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Poverty and Environmental Degradation in the Nicaraguan Hillsides

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Summary. — This article questions the assumption of poverty as a major cause of environmental degradation. Examining five environmentally harmful natural resource management practices in the Nicaraguan hillsides, it shows that the immediate agents of environmental degradation are the nonpoor farmers, not the poorest. It argues that to analyze the causal links between poverty and environment, a distinction between poverty as a state of deprivation and poverty as a relational phenomenon is necessary. Finally, the article warns that the often strategic reference to poverty as the major cause of environmental degradation made by nonpoor and poor farmers may lead to negative environmental impacts.

Key words — Central America, Nicaragua, poverty, environment, political ecology

1. INTRODUCTION

The assumption of a vicious circle relationship between poverty and environmental degradation in developing countries has long prevailed in the debate on poverty–environment linkages. The assumptions were first launched in the report of the World Commission on Environment and Development (WCED, 1987—the so-called Brundtland report) and have later been echoed by a wide range of organizations (e.g., Durning, 1989; UNEP, 1995; World Bank, 1992). Due to lack of resources and their struggle just to ensure day-to-day survival, poor farmers are believed to offset concerns with the long-term sustainability of their resource management and to degrade already fragile resources, such as steeply sloping, erosion-prone hillsides. This resource degradation, in turn, aggravates their poverty even more. Thus, poor people are seen both as victims and agents of environmental degradation.

Recent literature points to two major shortcomings related to the hypotheses of poverty as a major cause of environmental degradation and the vicious circle relationship between poverty and environmental degradation. First, fundamental to the vicious circle hypothesis is the view of poor farmers as short-term maximizers unable to sacrifice immediate economic gains, from natural resource exploitation or to make long-term investments in sustained productivity (e.g., in soil erosion control) (Broad, 1994). Recent research however suggests that there is more to farmers' environmental management than their wealth and the time-horizon over which potential economic benefits are likely to materialize. Besides the existence of an economic incentive, Broad (1994) points to other conditions that are likely to shape farmers' interest to invest in environmental protection. These conditions include (a) residence in the area long enough to develop some sense of *permanence* (Bebbington, 1999), and (b) existence of a civil society that provides people the space to act (e.g., to coordinate in order to oppose the degrading resource management practices of others). This underscores the importance of recent ecological approaches in social sciences outlined by Peet and Watts (1996) and Bryant and Bailey (1997), among others.

Second, the hypothesis of a poverty–environment link is typically based on anecdotal evidence. Virtually no evidence exists to

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establish the relative importance of the economic activities of the poor *vis-à-vis* those of the nonpoor in explaining environmental degradation (Boyce, 1994; Duraiappah, 1998; Leach & Mearns, 1995; Reardon & Vosti, 1995; Ravnborg, 2002a; Scherr, 2000; Templeton & Scherr, 1999). An example of anecdotal, but powerful evidence was provided by Alan Durning from the Worldwatch Institute in his report *Poverty and the Environment: Reversing the downward Spiral* (1989). Quoting the anthropologist Sheldon Annis, he depicts a poor Guatemalan farmer planting maize on a forested slope together with his son. The land was so steep that the son had to be held in place with a rope looped around his waist. Ten years later, when Sheldon Annis returned to that spot, the farmer was no longer there. Neither was the hillside. What remained was a reddish, eroded nub—which looked just like the next and the next and the next former hillside (Durning, 1989, quoting Annis). Images such as this one have contributed to the debate's focus on certain aspects of environmental degradation, namely soil erosion and deforestation, at the expense of other aspects such as loss of biodiversity and chemical pollution. Given that many poor farmers around the world manage rather complex crop and livestock portfolios and can be considered "ecological farmers," turning the focus to biodiversity loss and chemical pollution would undoubtedly change the assessment of poverty as a major cause of environmental degradation (Reardon & Vosti, 1995).

Based on research from the Nicaraguan hillsides, this article contributes to this criticism. The Nicaraguan hillsides bear witness to considerable environmental degradation, including deforestation, decreasing and irregular water flows, and loss of biodiversity. At the same time, their population is characterized by widespread poverty. Examining five natural resource management practices commonly perceived to cause environmental degradation, the article shows that the immediate agents of environmental degradation are the nonpoor farmers, not the poorest. The article argues that in order to analyze the links between poverty and environment, it is necessary to distinguish between poverty as a state of deprivation of assets experienced by an individual or a household and poverty as a relational phenomenon among poor, less poor and nonpoor households contributes to produce poverty. In rural societies, particularly in Latin America, control over land and labor and the institutions through which control is negotiated and legitimized are important elements of a relational understanding of poverty. Drawing on a political ecology approach, the article argues that farmers' natural resource management is shaped not only by individual resource endowments, but also by the societal relationships governing access to and control over resources, and the norms for which type of natural resource management should be stimulated.

