. CONSERVATION PRACTICES

Now we would like to know if you used any soil management practices.
We would like to know if you have noted any changes in the soil and the productivity of your fields.

VARIABLE	SOIL DEGRADATION INDICATOR	0=NO, 1=YES, -99=DON'T KNOW
CORNLOW	Is maize lower?	
SOILCOL	Is soil color lighter?	
GULLIES	Are there gullies?	
ROCKS	Are there more rocks in the fields?	
BURN	Do you burn fewer fields?	
LEAVTREE	Do you leave trees in the field?	
FUELT	How much time does it take to collect fuelwood for one week (in hours)?	

Use the diagrams to explain the practices to producers. Ask about the categories that are in the table. Then, ask if they know of other practices that are not listed. If there is any doubt about the category of a practice, make a new category and explain it well.

table XIX. KNOWLEDGE OF SOIL MANAGEMENT PRACTICES

practice	have you heard of the practice? 0 no 1 yes	have you used the practice? 0 no, never 1 yes, am using it 2 yes, but stopped	if they know of a practice but don't use it or have stopped using it, why? 1 don't have a erosion problem, a fertility problem or a moisture problem 2 requires too much labor 3 requires too much money 4 can earn more working for salary 5 use fertilizer as a subsitute 6 it's so complicated 7 don't know how to use 8 other	has planes to use: 0 no planes 1 introduce 2 extend use 3 eliminate this practice	has an interest in: 0 no interest 1 introduce 2 extend use 3 eliminate this practice
PRACT	KNOWP	USEP	WHYNOTP	PLANP	INTERP
1 managing maize stubble					
2 drains					
3 manure or compost					
4 fertilizer bean or other green manure					
5 live barriers: zacate, vetiver, king grass, pineapple sugar cane (don't include dead barriers here)					
6 contour planting					
7 minium tillage					
8 Terraces (don't include stone walls)					
9					
10					
11					

Now we would like to talk about each one of the practices that you indicated that you use.

table XX: INVENTORY OF SOIL MAMAGEMENT PRACTICES

field #	practice 1 manage corn stubble 2 drains 3 manure and compost 4. fertilizer beans and green manure 5 live barriers: zacate, vetiver, king grass, pineapple and sugar cane (don't include dead barriers) 6 contour planting 7 minimum tillage 8 terraces (not including stone walls)	how many years have you had this practice?	how did you learn about it? 1 family 2 neighbor 3 project 4 extension agent 5 radio 6 other
TERR	**PRACT**	**XX1**	**XX2**

Use the diagrams to explain the practices to producers. Ask about the practices that are listed on the previous table. Then ask if they know other practices that are not already listed.

Now we would like talk about each of the practices that you indicated you use on your fields.

Table SC1: COSTS OF SOIL MANAGEMENT PRACTICES

Field number	Practice 1 manage corn stubble 2 drains 3 manure and compost 4 fertilizer bean or other green manures 5 live barriers: zacate, vetiver, king grass, pineapple, or sugar cane (not including dead barriers) 6 contour planting 7 minimum tillage 8 terraces (not including stone walls)	Area		For how many years have you used this practice in your field?	How much family labor did you use to install the practice? **(enter the number of total days)**	How much **wage labor did you use to install the practice?**		Other cash expenses to install the practice? **(enter cost in lempiras)**	Labor needed to maintain the practice **(enter the number of days per period)**		What were the two principal problem you had with this practice? (in order of importance) 0 no problem 1 too much labor 2 other costs were very high 3 benefits take too long to receive 4 takes land out of production 5 too difficult to manage 6 other		What is your overall opinion of the practice? 1 very good 2 good 3 regular 4 bad 5 other
		Quant.	Unit 1 manz 2 tarea 3 ha 4 other			days	Total costs (L)		How many (days)	Frequency 1 year 2 month 3 season 4 week 5 other			
TERR	SC11	SC12	SC13	SC13	SC14	SC15	SC16	SC17	SC18	SC19	PROB1	PROB2	SC110

BENEF	have you received any benefits for these practices?	
	0 no 1 yes	
	What are the three most important benefits from these practices? First start with the most important. 1 land produces more 2 don't have to cultivate some many fields 3 don't have to purchase as much basic grain 4 don't have to use so much fertilizer 5 can now sell more 6 can produce other types of products 7 food for animals 8 other	
BENEF1	first benefit	
BENEF2	second benefit	
BENEF3	third benefit	

FERTILIZER

FERT	Last year, did you use fertilizer? 0 no (--> H65) 1 yes	
FERTC	How much did the fertilizer cost (total in lempiras)?	

MACHINERY/WAGE LABOR

H65.	Do you own a tractor, pump, or oxen? 0 no 1 yes	
SC1.	During last year, did you use machinery or animal traction? (own or rented) to work in your fields? 0 no 1 yes	
SC2.	During the last year, did you wage labor to work in your fields? 0 no 1 yes	
H63.	How much can you make as a daily wage in this area?	
H63A.	man/young man	
H63B.	woman	
H63C.	child	

Fill these questions out for all fields.

Table SC2. INVENTORY OF LAND TENANCY AND TITLES/DOCUMENTS:

Field number	Are you the owner? 0 no 1 yes	How did you obtain the field 1 bought (as individual) 2 bought (as group) 3 ajudicated (without paying/ individual) 4 ajudicated (without paying/group) 5 rented 6 borrowed 7 inherited or given 8 verbal agreement 9 occupied/ without permision	Type of Land 1 national 2 ejidal 3 private 4 other	Title or document 0 none 1 public witnessed registered document/ dominio plano/full rights 2 private legal document/ witnessed 3 dominio útil/use right 4 other document 5 verbal	How long did it take to get the document? how many	period 1 year 2 month 3 day	if no documento Why don't you have a document? 1 too expensive 2 process is too complicatedc 3 don't know how to get one 4 other	How do you feel? 1 very secure 2 secure 3 insecure 4 very insecure with respect to your right to use this land with this document
TERR	OWNER	ACQUIRE	LANDTYP	DOCTYP	DOCT	DOCUT	WHYNOT	SECURE

