

EPTD DISCUSSION PAPER NO. 49

**ORGANIZATIONAL DEVELOPMENT AND NATURAL
RESOURCE MANAGEMENT: EVIDENCE FROM
CENTRAL HONDURAS**

John Pender and Sara J. Scherr

Environment and Production Technology Division

**International Food Policy Research Institute
2033 K Street, N.W.
Washington, D.C. 20006 U.S.A.**

November 1999

EPTD Discussion Papers contain preliminary material and research results, and are circulated prior to a full peer review in order to stimulate discussion and critical comment. It is expected that most Discussion Papers will eventually be published in some other form, and that their content may also be revised.

ABSTRACT

The determinants of local organizational density and the impacts of local and external organizations on collective and private natural resource management decisions are investigated based on a survey of 48 villages in central Honduras. Factors positively associated with local organizational development include the presence of external organizations, population level, moderate population growth, lower population density, the presence of immigrants, distance from the urban market, literacy and coffee production. Local organizations are found to contribute to collective action to conserve resources, while government organizations appear to displace it, though not in all cases. The findings suggest that external organizations can play a catalytic role in fostering development of local organizations and emphasize the importance of improved understanding of the roles of local organizations, in order to enhance complementarity and minimize competition between these different agents in promoting sustainable development.

CONTENTS

1. Introduction	1
2. Conceptual Framework	3
3. Research Method	6
Study Sample	7
Sources of Data	7
Analysis	9
4. Local Organizations and NRM in Central Honduras	10
Organizational Presence	10
Organizational Activities In NRM	12
Support for Local Farmers in NRM	13
Collective Investment	14
Local Regulation of Natural Resources	16
5. Econometric Analysis	19
Determinants of Organizational Density	19
Variables and Hypotheses	19
Results	24
Determinants of Collective Investment Affecting NRM	29
Variables and Hypotheses	29
Results	30
Determinants of Private Action Affecting NRM	34
Variables and Hypotheses	34
Results	36
6. Conclusions and Implications	40
Appendix	44
References	47
Acknowledgements	50

ORGANIZATIONAL DEVELOPMENT AND NATURAL RESOURCE MANAGEMENT: EVIDENCE FROM CENTRAL HONDURAS

John Pender and Sara J. Scherr

1. INTRODUCTION

In recent years a consensus has begun to emerge regarding the importance of local institutional and organizational development in developing countries as a necessary complement to economic, social and political development. Numerous observers have hailed the increased role for local organizations and other elements of civil society in the wake of structural adjustment policies and declining government budgets in many developing countries (Farrington and Bebbington 1993; de Janvry and Sadoulet 1993; Uphoff 1993; Nugent 1993).

Local (or "grassroots") organizations, defined in this paper as non-governmental organizations (excluding private firms operating for profit) governed and operating at the village level or below (Uphoff 1993), have been claimed to offer numerous advantages favoring rural development (Farrington and Bebbington 1993).¹ These include increasing economic efficiency where private markets fail; increasing the effectiveness of government and non-government programs by involving local people in the design and implementation of such programs; reducing poverty in rural areas by responding to the needs of the rural poor; empowering rural people by increasing their role in decision processes that affect their lives; and improving management of natural resources by

¹ Uphoff (1986) distinguishes organizations, defined as "structures of recognized and accepted roles", from institutions, defined as "complexes of norms and behaviors that persist over time by serving collectively valued purposes". There are many examples of organizations that are not institutions (for example, a particular law firm), institutions that are not organizations ("the law"), and organizations that are institutions (the Supreme Court). We follow Uphoff's distinction in this paper.

helping to foster collective action to manage externalities or common property resources (Baland and Platteau 1996; Rasmussen and Meinzen-Dick 1995; Uphoff 1986).

Although substantial work has investigated some of these claims, drawing comparative conclusions about these issues from much of the literature is difficult because of the idiosyncratic nature of many of the case studies that are reported, lack of a representative sampling frame, measurement of different variables in different studies, and lack of use of rigorous statistical procedures to test hypotheses about the impacts of key variables (Rasmussen and Meinzen-Dick 1995).²

The present study represents a modest effort to address some of these shortcomings through a study of the development of local organizations and their impacts on natural resource management (NRM) in a representative sample of villages in central Honduras. The issues of local organizational development and natural resource management are critical in Honduras. Local organizational development is relatively limited in most of rural Honduras, and problems of resource degradation—including deforestation, watershed degradation, soil erosion, soil fertility decline, water scarcity and water contamination—are increasingly critical as population continues to grow rapidly in the fragile hillsides of the country (Pender and Durón 1996). However, new opportunities have arisen as a result of declining central government presence in rural areas, increased authority of local governments, and greater presence of non-

² The seminal work of Esman and Uphoff (1984) is an exception to this generalization, although the method of selection of their case studies limits the ability to generalize from their findings, as the authors note.

governmental organizations (NGOs) since the early 1990s (Durón and Bergeron 1995). Now is thus an opportune time to study organizational development in Honduras.

In this study, we do not focus on organizational function or performance, but rather on the determinants and impacts of local organizational presence. We focus on voluntary local organizations, which are the dominant form of local organization in the region. In contrast to some recent literature, we emphasize that local organizational development may affect private NRM decisions as well as affecting collective action to manage resources.

2. CONCEPTUAL FRAMEWORK

The conceptual model for this study draws upon the theory of induced institutional innovation (Hayami and Ruttan 1985; North 1990). This theory posits that institutional innovation is induced by changes in relative factor prices or other changes in the net benefits of innovation, and that such innovation influences farmer decisions and can thus have feedback effects on the disequilibria that stimulated the change. In our case, we hypothesize that organizational innovation responds to changes in the factors influencing the costs and benefits of organizational activity. Although organizations and institutions are not identical, we posit that a similar process of induced change applies to organizational development as to institutional change.³ As in the case of institutional change, the process of induced organizational development is not likely to be automatic, occurring whenever the aggregate benefits of change exceed the costs, because of the

³ Many of the changes discussed by North and Hayami and Ruttan involve organizational as well as institutional change.

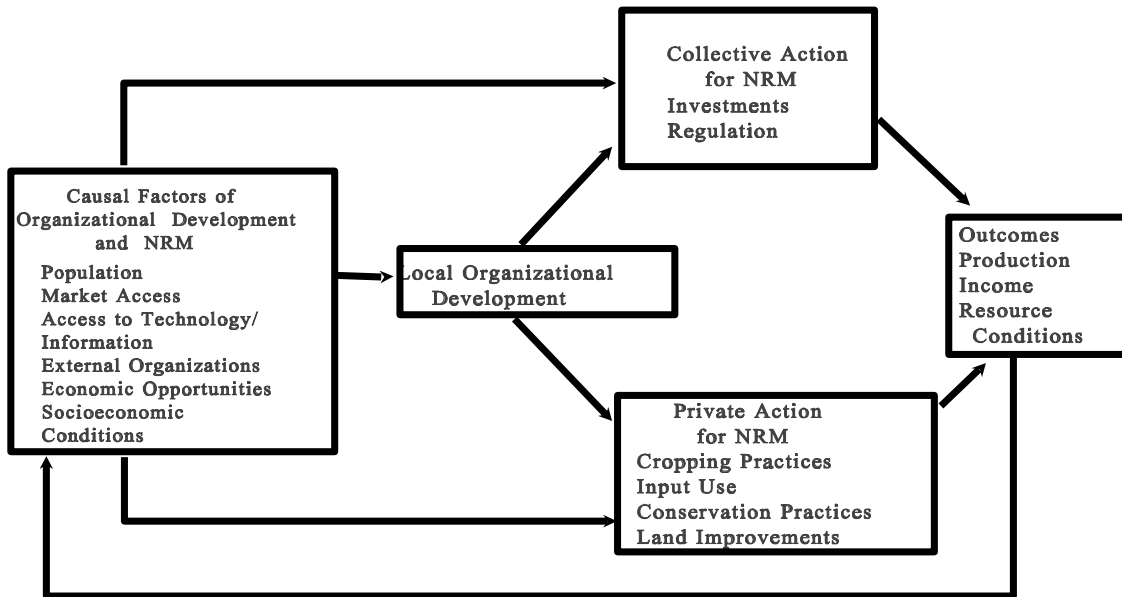
high degree of uncertainty about the benefits and costs, the need for collective action to attain the benefits, and the presence of high fixed costs and other indivisibilities that may cause the process to be path-dependent (North).

In our conceptual framework, changes in factor endowments, market access, economic opportunities, access to technology, interventions by external programs and organizations, local natural resource and socioeconomic conditions and other factors affecting the benefits and costs of organizational activity are hypothesized to induce local organizational change (Figure 1). Development of local organizations can influence natural resource management (NRM) by affecting collective or private actions. Collective action affecting NRM may include community regulation to address externalities, or collective investments to improve common lands, protect the watershed, or otherwise achieve collective benefits. Private actions affecting NRM may include adoption and/or adaptation of new agricultural technologies; intensification of use of factors of production; investments in land or other resource improvements on private land; adoption of soil and water conservation and organic fertility management practices.⁴ Both collective and private action affecting NRM may be influenced by a large number of factors other than organizational development; including many of the factors that influence organizational development itself. These factors include access to infrastructure, information, local knowledge, risk, factors of production (land, labor, capital), wealth, and the physical/technical factors that determine local comparative advantage (rainfall, soil types, etc.) (McCullough et al. 1998). Changes in NRM as

⁴ Some of these investments may also occur on common or private lands through collective action where collective benefits arise.

determined by collective and private actions lead to changes in outcomes within the village, including impacts on agricultural production, incomes, and resource conditions. These changes in outcomes may influence the costs and benefits of organizational activity, as well as affecting the returns to collective and private action directly, and thus have feedback effects on the process of organizational development and NRM.

Figure 1 Conceptual framework



3. RESEARCH METHOD

We investigated the determinants of local organizational development and the impacts of organizational development on collective and private action affecting NRM using data collected from a survey of 48 villages in the central hillsides region of Honduras. The central region was defined to include all *municipios* (analogous to counties) of the department of Francisco Morazan except two lowland valley communities, and five adjacent hilly *municipios* in the department of El Paraiso.