2. METHODOLOGY

This article is based on field research carried out in two adjacent areas in the mountainous northwestern region of Nicaragua, the natural reserve Miraflor-Moropotente in the municipality of Estelí (covering 75 km^2) and the rural part of the municipality of Condega (covering 438 km^2). Both areas include the eco-regions, dry plains at about 500–700 m above sea level (m.a.s.l.), mountainous cloud forest, and cool, humid plains with plenty of small springs at altitudes about 1,300–1,400 m a.s.l. The population density is around 60 persons/km^2 in Miraflor-Moropotente and 70 persons/km^2 in Condega.

The field research consisted of two parts. The first part was designed to develop a poverty profile for each of the two areas and to explore whether and how the level of household poverty relates to natural resource endowments and management strategies. The second part was designed to gain insight into the organizing practices taking place at various levels in the context of natural resource management. Semi-structured and conversational interviews were conducted with key actors from ministerial to the local level, in addition to participation in meetings and workshops concerning natural resource management, particularly in Miraflor-Moropotente.

The poverty profiles developed for this research are based on people's own perceptions of poverty, identified through well-being rankings. The choice to use self-perceived poverty rankings was inspired both by Sen's reservations about the practicality of measuring poverty and well-being solely on the basis of income or expenditure data (Sen, 1981, 1985), and the increasing recognition among agencies like IFAD (Jazairy, Alamgir, & Panuccio, 1992), UNDP and the World Bank (e.g., Narayan, Patel, Schafft, Rademacher, & Koch-Schulte, 2000) of the multidimensionality of

poverty and the importance of including poor people's own perceptions in poverty assessments. The rankings were conducted in a sample of six communities, drawn from the two areas using a maximum variation sampling strategy with respect to factors that could potentially lead to the existence of different perceptions of well-being. The descriptions of different poverty levels resulting from the rankings were "translated" into indicators. Subsequent analysis examining the extent to which the use of specific indicators was associated with specific types of communities found no such association. Thus, one single set of well-being indicators could be identified for the two areas. The indicators, which are listed in Table 1, covered aspects related to sources of livelihood, basic needs satisfaction, animal ownership and access to institutional credit and were made quantifiable through the formulation of a household questionnaire.

The questionnaire was administered to two independent samples, drawn as a two-stage random sample from each of the two areas, based on complete lists of households living in the areas. Absentee landowners are not included in the survey and thus that survey data cannot provide a full picture of issues such as land distribution. The samples comprise 306 households for Miraflor-Moropotente and 363 households for Condega. [1] A scoring system was designed according to which a score (33, 67 or 100) was assigned to each household for each indicator depending on its characteristics. Table 1 lists the indicators and describes the scoring system. For each household, the scores obtained on each of these 11 indicators were then averaged to create a poverty index. This index was used to define three categories of poverty: the poorest, the less poor and the nonpoor. Table 2 describes the household poverty index and the threshold values defining the three poverty categories. Following this procedure, qualitative poverty descriptions were turned into an absolute, but locally informed poverty measure. For a more detailed description of the methodology, please refer to Ravnborg (2002b) and Ravnborg *et al.* (1999).

The questionnaire also covered the biophysical properties of the household's most important maize and beans plot, [2] and the soil management strategy employed in this plot. Not all of the households surveyed operate land that they own, rent, or sharecrop. Thus, only about 80% of the households surveyed are "farming households."

3. ACCESS TO LAND IN THE NICARAGUAN HILLSIDES

(a) *Land ownership*

Land distribution has historically been more skewed in Miraflor-Moropotente than in Condega. One-third of the households living in Miraflor-Moropotente today are landless and an additional quarter of the households are virtually landless, owning 1 *manzana* ($=0.7$ ha) or less. In Condega, only 12% of the households are landless and 29% are virtually landless (Table 3). Among the landed households, the land distribution is significantly more skewed in Miraflor-Moropotente than in Condega. As shown in Table 3, the average farm size for the nonpoor households in Miraflor-Moropotente is 18 times larger than the average farm size for the poorest households in the same area, whereas in Condega, the average farm size for the nonpoor households is only five times larger than that of the poorest households.

Before the Sandinista revolution in 1979, land in Miraflor-Moropotente was owned by a few big landowners who kept cattle and used the upper part of the area for summer grazing. Increasingly, they also grew coffee through various systems of tenant farming and sharecropping. This skewed land distribution was modified during the 1980s when land was expropriated. After a brief phase when land was held in production cooperatives, land was allocated to former tenant farmers and sharecroppers as well as people from other parts of the country. Both areas were severely affected during the period of the "contra" civil war in the latter part of the 1980s, Miraflor-Moropotente more so than Condega. Many of those who had benefited from the agrarian reform felt threatened to sell off their land.