Table XXVII. PRICE/VALUE OF LAND:

land not rented or borrowed			land rented or borrowed							
Field number	If you wanted to sell this field what would be the price?		field #	do you pay cash, in product of in labor 1 cash 2 product 3 labor	frequency of payment 1 year 2 season 3 month 4 other	if cash payment		if paid in product or labor		
	What price for the field (L)	unit 1 total 2 manz 3 tarea 4 other				how much (L)	unit 1 total 2 manz 3 tarez 4 other	crop 1 maize 2 frijo 3 sorghum 4 labor 5 other	how much	unit 1 percente 2 lbs 3 days 4 other
TERR	LANDPR	LANDUT	TERR	RENTTYP	RENTFRQ	RENTP	RENTUT	KINDTYP	KINDQ	KINDUT

ANIMALS

ANIMALS	Do you have animals? 0 no (–> VENTAS H70) 1 yes	
HORSE	horses 0 no 1 yes (how many)	
COW	cows/cattle 0 no 1 yes (how many)	
DONKEY	donkeys 0 no 1 yes (how many)	
PIG	pigs 0 no 1 yes (how many)	

XI. SALES OF AGRICULTURAL PRODUCTS
SALES FROM PLANTING OF THE PRIMERA UNTILL NOW.
(MAY 1993 UNTILL NOW)

INSTRUCTION: ASK QUESTIONS CONCERNING SALES AND PURCHASES WITH BOTH HUSBAND AND WIFE PRESENT.

We would like to ask some questions about sales of agricultural products from the planting of primera until now. This information will help us understand how th e the marketing system in Honduras functions.

H70.	Since the planting of primera last year until now, how many times did you make a sale of your own agricultural production?	

INSTRUCTION: if the number of sales are more than 5, skip to the following page.

table XIII. Sales of Agricultural Products

Sale #	SEASON 1 PRIMERA (MAY-OCT 1993) 2 POSTRERA (NOV-NOW)	when (month)?	Crop 1 maize 2 beans 3 sorghum 4 coffee 5 horticulture 6 pigs 7 banana 8 eggs 9 other	who sold? 1 head of household 2 wife 3 child	how much sold?		where? 1 Farm 2 in the caserio 3 other town (esp)	how long did it take to get to where you went to sell?	Purchaser? 1 intermed. 2 pulpero 3 wholesaler 4 neighbor 5 other	why did you sell to this pruchaser?	value of sale	
					qt	unit 1 qq 2 carga 3 other					Lps	1 unit 2 total
SALE	CICLO	MONTH	CROP		XII1	XII2	XII3	XII4	XII7	XII8	XVII2	XVII3

INSTRUCTION: THIS PAGE AND THE NEXT ARE ONLY FOR PRODUCERS WITH MORE THAN 5 SALES

H71.	How many times did you sell agricultural products from your farm **from the begining of the harvest of postrera until now?**	
H72.	How many times did you sell agricultural products away from your farm since the begining of the harvest of **postrere untill now?**	

Among all the sales including all crops and animal products, how much of each product did you sell at the farm and away from the farm?

table XIV.

Crop 1 maize 2 beans 3 sorghum 4 coffee 5 horticulture 6 pigs 7 banana 8 eggs 9 other	where did the sale take place? 1 at the farm 2 in the caserio 3 Other town (esp)	if the sale was away from the farm, generally where do you sell? 1 varios places 2 a town or city (write the name)	Generally to whom do you sell **1 intermed.** **2 pulpero** **3 wholesaler** **4 neighbor** **5 other**	value of sales (lempira)	frequency of sale 1 weekly 2 fortnightly 3 monthly 4 other	Sales	
						Quantity	Unit 1 lbs 2 arroba 3 quintal 4 carga 5 saco 6 other
CROP	**XIV1**	**XIV2**	**XIV3**	**XV7**	**XV6**	**XIV4**	**XIV5**

LANDPAY	If you wanted more land in this area, would you have to buy it or could you occupy without paying?	
	1 you have to buy 2 it would be free or you could open more land without paying -99 don't know	
LANDSUP	If you have sufficient money, how easy would it be to obtain more land in this area?	

	1 easy 2 difficult 3 imposible -99 don't know	

XV. STRUCTURE OF THE FAMILY

INSTRUCTION: ASK THESE QUESTIONS UP TILL PAGE 33 TO THE WOMAN OF THE HOUSE

H111.	how many people currently live in this house?	

We would like to ask some question about each member of the household

table XXI. Characteristics of the family, resident members

number	Name	Relation to the head 1 head 2 spouse 3 child 4 aunt/uncle 5 cousin 6 other (esp)	age year	sex 1 M 2 F	highest level of schooling completed	do they work in the family fields? 0 no 1 yes	did they work for salary or in kind since planting of primera until today? 0 no 1 yes	did they work on their on account since planing of primera last year? 0 no 1 yes
MEM	NAME	RELATION	AGE	SEX	EDU	XXI7	XXI8	XXI10
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								

H112.	with respect to bean production, what activities do women participate in? (for the woman of the)? **1 planting, 2 weeding, 3 application of fertilizers, 4 application of other chemicals, 5 other (esp)**	
H113.	besides production, what other activities related to beans do women participate (for the woman of the house) (e.g. 1 arrancado, 2 aporreado, 3 soplado, 4 storage, 5 sales, 6 other (esp.)).?	
H114.	how do you like to prepare beans for home consumption?	
H115.	what type of beans do you prefer to consume at home **(use the samples)**?	

H116.	are there family members who did not live in the house at this moment, but contribute in some manner to the activities of the house (e.g. send money, work on the farm, send food) during the past year or someone to whom you sent money, food or other things? 0 no (–> H117) 1 yes (–> USE TABLE XXII)	

table XXII. Characteristics of nonresisdent family members

number	Name	relation to head 1 head 2 spouse 3 child 4 aunt/uncle 5 cousin 6 other (esp)	age years	sex 1 M 2 F	why were they absent? 1 studying 2 working 3 other (esp)	have they been at the house since the planting of primera last year? 0 no 1 yes	have they sent money to the house since planting of primera last year? o no 1 yes	have they worked on the family's land during this period? 0 no 1 yes	Ha enviado comida u others cosas para la family? 0 no 1 yes	Uds. han enviado dinero o especies desde la siembra de primera del año pasado? 0 no 1 yes
MEMB	NAME	RELATION	AGE	SEX	XXII5	XXII6	XXII7	XXII8	XXII9	XXII10
1										
2										
3										
4										

XVI. WAGE INCOME (CASH OR INKIND) OFF THE FARM

Up untill now we have talked about income derived from the farm. We would like to talk about income earned off the farm such as salaried employment and non-farm income (both cash and inkind).

