Chapter 4:
Soil Conservation Decisions and Non-Farm Economic Conditions: A Study of the Rural Labor Market in the Philippine Uplands of Bukidnon[1]

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Introduction

Intensive agriculture in the fragile uplands is observed to cause environmental damage. In the long run, this might jeopardize the resource base and ultimately the capacity of upland households to maintain self-sufficiency in food supplies. There are, in general, two ways to influence farmers' use of natural resources: direct interventions aimed at altering behavior, and indirect interventions, such as through prices, aimed at altering factors that influence farm decisions. In the Philippines, the most common mitigating measure for seemingly unsustainable upland agricultural practices is the direct approach, especially the introduction of soil-conserving methods through extension and farmer education. For example, the Philippine Department of Agriculture (DA) introduced Sloping Agricultural Land Technology (SALT), which is a package of soil management measures for sloping lands, in the early 1980s to combat soil erosion and land degradation in uplands. However, while there is some adoption of conservation measures such as hedgerows in high-intensity extension projects, there is little evidence of widespread farmer interest in SALT (Garrity *et al.* 1993). Though no systematic evaluation is available, the general impression is one of low and slow adoption rates primarily because farmers do not perceive such very

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labor-intensive technologies to be economically profitable (Regmi 1997). Tenure insecurity is also cited as a constraining factor, as it is with any investment in fixed capital.

On the other hand, indirect policy options for soil conservation in the uplands are not widespread. This is arguably due to the perception among policy makers and their advisors that upland farmers are characteristically subsistence-oriented, existing somehow beyond the reach of market-based policies. However, the evidence shows that upland farmers respond to output price incentives (Coxhead *et al.* 2001). Commercial upland farmers in Bukidnon cultivate land intensively, producing crops mainly for the market (Coxhead, Rola and Kim, Chapter 3 this volume). When output price changes, so too does the mix of crops produced, and labor demand alters as a consequence. Moreover, in adoption decisions on land-clearing or soil-conserving actions, where long-term land productivity and sustainable resource management are issues of concern, the repercussions of a land use change due to external shocks such as market price or policy changes will also affect technology decisions and agricultural labor demand. One shock that would have a significant impact on labor allocation decisions in upland agriculture is the emergence of rural non-farm employment opportunities.

There is a need to explain the link between non-farm economic conditions and farmers' choice of crops and techniques. In general, the availability of farm household labor is an important determinant of production and land management decisions, including those affecting soil conservation. The capacity of a farm household to establish and maintain a hedgerow system, for example, depends in part on the availability of labor and management skills for the purpose. However, the number of household members available on-farm, and the amount of time they are willing to devote to farm labor and management, could be influenced by conditions in the non-farm labor market. In general, greater earning opportunities in non-farm employment cause the supply of family labor on-farm to diminish.

There have been few attempts to examine agricultural household labor supply in the context of the wider rural labor market (Sanchez 1991). One early work was of Lee Jr. (1965, as cited in Sanchez 1991), who provided a theoretical framework to explain the motivation behind decisions on the allocation of farm resources, particularly labor. The allocation decision between farm and non-farm activities is shown to be consistent with the objective of a household's welfare maximization and efficiency in the use of farm and household resources. His model suggests that the availability of non-farm employment opportunities,

coupled with the awareness of farmers of such opportunities, reduces labor input on family farms.

Experience suggests that some transfer of family labor to non-farm jobs might reduce the level of disguised unemployment and thus promote more efficient use of resources in agriculture, without significantly altering the level of farm output. This would be the case if some labor were initially underemployed on the farm. In the more usual case, however, the withdrawal of some family labor from the farm requires an adjustment in crops or technologies to reduce labor input.

In this paper we hypothesize that non-farm opportunities will reduce family labor input in farm operations even in a relatively remote upland area. This, we hypothesize, will occur because rising wages or earnings opportunities make farm work less remunerative relative to non-farm. Households will respond by cultivating less land, mechanizing some tasks, or shifting to crops or techniques that are less management and labor-intensive. In wealthy countries, rising non-farm wages have historically been associated with mechanization and the adoption of less labor-intensive cropping patterns (Hayami and Ruttan 1985; Binswanger and Ruttan 1978). In the uplands of a developing country like the Philippines, rising wages may under some circumstances signal a shift from relatively labor-intensive annual crops to perennial crops or to less intensive farming systems, including agroforestry. Depending on its exact nature, such a shift might be characterized as a move toward a more environment-friendly agricultural development.[2]

We use the case of the upland community of the SANREM project site in Lantapan to analyze farmer behavior in terms of crop choices and soil conservation technologies in the presence of an emerging rural non-farm labor market.[3] The main question that we seek to address is whether changes in non-farm employment opportunities have measurable environmental effects either directly, through adoption of soil conservation practices, or indirectly, through changes in land use or technology.

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[2] A number of studies conducted in the Philippines and elsewhere in the sloping uplands of the humid tropics identify the expansion and intensification of annual crop cultivation (primarily corn and upland rice) as the primary sources of agricultural land degradation, soil erosion, and (in areas where commercial forestry is no longer dominant) deforestation. Unit erosion rates are far higher under annual crops than under agroforestry and other perennial-based land use systems (David 1988), and the area covered by upland food crops is very large in relation to total upland agricultural area.

[3] "Rural" here also includes surrounding towns in the province such as Malaybalay and Valencia, which are densely populated.

In the next section we discuss economic development and employment trends in the Philippines, and the Bukidnon and Lantapan labor markets, in particular. In the third section we analyze the link between non-farm employment and changes in agricultural techniques and activities, including practices with direct environmental implications. In section 4 we present a policy scenario for sustainable resource management. Section 5 contains a brief conclusion.