Following the change of government in 1990, the technical and legal support to beneficiaries of the agrarian reform ceased, and farmers were left in economic and legal insecurity. The land of many land reform farmers was registered as cooperative land, and many cooperatives had incurred large debts during the 1980s. As elsewhere in Nicaragua land sales continued during the 1990s (Baltodano, 2001; Baumeister, 2001), [3] either because land reform beneficiaries had become heavily indebted due to the sudden reduction of economic and technical support to agriculture or because they feared that former landowners would return and claim back their

Table 1. *Household poverty indicators and scoring system, Miraflor-Moropotente and Condega*

Indicator	Score	Description
Access to land	33	Own more than 10 *manzanas* of land
	67	Own between 1 and 10 *manzanas* of land or do not own land or own less than 1 *manzana* but sharecrop with somebody or rent in land
	100	Do not own land and do not sharecrop or rent in land
Sale of agricultural products	33	Sell milk or milk products, tomatoes, coffee or more than half of their maize and beans production while still satisfying household needs for maize and beans
	67	Sell half or less of the maize and beans production or are self-sufficient with maize and beans
	100	Do not sell any agricultural products and are not self-sufficient with maize and beans
Nonagricultural sources of income	33	Somebody in the household is a shopkeeper, engage in retail marketing of agricultural products, is a professional or receives remittances from relatives working elsewhere
	67	Somebody in the household is a wage laborer, engage in seasonal migration, tailoring, construction, or prepares and sell food
	100	Nobody in the household has nonagricultural sources of income
Dependency upon employment as casual laborer	33	Nobody in the family works for others as casual laborer or doing housework
	67	The household head works for others as a casual laborer during one month a year or less or the son work for others as a casual laborer
	100	The household head works for others as a casual laborer during more than one month a year or the housewife does housework for others
Food security	33	The household has not experienced a period of food shortage during the last year
	67	The household has experienced a period of food shortage during the last year which lasted less than two months
	100	The household has experienced a period of food shortage during the last year which lasted more than two months
House ownership	67	Own their house
	100	Do not own their house
Capacity to deal with health problems	67	Nobody in the household has experienced health problems during the last year or somebody in the household had experienced health problems during the last year but were able to pay the doctor's fee with own money or through the social security
	100	Somebody in the household had health problems during the last year but were unable to pay to consult a doctor with own money
Marital status	67	The household head is not a single mother
	100	The household head is a single mother
Livestock ownership	33	Own four heads of cattle or more
	67	Own less than four heads of cattle or own oxen
	100	Do not own cattle or oxen
Animal ownership	67	Own animals other than cattle and oxen
	100	Do not own animals
Institutional credit	33	Has obtained credit from an institution during the last five years
	67	Has not obtained credit from an institution during the last five years

Table 2. *Description of household poverty index and threshold values defining the categories of "better-off," "less poor" and "poorest" households, Miraflor-Moropotente (N = 306 households) and Condega (N = 363 households)*

Area	Minimum	Maximum	Median	Average	Threshold values
Miraflor-Moropotente	45.4	94.0	72.9	72.9	better-off: = <62.0
Condega	48.5	97.0	69.9	71.1	less poor: >62.0 and = <76.5 poorest: >76.5

land. Of the present population living in Miraflor-Moropotente and Condega, approximately 15% indicated having sold or lost land during the past 20 years. Roughly a quarter of the landowning households who live in Miraflor-Moropotente and Condega received land during the agrarian reform, and only a fraction of the agrarian reform beneficiaries (15% and 9%, respectively) have obtained individual land titles. The rest of the beneficiaries have an agrarian reform title either in the name of the former cooperative or in their own name, or else they lack any title whatsoever. Overall, approximately half of the households possess individual land titles to their land and about one-quarter lack any land title at all. Particularly in Condega, the poorest households tend not to possess any type of land title. Nevertheless, barely 10% of the households living in Miraflor-Moropotente and Condega indicated feeling insecure about all or the majority of their land.

(b) *Sharecropping and land rentals*

In spite of the intentions of the Sandinista revolutionaries, sharecropping remains widespread in many parts of Nicaragua. The most common practice is that a landowner provides land and at times also purchased inputs, while the sharecropper provides all labor. Production is usually divided equally between the landowner and the sharecropper. Approximately 40% of the households living in Miraflor-Moropotente and Condega access land through sharecropping. A larger proportion of the households in Miraflor-Moropotente than in Condega rely almost exclusively on sharecropping, as their own land amounts to 1 *manzana* or less. This difference is particularly pronounced among the less poor households, of whom 35% rely heavily upon sharecropping in Miraflor-Moropotente *versus* 20% in Condega (Table 3).

Cash rental is a less frequent means of accessing land with barely 10% of the households renting land. In Miraflor-Moropotente, it is mainly the landless and near landless households who rent in land, accounting for three-quarters of the households who rent land. In Condega, the approximately 40% of the households who rent in land are landless or virtually landless, while slightly more than half of the land-renting households own between 1 and 10 *manzanas*. In both Miraflor-Moropotente and Condega, the vast majority of the land-renting households also access land through sharecropping arrangements.