SINCE PLANTING OF THE PRIMERA LAST YEAR UNTIL NOW (MAY 1993/UNTILL NOW)

ENUMERATOR: confirm that the responses given in the previous table correspond to those given here. If not, go back to the previous table and make the necessary corrections.

We would like to ask you about the work preformed by each of these people.

table XXIII. Off-farm income

member of the family	Type of work 1 employee 2 domestic service 3 farm worker/local 4 farm worker/outside the region 5 other	where did they work? 1 urban area (< 1 hour 2 urban area (>1 and < 3 hours) 3 urban area (> 3 hours) 4) rural area (< 1 hour) 5) rural area (>1 and <3 hours) 6) rural area (>3 hours)	did they live at the house during a lapse of work time? 0 no 1 yes	duration of work				which months? 5 MAY(93) 6 JUN(93) 7 JUL(93) 8 AGU(93) 9 SEP(93) 10 OCT(93) 11 NOV(93) 12 DEC(93) 1 JAN(94) 2 FEB(94) 3 MAR(94) 4 ABR(94)	did they receive cash payment? 0 NO 1 YES	what portion was in cash?	how did they earn in cash?		estimated value of inkind payments (value in lempiras)
				number of months	wks/ month	days /wk	hour/ day				Quant	freq 1 total 2 month 3 weekly 4 daily 5 hourly 6 other (esp)	
MEMB	XXIII1	XXIII2	XXIII3	XXIII4	XXIII5	XXIII6	XXIII7	XXIII8	XXIII9	XXIII10	XXIII12	XXIII11	XXIII13

XVII. INCOME EARNED THROUGH SELF-EMPLOYMENT BUT NOT AGRICULTURE

ENUMERATOR: confirm the responses given in the previous table with those given here. If there are differences, make the necessary change to the previous table.

We would like to ask questions about self-employment activities of these people.

table XXIV. self-employment, both periods

member of the family	type of work 1 commercial agriculture 2 other commerce 3 artesantry 4 carpentry 5 domestic services 6 sales of food, not produce 7. other services 8 other (esp)	describe the work	frequency in which they worked?		Cuanto hizo normalmente en esta actividad ? lempiras
			frequency of work? 1 daily 2 weekly 3 fortnightly 4 monthly 5 one time 6 other (esp)	in what months did they work?	
XXIV1	XXIV2	XXIV3	XXIV4	XXIV5	XXIV6

XVIII. REMITANCES

you previously mentioned that the following people were currently absent from the house, but they sent remitances last year.

ENUMERATOR: confirm that the responses given previously correspond to those given here. If there are difference make the necessary changes in the previous table.
We would like to ask questions about remitances from each of the previously mentioned people.

table XXV. remitances sent to the family by members or non-residents for both periods

Member of the family	what type of current work? 1 employee 2 domestic service 3 farm worker/local 4 farm worker/outside the region 5 other	where did they work? 1 urban area (< 1 hour) 2 urban area (>1 and < 3 hours) 3 urban area (> 3 hours) 4) rural area (< 1 hour) 5) rural area (>1 and <3 hours) 6) rural area (>3 hours)	since when have they been absent?		estimated value of totat cash remitances sent to the family since planting of primera last year lempiras	estimated value of total non-cash remitances sent to the family since planting of primera last year lempiras	days worked on the farm since the planting of primera last year?
			year	month			
MEMB	XXV1	XXV2	XXV3	XXV4	XXV5	XXV6	XXV7

H133	What do you think of the new agrarian reform? (-99=never heard of it)	

H133	What do you think of the new agrarian reform? (**-99=never heard of it**)	

H117. (RESID)	how much time have you lived in this area?	
RESIDQ	how much	
RESIDUN	period (1=year, 2=month, 3=always)	
DEPART	**if they haven't always lived here**, what department did they move from?	
RESIDWHY	why did they move here?	

1. Since the planting of the primera last year until now, have you purchased any maize or beans?
   _____ yes
   _____ no

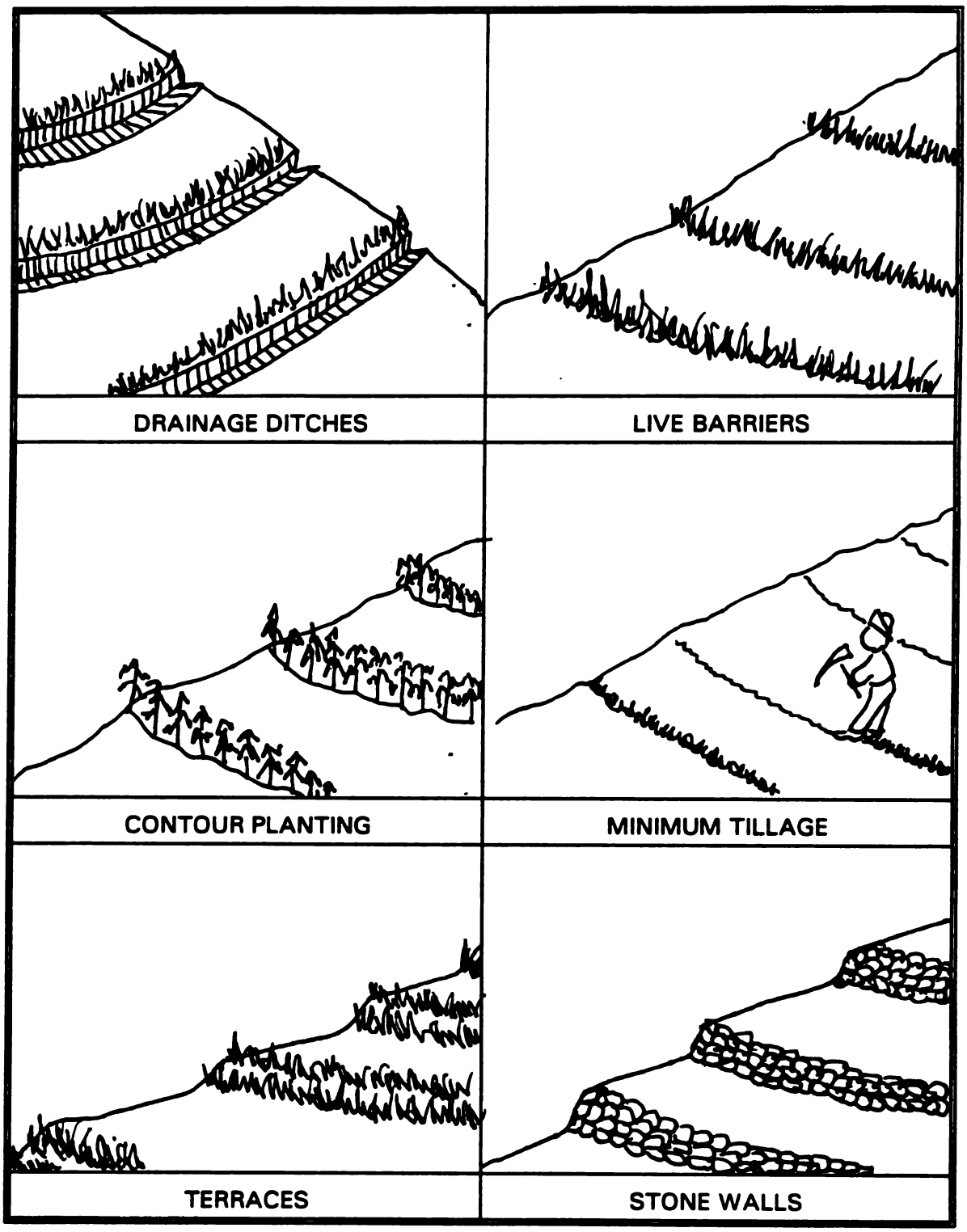
2. If you had any extra time, would you prefer to:
   _____ work more on your farm
   _____ work for salary/wage
   _____ other