The central region is relatively homogeneous in terms of topography and climate, while it includes substantial variation in population density, access to markets, and agricultural practices.⁵ Over 90% of the region is on hillsides and the climate is generally sub-humid tropical, with annual rainfall ranging from 1000 to 2000 mm. Rural population density averaged 25 persons/km.² in 1988, though it ranged from as low as 9 to as high as 87 in some municipalities. Many villages in the region lack access to roads, requiring up to a half-day by foot or pack animal to reach from the nearest road. Although soils are generally of poor quality and thin and natural pastures are limited, crop and livestock production are the main sources of rural livelihood.

There are serious resource degradation and poverty problems in the region. About half of the region is still covered by pine forest, though nearly one-fifth of the area has been deforested since the 1960s. Soil erosion is a serious problem, with estimated erosion rates in the region ranging from 22 to 46 tons per hectare per year, causing economic losses of as much as 700 Lempiras (\$60) per hectare per year (World Bank,

⁵ The region is described in detail in Pender and Durón (1996).

1991). Other major resource and environmental concerns include declining forest quality, soil fertility depletion, watershed degradation, water pollution caused by agrochemicals and other factors, and air pollution caused by forest fires and agricultural burning. Poverty is severe; more than 40% of children were malnourished and more than half of households lack access to potable water or health services in 1991.⁶

STUDY SAMPLE

The villages surveyed were selected by a stratified random sample of 48 of the 325 rural *aldeas* (villages) in this region (excluding Tegucigalpa, the urban center of the region and the capital of Honduras). The stratification was based on 1974 population density of the *municipio* (municipality) in which each *aldea* was located (more or less than 30 persons per km.²) and the distance of the *municipio* county seat to Tegucigalpa (more or less than 60 km.). Twelve *aldeas* were selected from each stratum, and all of the *aldeas* selected participated in the study.⁷ We over-sampled high population density *municipios* to obtain sufficient variation in population density in the sample.

SOURCES OF DATA

The sources of information used for the study included a community-level questionnaire administered with groups of typically 15 to 20 respondents, participatory resource mapping, data from the 1974 and 1988 population census, and maps of

⁶ Based on data from the Fondo Hondureño de Inversión Social for the *municipios* in the central region, excluding Distrito Central, which is dominated by Tegucigalpa.

⁷ Of the 31 *municipios* in the central region, 12 (representing 153 *aldeas*) were classified as low population density/close to Tegucigalpa, 11 (101 *aldeas*) were classified as low density/far, 4 (31 *aldeas*) as high density/close, and 4 (40 *aldeas*) as high density/far.

topography, climate, soils and other geographical features of Honduras. The questionnaire explored community members' perceptions about the current state and changes since 1975 in agriculture and NRM (including private and collective action), the factors causing or conditioning these changes (including organizational presence), and some of the consequences of these changes for agricultural production, human welfare and natural resource conditions.⁸ The questionnaire included a census of all of the organizations that had worked in the *aldea* since 1975 and descriptions of the activities of those that were involved in NRM. Complete information on organizations was obtained for only 40 of the communities, so these are used as the basis for the analysis in this paper.⁹ The participatory mapping identified *aldea* boundaries (needed to compute village area and population density). The census data provided information on population and some indicators of access to social services, literacy and poverty.

In the respondent groups, we sought to obtain representation of people of different ages, gender, and from different neighborhoods in each village. Unfortunately, however, women were under-represented in the group of respondents in most communities, probably for cultural reasons. This may have reduced the availability and quality of information related to women's organizations (such as housewives' clubs) and activities in which women are more commonly involved. However, according to the respondents

⁸ The questionnaire and details on the implementation of the survey are provided in Pender and Scherr (1997).

⁹ Information on the extent of participation in local organizations was collected but was not sufficiently complete to be used in the analysis. Nearly all of the organizations mentioned in the organization census were organizations that still exist in the communities. It is possible that there was under-reporting of organizations that have ceased to exist, though further data collection would be needed to verify that.

(including the women respondents), women are generally less involved than men in most of the agricultural and resource management activities discussed in this paper, so the bias in the results reported here related to under-representation of women may not have been large.

ANALYSIS

We investigated the determinants of local organizational presence and the impacts of organizational presence using econometric analysis, supported by qualitative information from the survey. The variables included in these regressions and the hypotheses about the impacts of explanatory variables are discussed in a later section. In all regressions, the coefficients and standard errors were corrected for sampling weights, stratification, and the total number of communities in the central region (StataCorp 1997). The results are thus representative of the region as a whole. Standard errors were estimated using the Huber-White estimator, and are thus robust to general forms of heteroskedasticity (White 1980).

The “pathways of development” found in the region, were included as explanatory factors in the analysis (along with other factors).¹⁰ A development pathway is defined as a common pattern of change in livelihoods and resource management, and thus represents a particular set of economic opportunities and constraints (Pender, Scherr, and Duron 1999). Using data on occupations and changes in occupations and land use since the mid-1970s, six pathways of development were identified. Basic grain (maize, beans and sorghum) production is the most or second most important occupation in all but one of

¹⁰ The explanatory factors and hypotheses concerning their impacts are discussed later in the paper. Here, we introduce the concept of development pathways, since this is used in the next section.

the sample communities. Other factors were therefore more determinate in distinguishing the pathways. The pathways include villages where 1) basic grain production is the dominant economic activity and has been expanding during the past 20 years ("basic grains expansion pathway"), 2) basic grains production is the dominant economic activity though production has been stagnant or declining ("basic grains stagnation pathway"), 3) horticultural (mainly vegetable) production has increased and has become the first or second most important activity ("horticultural expansion pathway"), 4) coffee production has increased and is the first or second most important activity ("coffee expansion pathway"), 5) forestry activities are the first or second most important activity ("forestry specialization pathway"), and 6) non-farm employment has increased and become the first or second most important source of income ("non-farm employment pathway").¹¹

4. LOCAL ORGANIZATIONS AND NRM IN CENTRAL HONDURAS

ORGANIZATIONAL PRESENCE

Rural organization in the central region has historically been poorly developed. Factors that may have contributed to this include poverty, low population density, poor communications infrastructure, political and economic marginality, a tradition of dependence on government organizations, and the relative lack of ethnic differentiation in

¹¹ In almost all of the basic grains expansion and stagnation communities, livestock production is the second most important activity. All of these pathways are described and analyzed in detail in Pender et al. (1999).

the region.¹² In the 1970s, most organizations were the local offices of national ministries or programs. Local people organized themselves mainly for marketing coffee, pine resin and processed forest products.

Externally-governed organizations, defined as organizations governed at a level above the *aldea* (village), continue to dominate the landscape. Many national government organizations are directly involved in technical assistance related to agriculture and NRM, and water and forest management. Other agencies have indirect effects on NRM through infrastructure, social investment, education, and nutrition and health programs. External NGOs proliferated in the region during the 1980s and early 1990s, with the withdrawal of government social and technical assistance programs, increased availability of international funding, new attention to local environmental concerns, and new philosophies of decentralization and local action for public services, including NRM (Miranda 1997). Over 20 externally-directed NGOs were operating there in 1997.

The density of locally-governed community organizations averages about seven organizations per community (similar to the average number of externally-governed organizations) (Table 1). Of these, nearly 40% are involved to some extent in agricultural or natural resource management activities, although not usually as their primary or original mandate. All are voluntary organizations.

¹² The ethnic composition of the central region is predominantly *ladino* (mixed indigenous/European). Some sociologists hypothesize that rural organizations are more likely to form where there are readily identifiable ethnic or social groups, such as indigenous groups. We are grateful to Stephen Sherwood for this suggestion.

Table 1 Organizational presence in Central Honduras

Mean number of organizations per village (Robust Standard Errors in Parentheses) ^a		
Type of Organization	Total Number per Village	Number involved in NRM
Government organization	4.2 (3.1)	2.7 (1.8)
External NGO	2.3 (2.0)	1.8 (1.7)
Local NGO	7.1 (2.8)	2.6 (2.3)

^a Means and standard errors corrected for sampling weights, stratification, and finite population.

The "*patronato*" has official status as the primary local decision making body at the village level, and exists in almost all villages. *Patronatos* are involved in NRM activities such as repair and construction of drinking water systems, and forest protection, management or establishment in public areas or near water sources. Water committees are relatively common (found in over 60% of villages), and are responsible for maintaining and protecting drinking water systems. Parent associations are common (in over three-fourths of villages), and are mainly involved in school improvements, sometimes including tree planting. Church groups are very common, but they are not often involved in NRM activities, though some have been involved in reforestation, guarding forests, and education about safe use of water. Various types of cooperatives and work groups are found in a few communities, mainly in the non-farm and coffee pathways. A few student and school groups undertake reforestation. A few communities have local chapters of indigenous councils or other civic and social groups.

ORGANIZATIONAL ACTIVITIES IN NRM

Organizations in the central region commonly play three roles in natural resource management:

- Service or support to local farmers and residents in managing privately held natural resources (for example, to improve agricultural production and conservation);
- Collective investment in common property resources (e.g., community forest management, reforestation, building and repairing water systems, run-off control); and
- Regulation of local natural resource use and management by individuals and groups (e.g., watershed and forest protection, water distribution, forest management).

Organizational activities related to common property resources have only recently begun to shift from protection (reducing degradation) to improvement (rehabilitating degraded land or enhancing the quality of existing resources), while organizational activities related to private farm resources is shifting slowly from production to conservation. The greatest concern sparking voluntary collective action has been protection of water resources for local consumption. Local people were also willing to organize to protect forest resources where these are important economically or to protect local watersheds. Similar efforts were uncommon for soil conservation. Local people acted mainly through existing organizations, although new temporary coalitions arose in a few cases to address perceived emergencies.

Support for Local Farmers in NRM

Externally-managed organizations have played a pivotal role in the introduction and dissemination of new agricultural, conservation, livestock and forestry technologies in the central region, both through direct extension and indirectly through diffusion and local information systems. Municipalities were active in no-burning campaigns. Many external agencies provided inputs and services—for example, technical extension, inputs,

bank credit or forest micro-enterprise support—through specially organized farmer groups, but these typically disbanded when services were discontinued. Some farmer cooperatives and work groups are supported by outside agencies or supra-local farmer organizations, which provide access to production technology, agricultural inputs, credit, or marketing services for particular commercial products (coffee, resin, sugar, wood products). Most spontaneous diffusion of new NRM practices has occurred through individual, rather than collective, action.