(c) *Soil quality*

Apart from land quantity and means of access, land quality is also important to describing households' natural resource endowments. Inspired by research aimed at developing a locally applicable tool to evaluate soil quality based on immediately observable characteristics (Burpee, 1997; Burpee & Turcios, 1997), researchers asked respondents to characterize the soil of their most important grain field plot according to slope, soil depth, erosion-proneness, water infiltration and retention, and presence of soil life. Such local classifications of soils have been found to correlate well with scientific measures of soil quality (e.g., Bellon & Taylor, 1993; Talawar & Rhoades, 1998). These variables were entered into a multiple correspondence analysis, and the object scores from the first two resulting dimensions were subsequently entered into a cluster analysis from which the solution with three clusters of soil quality was selected. Table 4 summarizes the characteristics of these three soil quality clusters, labeled "poor," "regular" and "good" soils. Of the plots included in the survey, 29% were characterized as good, 43% as regular, and 28% as poor. There was no significant difference between the two study areas.

Almost counterintuitively, no significant correlation was found between poverty level and soil quality, nor between sharecropping and soil quality in any of the two study areas. This means that neither the poorest households, nor the sharecropper households are

Table 3. *Access to land by household poverty level, Miraflor-Moropotente and Condega (percentage households per poverty level, by area)*

	Miraflor-Moropotente				Condega			
	Poverty level			All levels ($N = 306$)	Poverty level			All levels ($N = 363$)
	Nonpoor ($n = 61$)	Less poor ($n = 120$)	Poorest ($n = 125$)		Nonpoor ($n = 79$)	Less poor ($n = 179$)	Poorest ($n = 105$)	
Land ownership category[a]								
Landless	3	19	59	32	0	7	31	12
—=<1 manzana[b]	0	29	31	24	10	27	46	29
—1–10 manzanas	20	43	9	25	47	58	24	46
—>10 manzanas	77	8	1	19	43	8	0	14
Average farm size[c,d] (manzanas)	38.2	7.3	2.1	18.0	13.1	7.5	2.4	8.4
Proportion of the total farm area included in the survey	79	19	2	100	47	48	5	100
Land title held[e]								
—Individual land title	55	51	51	52	58	43	21	44
—Other land title (agrarian reform title, land title in other name, etc.)	33	23	14	24	33	33	38	34
—No land title	12	26	34	23	9	24	40	23
Perceive own land tenure as insecure[f]	9	10	6	9	1	8	15	7
Access land through sharecropping[g]								
—Sharecropping as main source of access	3	35	31	27	10	20	24	19
—Sharecropping as additional source of access	18	23	2	14	24	21	8	18

[a] Significant correlation at 0.001 level exists between land ownership category and poverty level in both areas. Significant correlation at 0.001 level exists between land ownership category and area for all poverty levels (Pearson χ^2).

[b] 1 manzana = 0.7 ha.

[c] Landless households and households indicating only to own the plot around their house (el solar) are not included in the calculation of the average farm size.

[d] Average farm size of the nonpoor is significantly different from that of the less poor and poorest households at 0.05 level in Miraflor-Moropotente and in Condega significant difference is found in the average farm size comparing all the poverty levels at 0.05 level (Scheffe's test). The average farm size of the nonpoor households in Miraflor-Moropotente is significantly larger than that of the nonpoor in Condega at 0.05 level (Scheffe's test).

[e] Type of land title held is significantly correlated with poverty level at 0.001 level in Condega only (Pearson χ^2). Type of land title held is significantly correlated with area at 0.01 level for the category of poorest households only (Pearson χ^2 test).

[f] In Condega, the perception of insecure land tenure is significantly correlated with poverty level at 0.05 level (Pearson χ^2).

[g] Accessing land through sharecropping is significantly correlated with poverty level at 0.001 level in Miraflor-Moropotente and at 0.01 level in Condega (Pearson χ^2). Accessing land through sharecropping is significantly correlated with area at 0.01 level for the category of less poor households only (Pearson χ^2).

Table 4. *Description of soil quality clusters according to immediately observable characteristics (N = 529 plots)*[a]

Soil characteristics	Soil quality cluster		
	Poor ($n = 149$)	Regular ($n = 228$)	Good ($n = 152$)
Slope	Moderately sloping (45%) Steeply sloping (32%)	Moderately sloping (72%)	Flat (53%) Moderately sloping (41%)
Depth of top soil	<5 inches (81%)	2–10 inches (96%)	>5 inches (73%)
Water infiltration	Very slow (60%) Slow (23%)	Slow (75%)	Immediate (43%) Slow (29%)
Water retention	Dry out rapidly (69%)	Dry out slowly (75%)	Maintain humidity (68%)
Erosion-proneness	Very erosion-prone (81%)	Little erosion-prone (71%)	Not erosion-prone (51%) Little erosion-prone (32%)
Soil life	Little soil life (82%)	Some soil life (50%) Little soil life (46%)	Some soil life (34%) Much soil life (33%)

[a] Percentages in parentheses indicate the proportion of the plots contained in the cluster for which the option applies. Only the most predominant options are included in the table, so that for each characteristic, a minimum of two-thirds of the plots contained in each cluster are described in the table.