3. When was the last time a technican visited you
   _____ (0=never, otherwise year)

4. How many years are you able to continuously plant in the hillsides here.
   _____

APPENDIX B

Drawings of Soil Mangement Practices Used in the Field



APPENDIX C

Areas included in the survey

EL PARAISO		
Municipality	Village	Caserio
Danli	El Pataste	El Pataste
	El Barro	Los Platanos
	El Pie de la Cuesta	El Pie de la Cuesta
	La Musica	La Musica
	Chichicaste	Consuelo
	Los Almendros	Capules
	Las Camelias	El Pinonal
	Sartenejas	Los Almendros
		Guayambre
		La Suiza
Guinope	Lavanderos	Lavanderos
		Plancitos
Jacaleapa	Lomas Limpias	Lomas Limpias
	La Chorrera	Rio Azul
	Rio Azul	La Chorrera
San Lucas	Apalipi	Apalipi
	La Reina	La Reina
Teupasenti	El Rodeo	El Rodeo
	Las Delicias	Los Almendros
	Los Almendros	Las Delicias
	El Rito #2	El Rito #2
	El Chelon #1	El Chelon #1
	Saladino	Saladino
	El Caulote	El Caulote
	El Chelon #3	El Chelon #2
		El Chelon #3

FRANCISCO MORAZAN		
Municipality	Village	Caserio
Cedros	El Tablon	Los Talleres
	El Tablon del Guante	Jaltervita
		Mululár
		Pinuelas
Districto Central	El Naranjal	El Naranjal
Marale	Los Tablones	La Esperanza
Orica	San Francisco	San Francisco
	Los Pozos	Los Pozos
	San Cristobal	Mata Palo
	El Nance	Piedra Gorda
		San Cristobal
		El Nance
		Los Marquitos
San Ignacio	El Naranjal	San Jose del Naranjal
	Urrutias	El Portillo de Cordova
		La Aguja
Talanga	La Ermita	La Ermita #1
		La Ermita #2

OLANCHO		
Municipality	Village	Caserio
Concordia	El Tablon	El Tablon
		Ojo de Agua
Guarizama	El Trinidad	El Rincon
	La Carta	Cabeceras
		Sabana Larga
		Jicarito
Guayape	El Paraiso	El Paraiso
	La Concepcion	Los Tablones
	El Paso de la Olla	La Concepcion
		El Paso de la Olla
		Santa Cruz
Juticalpa	La Concepcion	La Concepcion
Manguilile	Los Blancos	Tierra Blanca
	Camalotillo	Camalotillo
		Los Blancos
		El Chorro
		La Lola
		Los Prietas
		La Mica
		Monte Flores
Silca	Panuaya	El Quebrachal
	El Carbonal	Cacao Moran
		El Pastoreo
		El Zapote
		Las Pantas

APPENDIX D

Computer printouts of econometric model estimations

LIST OF PARCEL-LEVEL VARIABLES:

Variable	Explanation
AGLAB (LABORFAM)	number of family agricultural laborers
BUYGR (BUYGRAIN)	binary household-level variable where 1 is sold crop other than maize or beans during the last agriculture season
CASHCRP (CASHCROP)	binary parcel-level variable where 1 is planted cash crops
COFFEE	binary parcel-level variable where 1 is planted coffee
CREDIT	binary household-level variable where 1 is received credit within last 5 years
DEJIDO (EJIDO)	binary parcel-level variable where 1 is ejidal land
DINA (INA)	binary parcel-level variable where 1 is possesses offical INA title
DNAT (NATIONAL)	binary parcel-level variable where 1 is national land
DNOSTUB (ADOPT)	binary parcel-level variable where 1 is adopts any practice but managed maize stubble
DOTHDOC (OTHERDOC)	binary parcel-level variable where 1 is possesses a document other than offical INA title
DOWN (OWNER)	binary parcel-level variable where 1 is farmer perceives him/herself to be the owner
DPRACT (ADOPT)	binary parcel-level variable where 1 is adopts any practice
DPROJ (PROJECT)	binary household-level variable where 1 is development project active in the municipality
DSTR2 (STRATA2)	binary household-level variable where 1 is farm size $>=1$ ha and <5 ha
DSTR3 (STRATA3)	binary household-level variable where 1 is farm size $>=5$ ha and <10 ha
DSTR4 (STRATA4)	binary household-level variable where 1 is farm size $>=10$ ha
EXTEN (EXTENSION)	binary household-level variable where 1 is extension in area of farm
FAR (DISTANCE)	binary parcel-level variable where 1 is greater than 25 minute walk to field from homestead
FERT (FERTILIZER)	binary household-level variable where 1 is uses fertilizer on the farm
LAB (LABORHIRE)	binary household-level variable where 1 hires labor
LANDYR (YEARS)	number of years cultivating parcel