Our study makes use of both primary and secondary data. Secondary data are taken from published reports and municipal (Lantapan) and provincial (Bukidnon) statistics. Farm and household level data are from farm surveys conducted in the study site during the dry seasons 1996, 1998 and 1999, and in the wet season of 1998. The sampling and survey methodology are described in Coxhead (1995). Other demographic statistics and human capital data have been taken from earlier benchmark surveys (Rola *et al*. 1995). Data that characterize labor supply consist of the gender of labor market participants, educational attainment, place of residence, and nature of labor participation.

Economic Growth and Labor Market Trends Since the 1970s

Economic Growth and Employment Trends

A review of Philippine economic performance over recent decades reveals that as the economy grew, it experienced structural changes of the kind predicted by development theory, although at a rather low and fitful pace. The share of agriculture in Gross Domestic Product (GDP) has declined somewhat, from 28% in 1970 to 19% in 1998 (Table 4.1). The

Table 4.1. Shares in the real gross domestic product by major industry (in percent), Philippines, 1970-1998 (1985=100).

Major Industry Group	1970	1980	1990	1998
Agriculture, Fisheries and Forestry	28.18	23.50	22.38	19.42
Industrial Sector	33.70	40.52	35.59	35.42
Services Sector	38.12	35.98	42.03	45.16
Gross Domestic Product (in millions)	343,162	609,768	718,069	888,075

Source: Philippine Statistical Yearbook, 1999.

industrial sector share of GDP remained roughly steady at around 35%, while the services sector increased from 38.12% in 1970 to over 45% by 1998.

While economic performance was robust from the 1970s to the early 1980s, sluggish performance in the mid-80s was caused by unstable political conditions as well as the delayed effects of economic adjustments to the 1970s world oil price and interest rate shocks. The economic recovery, which began after the 1986 People Power Revolution, was cut short by a series of coups d'etat and natural disasters in the late 1980s and early 1990s. The economic turnaround of the mid-1990s was largely the result of economic and labor policy reforms, strong merchandise export growth, and a double-digit growth rate of net factor income from abroad, mainly in the form of foreign exchange remittances by overseas workers. The period was marked by a big improvement in productivity and output in the industrial and services sectors, led by electronics, garments and other manufactured exports which ballooned from barely 1% of exports in 1970 to more than 70% by the late 1990s. In stark contrast, agricultural exports fell from more than 90% of the total in 1970 to 28.17% in 1985, and to 15% by 1995 (ILS 1997).

The slow decline of agriculture in GDP is matched by the trend of its employment share, which declined from more than 50% in the late 1960s to about 40% by 1997 (Fig. 4.1). Most of the change in the structure of labor

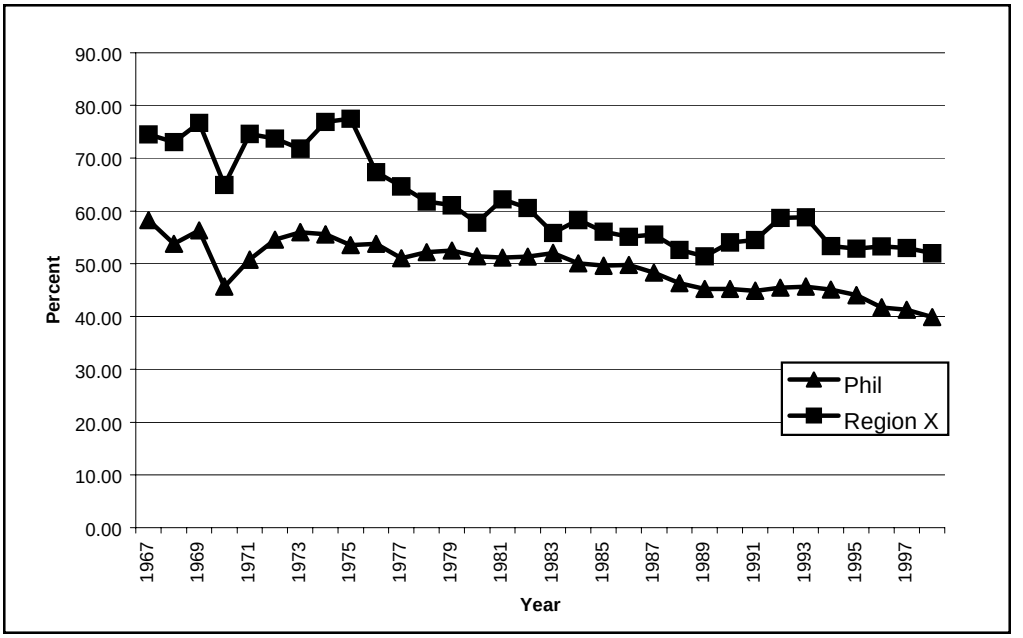

Fig. 4.1. Percent share of agricultural employment to total employment.

demand came from growth in the service sector, as industry employment remained quite stable over the past 25 years (Table 4.2).

The economic performance just described is also reflected in employment trends. Unemployment rates were much lower during the growth periods prior to and after the 1980s. Also, there has been a gradual structural shift in the composition of employment. While wage and salary workers have remained steady (as a fraction of the labor force) at around 42%, the proportion classed as unpaid family workers has fallen from 20.3% in 1980 to 14.9% in July 1996 (ILS 1997).

With relatively rapidly growing population and slow overall economic growth, real wages in the Philippines since 1980 present a rather depressing picture (Fig. 4.2). While nominal wages have for the most part risen steadily, real wages in both agricultural and non-agricultural sectors have barely changed since the major recession of the mid-1980s.[4] Steeper increases in the agricultural wage after 1994—and a compression of the sectoral wage ratio—correspond to the decline in the agricultural sector share in total employment. This could reflect the effects of the structural change toward growth in more labor-intensive manufacturing sectors.

Table 4.2. Proportion of employed persons in major industry, Philippines, 1970-1998.

Major Industry Group	1970	1980	1990	1998 (October)
Agriculture, Fisheries and Forestry	53.80	51.44	45.20	39.89
Industrial Sector	20.80	20.00	20.07	25.22
Services Sector	23.67	28.53	34.66	34.90
Total (1,000)	11,775	16,434	22,532	28,262

Source: Philippine Statistical Yearbook, 1999.