Table 5. *Natural resource management practices considered to threat the conservation of natural resources (percentage households considering the practice as an environmental threat, by area)*

Natural resource management practice	Miraflor-Moropotente ($N = 306$)	Condega ($N = 363$)
Burning of pastures	59	52
Burning of crop land	47	63
Use of herbicides	39	30
Use of pesticides	29	20
Cutting and sale of firewood	26	26
Use of water for irrigation	17	9
Cultivation without erosion control measures	6	7

significantly more (or less) likely to have poor soils than are the more prosperous households who mainly cultivate their own land.

4. ENVIRONMENTAL DEGRADATION AND ITS IMMEDIATE AGENTS

In order to understand the causes of natural resource management practices that are perceived to cause environmental degradation, five specific practices were examined: agricultural burnings, use of herbicides and pesticides, cutting and selling of firewood, irrigation, and lack of erosion control.

(a) *Agricultural burnings*

When asked to indicate which farming practices posed a threat to the environment, most inhabitants of Miraflor-Moropotente and Condega cited the annual burning of natural pastures [4] and crop land in order to remove crop residues before planting (Table 5). The burnings cause loss of flora and fauna in general and of soil micro-organisms in particular; they also degrade soil structure and pose the risk of wild fires. The latter is considered a particularly serious problem in Miraflor-Moropotente, which was declared a natural reserve primarily due to its patches of biodiversity-rich humid forest. Burning is however an easy way of clearing land and managing crop and animal pests. It is believed to be particularly attractive to poorer farmers who often lack both labor and cash at the time of land preparation. Table 5 shows that more than half of the households considered burnings of pasture as a serious environmental threat and that 47% and 63% in Miraflor-Moropotente and Condega, respectively, considered the burning of cropland a serious environmental threat. Combining views about both pasture and crop land, more than 80% of the households consider agricultural

burning as a serious environmental threat. Popular marches against the use of burning as part of land preparation have been organized and well attended.

Agricultural burnings are considered legal, if they comply with certain conditions to minimize the risk to the surrounding area. These conditions include making sufficiently wide firebreaks and obtaining permission from the Ministry of Agriculture, Livestock and Forestry (MAGFOR) or from MARENA. These conditions are generally easier to comply with for burning cropland than for burning natural pastures, due to the smaller land area of cropped fields and the greater ease of clearing a firebreak during tillage operations. Thus, it should be expected that respondents would be reluctant to admit to illegal agricultural burnings. Such reluctance is likely in Miraflor-Moropotente, where the authorities monitor fires more actively and issue sanctions against illegal fires due to the area's status as a natural reserve.

In Miraflor-Moropotente, 32% of the farming households indicated having burned either crop residues or pasture land during the 2000–01 season while in Condega, the corresponding figure was 42%. In both areas, only about a quarter of these households had obtained permission to undertake the burning with the responsible authorities or, just as frequently, informally with the community leader or a neighbor. In both areas, the nonpoor farming households were as likely as the less poor and poorest farming households to use burning as part of their land preparation or pasture management (Table 6). Among owners of natural pastures, 83% used burnings in Condega *versus* 29% in Miraflor-Moropotente. Judging from personal observations during the 2000–01 season, part of this difference can be explained by underreporting in Miraflor-Moropotente.

Less than 1% of the poorest households own pasture in either municipality, and virtually no common grazing areas exist. At the other end of the scale, the nonpoor households own 76% the natural pasture in Miraflor-Moropotente and 61% of the natural pasture in Condega (Table 6). Thus while all wealth classes share equally in cropland burning, the nonpoor are chiefly responsible for the burnings of natural pasture.

(b) *Use of herbicides and pesticides*

Agro-chemicals are also considered to constitute a serious threat to the environment (Table 5). More than 85% of the farming households in Miraflor-Moropotente and Condega use herbicides, and approximately one-third of these farmers reported at least one incidence of poisoning after the application of either herbicides or pesticides. Moreover, after spraying, farmers tend to wash their pumps and clothes in the streams, contributing to water contamination. In Miraflor-Moropotente, where the intensity of agro-chemical use is much higher than in Condega, several incidents of contamination of drinking water due to the use of agro-chemicals have been reported to the Ministry of Health. Thus, 56% of the households living in Miraflor-Moropotente perceived the use of herbicides and/or pesticides to be a serious environmental problem as compared with 41% of the households in Condega.

The poorest households are as likely as the less and nonpoor households to use both herbicides and pesticides (Table 6). In Miraflor-Moropotente, this applies even if excluding sharecropping households for whom purchased inputs tend to be provided by the landowner. In Condega, on the other hand, the poorest households cultivating only own land are less likely than the less and nonpoor households to use both herbicides and pesticides. Obviously, these frequencies do not tell anything about the amounts of chemicals used. But, judging simply from their larger landholdings, the nonpoor and the less poor households may be assumed to use more agro-chemical than the poorest households.