MECH (MACHINERY)	binary household-level variable where 1 uses machinery on farm
SALLAB (OFFFARM)	number of household members working off-farm
SELL (SELLCROP)	binary household-level variable where 1 is sold crop other than maize or beans during last agricultural year
SLOPE	categorical variable where 1 is flat, 2 is slightly sloped, 3 is sloped, and 4 is very steep
SOIL	categorical variable where 1 is good soil, 2 is average soil, 3 is poor soil, and 4 is very poor soil
DSPRACT	number of practices on a parcel
VISIT	binary household-level variable where 1 is extension agent visited farm in last five years

LIST OF HOUSEHOLD-LEVEL VARIABLES:

Variable	Explanation
AGLAB (LABORFAM)	number of family agricultural laborers
BUYCR (BUYGRAIN)	binary household-level variable where 1 is sold crop other than maize or beans during the last agriculture season
CASHCRP (CASHCROP)	binary parcel-level variable where 1 is planted cash crops
COFFEE	binary parcel-level variable where 1 is planted coffee
CREDIT	binary household-level variable where 1 is received credit within last 5 years
DOCL_P	percent of total farm area with any type of document
DPROJ (PROJECT)	binary household-level variable where 1 is development project active in the municipality
DSTR2 (STRATA2)	binary household-level variable where 1 is farm size >=1 ha and <5 ha
DSTR3 (STRATA3)	binary household-level variable where 1 is farm size >=5 ha and <10 ha
DSTR4 (STRATA4)	binary household-level variable where 1 is farm size >=10 ha
EXTEN (EXTENSION)	binary household-level variable where 1 is extension in area of farm
EJIL_P	percent of total farm size on ejidal land
FSIZE	farm size in hectares
HILL_P	percent of parcels that are hilly
HILLL_P	percent of total farm size on ejidal land
HHUSE	number of practices used by household
MECH	binary household-level variable where 1 is use machinery on farm
NATL_P	percent of total farm size on national land
OWNL_P	percent of total farm size farmer perceives that s(he) owns
RESIDYR	number of years leaving at current residence
SALLAB	number of household members earning off farm
SELL	binary household-level variable where 1 is sold crop other than maize or beans during last agricultural year
USE	binary household-level variable where 1 is uses a practice
VISIT	binary household-level variable where 1 is extension agent visited the farm within last 5 years

PARCEL-LEVEL PROBIT MODEL WITH ALL PRACTICES INCLUDED:

```
Reading file  C:\PB\PLOTPRO1.WK1
SAMPLE set to observations 1 to     874
There are  64 variables in the data work area.
Use STATUS for a list.


 MODEL COMMAND:
 PROBIT;LHS=DPRACT;RHS=ONE,DINA,DOTHDOC,DOWN,SOIL,DSTR2,DSTR3
 ,DSTR4,SLOPE,AGLAB,SALLAB,LAB,MECH,FERT,COFFEE,CASHCRP,DEJID
 O,DNAT,BUYGR,VISIT,EXTEN,SELL,FAR,LANDYR,CREDIT,DPROJ$

Binomial Probit Model
Maximum Likelihood Estimates
Log-Likelihood.............    -524.5450
Restricted (Slopes=0) Log-L.   -575.7247
Chi-Squared (25)............    102.3594
Significance Level.........   0.1000000E-06
```

Variable	Coefficient	Std. Error	t-ratio	Prob|t|>x	Mean of X	Std.Dev.of X
Constant	-0.83329	0.3525	-2.364	0.01808		
DINA	0.22980E-02	0.1209	0.019	0.98484	-30.747	172.97
DOTHDOC	0.34324E-02	0.9401E-01	0.037	0.97087	-30.518	173.01
DOWN	0.14049E-01	0.1285	0.109	0.91295	-30.068	173.09
SOIL	0.68412E-03	0.2908E-03	2.352	0.01866	-42.207	206.90
DSTR2	-0.37570	0.2863	-1.312	0.18949	0.42906	0.49523
DSTR3	-0.44446	0.3131	-1.420	0.15572	0.15332	0.36050
DSTR4	-0.80163	0.3050	-2.629	0.00858	0.39245	0.48858
SLOPE	0.37755E-02	0.2973E-01	0.127	0.89894	-10.706	111.65
AGLAB	0.10643	0.2950E-01	3.608	0.00031	1.6350	33.927
SALLAB	-0.14332	0.4942E-01	-2.900	0.00373	-0.42792	33.833
LAB	0.64665E-01	0.1218	0.531	0.59559	0.75286	0.43160
MECH	0.23110	0.1447	1.598	0.11012	0.84439	0.36269
FERT	0.10287E-02	0.1082	0.010	0.99241	0.56178	0.49645
COFFEE	-0.65243	0.2788	-2.340	0.01928	0.85812E-01	0.28025
CASHCRP	0.53648	0.2365	2.268	0.02330	0.12700	0.33317
DEJIDO	0.93095E-01	0.1088	0.856	0.39214	-30.696	172.98
DNAT	-0.11199	0.9179E-01	-1.220	0.22246	-30.521	173.01
BUYGR	0.62669E-01	0.1008	0.622	0.53426	0.50915	0.50020
VISIT	0.50321E-05	0.1034E-03	0.049	0.96117	-625.07	483.91
EXTEN	0.49716E-03	0.1427E-03	3.484	0.00049	-149.37	356.96
SELL	0.16245	0.1072	1.516	0.12962	0.49428	0.50025
FAR	-0.20156E-02	0.3020E-01	-0.067	0.94678	-8.8982	95.218
LANDYR	0.92994E-03	0.6379E-03	1.458	0.14492	-2.5042	128.81
CREDIT	0.73543E-01	0.9676E-01	0.760	0.44723	0.49199	0.50022
DPROJ	0.50618	0.1261	4.014	0.00006	0.80092	0.39954