[4] Real wage increases in the late 1980s reflected recovery from this recession, and were reversed by the subsequent downturn of 1990-92. The agriculture-non-agriculture wage ratio remained roughly constant through the 1980s at about 1.4, indicating that the two labor markets were closely integrated in spite of a much lower participation rate by agricultural workers in *formal* labor markets. The gap widened as agricultural nominal wages stagnated (and the real agricultural wage fell sharply) in the early 1990s.

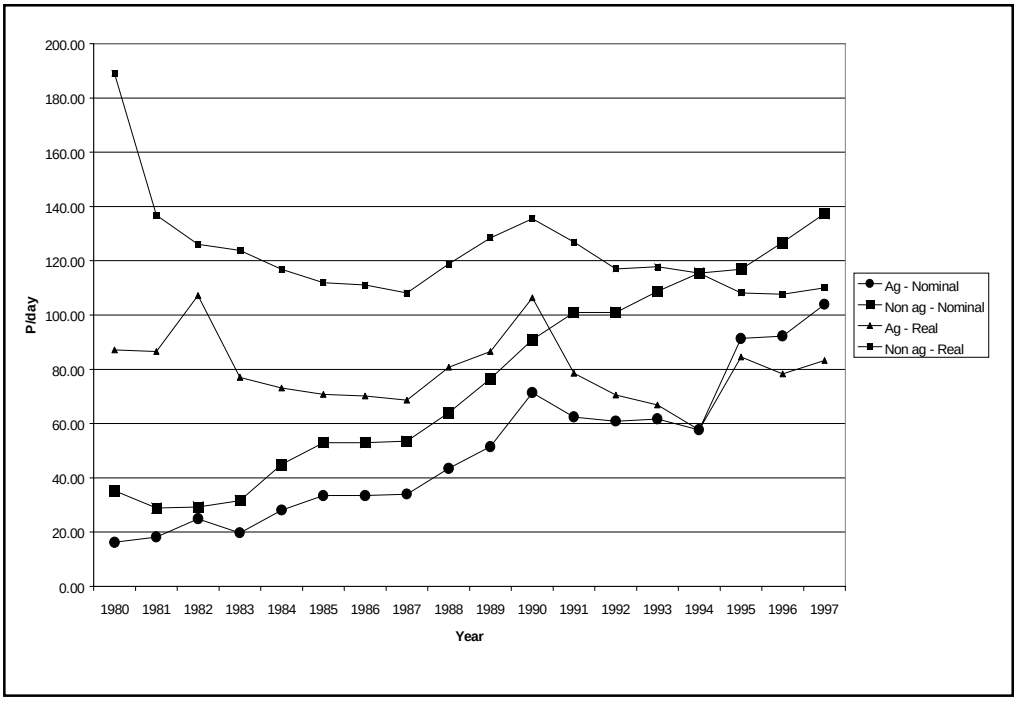

Fig. 4.2. Real and nominal wages by type of employment, Philippines, 1980-1997. (1994=100).

Migration and Agricultural Expansion in Upland and Forestlands

Migration to upland and frontier areas has been a prominent feature of modern economic development in the Philippines. In the early post-war years, government programs sponsored migrants to convert forestlands for agriculture. Subsequent migration, though spontaneous rather than sponsored, has retained the same motivation, i.e. the search for resources which, when combined with labor, can generate household income. The total population living in "forestlands" (officially defined as land of slope greater than 18%, whether forested or not) continued to grow rapidly through the second half of the twentieth century, trebling from 6 million in 1950 to nearly 18 million by 1985 (M.Cruz *et al.* 1992). The growth rate of the upland population has consistently exceeded that of the population as a whole. Accordingly, a very large fraction of Filipinos now resident in "forestlands" (*i.e.* engaged in upland agriculture) are at most second-generation descendants of in-migrants.

The motives for migration are not hard to intuit, and have been quantified in an excellent empirical study by Cruz and Francisco (1993). These authors used linear regression techniques on municipality-level

migration data together with economic, geographic and demographic data from censuses and other official sources to identify factors associated with migration into forestlands. Their results reveal per capita income and literacy in lowlands, and population density in uplands, were factors associated with low upland migration rates. Slope, upland urbanization, and the open access nature of uplands were all associated with higher migration rates. Upland incomes were not significantly associated with migration. Cruz and Francisco concluded that "migrants are motivated more by lack of other livelihood options than by the attractiveness of destination lands"(1993: 26); increases in lowland incomes, and better definition and enforcement of property rights over forest lands could both constitute major deterrents to migration.

Of course, the migration decision was undoubtedly driven in part by *changes* in expected income in uplands relative to that in the location of origin, and this feature of the economic calculus of migrants may not have been well captured in the census data on average household income used by Cruz and Francisco. In particular, changes in the relative profitability of lowland and upland agricultural production were likely to have influenced intra-rural migration decisions. The peak years of the Green Revolution, which enabled lowland irrigated rice farms to increase factor productivity by very large margins during the 1970s, were accompanied by down-slope migration from neighboring upland areas (Kikuchi and Hayami 1983). In subsequent decades, however, the rate of technical progress slowed, and the thrust of Philippine agricultural policy generally delivered relatively large profitability gains to crops grown in uplands rather than in irrigated lowlands. The implicit and effective protection rates on corn, the largest upland crop by area sown, increased dramatically from the 1970s to the end of the century, with the nominal protection coefficient (the ratio of domestic wholesale to world market prices) rising from near zero to 100% and more (David and Roumasset 2001). Similarly high protective rates prevailed throughout the period for other upland crops such as temperate climate vegetables (Coxhead 1997). The rise in price of these upland crops relative to rice, in a context of generally static real wages and slow growth in non-agricultural incomes, must also have been a factor in encouraging migration to uplands. We may therefore expect to observe that late twentieth century migration rates to areas in the Philippines that combined both open access to land and agronomic conditions suitable for corn and vegetable cultivation to be very high. This was indeed the case in the upland areas of Bukidnon province.