(c) *Cutting and selling of firewood*

The cutting of firewood for sale outside the area is a third widely recognized problem. In both municipalities, the poorest households have very limited access to forestland and firewood, with 15% or fewer having their own source of firewood (Table 6). Thus, the commercial logging of trees for sale of construction material and firewood outside the area should largely be ascribed to the less poor and nonpoor households. Besides having access to forest resources, these households also are more likely to own the means for transportation of larger quantities. In Miraflor-Moropotente, the cooperative union has at several occasions accused the authorities for not acting upon illegal exports of timber and firewood.

(d) *Irrigation*

Irrigation is rapidly developing particularly in Miraflor-Moropotente and to a lesser extent

Table 6. *Natural resource management practices and resource ownership related to environmental problems by household poverty level, Miraflor-Moropotente and Condega (percentage farming households per poverty level, by area)*

Natural resource management practice	Miraflor-Moropotente				Condega			
	Poverty level			All levels ($N = 242$)	Poverty level			All levels ($N = 307$)
	Nonpoor ($n = 61$)	Less poor ($n = 112$)	Poorest ($n = 69$)		Nonpoor ($n = 79$)	Less poor ($n = 167$)	Poorest ($n = 61$)	
Undertake agricultural burnings (pasture or crop residues)[ns/ns,a]	33	31	32	32	44	42	38	42
Own natural pasture[***/***]	66	31	3	26	49	27	0	24
Proportion of the total natural pasture area included in the survey	76	23	1	100	61	39	1	100
Use herbicides[ns/ns]	72	66	61	67	86	77	72	78
—Use herbicides on own land (no sharecropping)[ns/*]	71	64	60	67	87	74	56	75
Use pesticides[ns/ns]	79	84	81	82	94	87	80	88
—Use pesticides on own land (no sharecropping)[ns/*]	79	77	73	78	90	80	67	81
Own forest[***/***]	85	37	8	35	53	40	12	35
Have own source of firewood[***/***]	89	42	10	38	75	51	15	46
Have irrigation[***/ns]	43	28	11	27	17	10	7	11
Having taken erosion control measures[***/*]	64	63	25	54	75	73	54	70
Contact with external organizations[**/***]	80	73	55	70	78	76	40	70

[a] Asterisks or "ns" written in superscript indicate level of correlation between variable listed in left-hand column and poverty level in Miraflor-Moropotente/Condega, respectively. In the present case, no significant correlation was found between undertaking agricultural burnings and poverty level, neither in Miraflor-Moropotente, nor in Condega.

[ns] No significant correlation.

[*] Correlation significant at 0.05 level (Pearson χ^2).

[**] Correlation significant at 0.01 level (Pearson χ^2).

[***] Correlation significant at 0.001 level (Pearson χ^2).

in Condega. Rainfall is generally low, erratic and unpredictable, so most farmers view irrigation as "the investment that makes a difference." Those who can afford it—especially vegetable growers—look for opportunities to tap their polythene tube into a local spring or immerse their pumps in a river. As a result, many inhabitants have started to experience water shortages and increased water contamination. One-third of the households living in Miraflor-Moropotente and 10% of the those in Condega reported having experienced that their drinking water source had run dry or been contaminated. In Miraflor-Moropotente, one-third of these households believed that the problem was at partly caused by the diversion of water for irrigation. Concern about the increasing use of water for irrigation is greater in Miraflor-Moropotente than in Condega (Table 5).

Not surprisingly, the nonpoor households do most irrigation. In Miraflor-Moropotente, 43% of the nonpoor have at least some irrigation as compared to only 11% of the poorest households. In Condega, irrigation is limited to 17% of the nonpoor and 7% of the poorest households (Table 6).

(e) *Lack of erosion control*

The last practice to be discussed is the cultivation of land without erosion control measures. This is the practice of least environmental concern among respondents from the two municipalities, with fewer than 10% citing it as a problem (Table 5).

Three possible explanations exist for this low level of concern: (i) that erosion does not take place or is not observed; (ii) that erosion, although observed, is not regarded as a problem; or (iii) that measures to prevent erosion are already widely taken. Based on the finding that 76% of farming households in Miraflor-Moropotente and 86% in Condega have observed erosion taking place on their own fields, the first option can be ruled out. Likewise, the second explanation fails, because among those farming households who do observe erosion taking place but who have not applied any erosion control measures, only one-third in Miraflor-Moropotente and 4% in Condega perceive erosion as a problem. But, the third explanation does appear viable. More than half of the farming households in Miraflor-Moropotente and Condega have applied erosion control measures such as contour bunds of stone or weeds and crop residues (Table 6).

The general attitude toward the problem of erosion is one of considerable awareness and preventive measures being applied. Closer inspection shows however that the poorest households both in Miraflor-Moropotente and in Condega are less likely than the lesspoor and nonpoor households to undertake erosion control. Thus, "at last" there seems to be a case of an environmental problem where the immediate agents are the poorest farmers and thus a case that confirms the narrative of poverty as a cause of environmental degradation. But, at least two reasons exist for being cautious about rushing to this conclusion. The first is a simple reminder about the amount of land owned by the poorest households, namely 5% or less (Table 3). Hence, even if all the poorest farming households were to cultivate without applying erosion control measures, the environmental impact would still be rather limited.