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	481	70	551
1	215	108	323
TOTAL	696	178	874

PARCEL-LEVEL PROBIT WITH ALL PRACTICES EXCEPT MANAGED MAIZE STUBBLE:

```
Reading file  C:\PB\PLOTPRO1.WK1
SAMPLE set to observations 1 to     874
There are  64 variables in the data work area.
Use STATUS for a list.


 MODEL COMMAND:
 PROBIT;LHS=DNOSTUB;RHS=ONE,DINA,DOTHDOC,DOWN,SOIL,DSTR2,DSTR
 3,DSTR4,SLOPE,AGLAB,SALLAB,LAB,MECH,FERT,COFFEE,CASHCRP,DEJI
 DO,DNAT,BUYGR,VISIT,EXTEN,SELL,FAR,LANDYR,CREDIT,DPROJ$

Binomial Probit Model
Maximum Likelihood Estimates
Log-Likelihood.............    -391.4561
Restricted (Slopes=0) Log-L.   -447.1495
Chi-Squared (25)............    111.3869
Significance Level.........   0.1000000E-06
```

Variable	Coefficient	Std. Error	t-ratio	Prob|t|>x	Mean of X	Std.Dev.of X
Constant	-1.1174	0.3884	-2.877	0.00402		
DINA	-0.12731	0.1372	-0.928	0.35335	-30.747	172.97
DOTHDOC	-0.44491E-01	0.1058	-0.421	0.67412	-30.518	173.01
DOWN	0.20988	0.1503	1.396	0.16267	-30.068	173.09
SOIL	0.75908E-03	0.3981E-03	1.907	0.05652	-42.207	206.90
DSTR2	-0.51353	0.3119	-1.646	0.09970	0.42906	0.49523
DSTR3	-0.46977	0.3433	-1.368	0.17116	0.15332	0.36050
DSTR4	-0.68935	0.3334	-2.067	0.03869	0.39245	0.48858
SLOPE	0.14422	0.5467E-01	2.638	0.00833	-10.706	111.65
AGLAB	0.10520	0.3001E-01	3.506	0.00046	1.6350	33.927
SALLAB	-0.10350	0.3035E-01	-3.410	0.00065	-0.42792	33.833
LAB	-0.29708	0.1341	-2.215	0.02674	0.75286	0.43160
MECH	-0.60779E-01	0.1600	-0.380	0.70401	0.84439	0.36269
FERT	0.15928	0.1237	1.288	0.19782	0.56178	0.49645
COFFEE	-0.12860	0.2924	-0.440	0.66011	0.85812E-01	0.28025
CASHCRP	0.42676	0.2527	1.689	0.09121	0.12700	0.33317
DEJIDO	0.22677	0.1173	1.933	0.05323	-30.696	172.98
DNAT	-0.26426	0.1066	-2.478	0.01322	-30.521	173.01
BUYGR	0.14756E-01	0.1138	0.130	0.89685	0.50915	0.50020
VISIT	0.25269E-03	0.1203E-03	2.100	0.03570	-625.07	483.91
EXTEN	0.84562E-03	0.1508E-03	5.607	0.00000	-149.37	356.96
SELL	0.10743	0.1221	0.880	0.37879	0.49428	0.50025
FAR	-0.14273	0.5492E-01	-2.599	0.00936	-8.8982	95.218
LANDYR	0.45223E-03	0.6354E-03	0.712	0.47666	-2.5042	128.81
CREDIT	0.63478E-01	0.1097	0.579	0.56288	0.49199	0.50022
DPROJ	0.45160	0.1482	3.047	0.00231	0.80092	0.39954

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	676	16	692
1	150	32	182
TOTAL	826	48	874

PARCEL LEVEL ORDINARY LEAST SQUARES MODEL WITH MORE EXPLANATORY VARIABLES:

```
Reading file  C:\PB\PLOTPRO1.WK1
SAMPLE set to observations 1 to     87F4
There are  64 variables in the data work area.
Use STATUS for a list.

 MODEL COMMAND:
 REGRESS;LHS=SPRACT;RHS=ONE,DOTHDOC,DINA,DSLOPE,DOWN,DSOIL,DS
 TR2,DSTR3,DSTR4,AGLAB,SALLAB,LAB,DEJIDO,FERT,DNAT,BUYGR,SELL
 ,FAR,EXTEN$

Ordinary    least squares regression.     Dep. Variable     =  SPRACT
Observations      =            874        Weights           =  ONE
Mean of LHS       =  0.5995423E+00        Std.Dev of LHS    =  0.1014127E+01
StdDev of residuals=  0.9734062E+00       Sum of squares    =  0.8101293E+03
R-squared         =  0.9769063E-01        Adjusted R-squared=  0.7869464E-01
F[ 18,   855]     =  0.5142698E+01
Log-likelihood    = -0.1206990E+04        Restr.(Ã=0) Log-l = -0.1251913E+04
Amemiya Pr. Criter.=  0.2805469E+01       Akaike Info.Crit. =  0.9681179E+00
ANOVA  Source          Variation     Degrees of Freedom       Mean Square
       Regression      0.8771053E+02          18.               0.4872807E+01
       Residual        0.8101293E+03         855.               0.9475196E+00
       Total           0.8978398E+03         873.               0.1028453E+01
Durbin-Watson stat.=   1.8771649          Autocorrelation   =   0.0614176
Variable  Coefficient  Std. Error   t-ratio Prob|t|·x   Mean of X  Std.Dev.of X
---------------------------------------------------------------------------
Constant  0.67082       0.2243        2.990  0.00279
DOTHDOC   0.20900E-01   0.6832E-01    0.306  0.75968   -30.518        173.01
DINA      0.25048E-01   0.8832E-01    0.284  0.77672   -30.747        172.97
DSLOPE    0.13647       0.5676E-01    2.404  0.01620   -8.5950        95.247
DOWN      0.28346E-01   0.9399E-01    0.302  0.76298   -30.068        173.09
DSOIL     0.42744E-01   0.5642E-01    0.758  0.44867   -8.6259        95.244
DSTR2    -0.32359       0.2192       -1.476  0.13990    0.42906       0.49523
DSTR3    -0.35467       0.2364       -1.500  0.13360    0.15332       0.36050
DSTR4    -0.53791       0.2307       -2.332  0.01970    0.39245       0.48858
AGLAB     0.69434E-01   0.1969E-01    3.526  0.00042     1.6350        33.927
SALLAB   -0.70001E-01   0.1975E-01   -3.545  0.00039   -0.42792        33.833
LAB      -0.39622E-01   0.8576E-01   -0.462  0.64407    0.75286       0.43160
DEJIDO    0.59049E-01   0.7800E-01    0.757  0.44905   -30.696        172.98
FERT      0.60155E-01   0.7356E-01    0.818  0.41351    0.56178       0.49645
DNAT     -0.13281       0.6636E-01   -2.001  0.04535   -30.521        173.01
BUYGR     0.12026E-01   0.7152E-01    0.168  0.86648    0.50915       0.50020
SELL      0.11456       0.7434E-01    1.541  0.12330    0.49428       0.50025
FAR      -0.17862       0.6852E-01   -2.607  0.00913   -8.8982        95.218
EXTEN     0.63332E-03   0.9789E-04    6.470  0.00000   -149.37        356.96
```