Collective Investment

Collective investment in natural resources is only incipient in the Central region. Most activities are organized by *patronatos*, local water committees, the municipality, or special projects partially financed externally; the major local input is labor. Group action was reported mainly for road maintenance or for building and maintaining potable water systems, which occurs in nearly all communities (Table 2). This reflects the local priority for activities with high near-term benefits. There has been little collective investment in irrigation systems; rather, inexpensive ditch and hose irrigation has been established by individual farmers close to either natural water sources or the new drinking water systems.

Table 2 Collective investments by communities in Central Honduras

Type of Investment	Percentage of Communities Investing ^a
Road maintenance	91.7
Constructing/maintaining potable water system	87.5
Controlling runoff	20.8
Investments on common land (mainly tree planting)	10.6
Collective investments on private land	4.2

^a Percentages corrected for sampling weights and stratification.

About one-fifth of the region's communities have organized to control water drainage or runoff, by planting trees near water sources or building stone walls. Field visits suggested that these were constructed principally to protect other infrastructure investments, such as roads or water tanks, or to avoid mass movement of soil. All tree planting was organized by local schools, while stone walls were constructed by community members after damage had occurred (Durón 1998). External organizations were involved in only a few of these cases (promoting tree planting near water sources).

Only a tenth of all communities worked collectively on common land improvements, mainly tree-planting.¹³ In one case, an external organization had catalyzed the effort by offering food for work to plant trees. All other cases were

¹³ "Common land" refers to national or municipal land that has not been allocated for private use. Such land is mainly used as forest land in the region.

organized by members of the community through the school or *patronato*. Collective investments on private land (e.g., drainage construction or maintenance) are even more rare.

Local Regulation of Natural Resources

Until recently, rural people have had limited legal control over natural resources other than private cropland. The national Forestry Law of 1974 gave control over forest resources on both public and private lands exclusively to the state. Much of the land was national or municipal land subject to restrictions on their use and sale, although most farmers had relatively secure tenure. In the 1990s, the legal and institutional context for local organization for NRM changed considerably. The Law of Modernization and Development of Agriculture (LMDSA) of 1992 led to the withdrawal of many national government services and market controls. Agrarian reform land was given full legal status as privately titled land. The Forest Law of 1993 returned many of the rights of commercial use and access to timber and forests to private landowners, local communities and municipalities, although usually subject to some rules for resource protection. Although the area of national or municipal lands had declined in many communities, they were still present in two thirds of our survey communities in 1996; Jurisdictional conflicts are common on such lands.

Local knowledge and interpretation of the new rules varies greatly. The resulting set of norms actually imposed locally to address externalities in NRM thus varied, sometimes reflecting local priorities as much as actual legislation. In 1996, fewer than half of communities in our survey with municipal or national lands restricted rights of

outsiders. A quarter prohibited agricultural cultivation on those public lands; few had grazing restrictions. The priority environmental concerns reflected in regulations were water supply and quality. A third of communities with public lands reported having local restrictions on the use of water from those lands. Water restrictions included granting priority for human consumption and prohibitions on contamination. Many forest regulations also serve to protect water resources. While fewer than half of the communities with public land reported restricting fuelwood collection, most restricted pole and timber extraction (requiring cutting permits, or prohibiting clearing around water sources). A few communities regulate or prohibit pine resin collection.

Regulations are occasionally enforced directly by the national forest, water or other agencies, but in most cases enforcement is the responsibility of the municipality (or its locally-based representative) or the local *patronato*.¹⁴ In cases involving problems caused by community members, there are usually attempts to first deal with externality problems informally. If there is no response, then officials or a community group approach the person; the next step is to bring the matter to the attention of the municipal representative. Continued intransigence would lead the community to raise their concerns to higher municipal authorities or a national public agency, and/or begin legal proceedings. For externalities caused by people from outside the *aldea*, the initial approach by community members is followed by recourse to the municipality and the public agencies. Formal complaints are uncommon. It is unclear whether this is due to few violations, the effectiveness of informal mechanisms, reluctance to impose sanctions,

¹⁴ In some cases, private organizations are contracted to manage protected areas.

questions as to the legitimacy or effectiveness of the formal mechanisms, or other reasons.

One would expect to find more dependence on non-local authorities for regulatory enforcement in conditions where local people are affected by few locally important externalities, where external authorities are actively present, or where the problems are caused by outside groups (or powerful individuals) over whom local authorities have no effective jurisdiction. By contrast, one would expect to find more dependence on local authorities where management practices are perceived to generate significant local externalities.

These expectations appear consistent with observed differences in enforcement of rules among the different development pathways. In the basic grains expansion and non-farm employment pathways, all enforcement was reported to be by outside agencies. In the former, this can be explained by the relatively low level of externalities of importance to local people, as a result of relatively low population density and resource pressures. In the latter, it may be explained by the greater presence of national agencies and large externalities caused by outsiders. In the horticultural pathway, most problems are resolved by the municipality, or otherwise by outside agencies; this may reflect the low level of local organizational development in this pathway. In the coffee and forestry pathways, the main actors are local organizations (e.g., forestry coops) and outside agencies. In the relatively densely populated basic grains stagnation pathway, with large local externalities, local and municipal authorities were the principal enforcers of natural resource rules.

5. ECONOMETRIC ANALYSIS

DETERMINANTS OF ORGANIZATIONAL DENSITY

Variables and hypotheses

The dependent variables in the analysis of local organizational development was the number of local organizations existing in the community at the time of the survey, and the number involved in NRM activities. These are obviously only very rough measures of organizational development and abstract from many important issues such as organizational performance, sustainability, intensity of activity, etc. We were not able to obtain satisfactory measures of such aspects of organizational development given the extensive nature of the survey and the limited time we were able to spend in each village (half a day). More intensive research is needed to study these issues.

Least squares regression was used to investigate the determinants of organizational presence. The explanatory variables included in the regressions were the number of external organizations that have worked in the village, the population of the village in 1974, population density in 1974, population growth rate (between 1974 and 1988) and growth rate squared, distance of the village from Tegucigalpa, distance to the nearest road, adult literacy rate in 1974, the percentage of the 1974 population born within the *municipio*, and dummy variables representing the different pathways of development identified by the survey.¹⁵

¹⁵ Summary statistics for all variables used in the regression analyses are reported in the Appendix.

Because they may be endogenous to the process of organizational development, predicted values of the population growth rate, the population growth rate squared, and development pathway variables were used in the regressions.^{16,17} The presence of external organizations also may be endogenous, since it could have been influenced by local organizational development. There is also the potential for omitted variable bias to cause a spurious correlation, if unobserved factors were responsible for both local and external organizational presence. We were not able to use an instrumental variables approach to correct for these problems, since any variable that influences development of external organizations may also directly affect local organizational development. Thus, the number of local and external organizations may be correlated not because external organizations stimulate local organizational development, but because local organizations attract external organizations, or because both local and external organizational development are stimulated by other, unobserved factors.

¹⁶ The variables used to predict the population growth rate and growth rate squared include all of the other explanatory variables, plus dummy variables for whether the community had access to a road in 1975, whether road access had been obtained since 1975, and the proportions of households having access to water, sanitation, electricity or radio in 1974. The development pathway dummy variables were replaced by predicted probabilities from a multinomial logit regression of pathway determinants (this regression is reported in Pender et al. 1999). The explanatory variables for the pathways include mid-point altitude of the village, average number of rainfall days, 1974 population density, distance to Tegucigalpa, distance to the nearest road, and whether a technical assistance program had worked in the village.

¹⁷ For technical reasons, the standard errors could not be corrected for the fact that predicted values were used in the regressions in this study. We are not aware of analytical formulas to correct the standard errors for the complex two-stage regressions used (e.g., including predicted probabilities from a multinomial logit model for an ordered probit model in a second stage regression). Given the small number of observations per stratum, bootstrapping does not appear justifiable. We examined the robustness of our findings to use of actual vs. predicted values and to exclusion of the pathway variables; the robustness of the findings is discussed later in the paper.

The explanatory variables may affect the benefits or costs of organizational development. A higher population level is expected to positively affect the demand for organizations, but may also increase the cost of organizing. Controlling for population level, population density represents the scarcity of resources and geographic proximity of village households, both factors that may increase organizational density. Greater scarcity of resources may lead to greater demand for organizations to help allocate and conserve resources (such as water user associations) (Scherr and Hazell 1994); while closer proximity of households is expected to reduce the transactions costs of organizational development (Mumtaz 1995). On the other hand, resource scarcity may increase potential conflict and thus undermine the ability to establish and maintain effective organizations to regulate use of natural resources.¹⁸

We also include the population growth rate and the square of the population growth rate to reflect the impact of immigration or emigration.¹⁹ Where the population growth rate is unusually low this is likely due to emigration, while an unusually high growth rate is likely due to immigration. In both cases, lower stability of the community population may reduce the ability to achieve collective action in organizational development (Rasmussen and Meinzen-Dick 1995; Baland and Platteau 1996; Bardhan

¹⁸ It may be that resource scarcity induces organizational or institutional development only after a threshold level of resource damage has been realized (Scherr and Hazell 1994; Otsuka and Place forthcoming). One way to test for this is to include higher order polynomial terms (e.g., population density squared). Unfortunately, the correlation of population density squared with population density in our sample is very high (0.94), limiting our ability to identify such nonlinear effects. Regressions including both population density squared and population density as explanatory variables resulted in both variables being statistically insignificant.

¹⁹ The correlation between population growth rate and growth rate squared is 0.81.

1993; Ostrom 1990). Thus we expect an inverted U-shaped relationship between population growth and organizational development, with a positive effect of growth rate and negative effect of growth rate squared.

The percentage of the village born within the *municipio* reflects the absence of immigrants, and may be related to the social proximity of village members, presence of relations of trust and potential for social sanctions, all of which may determine the ability to achieve collective action in forming and maintaining organizations (*Ibid.*). On the other hand, the presence of immigrants may increase the demand for organizations to manage potential conflicts or increase awareness of opportunities for organizational development. Thus this variable may have mixed effects.

As with migration, market integration may undermine the ability to attain collective action, since community members may have more "exit" options where markets are more integrated (*Ibid.*). On the other hand, greater access to markets may increase the demand for some kinds of organizational development related to economic opportunities, unless entry of private firms or state intervention displace the need for such development (Bebbington et al. 1996; Uphoff 1986). Market access may also influence organizational development by affecting village members' access to information and knowledge of alternative organizational forms, as well as by affecting economic opportunities. Thus the expected impacts of measures of market access, including distance to Tegucigalpa and distance to a road, are ambiguous.