The Labor Market in Bukidnon, Philippines

Labor force growth in Bukidnon province is seen to be strongly influenced by in-migration. In the 1995 Philippine Census (National Statistics Office 1995) projections of inter-regional and inter-provincial migration patterns, Bukidnon was projected to have positive net migration rates (NMR), for both males and females (Table 4.3).[5]

Why has Bukidnon been such an attractive area for migrants? Surveys and local histories show that migrants came from other parts of the country to cultivate temperate crops in the cool highlands (Chapter 2, this volume), attracted by the opportunity to colonize or otherwise acquire land and convert it to intensive agricultural production. In recent years, the high migration rate also reflects strong job growth in the province, compared to the other provinces in Northern Mindanao (Table 4.4). Non-farm employment opportunities have increased rapidly in the urban areas of Malaybalay and Valencia, and province-wide data show nominal and real non-agricultural wages to be slightly higher than plantation wages, but significantly higher than the non-plantation (*i.e.* farm) wages since the mid-1990s. However, Bukidnon also had the highest visible underemployment rate, *i.e.* those employed were not necessarily fully employed. This may reflect in-migration by workers hoping to find full-time work, and willing to endure a period of unemployment or underemployment in the course of their search—a provincial version of the well-known Harris-Todaro migration model (Harris and Todaro 1970).

Rapid growth of the provincial economy also affected the labor supply decisions of long-term Bukidnon residents. For many farm families in the province, distances and travel times to urban areas was small enough to allow for daily (or at least weekly) commuting. Because of the proximity to alternative employment opportunities, rural household members can decide whether to seek farm, off-farm or non-farm jobs. Naturally, non-agricultural labor demand favors more educated workers, so the degree of intersectoral labor mobility is likely to be

[5] The migration projection assumptions include the differentials in the levels of development of the provinces as well as the presence or absence of a growth center. The basic indicator of change in the level and direction of net migration was the percentage change over the two migration intervals (1975-1980 and 1985-1990). In both periods, the computed NMR for Bukidnon is positive. This is in contrast with other upland areas in the Philippines like Misamis Occidental and Mountain Province, which have negative NMRs, meaning, outmigration trends.

Table 4.3. Net migration rates (NMR), by gender, selected provinces, 1975-1990.

Province	Male			Female		
	1985-1990	1975-1980	2005-2010[1]	1985-1990	1975-1980	2005-2010[1]
Bukidnon	0.017	0.015	0.020	0.008	0.011	0.005
Misamis Occidental	-0.015	-0.023	-0.010	-0.018	-0.032	-0.010
Mountain Province	-0.028	-0.056	-0.014	-0.034	-0.064	-0.017
Cavite	0.057	0.061	0.118	0.059	0.059	0.075
Laguna	0.042	0.022	0.121	0.046	0.025	0.123
Nueva Ecija	-0.011	-0.019	-0.005	-0.015	-0.019	-0.003

Source: 1995 Census-based National Region and Provincial Population Projection, NSO, Manila.
[1] Projection by NSO

Table 4.4. Total population 15 years old and over and employment status, Region 10, selected provinces, 1996-1998.

Province/ City	Total 15 years old and over (1,000)		Labor Force Participation Rate (LFPR)[1]		Employment Rate[2]		Visible Underemployment Rate[3]	
	1996	1998	1996	1998	1996	1998	1996	1998
Region 10-Northern Mindanao	2602	1709	69.8	73.0	92.7	94.1	15.4	16.1
Bukidnon	588	623	78.7	88.0	95.0	96.7	22.3	25.2
Camiguin	42	43	50.0	57.6	95.2	96.3	5.0	5.3
Misamis Occidental	323	340	64.1	64.2	94.2	91.5	3.1	5.5
Misamis Oriental	701	743	65.3	65.4	94.1	92.3	20.2	10.5
Cagayan de Oro	274	295	60.2	63.0	91.5	89.9	3.3	4.4

Source: Integrated survey of Households Bulletin, 1998.
[1] LFPR = % of people in the labor force over population 15 years old. People in the labor force are those who are working plus people who are looking for work during the reference period.
[2] Number of people employed/number of persons in the labor force.
[3] Visible under employment rate – working for less than 8 hours a day.

influenced by factors on both the demand and supply sides of the market as well as the transactions costs of moving between markets.

Labor Market in Lantapan Municipality, Bukidnon, Philippines

Compared with other Philippine upland communities, Lantapan farmers practice highly commercialized agriculture, thus providing for year-round agricultural employment. A number of farm activities have remuneration on a daily wage rate basis.[6]

Are there other opportunities for employment in Lantapan aside from agriculture? From a 1996 survey of 120 households, 66% of all labor is mainly on own farm, 7% mainly in off-farm, and 27% mainly in non-farm activities. Eighty-six (86) percent of the non-farm workers are females.[7] The results of a 1998 survey of the same set of households also suggest higher wage rates per day for non-farm incomes obtained by households than farm incomes (Table 4.5).

Several factors influence entry to non-farm work, including education and the willingness to pay for transport and transactions costs, and sometimes the cost of migration. Our data show that most farm workers reside on their own farm, while some non-farm workers reside outside Lantapan. The proportion of latter is increasing (Fig. 4.3). Empirical studies from comparable areas elsewhere in Asia suggest that these decisions are mostly irreversible, *i.e.* farm migrants are unlikely to move back to the farms, no matter what happens in the labor market (Coxhead and Jiraporn 1998).

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[6] Agricultural wage labor is usually called upon in times of plowing, planting, weeding, and harvesting. Farm labor remuneration in Lantapan includes both cash and non-cash payments. Cash payment may be daily per individual, or on a contractual basis, i.e. per hectare of land worked, per bag of fertilizer applied or per unit of crop harvested. Non-cash payments are observed in the harvesting of some crops, when harvesters get a share of output as payment. Exchange labor agreements (*hunglos*) among farmers are sometimes observed, specifically for planting and weeding. Daily wage rates vary depending on location, type of farm operation, sex and age of the laborer. Gender discrepancies are not distinct in corn areas, although some farmers have reported paying higher female wages in vegetable cultivation (Rola *et al*. 1995).