The second reason for caution emerges from a look at farmers' reasons for not applying erosion control measures. Table 7 shows that lack of labor and capital is the leading reason for not practicing soil conservation. This reason would seem to confirm poverty as a state of deprivation contributing to environmental degradation. The poorest households are not however the ones most likely to cite lack of time and money as the cause. Hence, factors must contribute to preventing or discouraging the poorest households from taking measures to control erosion. A look at Table 7 suggests that in Miraflor-Moropotente, sharecropping is an equally important reason; the land that the poorest households cultivate often is not their own. In Condega, lack of knowledge about how to control erosion (due partly to lack of contact with external organizations), appears to be an additional reason for not taking measures to control erosion. A pairwise analysis between the adoption (or nonadoption) of erosion control measures on the one hand, and the involvement in sharecropping and contact with external organizations on the other hand, confirms the existence of a significant correlation. Both of these aspects point to the importance of poverty as a relational phenomenon as a factor explaining environmental management and degradation. But, despite the fact that formal land title and perceived tenure security are often cited in the literature as determinants of farmers' willingness to undertake long-term investments in land improvement (e.g., Feder,

Table 7. *Reasons for not applying erosion control measures by household poverty level, Miraflor-Moropotente and Condega (percentage households per poverty level, by area)*

Reason[a]	Miraflor-Moropotente				Condega			
	Poverty level			All levels ($N = 76$)[b]	Poverty level			All levels ($N = 81$)[b]
	Non-poor ($n = 16$)	Less poor ($n = 28$)	Poorest ($n = 33$)		Non-poor ($n = 17$)	Less poor ($n = 34$)	Poorest ($n = 30$)	
Erosion is not a problem	32	36	31	33	6	6	0	4
Lack of time and/or money	44	43	32	38	82	68	70	72
Lack of knowledge about what to do	25	11	3	11	12	21	20	19
Not own land	0	11	34	18	0	6	10	6

[a] Significant correlation between reason for not undertaking erosion control and poverty level at 0.05 level in Miraflor-Moropotente only (Pearson χ^2).
[b] Only households who indicated that erosion took place and who do not apply erosion control measures are included in the table.

1999; Feder, Onchan, Chalamwong, & Hongladarom, 1988), they were neither mentioned as reasons for not undertaking erosion control, nor were they significantly correlated with the adoption of erosion control measures.

In summary, the immediate agents of environmentally damaging practices such as burnings, the use of agro-chemicals, irrigation and lack of erosion control are overwhelmingly the nonpoor, not the poorest households. As expressed by a land reform farmer in Miraflor-Moropotente,

> ...those who are against Miraflor as a protected area are people with money... they are worried because they know they are a minority, but they are the ones who can take their car and transport a load of firewood, and who have the resources for using lots of agro-chemicals... (Interview with Sontule farmer, March 2001).

But, because the environmental degradation takes place in areas of widespread poverty, the causes require closer scrutiny.

5. RELATIONAL POVERTY AS THE "AGENT" OF ENVIRONMENTAL DEGRADATION

Social relations in Miraflor-Moropotente and Condega are best described as feudal, nested as pockets in a market-based economy. Many of the poorest households depend on the bigger landowners for access to land and agro-chemicals through sharecropping. An even bigger share of the population depends on the nonpoor farmers for employment as day-laborers on their farms, for permission to collect firewood on their land, and for access to the benefits provided by external organizations (this last being a more recent phenomenon).

Miraflor-Moropotente was declared a protected area in 1996. Almost counterintuitively, the initiative came from small-scale cooperative farmers who began to feel alarmed by the rapidly disappearing forests and the problems associated with high levels of agro-chemicals used, particularly in potato farming. Contributing to stimulate this initiative was the fact that an increasing number of donor organizations were taking environmental issues on to their agenda. Achieving status as protected area could thus serve as a means to attract the attention of donor organizations toward Miraflor-Moropotente.

Due to the status of Miraflor-Moropotente as a protected landscape, the area and its stakeholders are in the process of negotiating a management plan to define the activities to be permitted in the protected area (MARENA-PANIF, 2001). Through this process, a wide range of stakeholders has actively organized to build strategic alliances and influence the formulation of the management plan. The area therefore serves as an illustration of social and political relations at play in shaping the management of natural resources and its environmental impacts.

The latest organizational creation is the so-called Miraflor Forum—the Association of Inhabitants and Producers of the Natural Reserve Miraflor Moropotente—established in January 2002. Its stated objectives are to create "a platform for the discussion, evaluation and dissemination of the management plan for Miraflor," and to inhabitants of Miraflor-Moropotente with external organizations in order to attract externally funded projects to improve the inhabitants' welfare. An important part of the picture however is that the leadership of the Miraflor Forum predominantly consists of larger, absentee landowners, the same persons who overtly criticized proposed restrictions on certain agricultural practices during the discussions of the 2001 draft management plan for the reserve. They actively sought to permit the use of chemical inputs, they contested the proposal to rehabilitate 4,000 ha of land and to regulate the introduction of exotic crop and pasture species, and they threatened to obstruct approval of the plan (Ravnborg, 2002c).