Education and literacy may affect organizational development. Education may increase awareness of opportunities for organizational development and the ability of individuals to organize (Meinzen-Dick 1997; Bebbington et al. 1994; Esman and Uphoff

1984). More educated individuals may have a longer-term perspective due to greater access to credit or greater ability to save (Pender 1996). Where a high proportion of a community is literate (compared to a moderate percentage as in the less literate communities in the sample), this may indicate less heterogeneity in terms of wealth or social status, which may favor collective action as argued by many authors (Ostrom 1990; Tang 1992; Bardhan 1993); though the negative impact of wealth heterogeneity is disputed by Baland and Platteau (1996). On the other hand, education may increase the awareness of exit options of community members and thus tend to undermine collective action. More educated people may have higher opportunity costs of their time, so they may be less prone to participate in collective action. Thus the net impact of education is theoretically ambiguous.

The presence of external organizations in the village can also have mixed effects. On one hand, such organizations may be catalysts for local organizational development and help to strengthen the capacity of local organizations (Farrington and Bebbington 1993; Esman and Uphoff 1984; Ostrom 1990; Thomas-Slayter 1992). On the other hand, such external influences may compete with or undermine local organizations, by reducing the need for local collective action (Thomas-Slayter 1992; Thomas-Slayter 1994).

The different pathways of development may have different implications for organizational development. We expect greater demand for economic organizations such as producer associations, credit groups and cooperatives where cash crop production is occurring, as in the horticultural and coffee expansion pathways, than in the basic grains pathways (Uphoff 1986). On the other hand, the higher incomes associated with such commercial pathways may undermine organizational development by causing people to

have a higher opportunity cost of their time, increased exit options from their communities, or greater social heterogeneity. Thus the net impact of development pathways on organizational development, as with most other factors, cannot be determined *a priori*, but is an important empirical issue.

Cultural, ethnic or religious heterogeneity, distribution of assets or income are also factors that could affect the costs and perceived benefits of organizing. Lack of variation in ethnic and religious makeup of the study communities prevented inclusion of these variables in the analysis, however. We were not able to obtain information on asset or income distribution so could not include this in the analysis.²⁰

Results

The regression results for organizational density are reported in Table 3. Local organizational density is positively associated (at the 10% level) with the presence of external organizations, population level, distance from the urban market and adult literacy; and negatively associated with rapid population growth, the percent of the community born in the *municipio*, and the basic grains expansion and forestry pathways. The number of local organizations involved in NRM activities is positively associated with the number of external organizations involved in NRM activities, population level, adult literacy and the coffee expansion and non-farm employment pathways; and negatively associated with population density and the forestry pathway.

²⁰ In our study design, we intended to use information on land distribution from the agricultural census of Honduras, but this information could not be obtained.

The robustness of these findings was explored in regressions using actual rather than predicted population growth rate and pathway dummies, and excluding the pathways.²¹ Almost all of the coefficients significant at the 5% level in Table 3 have the same sign and are significant at the 5% level in these other regressions.²² In addition, we find support for the hypothesized inverted U-shaped relationship between population growth and organizational development in these additional regressions, with a significant positive coefficient of population growth rate and a significant negative coefficient of growth rate squared. Based on the estimated coefficients, the maximum predicted number of local organizations occurs at a population growth rate of 4.0% per year in the first regression and 3.3% per year in the second regression. These population growth rates are well within the range of population growth rates in the sample (see Appendix), indicating that the turning point of the inverted-U relationship occurs within the sample.

These results generally support the theory of induced organizational development, particularly as regards the positive impact of population level, which we expected to be associated with the demand for organizations. Interestingly, however, land scarcity (as measured by population density) does not appear to induce organizational development, and in fact is negatively associated with organizational involvement in NRM. This suggests that the greater potential for conflict over resources caused by resource scarcity may undermine organizational development. The results also suggest that interventions

²¹ Regression results available from the authors.

²² The exceptions are the coefficient of basic grains expansion in the first regression, which is negative and significant at the 10% level when actual values are used; and the coefficient of the forestry pathway in both regressions, which is insignificant in the first regression and positive and significant in the second regression.

by external programs and organizations have promoted local organizational development in central Honduras, though this is subject to the possibilities of reverse causality or omitted variable bias mentioned above. We know from qualitative evidence that in some cases external agencies have promoted local organizational development (Durón 1998); for example, efforts by an externally funded forestry project (MAFOR) to promote forest management cooperatives.

The greater presence of local organizations in communities further from Tegucigalpa supports the argument that greater market access may undermine local organization by increasing community members' alternatives to participation in such organizations. There may also be greater intensity of government involvement in communities closer to the capital city (even controlling for the number of external organizations involved), which would tend to substitute for local organization. We did not find the same impact of proximity to Tegucigalpa for the presence of local organizations involved in natural resource management, perhaps because the types of services provided by the government do not substitute well for the natural resource management functions of these local organizations.

The positive association between literacy and local organizational presence supports the hypothesis that more educated people may be more aware or more able to take advantage of opportunities for organizational development. More educated people may also be more receptive to encouragement from external organizations to organize.

The negative association between the percentage of village members born in the *municipio* and local organizational density is interesting. This suggests that immigration increases the demand for formal organizations or that immigration helps villages become

more aware of opportunities for local organizational development. However, there appears to be a diminishing impact of immigration on organizational development (shown by the negative coefficient of the square of the population growth rate).

We found some impact of the pathways of development on organizational development, though some of the effects were not robust to the specification (see footnote 21). The most robust finding with regard to the pathways is that the presence of local organizations involved in NRM is greater in the coffee than basic grains pathways. The greater presence of organizations involved in NRM in coffee communities may be due to several factors, including the effort by external organizations to promote local organizations in such areas, the greater economic value of resources in coffee communities, and common concerns about pollution problems caused by coffee processing. The latter two possibilities are consistent with the hypothesis of induced organizational development.

Table 3 Determinants of local organizational presenceLeast Squares Regression (Robust Standard Errors in Parentheses)^{a, b}

Variable	Total Number of Local Organizations	Number of Local Organizations involved in NRM ^c
Number of external organizations ^c	0.1976** (0.0833)	0.1443* (0.0807)
1974 population	0.002173*** (0.000722)	0.002254*** (0.000491)
1974 population density	-0.00675 (0.00871)	-0.03850*** (0.00822)
Population growth rate, 1974-88 ^b (percentage)	0.380 (0.230)	0.154 (0.331)
Population growth rate squared ^b	-0.0475** (0.0190)	-0.0235 (0.0247)
Distance to Tegucigalpa (km.)	0.0248** (0.0108)	-0.0055 (0.0135)
Distance to nearest road (km.)	-0.0256 (0.0821)	0.213 (0.154)
Rate of adult literacy in 1974 (percent)	0.0459* (0.0234)	0.0818*** (0.0213)
Percent of 1974 population born in the <i>municipio</i>	-0.0629** (0.0258)	0.0038 (0.0289)
Basic grains expansion ^b	-2.775** (1.059)	-0.115 (2.037)
Horticultural expansion ^b	0.774 (1.633)	2.368 (1.840)
Coffee expansion ^b	1.268 (0.866)	2.513*** (0.876)
Forestry specialization ^b	-4.618*** (1.390)	-3.869*** (1.339)
Non-farm employment ^b	1.077 (0.865)	1.667* (0.934)
Intercept	5.827 (3.425)	-3.593 (3.800)
Number of observations	39	38
R ^b	0.825	0.742

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% level.

^a Coefficients and standard errors adjusted for sampling weights, stratification, and finite population.

^b Predicted values are used for population growth rate, population growth rate squared, and the pathway dummy variables. Standard errors are not adjusted for use of predicted values. The variables used to predict the population growth rate and growth rate squared include all of the other explanatory variables, plus dummy variables for communities that had access to a road in 1975 and for communities that gained road access since 1975, and the proportions of households having access to water, sanitation, electricity, or radio in 1974. Pathway probabilities are from a multinomial logit regression using as explanatory variables mid-point altitude, average number of rainfall days, 1974 population density, distance to Tegucigalpa, distance to the nearest road, and whether a technical assistance program had worked in the village.

^c For the regressions of determinants of the number of local organizations involved in natural resource management (NRM), the number of external organizations involved in NRM is the first explanatory variable.

DETERMINANTS OF COLLECTIVE INVESTMENT AFFECTING NRM

Variables and hypotheses

The community survey asked specifically about whether community members had invested collectively in efforts to control runoff, such as by planting trees and constructing stone walls or ditches; and whether they had invested collectively in improvements to common lands, such as by planting trees or shrubs in community forests or fencing common areas.²³ Because it may have been difficult for respondents to distinguish these questions, for econometric analysis we combined the responses into a single variable representing collective action relating to NRM (a “yes” to either question was treated as a yes, a “no” to both questions treated as a “no”). We also collected information on local rules for managing forests, water, and common lands (discussed previously in Section 4), but this information is not suitable for econometric analysis.

A probit model was used to investigate the determinants of collective action relating to NRM. Most of the explanatory variables used in the regressions for determinants of local organizational density were included in this regression, since organizational development also involves collective action and thus is affected by many of the same factors. We included the number of government organizations and the number of external non-government organizations (NGOs) as separate variables, to investigate whether these different types of external organizations have different impacts. We also included the predicted number of local organizations from the regressions discussed in the preceding section as an explanatory variable. It is arguable that all

²³ The questionnaire did not investigate the intensity or frequency of these activities, only whether they had occurred.

organizations, and not only those involved in NRM activities, may influence collective action related to NRM by affecting the level of “social capital” in the village. Thus in one regression we consider the total numbers of external and local organizations as explanatory variables, and in another we consider the number involved in NRM activities. The models were not estimable when the development pathway variables were included; so these were excluded.²⁴

We expect that local organizational density will contribute to the possibility of collective investment, whether or not the organizations are directly involved in natural resource management. This is because the presence of local organizations may increase social interactions and the possibility of enforcing agreements based on the multiplex relationships among community members (Baland and Platteau 1996; White and Runge 1995). Our expectations about the effects of other variables on collective investment are similar to our expectations about their impact on local organizational development, since local organizational development itself requires collective action, as discussed above.