[7] The reason for the high proportion of females engaged in non-farm work is that better-educated members of the population do more non-farm work, and more females than males complete high school and college degrees (Rola *et al*. 1995).

Table 4.5. Average non-farm and farm wages (₱/day) by type of employment, in selected barangays, Lantapan, Bukidnon, 1998.

Type of Employment	SON	KIB	VIC	BAS	CAW	ALA	BAL	BAC
Office employment	77		78	47	364		159	137
Small-scale enterprise	95	136	68	23	150	32		
Construction work		150				150		200
Household help	45	120		32	23	57	68	
Sales lady		70				170	105	
Local midwife						18		
Farm work	64	55	60	63	55	50		49

Note: SON-Songco; KIB-Kibangay; VIC-Victory; BAS-Basal; CAW-Cawayan; ALA-Alanib; BAL-Balila; and BAC-Baclayon.

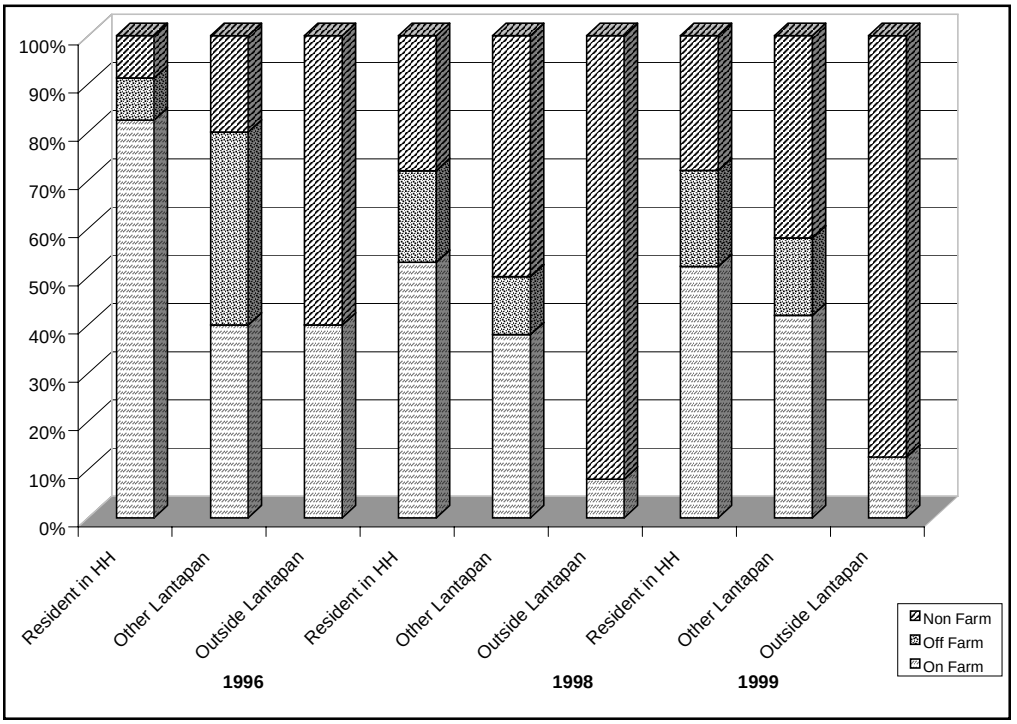

Fig. 4.3. Distribution of residence of household members over 15 years old, by type of employment, Lantapan, 1996, 1998 and 1999.

Non-farm Employment and Changes in Agricultural Techniques

Crop Choices and Soil Conservation Decisions

For given non-farm conditions, the level of farm employment in Lantapan is largely influenced by technology and crop choices. Farm labor intensity differs by crop. Hired (or paid) labor is high when external input use is high (Rola and Tagarino 1996); it is thus lowest in coffee and highest in vegetable systems. A shift from monocrop corn to vegetables would involve increased demand and management for both, as would the shift from perennials to annuals (*e.g.* coffee to corn) (Rola 1995; Coxhead *et al.* 2002). Less labor available for farm work should then shift crop choices to perennial (and more environment-friendly) crops such as coffee.

However, less labor on the farm would also discourage labor-using technologies, including soil conservation measures. Our data are consistent with this claim (Table 4.6). The percentage of sample plots with contours and hedgerows declined from 16% in 1996 to barely 5% in 1999. On the other hand, the proportion of plots with trees and fallow, or techniques with labor saving conservation measures, increased significantly, from 25% in 1996 to 68% in 1999.

Tables 4.7 and 4.8 provide information on crop-specific soil conservation measures. The number of cabbage plots with soil conservation measures was six in 1996, and fell to one in 1999 (Table 4.7). In the cabbage plots, contour plowing and hedgerows were more popular practices than trees and fallow. On the other hand, there was a smaller number of corn plots with soil conservation measures in the lower part of the Lantapan

Table 4.6. Number of plots with soil conservation measures, Lantapan, Bukidnon, 1996-1999.

Year	Total Plots (n=)	% of Plots with Contour/Hedgerows		% Plots with Trees/ Fallow	
		n	%	n	%
1996	224	37	16.52	56	25.00
1998-1	129	35	27.13	54	41.86
1998-2	135	33	24.44	60	44.44
1999-1	126	6	4.76	86	68.25

Note: 1998-1 and 1999-1 refers to dry season; 1998-2 refers to wet season.

Table 4.7. Number of plots with soil conservation measures by crop, Lantapan, Bukidnon 1996-1999.