PARCEL LEVEL ORDINARY LEAST SQUARES MODEL WITH FEWER EXPLANATORY VARIABLES:

```
Reading file  C:\PB\PLOTPRO1.WK1
SAMPLE set to observations 1 to     874
There are  64 variables in the data work area.
Use STATUS for a list.


 MODEL COMMAND:
 REGRESS;LHS=SPRACT;RHS=DINA,DOTHDOC,DOWN,SOIL,DSTR2,DSTR3,DS
 TR4,SLOPE,AGLAB,SALLAB,LAB,MECH,FERT,COFFEE,CASHCRP,DEJIDO,D
 NAT,BUYGR,VISIT,EXTEN,SELL,FAR,LANDYR,CREDIT,DPROJ$


Ordinary    least squares regression.     Dep. Variable      =  SPRACT
Observations       =            874       Weights            =  ONE
Mean of LHS        =  0.5995423E+00       Std.Dev of LHS     =  0.1014127E+01
StdDev of residuals=  0.9646292E+00       Sum of squares     =  0.7900026E+03
R-squared          =  0.1201074E+00       Adjusted R-squared=  0.9523413E-01
F[ 24,   849]      =  0.4828771E+01
Log-likelihood     = -0.1195996E+04       Restr.(Ã=0) Log-l = -0.1251913E+04
Amemiya Pr. Criter.=  0.2794041E+01       Akaike Info.Crit. =  0.9571259E+00
ANOVA  Source          Variation     Degrees of Freedom       Mean Square
       Regression      0.1078372E+03           24.               0.4493218E+01
       Residual        0.7900026E+03          849.               0.9305095E+00
       Total           0.8978398E+03          873.               0.1028453E+01
Durbin-Watson stat.=   1.9299232          Autocorrelation    =   0.0350384
Variable  Coefficient  Std. Error   t-ratio Prob|t|·x   Mean of X  Std.Dev.of X
---------------------------------------------------------------------------
DINA      -0.34287E-01   0.8827E-01   -0.388  0.69769  -30.747        172.97
DOTHDOC    0.14674E-01   0.6787E-01    0.216  0.82883  -30.518        173.01
DOWN       0.89942E-01   0.9232E-01    0.974  0.32993  -30.068        173.09
SOIL       0.41478E-03   0.1877E-03    2.210  0.02713  -42.207        206.90
DSTR2     -0.18739E-01   0.1361       -0.138  0.89049  0.42906       0.49523
DSTR3     -0.52897E-01   0.1591       -0.332  0.73956  0.15332       0.36050
DSTR4     -0.26084       0.1574       -1.657  0.09754  0.33245       0.48858
SLOPE      0.46615E-03   0.5750E-03    0.811  0.41754  -10.706        111.65
AGLAB      0.71206E-01   0.1960E-01    3.633  0.00028   1.6350        33.927
SALLAB    -0.71619E-01   0.1965E-01   -3.644  0.00027 -0.42792        33.833
LAB       -0.59085E-01   0.8707E-01   -0.679  0.49740  0.75286       0.43160
MECH       0.19531       0.9727E-01    2.008  0.04464  0.84439       0.36269
FERT      -0.49653E-01   0.7838E-01   -0.633  0.52641  0.56178       0.49645
COFFEE    -0.39423       0.2021       -1.951  0.05109  0.85812E-01   0.28025
CASHCRP    0.35089       0.1734        2.023  0.04302  0.12700       0.33317
DEJIDO     0.66020E-01   0.7907E-01    0.835  0.40373  -30.696        172.98
DNAT      -0.13588       0.6613E-01   -2.055  0.03991  -30.521        173.01
BUYGR      0.48281E-01   0.6946E-01    0.695  0.48703  0.50915       0.50020
VISIT     -0.61236E-05   0.7390E-04   -0.083  0.93396  -625.07        483.91
EXTEN      0.66635E-03   0.1034E-03    6.442  0.00000  -149.37        356.96
SELL       0.87713E-01   0.7722E-01    1.136  0.25600  0.49428       0.50025
FAR       -0.98113E-03   0.7565E-03   -1.297  0.19467  -8.8982        95.218
LANDYR     0.77421E-03   0.4031E-03    1.921  0.05478  -2.5042        128.81
CREDIT     0.12675       0.6979E-01    1.816  0.06933  0.49199       0.50022
DPROJ      0.27763       0.8339E-01    3.329  0.00087  0.80092       0.39954
```

HOUSEHOLD LEVEL TOBIT MODEL:

```
Reading file  C:\PB\HHTOB1.WK1
SAMPLE set to observations 1 to     263
There are  49 variables in the data work area.
Use STATUS for a list.


 MODEL COMMAND:
 TOBIT;LHS=HHUSE;RHS=NATL_P,EJIL_P,HILLL_P,RESIDYR,DSTR2,DSTR
 3,DSTR4,CREDIT,CASHCRP,LAB,MECH,AGLAB,SALLAB,DOCL_P,OWNL_P,B
 UYGR,SELL,EXTEN,VISIT,DPROJ$

Limited Dependent Variable Model - CENSORED   regression
Maximum Likelihood Estimates
Log-Likelihood.............   -788.7983
Threshold values for the model: Lower=    0.0000     Upper=+Infinity
```