Results

Interestingly, we find that the presence of local organizations involved in NRM activities is positively related to collective action (statistically significant in one specification), while the number of government organizations is negatively associated with collective action (significant in both) (Table 4). In one specification, we find that land scarcity is associated with less collective action, consistent with the finding of less

²⁴ When too many regressors were included in the model, the model predicted the outcomes perfectly, and not all coefficients could be estimated. This is a common problem in estimating binary probit models with a small data set.

Table 4 Determinants of collective action to control runoff or improve common land

Probit Regression (Robust Standard Errors in Parentheses) ^{a, b}		
Variable	Total Number of Organizations as Explanatory Variables ^c	Organizations Involved in NRM as Explanatory Variables ^c
Number of local organizations ^{b, c}	0.343 (0.413)	0.843** (0.333)
Number of government Organizations ^c	-0.538*** (0.157)	-0.519** (0.208)
Number of NGOs ^c	0.809* (0.428)	0.050 (0.245)
1974 population	0.00223 (0.00197)	-0.00066 (0.00117)
1974 population density	-0.0527*** (0.0137)	-0.0030 (0.0162)
Population growth rate, 1974-88 ^b (percentage)	1.210** (0.564)	0.343 (0.425)
Population growth rate squared ^b	-0.456** (0.192)	-0.220* (0.119)
Distance to Tegucigalpa (km.)	-0.0717** (0.0287)	-0.0122 (0.0141)
Distance to nearest road (km.)	0.013 (0.356)	-0.210 (0.146)
Rate of adult literacy in 1974 (percent)	-0.0342 (0.0396)	-0.0660** (0.0316)
Percent of 1974 population born in the <i>municipio</i>	-0.0685 (0.0526)	-0.0325 (0.0329)
Intercept	10.51 (7.65)	6.83 (4.70)
Number of observations	39	38

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% level.

^a Coefficients and standard errors adjusted for sampling weights, stratification, and finite population.

^b Predicted values are used for number of local organizations, population growth rate, and population growth rate squared. Standard errors are not adjusted for use of predicted values. Predicted values for number of local organizations are based on the regressions in Table 3. Predicted values for population growth rate and growth rate squared are determined as explained in footnote b, Table 3.

^c In the first regression, the total number of local organizations, government organizations, and NGOs are the first three explanatory variables. In the second regression, the numbers of these organizations involved in NRM are the explanatory variables.

organizational activity related to NRM. As in the case of organizational development, we find an inverted-U relationship between population growth and collective investment (though this is significant in only one specification).²⁵ Villages more distant from Tegucigalpa are less likely to engage in collective action (significant in one specification), while higher literacy rate is negatively associated with collective action (in the other specification).

We investigated the robustness of these results, using actual rather than predicted levels for the number of local organizations, population growth rate and growth rate squared. All of the coefficients significant at the 5% level in Table 4 are the same sign and significant in these other regressions, except the coefficient of literacy rate in the second regression (insignificant). In addition, we find statistically significant support for a positive effect of population, an inverted-U relationship between population growth and collective action, and a negative effect of distance to roads on collective action in these regressions.

Overall, these results confirm the importance of organizational presence, demographic factors and market access as factors influencing the potential for collective action. Local organizations appear to promote collective action while external government organizations appear to displace it. It may be that external government organizations substitute for local collective action, or they may simply choose to work in problem communities where local collective action is not occurring. Even if they do

²⁵ The maximum predicted probability of collective investment occurs at a population growth rate of 1.3% per year in the first regression and 0.8% per year in the second. These rates are well within the range of population growth rates of the sample.

displace local collective action, the net impact of external government organizations on collective action depends on indirect effects (via their contribution to development of local organizations) as well as direct effects. Based on the magnitude of the coefficients in Tables 3 and 4, the direct effects appear to outweigh the indirect effects, however, so that external organizations tend to reduce collective action on balance.

Qualitative information from the community survey indicates that in most cases, collective action to manage runoff or improve common lands occurred through local initiative, though in some cases, external organizations were involved (Durón 1998). Thus, external organizations do not always displace local action and in some cases promote it. Furthermore, co-involvement of external organizations and local organizations in constructing and maintaining potable water systems and roads was very common (Ibid.). Thus, the extent to which external organizations displaced local collective action appears to depend greatly on the type of collective action. For drinking water systems and roads, external organizations specialized in providing capital inputs and technical expertise, while expecting local communities to provide complementary labor inputs. The different comparative advantages of external and local organizations in providing these different kinds of complementary inputs explains the motive for the high degree of co-involvement of external and local organizations in such activities; and the large benefits of these activities to the recipient communities explains the near universal achievement of collective action in these cases. By contrast, collective action to protect natural resources by planting trees, etc. likely requires less technical or capital inputs from external agents and provides smaller perceived benefits to the community.

As with local organizational development, population growth appears to promote collective action, though rapid population growth may undermine it as a result of less stability of the population. Population density appears to undermine collective action, also consistent with its impact on local organizational development.

Unlike the case with local organizational development, proximity to the urban market appears to promote collective action. This may be because of greater intensity of effort in such areas by external programs seeking to promote collective action in more accessible communities. Since local organizations also favor collective action, the net impact of proximity to the urban market on collective action depends on indirect effects (via its impact on local organizational development) as well as direct effects. Based on the magnitude of the coefficients in Tables 3 and 4, the direct effect appears to outweigh the indirect effect, so that communities closer to Tegucigalpa are predicted to have greater collective action.

DETERMINANTS OF PRIVATE ACTION AFFECTING NRM

Variables and hypotheses

The variables reflecting private actions affecting NRM include the extent of use of various cropping practices (fallow, burning, irrigation), purchased inputs (chemical fertilizer, insecticides, herbicides, improved seeds), annual conservation or fertility management practices (contour planting, green manures, minimum tillage, mulch, incorporation of crop residues, use of cow manure or chicken manure), and land improving investments (terraces, live barriers, stone walls, drainage ditches, trees). These variables were measured as an ordinal index from 0 to 6 (0 = no farmers use the practice, 1 = a few (less than 10%), 2 = minority, 3 = about half, 4 = majority, 5 = almost

all (more than 90%), 6 = all). We used ordered probit regressions to estimate the impacts of the explanatory variables on farmers' likelihood of adopting different practices.²⁶

The explanatory variables included in these regressions include the number of local organizations (predicted), number of government organizations and number of NGOs involved in NRM activities in the village, population density, distance of the village from Tegucigalpa, distance to the nearest road, literacy rate, and the (predicted) development pathways. These variables reflect many of the factors hypothesized by McCullough et al. (1998) to affect private technology choice, including access to infrastructure (distance to a road), access to information (presence of external organizations, distance to Tegucigalpa, literacy), credit (proxied by development pathways and literacy rate), labor/land endowment (population density), physical/technical conditioning factors determining comparative advantage (determinants of predicted pathways of development), and collective action (presence of local organizations). Household and plot level data and time-series data would be needed to adequately incorporate some of the other factors, such as risk, property rights, prices, and wealth.

There are too many dependent variables reflecting private NRM decisions to discuss hypotheses specific to each one. We focus here on the expected impacts of organizations. Government and NGO technical assistance organizations are expected to have increased adoption of practices they have been promoting, such as various conservation practices, while reducing use of some traditional practices that they have discouraged, such as burning. The presence of local producer associations may favor

²⁶ Ordered probit is a simple generalization of a standard binary probit model allowing for multiple ordered categories, estimated by maximum likelihood. See Amemiya (1985) or other advanced econometrics texts for a detailed explanation.

adoption of more modern commercial practices, such as adoption of irrigation and purchased inputs, to the extent that they help farmers obtain access to information about such technologies or access to inputs and credit (Uphoff 1986).

Results

The effects of organizations on cropping practices and use of inputs are mixed. Local organizations are associated with greater use of burning, chemical fertilizer, chicken manure and mulching, but less use of insecticides or plowing in of crop residues (Tables 5, 6 and 7). Government organizations are associated with greater use of insecticides, plowing in of crop residues, and terracing, and less use of fallow, burning and mulching. NGOs are associated with greater use of fallow, minimum till, plowing in of crop residues, and live barriers, and less use of chemical fertilizers and chicken manure.

The robustness of these findings was investigated using regressions including actual rather than predicted values of the number of local organizations and the pathway variables, and regressions excluding the pathways. Most of these results were found to be robust.²⁷

It is difficult to simply characterize such complex results, but it appears that NGOs and government organizations have a tendency to promote more labor intensive practices and investments such as terracing, live barriers, and plowing in of crop residues, while local farmer organizations help to promote more immediately profitable and less

²⁷ The non-robust exceptions were the positive association between NGOs and fallow, the negative association between NGOs and chemical fertilizer use, the negative association between government organizations and mulching, and the positive association between government organizations and terracing.

labor intensive methods such as use of chemical fertilizer and chicken manure. The differential association of local and government organizations with burning practices is an example of this; where local organizations are more prevalent, burning is more common, whereas government organizations inhibit use of burning. The fact that government organizations discourage burning is not surprising, given that it is government policy to prevent agricultural burning. The positive association of burning with local organizations is somewhat surprising. This finding probably does not mean that local organizations promote burning; rather, government organizations may be less actively involved (even if present) in areas where local organizations are well developed, so the discouraging effects of government presence may be lower.