Year	# of Plots with Contour/ Hedgerows	# of Cabbage Plots with Contour/ Hedgerows	# of Corn Plots with Contour/ Hedgerows		# of Other Crops with Contour/ Hedgerows	# of Plots with Trees/ Fallow	# of Cabbage Plots with Trees/ Fallow	# of Corn Plots with Trees/Fallow		# of Other Crops with Trees/ Fallow
			LW	UW				LW	UW	
1996	37	6	8	11	12	56	1	11	18	26
1998-1	35	1	4	11	19	54	1	12	5	36
1998-2	33	2	6	17	8	60	1	8	18	33
1999-1	6	1	0	4	1	86	1	20	18	47

LW (Lower watershed)- Alanib, Balila, Baclayon
UW (Upper watershed)- Songco, Cawayan, Kibangay, Victory, Basac
Note: 1998-1 and 1999-1 refers to dry season; 1998-2 refers to wet season.

Table 4.8. Soil conservation measures of sample parcels, by crop type, Lantapan, Bukidnon, 1996-1999.

Year	Cabbage			Corn (Lower Watershed)			Corn (Upper Watershed)		
Year	% of Parcels with Soil Conservation Measures	% of Parcels Practicing Contours/ Hedgerows	% of Parcels Practicing Trees/Fallow	% of Parcels with Soil Conservation Measures	% of Parcels Practicing Contours/ Hedgerows	% of Parcels Practicing Trees/Fallow	% of Parcels with Soil Conservation Measures	% of Parcels Practicing Contours/ Hedgerows	% of Parcels Conservation Trees/Fallow
1996	58.33	85.71	14.29	52.78	42.11	57.89	42.65	37.93	62.07
1998-1	50.00	50.00	50.00	55.17	25.00	75.00	50.00	68.75	31.25
1998-2	100.00	66.67	33.33	50.00	42.86	57.14	70.00	48.57	51.43
1999	100.00	50.00	50.00	76.92	0.00	100.00	53.66	18.18	81.82

Note: 1998-1 and 1999-1 refers to dry season; 1998-2 refers to wet season.

sub-watershed than in the upper part. Trees and fallow were the more popular soil conserving practices in the corn areas (Table 4.8).

Non-farm Opportunities and Soil Conservation Practices in Lantapan

The previous analysis reveals that more corn farmers practiced soil conservation than vegetable farmers; and that labor-saving techniques were usually preferred among the former. Is labor the constraining factor? Do corn farmers' family members have access to jobs other than the farm jobs?

Our data show that farm household members in Lantapan are indeed participated in non-farm work (Fig. 4.4). In 1996, a higher proportion of non-farm employment in vegetable areas than in corn areas was observed. Interestingly, in 1998, households in corn areas had higher non-farm employment shares. Note that the data represent the dry seasons of 1996, 1998 and 1999.[8] We also wanted to know the income composition of farm households practising soil conservation measures. In Figure 4.5 we note that those practicing contour plowing and hedgerows had a lower proportion of family members with non-farm incomes as compared to those practising trees and fallow. The positive growth of off-farm incomes in families practicing contour plowing and hedgerows was also evident. But in both types of soil conservation measures, there is an increasing trend of households with non-farm incomes (Table 4.9). The rate of increase was higher among households practising trees and fallow. The proportion of households with non-farm incomes practising this measure increased from 52% in 1996 to 79% in 1999.

Do Labor Market Trends Influence Adoption of Soil Conservation Measures?

The foregoing discussion suggests that labor market changes may influence farmers' choice of crop, technique and adoption of conservation measures. If so, what effect does the growth of non-farm jobs have on farm-level decisions that affect deforestation, soil erosion and other

[8] The 1998 figures reflect the impact of El Niño on Lantapan agriculture. Because of the unfavorable weather conditions, some farmers did not plant corn in middle level areas, and had to look for non-farm jobs. However, the trend was maintained in 1999; as a conjecture, it may be that these family members have found a more permanent non-farm job, that despite the better farm environment, they were not willing to go back to the farm.

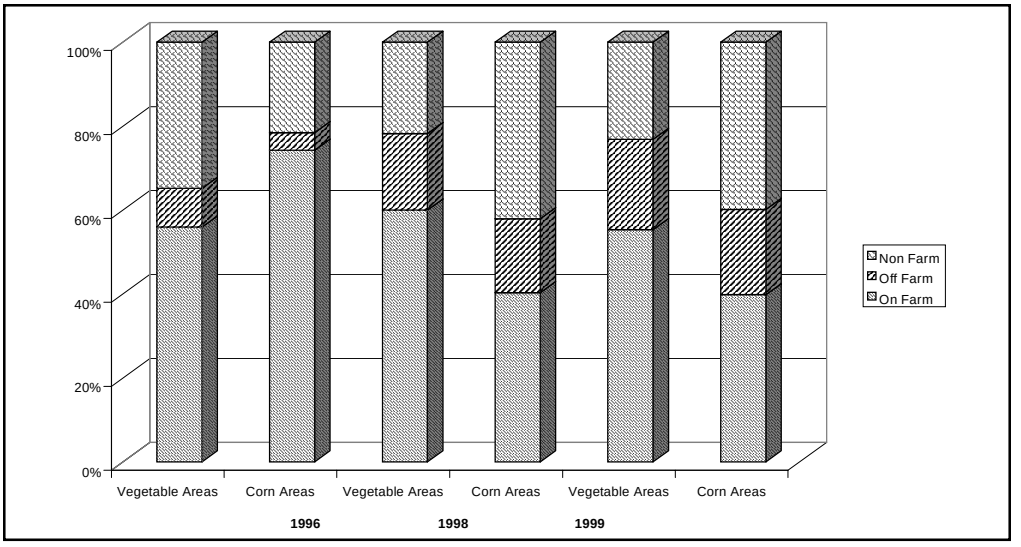

Fig. 4.4. Distribution of residence of household members over 15 years old, by type of employment, Lantapan, 1996, 1998 and 1999.