Interestingly, many criticisms of the draft management plan were legitimized by reference to poverty as the main cause of environmental degradation. "It is the poverty which is destroying the environment," the current president of the Miraflor Forum said at a workshop held the day before the official presentation of the draft management plan. "They [the poor] enter into our properties and cut down firewood; they are destroying our land." The small-scale cooperative farmers increasingly see their livelihood threatened by this emerging group of absentee landowners. The small-scale farmers have remained advocates of Miraflor-Moropotente as a protected area and hence of a relatively restrictive management plan, which they hope could favor labor-intensive, low-external input farming. Environmentally, the interests of the small-scale cooperative farmers to a large extent coincide with those of MARENA and the wider national and international environmental constituency. Politically however this alliance has had difficulties in materializing.

Opposed to this potential alliance, the Miraflor Forum appears to signify the emergence of a strategic patron–client alliance between a few rich, mostly absentee landowners, and the numerous poorest households. The wealthy minority needs a numerous alliance partner in order to claim legitimacy, and the poorest need help to connect to external organizations. Both parties gain from referring to the narrative of the vicious circle relationship between poverty and environmental degradation. The poor evoke the vicious circle relationship to draw attention to their basic needs, like food security, housing and health (i.e., to fields different from the environment). The nonpoor, on the other hand, refer to poverty as the main cause of environmental degradation in an effort to deflect attention from the environmental impact of their own natural resource management. The fate of the environment in Miraflor-Moropotente largely depends on the strength of these alliances and the outcome of the conflict between their underlying interests, rather than simply on the capacity of the individual farmer to invest in environmental protection.

6. CONCLUSIONS

The empirical evidence presented in this article does not support the hypothesis that poverty is a major cause of environmental degradation. Due to the limited access of poor farmers to productive resources such as land, forest and forest resources, agro-chemicals and irrigation, the environmental impact of their resource management is limited in comparison with that of the nonpoor. The hypothesis that poverty prevents farmers from investing in environmental protection does not provide a sufficient explanation of the environmental degradation that is taking place in Miraflor-Moropotente and Condega.

The environmental degradation taking place is more compellingly explained by the social and political relations that shape access to natural resources and the norms for their management. Although the nonpoor possess the economic means to sacrifice current economic gains in order to prevent environmental degradation, this condition alone is not a sufficient. Our research shows that environmental degradation is chiefly due to the farming practices of the most prosperous farmers. Yet, due to the inability of the small-scale cooperative farmers to forge a strong alliance with the environmental ministry (MARENA) based on shared concerns, it has been difficult to mobilize opposition to the destructive resource management practices of the nonpoor farmers.

The recent alliance between the wealthiest landowners and the poorest rural residents only contributes to making this situation both politically and socially more difficult. First, the reference to poverty as a major cause of envi-

ronmental degradation provides a convenient means for the nonpoor farmers to deflect attention from the environmental degradation caused by their own resource management. Second, the reference to poverty as the cause of environmental degradation helps the wealthy landowners to attract development interventions that address the basic needs of the poor, thereby strengthening their image as ''the good patrons'' of the poor. While such strategic reference to the assumption of poverty as a major cause of environmental degradation may alleviate poverty in the short run, it is unlikely to lead to positive environmental impacts. In order to address natural resource degradation effectively, environmental management has to be understood not only in its economic context at the individual farm level, but also in the context of the wider social and political relations and organizing practices that shape it.

NOTES

1. Unless another source is indicated, in the following information about the population of Miraflor-Moropotente and Condega stems from this household questionnaire survey. Data obtained through the questionnaire survey were entered into a database and analyzed using the Statistical Package for Social Sciences (SPSS). In addition to two-way contingency tables, multiple correspondence analysis, a multivariate dimension reduction technique, was also used. Multiple correspondence analysis explores the relationships between two or more categorical variables, by representing these in a few dimensions. Using the iterative alternating least-square technique, object scores are calculated, corresponding to the coordinates of the point representing the object along the dimensions included in the solution. As these object scores have metric properties, multiple correspondence analysis performs a quantification of qualitative data and the object scores can be used as input variables for other procedures requiring interval data. In this study, the object scores are used as input variables for a cluster analysis, using the *K*-means cluster analysis procedure (e.g., to construct a composite variable representing soil quality).

2. Only 5% of the farming households in the two study areas did not grow maize and beans in 2000–01. For these households, biophysical measures were taken of the most important farm field.

3. Baltodano (2001) quotes the Ministry of Agriculture and Forestry (MAGFOR), stating that more than 1 million *manzanas* of land redistributed during the land reform of the 1980s have been returned to their previous owners.

4. Only 5% of the farmers in Miraflor-Moropotente and Condega cultivate pasture.

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