Table 5 Determinants of cropping practices

Variable	Ordered Probit Regressions (Robust Standard Error in Parentheses) ^a						
	Continuous cropping	Burning	Irrigation	Fertilizer	Insecticide	Herbicide	Improved Seeds
Number of local organizations affecting NRM ^b	0.260* (0.150)	0.749*** (0.138)	0.036 (0.144)	0.432** (0.183)	-0.498*** (0.123)	0.200 (0.138)	-0.553 (0.361)
Number of government organizations affecting NRM	0.318** (0.153)	-0.706*** (0.160)	-0.043 (0.157)	-0.083 (0.183)	0.838*** (0.164)	-0.235 (0.180)	0.723 (0.457)
Number of NGOs affecting NRM	-0.368*** (0.127)	-0.166 (0.133)	0.156 (0.113)	-0.376*** (0.108)	0.0271 (0.1178)	-0.237* (0.121)	0.386 (0.238)
1988 population density (persons/km ^b)	0.0172** (0.0077)	-0.0122 (0.0077)	-0.00142 (0.00594)	-0.00171 (0.00495)	0.00246 (0.00543)	-0.00416 (0.00584)	-0.00113 (0.00876)
Distance to Tegucigalpa (km.)	0.0295*** (0.0096)	0.0306*** (0.0103)	0.0194 (0.0117)	-0.0118 (0.0115)	0.0302*** (0.0097)	0.0174 (0.0142)	-0.0014 (0.0138)
Distance to nearest road (km.)	0.0631 (0.0917)	0.0558 (0.1147)	-0.0857 (0.0903)	-0.2353*** (0.0698)	-0.0652 (0.0734)	0.1639** (0.0721)	-3.594 (2.996)
1988 adult literacy rate (percent)	-0.0250 (0.0217)	0.0363** (0.0150)	0.0018 (0.0161)	-0.0350** (0.0163)	0.0218 (0.0167)	-0.0327** (0.0135)	-0.0347* (0.0192)
Basic grains expansion ^c	-1.478* (0.855)	-3.899*** (0.960)	-0.528 (1.010)	4.979*** (0.776)	1.023 (0.970)	-1.712** (0.789)	-11951*** (4047)
Horticultural expansion ^c	1.782* (0.968)	-5.444*** (1.103)	3.726*** (1.327)	3.027*** (0.990)	4.756*** (1.010)	-1.387* (0.767)	5.891*** (1.603)
Coffee expansion ^c	-1.985** (0.877)	-3.550*** (0.800)	-1.291* (0.754)	2.554*** (0.624)	0.913 (0.878)	-0.761 (0.682)	3.238*** (1.160)
Forestry specialization ^c	6.497*** (1.891)	-5.996*** (1.326)	-1.308 (1.730)	2.171 (1.560)	-0.308 (1.840)	2.899* (1.630)	4.934* (2.555)
Non-farm employment ^c	-0.576 (0.868)	-1.259 (0.935)	0.072 (0.816)	-2.095*** (0.770)	2.171** (0.983)	-1.114 (0.899)	5.046** (1.910)
Number of observations	37	36	37	38	37	37	38

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% level.

^a Coefficient and standard errors corrected for sampling weights, stratification, and finite population.

^b Predicted number of organizations, based on results of regressions reported in Table 3.

^c Predicted pathway probability, based on the same multinomial logit regression reported in footnote b of Table 3.

Table 6 Determinants of annual soil conservation/organic fertility management practices
 Ordered Probit Regressions (Robust Standard Error in Parentheses)^a

Variable	Contour Planting	Green Manure	Minimum Till	Mulching	Plowing in Crop Residues	Cow Manure	Chicken Manure
Number of local organizations affecting NRM ^b	0.309 (0.250)	0.250 (0.185)	0.051 (0.190)	0.511*** (0.123)	-0.369** (0.152)	0.077 (0.167)	1.182*** (0.308)
Number of government organizations affecting NRM	0.106 (0.155)	0.282 (0.181)	0.163 (0.167)	-0.259** (0.123)	0.602*** (0.199)	0.126 (0.158)	0.149 (0.192)
Number of NGOs affecting NRM	-0.175 (0.205)	0.314 (0.195)	0.329* (0.177)	-0.185 (0.119)	0.341** (0.128)	-0.072 (0.109)	-0.965*** (0.226)
1988 population density (persons/km ^b)	-0.00855* (0.00447)	-0.00481 (0.00690)	-0.01112 (0.00749)	0.00681 (0.00414)	-0.00611 (0.00499)	0.00158 (0.00566)	0.00750 (0.00610)
Distance to Tegucigalpa (km.)	-0.0943*** (0.0209)	-0.0363* (0.0212)	-0.0514** (0.0214)	-0.0058 (0.0123)	-0.0569*** (0.0149)	-0.0315 (0.0210)	-0.0378* (0.0223)
Distance to nearest road (km.)	0.342** (0.131)	0.117 (0.159)	0.644** (0.268)	0.1438 (0.0948)	0.091 (0.191)	0.263** (0.118)	-20.22*** (2.64)
1988 adult literacy rate (percent)	-0.0048 (0.0133)	-0.0410* (0.0220)	-0.0080 (0.0174)	-0.0241** (0.0117)	0.0265 (0.0169)	0.0111 (0.0166)	-0.0187 (0.0188)
Basic grains expansion ^c	-1.857* (0.973)	-1.396 (1.765)	-2.311 (2.236)	-0.929 (1.287)	-23.888*** (8.194)	-2.963*** (0.691)	6.785** (3.331)
Horticultural expansion ^c	-3.735*** (1.209)	-7.870* (3.905)	-2.961 (1.894)	-1.388 (1.079)	-1.302 (0.990)	-2.674** (1.085)	-2.937 (2.124)
Coffee expansion ^c	0.441 (0.765)	1.050 (1.152)	1.827 (1.245)	0.462 (0.483)	-1.476* (0.768)	-0.622 (0.793)	0.245 (1.013)
Forestry specialization ^c	5.288*** (1.839)	-0.021 (1.898)	-1.138 (2.074)	-3.671 (3.405)	0.080 (1.334)	-0.279 (1.270)	-0.747 (2.039)
Non-farm employment ^c	-3.783*** (1.242)	-2.536* (1.370)	-1.264 (1.526)	-1.657** (0.724)	-1.705** (0.726)	-2.179* (1.109)	-1.232 (1.314)
Number of observations	37	38	38	38	36	38	38

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% level.

^a Coefficient and standard errors corrected for sampling weights, stratification, and finite population.

^b Predicted number of organizations, based on results of regressions reported in Table 3.

^c Predicted pathway probability, based on the same multinomial logit regression reported in footnote b of Table 3.

Table 7 Determinants of land improving investments

Variable	Ordered Probit Regressions (Robust Standard Error in Parentheses) ^a				
	Terraces	Live Barriers	Stone Walls	Drainage Ditches	Trees
Number of local organizations affecting NRM ^b	0.148 (0.169)	-0.168 (0.145)	-0.032 (0.215)	-0.131 (0.192)	0.1442 (0.0918)
Number of government organizations affecting NRM	0.316** (0.144)	0.061 (0.111)	-0.024 (0.189)	0.147 (0.159)	0.0610 (0.0894)
Number of NGOs affecting NRM	-0.043 (0.152)	0.230** (0.111)	0.237 (0.145)	0.051 (0.125)	0.0744 (0.1140)
1988 population density (persons/km ^b)	0.00408 (0.00698)	0.01071 (0.00893)	0.01579** (0.00669)	0.00259 (0.00609)	0.01115** (0.00552)
Distance to Tegucigalpa (km.)	-0.0209* (0.0118)	-0.0273*** (0.00899)	-0.0121 (0.0119)	-0.0345** (0.0130)	0.01162 (0.00826)
Distance to nearest road (km.)	0.2055** (0.0919)	-0.0416 (0.0771)	0.0426 (0.0765)	0.0938 (0.0999)	-0.1751** (0.0756)
1988 adult literacy rate (percent)	0.0024 (0.0140)	-0.0091 (0.0134)	-0.0041 (0.0167)	-0.0112 (0.0150)	-0.0088 (0.0134)
Basic grains expansion ^c	-0.956 (0.795)	1.058 (0.844)	-0.719 (0.754)	1.087 (1.185)	1.795** (0.718)
Horticultural expansion ^c	1.972** (0.821)	-2.605** (1.070)	-3.286*** (1.199)	-1.143 (1.128)	-0.147 (0.638)
Coffee expansion ^c	1.553* (0.865)	1.733 (1.167)	-2.235*** (0.819)	0.771 (0.829)	0.051 (0.712)
Forestry specialization ^c	2.760* (1.462)	-0.079 (1.183)	-0.433 (1.296)	3.017 (1.833)	-0.553 (1.596)
Non-farm employment ^c	-0.171 (0.768)	-1.044 (0.808)	-1.970** (0.910)	-0.776 (1.098)	-0.887 (0.579)
Number of observations	38	38	38	37	38

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% level.

^a Coefficient and standard errors corrected for sampling weights, stratification, and finite population.

^b Predicted number of organizations, based on results of regressions reported in Table 3.

^c Predicted pathway probability, based on the same multinomial logit regression reported in footnote b of Table 3.

6. CONCLUSIONS AND IMPLICATIONS

With regard to the determinants of local organizational development in central Honduras, the main findings of this study are that population growth contributes to organizational development at low levels of growth but has a diminishing and possibly negative effect at high growth rates, that proximity to the urban center reduces local organizational presence, and that the presence of immigrants appears to favor local organizational development. Local organizational development related to NRM is positively associated with larger population levels but negatively with population density (land scarcity), and positively associated with education levels and expansion of coffee production.

With regard to the impacts of local organizations on NRM, we find mixed results. Local organizations involved in NRM contribute to collective investment in NRM and assist in regulating use of common property resources and dealing with externalities (the *patronatos* are particularly important for establishing and enforcing these regulations), though these roles vary substantially across the development pathways. Local organizations have mixed impacts on farmers' private decisions to adopt resource conservation measures; in some cases being associated with less adoption of such measures, such as no-burn practices and plowing in crop residues. This may be because such conservation measures are of lower priority to many farmers than activities that generate greater income in the near term and which may substitute for conservation practices (such as use of chemical fertilizers rather than organic methods).

In contrast to the impacts of local organizations, we find that external government organizations seem to displace collective investment in NRM, though they promote other kinds of collective investment such as construction and maintenance of water systems and roads. External organizations have a stronger impact on promoting adoption of some labor-intensive conservation measures (such as no-burn, plowing in crop residues, and terracing) on private cropland. Some government organizations also play an important role in enforcing regulations or managing externalities, including the *municipios* in general and national level organizations in forestry communities (in combination with local organizations). NGOs are also important in promoting some conservation practices, such as plowing in crop residues and use of live barriers.

In a broad sense, the findings support the theory of induced organizational development, particularly the positive impact of population level and coffee production on local organizational presence. However, they also suggest that land scarcity and very rapid population growth may undermine the ability for organizational development to keep pace with population, or the ability to achieve collective action for NRM.²⁸ In many communities (most notably rapidly developing horticultural expansion communities), local organizational development is still very limited, despite (or perhaps because of) very rapid population growth, improvements in road and market access, and increases in demand for credit and other services. This suggests that local organizational development may be unable to respond to very rapid change.

²⁸ Negative impacts of a rapid population growth rate (as opposed to a high population level) on NRM due to lags in institutional adjustment have been hypothesized by several authors (see for example Templeton and Scherr (1997) and references cited therein).