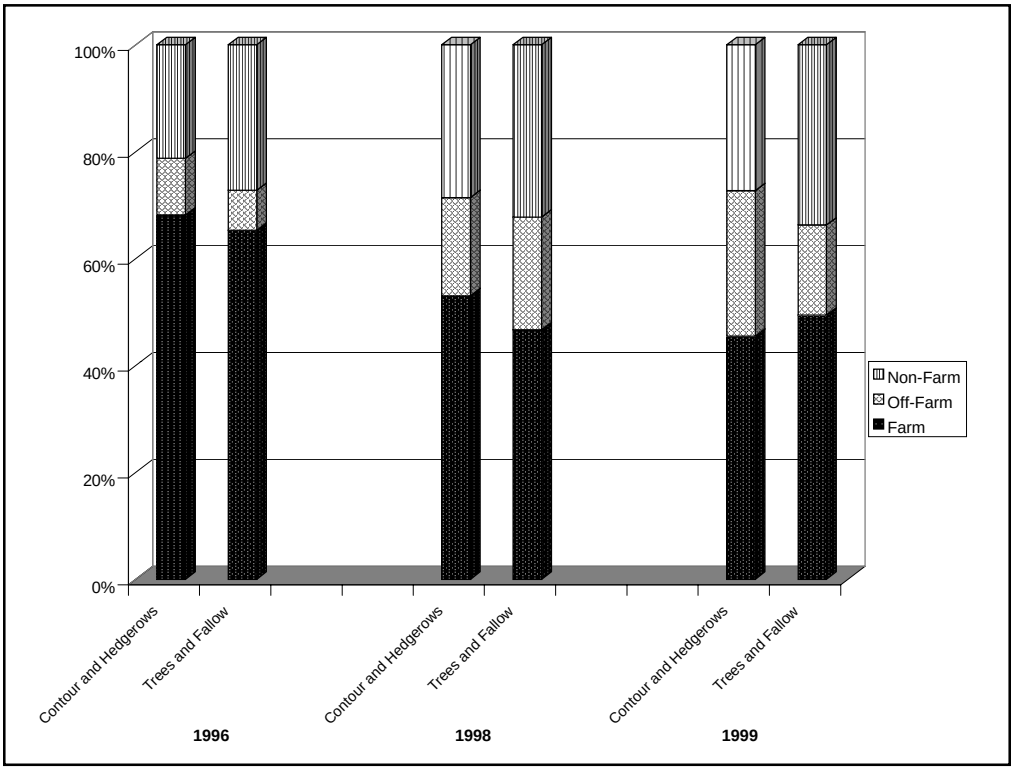

Fig. 4.5. Distribution of household members over 15 years old, by type of employment, practicing soil conservation measures.

Table 4.9. Percent of households practicing soil conservation with non-farm income, Lantapan Bukidnon, 1996-1999.

Year	% of Households Practicing Contour/Hedgerows with Non Farm Income		% of Households Practicing Trees/Fallow with Non-Farm Income	
	n	%	n	%
1996	19	51.35	29	51.79
1998-1	22	62.86	35	64.81
1998-2	22	66.67	32	53.33
1999-1	4	66.67	68	79.07

Note: 1998-1 and 1999-1 refers to dry season; 1998-2 refers to wet season.

environmental outcomes? As a first step toward an empirical answer to this question, we estimated a logit equation on farm-level survey data in which the binary dependent variable is defined as 1= practising conservation measures; and 0= not practicing conservation measures. Two equations were estimated to correspond to definition of two types of soil conservation practices as dependent variable: 1. Labor-using soil conserving technologies, such as contours, hedgerows and vegetative strips; and 2. Labor-saving soil conserving technologies such as trees and fallow, and planting of perennials. In addition, for each equation, two specifications were defined: Model 1. Pooled data of 1996, 1998 and 1999 dry seasons and 1998 wet season; and Model 2. A season dummy variable was included as independent variable, where 1= dry season for all years; and 0=wet season for 1998 only.

The unit of analysis is the parcel. In all estimated equations, the explanatory variables are slope of the parcel, tenure of the parcel, percent of non-farm employment to total number of employed adult members, and the average age of adult members.

The slope of the parcel affects farmers' soil conservation decisions; the higher the slope of the parcel, the higher is the probability of soil degradation due to intensive agriculture, and hence, the greater the benefits of soil conservation. Slope is measured by a discrete variable where 1 stands for flat land and 3 for the steepest slope. The proportion of parcels with flat land to total parcels is shown in Table 4.10. Note that mean slope of plots with contours and hedgerows is higher than with trees and fallow. This is especially true in wet season 1998, where more corn lands, (*i.e.* flatlands) were fallowed.

Table 4.10. Mean slope[a] of sample parcels, Lantapan, Bukidnon,1996-1999.

Year	Total Plots (n)	% of Parcels with Flat Slopes	Mean Slope of Plots Practicing Contour/ Hedgerows	Mean Slope of Plots with Trees/ Fallow
1996	224	29.90	2.40	2.18
1998-1	129	28.70	2.05	2.03
1998-2	135	31.10	2.27	1.89
1999-1	126	25.40	2.67	1.95

[a] 1= flat slope; 2= medium slope; 3= steep slope
Note: 1998-1 and 1999-1 refers to dry season; 1998-2 refers to wet season.

Tenure also determines farmers' soil conservation decisions in a positive way; farmers with more secure tenure have strong incentives to conserve soil resources (Table 4.11).

Average age of adult members is also deemed to be a determinant of soil conservation practices. It was observed that older persons knew more about soil conservation and that their indigenous knowledge leads to more sustainable practices. It could also be that younger farmers had more non-farm opportunities through higher educational attainment, and thus tended more readily to adopt labor-saving soil conservation technologies.[9] Older farmers—especially in vegetable areas—practised contour and hedgerows; their opportunities for non-farm jobs may be more limited. We note that farmers practising contour and hedgerows were older, on average, than farmers who fallowed (Table 4.12).