Variable	Coefficient	Std. Error	t-ratio	Prob|t|>x	Mean of X	Std.Dev.of X
NATL_P	-0.10248E-01	0.3687E-02	-2.779	0.00545	28.577	76.844
EJIL_P	0.41790E-03	0.4294E-02	0.097	0.92247	12.434	71.557
HILLL_P	-0.21642E-01	0.3780E-02	-5.726	0.00000	58.107	76.331
RESIDYR	-0.79698E-01	0.8109E-02	-9.829	0.00000	39.989	66.863
DSTR2	10.369	0.6540	15.856	0.00000	-3.2966	61.634
DSTR3	13.688	0.8229	16.635	0.00000	-3.6578	61.611
DSTR4	13.261	0.8084	16.405	0.00000	-3.4981	61.621
CREDIT	0.33789	0.2821	1.198	0.23096	-3.3308	61.632
CASHCRP	1.3745	0.3557	3.864	0.00011	-7.2624	86.981
LAB	-1.9210	0.3442	-5.581	0.00000	-3.1103	61.645
MECH	-0.52742	0.3631	-1.453	0.14635	-2.9772	61.653
AGLAB	-0.16382	0.8161E-01	-2.007	0.04472	-4.8669	87.206
SALLAB	0.17031	0.8184E-01	2.081	0.03743	-6.7719	87.030
DOCL_P	-0.11703E-01	0.3648E-02	-3.209	0.00133	41.515	78.051
OWNL_P	-0.21192E-01	0.4152E-02	-5.104	0.00000	72.150	76.333
BUYGR	0.88412	0.2779	3.182	0.00146	-3.2471	61.637
SELL	-1.1263	0.3790	-2.971	0.00296	-3.3650	61.630
EXTEN	0.13723E-02	0.4065E-03	3.376	0.00074	-170.59	377.10
VISIT	0.11378E-02	0.3110E-03	3.659	0.00025	-649.39	477.54
DPROJ	0.46699	0.3361	1.389	0.16476	-3.0000	61.652
1	2.1210	0.1046	20.283	0.00000		

HOUSEHOLD LEVEL PROBIT MODEL:

```
Reading file  C:\PB\HECKDAT.WK1
SAMPLE set to observations 1 to     262
There are  37 variables in the data work area.
Use STATUS for a list.


 MODEL COMMAND:
 PROBIT;LHS=USE;RHS=NATL_P,EJIL_P,OWNL_P,DOCL_P,HILLL_P,HILL_
 P,SALLAB,LAB,FERT,BUYGR,SELL,FSIZE$

Binomial Probit Model
Maximum Likelihood Estimates
Log-Likelihood.....            -121.6244
Restricted (Slopes=0) Log-L.   -129.1411
Chi-Squared (11).....           15.03342
Significance Level.....        0.1809723
```

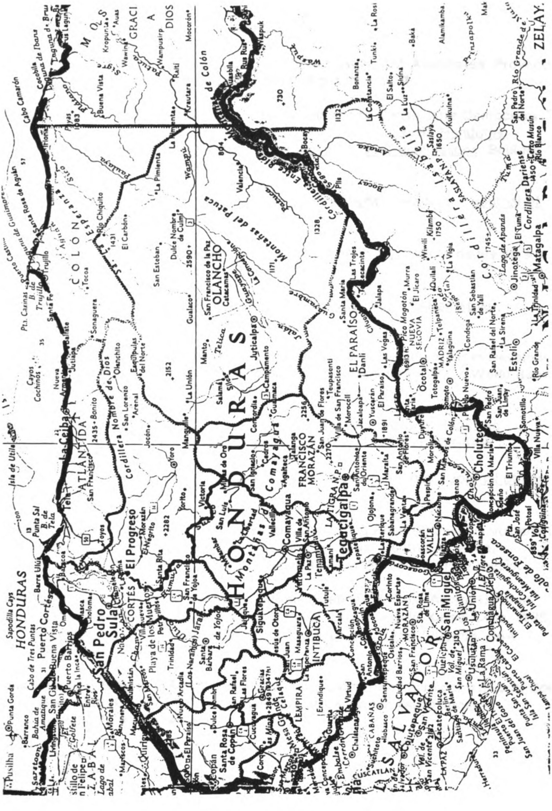
Variable	Coefficient	Std. Error	t-ratio	Prob|t|>x	Mean of X	Std.Dev.of X
NATL_P	-0.20889E-02	0.2351E-02	-0.888	0.37429	32.499	43.203
EJIL_P	0.32540E-02	0.3067E-02	1.061	0.28874	16.295	34.721
OWNL_P	0.36745E-02	0.2450E-02	1.500	0.13368	76.238	37.899
DOCL_P	0.93531E-03	0.2445E-02	0.383	0.70207	45.486	44.174
HILLL_P	-0.71514E-02	0.5420E-02	-1.319	0.18701	62.142	39.381
HILL_P	0.11787E-01	0.5876E-02	2.006	0.04485	53.650	36.964
SALLAB	-0.10424	0.7815E-01	-1.334	0.18223	-2.9847	61.780
LAB	0.54827E-01	0.2033	0.270	0.78740	0.69084	0.46303
FERT	0.24271	0.1878	1.292	0.19626	0.54580	0.49885
BUYGR	0.24888	0.1819	1.368	0.17129	0.55344	0.49809
SELL	0.38352	0.2099	1.828	0.06761	0.43511	0.49672
FSIZE	0.11879E-02	0.2716E-02	0.437	0.66189	13.268	45.734

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	1	50	51
1	5	206	211
TOTAL	6	256	262

REFERENCES

APPENDIX E


HONDURAS
Puerto Cortés
San Pedro Sula
El Progreso
La Ceiba
ATLÁNTIDA
COLÓN
Trujillo
OLANCHO
Juticalpa
EL PARAÍSO
Tegucigalpa
FRANCISCO MORAZÁN
Comayagua
Choluteca
VALLE
San Miguel
SALVADOR
Golfo de Fonseca
Montañas del Patuca
Cordillera Nombre de Dios
Estelí
Jinotega
Matagalpa
Ocotal
NUEVA SEGOVIA
ZELAYA

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