The positive association between external and local organizational presence suggests that external organizations are playing a catalytic or complementary role in many cases, though the effort still may be insufficient to fulfill the demand where the pace of change is very rapid. On the other hand, the negative impact of external organizations on collective investments in NRM suggests that caution is warranted when such organizations do intervene in local communities, to be sure that they are facilitating and not undermining local initiative. External organizations appear to be essential to promote soil conservation measures on private farmland.

Both external organizations and local organizations can play important and complementary roles in fostering more sustainable and productive use of natural resources. The challenge for policy makers and program managers is to identify and exploit cases where synergies exist between external and local organizational development (such as providing complementary inputs into infrastructure development or in regulating resource use and externalities), to be cautious about intervening in a way that displaces local initiative (such as displacing local collective investments), and to focus effort on activities that have significant social benefits but are not being addressed adequately by private action (such as many conservation measures). Given the possibilities of unexploited complementarities or unintended competition between the actions of external organizations and local organizations, increased investment by external actors in understanding the extent and roles of local organizations could yield substantial benefits.

It is important to recognize that the opportunities for and constraints upon efforts to meet this challenge may vary substantially from place to place, depending upon local

economic opportunities, population pressure, and other factors. This study focuses on a situation of relatively low level of economic development and low population density. One might expect to find similar results in similar conditions elsewhere, while in more developed or densely populated conditions substantially different relationships between organizational development and natural resource management may exist. As our conceptual discussion emphasized, most determinant factors have theoretically ambiguous impacts, which can only be determined through careful empirical research. Such research on organizational development is still relatively limited. It is hoped that this paper will encourage further efforts to disentangle the causes and effects of local organizational development in different circumstances, and help policy makers to consider such issues when considering how to target their efforts to promote more sustainable agricultural development.

APPENDIX

Summary statistics of variables used in the regressions

Variable	Number of Observations	Mean ^a	Robust Standard Error ^a	Minimum	Maximum
Number of local organizations	40	7.10	2.77	2	15
Number of local organizations involved in NRM	40	2.60	2.34	0	9
Number of government organizations	45	4.22	3.08	0	13
Number of government organizations involved in NRM	45	2.73	1.75	0	6
Number of external NGOs	40	2.25	2.02	0	9
Number of external NGOs involved in NRM	40	1.77	1.72	0	8
Whether collective investment to control runoff or improve common land occurred	47	0.30	0.46	0	1
Index of proportion of households using ^b :					
Continuous cultivation	45	3.84	1.58	0	6
Burning to prepare fields	46	2.87	1.53	0	6
Irrigation	46	0.70	0.96	0	4
Fertilizer	48	2.50	1.75	0	6

Variable	Number of Observations	Mean ^a	Robust Standard Error ^a	Minimum	Maximum
Insecticide	47	2.96	1.76	0	6
Herbicide	47	2.72	1.72	0	6
Improved seeds	48	1.33	1.98	0	6
Contour planting	47	1.55	1.73	0	5
Green manure	48	0.48	0.74	0	2
Minimum tillage	48	0.92	1.37	0	4
Mulching	48	1.40	1.77	0	5
Plowing in crop residues	46	1.37	1.74	0	5
Cow manure	48	0.94	1.21	0	4
Chicken manure	45	0.82	1.27	0	4
Terraces	48	1.29	1.50	0	4
Live barriers	48	1.85	1.57	0	6
Stone walls	48	2.02	1.68	0	6
Drainage ditches	47	1.09	1.28	0	4
Tree planting	48	1.69	1.64	0	5
Village population—1974	47	652	422	46	1903

Variable	Number of Observations	Mean ^a	Robust Standard Error ^a	Minimum	Maximum
Population density—1974 (persons/km ^b)	47	37.5	33.4	4.0	170.2
Population density—1988	47	46.9	43.5	5.0	223.0
Annual population growth rate, 1974-88	47	1.97	2.72	-2.68	14.81
Distance to urban market (km)	48	67.7	31.9	5	160
Distance to nearest road (km)	48	1.6	3.5	0	16
Percentage of literate adults, 1974	47	51.0	16.3	18.9	81.7
Percentage of literate adults, 1988	48	56.1	21.0	13.1	90.0
Percentage of 1974 population born in municipality	47	90.4	9.2	57.0	99.8
Basic grain expansion pathway	48	0.10	0.31	0	1
Basic grain stagnation pathway	48	0.31	0.47	0	1
Horticultural expansion pathway	48	0.10	0.31	0	1
Coffee expansion pathway	48	0.21	0.41	0	1
Forestry specialization pathway	48	0.06	0.24	0	1
Nonfarm employment pathway	48	0.21	0.41	0	1

^a Means and standard errors corrected for sampling weights, stratification, and finite population.

^b Index values: 0 = none; 1 = less than 10%; 2 = less than half; 3 = about half; 4 = more than half; 5 = more than 90%; 6 = all.

REFERENCES

- Amemiya, T. 1985. *Advanced econometrics*. Cambridge: Harvard University Press.
- Baland, J-M. and J-P. Platteau. 1996. *Halting degradation of natural resources. Is there a role for rural communities?* Oxford: Clarendon Press.
- Bardhan, P. 1993. Analytics of the institutions of informal cooperation in rural development. *World Development* 21(4): 633–639.
- Bebbington, A.J., D. Merrill-Sands, and J. Farrington. 1994. *Farmer and community organizations in agricultural research and extension: Functions, impacts and questions*. Overseas Development Institute (ODI) Agricultural Administration (Research and Extension Network) Network Paper 47. London: ODI.
- Bebbington, A.J., J. Quisbert, and G. Trujillo. 1996. Technology and rural development strategies in a small farmer organization: Lessons from Bolivia for rural policy and practice. *Public Administration and Development* 16: 195–213.
- Boserup, E. 1965. *The conditions of agricultural growth*. New York: Aldine Pub. Co.
- de Janvry, A. and E. Sadoulet. 1993. Market, state, and civil organizations in Latin America beyond the debt crisis: The context for rural development. *World Development* 21(4): 659–674.
- Durón, G. 1998. The influence of external organizations in the collective management of resources in Honduras. M.A. thesis, School of Development Studies, University of East Anglia, U.K.
- Durón, G. and G. Bergeron. 1995. *Las políticas sectoriales agrícolas y ambientales y su impacto en las laderas de Honduras*. Documento presentado en el Seminario Taller "Las Políticas Sectoriales y su Efecto en el Manejo de los Recursos Naturales en Areas de Lader en Honduras," 11-13 de Septiembre, 1995, Tegucigalpa, Honduras.
- Esman, M.J. and N.T. Uphoff. 1984. *Local organizations: Intermediaries in rural development*. Ithaca: Cornell University Press.
- Farrington, J. and A. Bebbington. 1993. *Reluctant partners? Non-governmental organizations, the state and sustainable agricultural development*. London and New York: Routledge.
- Hayami, Y. and V.W. Ruttan. 1985. *Agricultural development: An international perspective*. Baltimore: Johns Hopkins University Press.

- McCulloch, A.K., R. Meinzen-Dick, and P. Hazell. 1998. Property rights, collection action and technologies for natural resource management: A conceptual framework. Mimeo. Washington, D.C.: International Food Policy Research Institute.
- Meinzen-Dick, R. 1997. Farmer participation in irrigation: 20 years of experience and lessons for the future. *Irrigation and Drainage Systems* 11: 103–118.
- Miranda, B. 1997. Arreglos institucionales para el desarrollo sostenible de las laderas de America Central. In *Desarrollo agricola, sostenibilidad de recursos naturales y reduccion de la pobreza en America Latina: El papel de las regiones de laderas*, eds. O. Neidecker-Gonzales and S.J. Scherr, pp. 125-142. Feldafing: DSE.
- Mumtaz, S. 1995. The demographic determinants of "successful" village cooperatives. *The Pakistan Development Review* 34 (4 Part II): 609–617.
- North, D.C. 1990. *Institutions, institutional change and economic performance*. Cambridge: Cambridge University Press.
- Nugent, J.B. 1993. Between state, markets and households: A neoinstitutional analysis of local organizations and institutions. *World Development* 21(4): 623–632.
- Ostrom, E. 1990. *Governing the commons: The evolution of institutions for collective action*. Cambridge: Cambridge University Press.
- Otsuka, K. and F. Place. Land tenure and natural resource management: Forest, agroforest, and cropland management in Asia and Africa. Baltimore: Johns Hopkins University, forthcoming.
- Pender, J. 1996. Discount rates and credit markets: Theory and evidence from rural India. *Journal of Development Economics* 50: 257–296.
- Pender, J., S.J. Scherr, and G. Durón. 1999. *Pathways of development in the hillsides of Honduras: Causes and implications for agricultural production, poverty, and sustainable resource use*. Environment and Production Technology Division Discussion Paper No. 45. Washington, D.C.: International Food Policy Research Institute.
- Pender, J. and S. J. Scherr. 1997. Community survey of hillside development patterns in the central region of Honduras. Environment and Production Technology Division. Washington, D.C.: International Food Policy Research Institute. Mimeo.
- Pender, J., and G. Durón. 1996. *Pathways of development in the central hillsides of Honduras: 1970s - 1990s*. Environment and Production Technology Division, International Food Policy Research Institute, Washington, D.C. Mimeo.

- Rasmussen, L.N. and R. Meinzen-Dick. 1995. *Local organizations for natural resource management: Lessons from theoretical and empirical literature*. Environment and Production Technology Division, Discussion Paper No. 11. Washington, D.C.: International Food Policy Research Institute.
- Scherr, S.J., and P.B.R. Hazell. 1994. *Sustainable agricultural development strategies in fragile lands*. Environment and Production Technology Division, Discussion Paper No. 1. Washington, D.C.: International Food Policy Research Institute.
- StataCorp. 1997. *Stata statistical software: Release 5.0*. College Station, TX: Stata Corporation.
- Tang, S.Y. 1992. *Institutions and collective action: Self-governance in irrigation systems*. San Francisco: ICS Press.
- Templeton, S. and S.J. Scherr. 1997. *Population pressure and the microeconomy of land management in hills and mountains of developing countries*. Environment and Production Technology Division, Discussion Paper No. 26. Washington, D.C.: International Food Policy Research Institute.
- Thomas-Slayter, B.P. 1992. Implementing effective local management of natural resources: New roles for NGOs in Africa. *Human Organization* 51(2): 136–143.
- _____. 1994. Structural change, power politics, and community organizations in Africa: Challenging the patterns, puzzles and paradoxes. *World Development* 22(10): 1479–1490.
- Uphoff, N. 1986. *Local institutional development: An analytical sourcebook with cases*. West Hartford: Kumarian Press.
- _____. 1993. Grassroots organizations and NGOs in rural development: Opportunities with diminishing states and expanding markets. *World Development* 21(4): 607–622.
- White, A.T. and C.Ford Runge. 1995. The emergence and evolution of collective action: Lessons from watershed management in Haiti. *World Development* 23(10):1683–1698.
- White, H. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48: 817–838.
- World Bank. 1991. Honduras: Environmental Agenda. Mimeo. Washington, D.C.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the financial support of the Swiss Development Cooperation and the InterAmerican Development Bank for this research. We are grateful to the study team—Guadalupe Durón, Fernando Mendoza, Carlos Duarte, Juan Manuel Medina, and Roduel Rodriguez—for their tireless efforts to complete the survey; to Oscar Neidecker-Gonzales for research assistance; to Lourdes Hinayon, Nancy Romero, and Nolvía Lagos for administrative support; to Peter Hazell, Gilles Bergeron, Bruno Barbier, and other colleagues at IFPRI for advice in the conduct of the research; to Byron Miranda of the Instituto Interamericano para la Cooperación en la Agricultura (IICA), Peter Heffron of CARE and other colleagues outside of IFPRI for advice on the survey design and implementation; to Hector Barreto and Pedro Jimenez of CIAT for providing secondary data; to IICA/Honduras for providing logistical support to the research; to numerous government agencies, municipal governments, and local teachers who helped to make arrangements for the survey in the different communities; and to Ruth Meinzen-Dick, Anna Knox, Frank Place, and Stephen Sherwood for detailed and constructive comments on the manuscript. Most of all, we are grateful to the many farmers and representatives of organizations in Honduras who generously agreed to respond to our many questions. Any errors or omissions are solely the responsibility of the authors.

List of EPTD Discussion Papers

- 01 *Sustainable Agricultural Development Strategies in Fragile Lands*, by Sara J. Scherr and Peter B.R. Hazell, June 1994.
- 02 *Confronting the Environmental Consequences of the Green Revolution in Asia*, by Prabhu L. Pingali and Mark W. Rosegrant, August 1994.
- 03 *Infrastructure and Technology Constraints to Agricultural Development in the Humid and Subhumid Tropics of Africa*, by Dunstan S.C. Spencer, August 1994.
- 04 *Water Markets in Pakistan: Participation and Productivity*, by Ruth Meinzen-Dick and Martha Sullins, September 1994.
- 05 *The Impact of Technical Change in Agriculture on Human Fertility: District-level Evidence from India*, by Stephen A. Vosti, Julie Witcover, and Michael Lipton, October 1994.
- 06 *Reforming Water Allocation Policy Through Markets in Tradable Water Rights: Lessons from Chile, Mexico, and California*, by Mark W. Rosegrant and Renato Gazmuri S., October 1994.
- 07 *Total Factor Productivity and Sources of Long-Term Growth in Indian Agriculture*, by Mark W. Rosegrant and Robert E. Evenson, April 1995.
- 08 *Farm-Nonfarm Growth Linkages in Zambia*, by Peter B.R. Hazell and Behjat Hojjati, April 1995.
- 09 *Livestock and Deforestation in Central America in the 1980s and 1990s: A Policy Perspective*, by David Kaimowitz (Interamerican Institute for Cooperation on Agriculture), June 1995.
- 10 *Effects of the Structural Adjustment Program on Agricultural Production and Resource Use in Egypt*, by Peter B. R. Hazell, Nicostrato Perez, Gamal Siam and Ibrahim Soliman, August 1995.

- 11 *Local Organizations for Natural Resource Management: Lessons from Theoretical and Empirical Literature*, by Lise Nordvig Rasmussen and Ruth Meinzen-Dick, August 1995.
- 12 *Quality-Equivalent and Cost-Adjusted Measurement of International Competitiveness in Japanese Rice Markets*, by Shoichi Ito, Mark W. Rosegrant, and Mercedita C. Agcaoili-Sombilla, August, 1995.
- 13 *Role of Inputs, Institutions, and Technical Innovations in Stimulating Growth in Chinese Agriculture*, by Shenggen Fan and Philip G. Pardey, September 1995.
- 14 *Investments in African Agricultural Research*, by Philip G. Pardey, Johannes Roseboom, and Nienke Beintema, October 1995.
- 15 *Role of Terms of Trade in Indian Agricultural Growth: A National and State Level Analysis*, by Peter B. R. Hazell, V. N. Misra and Behjat Hojjati, December 1995.
- 16 *Policies and Markets for Non-Timber Tree Products*, by Peter A. Dewees and Sara J. Scherr, March 1996.
- 17 *Determinants of Farmers' Indigenous Soil and Water Conservation Investments in India's Semi-Arid Tropics*, by John Pender and John Kerr, August 1996.
- 18 *Summary of a Productive Partnership: The Benefits from U.S. Participation in the CGIAR*, by Philip G. Pardey, Julian M. Alston, Jason E. Christian and Shenggen Fan, October 1996.
- 19 *Crop Genetic Resource Policy: Towards a Research Agenda*, by Brian D. Wright, October 1996.
- 20 *Sustainable Development of Rainfed Agriculture in India*, by John M. Kerr, November 1996.
- 21 *Impact of Market and Population Pressure on Production, Incomes and Natural Resources in the Dryland Savannas of West Africa: Bioeconomic Modeling at the Village Level*, by Bruno Barbier, November 1996.

- 22 *Why Do Projections on China's Future Food Supply and Demand Differ?* by Shenggen Fan and Mercedita Agcaoili-Sombilla, March 1997.
- 23 *Agroecological Aspects of Evaluating Agricultural R&D*, by Stanley Wood and Philip G. Pardey, March 1997.
- 24 *Population Pressure, Land Tenure, and Tree Resource Management in Uganda*, by Frank Place and Keijiro Otsuka, March 1997.
- 25 *Should India Invest More in Less-favored Areas?* by Shenggen Fan and Peter Hazell, April 1997.
- 26 *Population Pressure and the Microeconomy of Land Management in Hills and Mountains of Developing Countries*, by Scott R. Templeton and Sara J. Scherr, April 1997.
- 27 *Population Land Tenure, and Natural Resource Management: The Case of Customary Land Area in Malawi*, by Frank Place and Keijiro Otsuka, April 1997.
- 28 *Water Resources Development in Africa: A Review and Synthesis of Issues, Potentials, and Strategies for the Future*, by Mark W. Rosegrant and Nicostrato D. Perez, September 1997.
- 29 *Financing Agricultural R&D in Rich Countries: What's Happening and Why*, by Julian M. Alston, Philip G. Pardey, and Vincent H. Smith, September 1997.
- 30 *How Fast Have China's Agricultural Production and Productivity Really Been Growing?* by Shenggen Fan, September 1997.
- 31 *Does Land Tenure Insecurity Discourage Tree Planting? Evolution of Customary Land Tenure and Agroforestry Management in Sumatra*, by Keijiro Otsuka, S. Suyanto, and Thomas P. Tomich, December 1997.
- 32 *Natural Resource Management in the Hillsides of Honduras: Bioeconomic Modeling at the Micro-Watershed Level*, by Bruno Barbier and Gilles Bergeron, January 1998.

- 33 *Government Spending, Growth and Poverty: An Analysis of Interlinkages in Rural India*, by Shenggen Fan, Peter Hazell, and Sukhadeo Thorat, March 1998, Revised December 1998.
- 34 *Coalitions and the Organization of Multiple-Stakeholder Action: A Case Study of Agricultural Research and Extension in Rajasthan, India*, by Ruth Alsop, April 1998.
- 35 *Dynamics in the Creation and Depreciation of Knowledge and the Returns to Research*, by Julian Alston, Barbara Craig, and Philip Pardey, July 1998.
- 36 *Educating Agricultural Researchers: A Review of the Role of African Universities*, by Nienke M. Beintema, Philip G. Pardey, and Johannes Roseboom, August 1998.
- 37 *The Changing Organizational Basis of African Agricultural Research*, by Johannes Roseboom, Philip G. Pardey, and Nienke M. Beintema, November 1998.
- 38 *Research Returns Redux: A Meta-Analysis of the Returns to Agricultural R&D*, by Julian M. Alston, Michele C. Marra, Philip G. Pardey, and T.J. Wyatt, November 1998.
- 39 *Technological Change, Technical and Allocative Efficiency in Chinese Agriculture: The Case of Rice Production in Jiangsu*, by Shenggen Fan, January 1999.
- 40 *The Substance of Interaction: Design and Policy Implications of NGO-Government Projects in India*, by Ruth Alsop with Ved Arya, January 1999.
- 41 *Strategies for Sustainable Agricultural Development in the East African Highlands*, by John Pender, Frank Place, and Simeon Ehui, April 1999.
- 42 *Cost Aspects of African Agricultural Research*, by Philip G. Pardey, Johannes Roseboom, Nienke M. Beintema, and Connie Chan-Kang, April 1999.
- 43 *Are Returns to Public Investment Lower in Less-favored Rural Areas? An Empirical Analysis of India*, by Shenggen Fan and Peter Hazell, May 1999.

- 44 *Spatial Aspects of the Design and Targeting of Agricultural Development Strategies*, by Stanley Wood, Kate Sebastian, Freddy Nachtergaele, Daniel Nielsen, and Aiguo Dai, May 1999.
- 45 *Pathways of Development in the Hillsides of Honduras: Causes and Implications for Agricultural Production, Poverty, and Sustainable Resource Use*, by John Pender, Sara J. Scherr, and Guadalupe Durón, May 1999.
- 46 *Determinants of Land Use Change: Evidence from a Community Study in Honduras*, by Gilles Bergeron and John Pender, July 1999.
- 47 *Impact on Food Security and Rural Development of Reallocating Water from Agriculture*, by Mark W. Rosegrant and Claudia Ringler, August 1999.
- 48 *Rural Population Growth, Agricultural Change and Natural Resource Management in Developing Countries: A review of Hypotheses and Some Evidence from Honduras*, by John Pender, August 1999.
- 49 *Organizational Development and Natural Resource Management: Evidence from Central Honduras*, by John Pender and Sara J. Scherr, November 1999.