Our main hypothesis is that available non-farm employment opportunities will entice farm household members to leave the farms. This will imply that labor-using soil conservation measures will have lower chances of adoption. On the other hand, labor-saving soil conservation technologies will be adopted more in the presence of non-farm employment opportunities.

[9] Further work on the logit analysis should try to capture life cycle effects and possibly education as a way of better separating incentives for various types of soil conservation.

Table 4.11. Percent of plots with soil conservation having secured tenure, Lantapan, Bukidnon, 1996-1999.

Year	% with Secured Tenure		% of Plots Practicing Contour/ Hedgerows with Secured Tenure		% of Plots Practicing Trees/Fallow with Secured Tenure	
	n	%	n	%	n	%
1996	147	65.63	28	75.68	35	62.50
1998-1	89	68.99	23	65.71	39	72.22
1998-2	101	74.81	24	72.73	49	81.67
1999-1	96	76.19	6	100.00	71	82.56

Note: 1998-1 and 1999-1 refers to dry season; 1998-2 refers to wet season.

Table 4.12. Mean age (in years) of adult household members practicing soil conservation measures, Lantapan, Bukidnon, 1996-1999.

Year	Mean Age of Sample Household	Mean Age of Farmers not Practicing any Conservation Measures	Mean Age of Farmers Practicing Contour/ Hedgerows	Mean Age of Farmers Practicing Trees/ Fallow
1996	32.79	32.44	34.10	32.41
1998-1	34.48	34.24	34.00	33.45
1998-2	34.75	33.49	35.32	33.01
1999-1	35.04	33.57	37.00	34.96

Econometric Model and Results

The logit equation (Greene 1993) is modeled as follows:

Y = f (slope, Tenure, NFE, Age), where
Y = 1 if parcel has soil conservation practice; = 0 otherwise,
Slope = 1 if plot is flat; = 2 if slightly rolling; = 3 if very steep,
Tenure = 1 if private title, shared ownership, tax declared or other owner-like tenure; = 0 if share tenant or cash rental
NFE = total adult members employed in non-farm work over total adult members of the household
Age = average age of adult household members.

The SPSS for Windows package was used in the estimation. The results (Table 4.13) reveal that slope was the most important determinant of soil conservation practices in the study area. Farmers with very steep parcels almost always practiced soil conservation. Both tenure and age yielded positive coefficients.

Tenure was not statistically significant in the labor-using soil conserving technologies, but was statistically significant in labor-saving soil conserving technologies. We note that cabbage plots used more of the labor using technologies. It could be that these vegetable plots were rented out, and hence the tenure variable did not have a significant effect on the farmers' decision to conserve soil. On the other hand, tenure was significant in the labor-saving technology; maybe more of these were owners; or were participants of social forestry programs and thus had more incentive to manage soil resources.

Table 4.13. Propensity to adopt soil conserving measures, Lantapan, Bukidnon 1996-1999. (Dependent variable is 1= with conservation measures; 0= no conservation measures)

Independent Variable	Soil Conservation Measures			
	Labor Using		Labor Saving	
	Model I	Model II	Model I	Model II
Tenure	0.32	0.16	0.43**	0.35**
	(0.29)	(0.21)	(0.21)	(.45)
Slope	1.01***	0.87***	0.50***	0.50 ***
	(.18)	(0.13)	(0.13)	(0.09)
Age	0.02	.03 **	0.03 **	0.03***
	(0.02)	(0.02)	(0.01)	(0.01)
NFE	-0.01*	-0.01*	-0.004	-0.003
	(0.005)	(0.004)	(0.004)	(0.003)
Season Dummy	-	-0.82**	-	-0.40*
1998 wet season = 0		(0.26)		(0.22)
1996-1999 Dry season = 1				
Constant	-3.41***	-2.92***	-1.91***	-1.77***
	(0.78)	(0.68)	(0.51)	(0.45)
Log Likelihood	367	682	640	1197

Note: Figures in parentheses are standard errors
*Significant at α= 0.10
** Significant at α= 0.05
*** Significant at α= 0.01

The coefficient of the mean age of adult farm family members was significant in all model specifications but one. Older farm family members had a higher propensity to adopt soil conservation measures, whether they be labor-using or saving. This may reflect experience and knowledge, or wealth and/or demographics. Older farmers, typically with fewer dependents and a strong bequest motive, may find it preferable to conserve their natural resource assets, whereas younger farmers with more dependents may find it optimal to liquidate their natural resources in return for greater current period income.

The NFE variable was negative and significant for Model 1, as expected. These results reveal that indeed, greater access to nonfarm job opportunities can discourage labor-using soil conservation techniques. On the other hand, the results in Model 2 provide no support for the hypothesis of a positive link between non-farm jobs and adoption of labor-saving soil conservation measures.

The coefficients of the season dummy were negative and significant in all equations. In the dry season, the propensity to practice soil conservation was lower than in the wet season. This behavior could be driven by the fallow practices. A caveat that must be mentioned, however, is the abnormal condition during 1998, when both climatic and economic crises hit the country.[10]

A Policy Scenario for Sustainable Resource Management in the Commercial Highlands

In the short term, agricultural growth in the Philippine commercial uplands will be high and will mostly be due to intensive cultivation of the profitable annuals. This is in response to the prevailing economic and technology policies. For instance, there is a significant investment in corn and vegetable technologies as driven by the perception that these crops generate potentially high incomes for farmers. But much of this perception is due to the presence of price supports, particularly those reflecting trade policy interventions (Coxhead *et al.* 2002). A widespread replacement of

[10] The impact of both these crises in the study site is ambiguous. Thus, for instance, farmers fallowed because of lack of rains, or they fallowed because credit cost was high, and there was no money for inputs. But the one thing that is quite clear is that more farm members especially in the corn areas (see also Rola and Tabien 1999) worked in non-farm activities during the crisis months because of the very limited farm opportunities.

coffee by corn in Lantapan can be attributed both to policy distortions and to the effects of yield-increasing research and development investments in corn, but not in coffee.

In the long term, continued growth and structural change in the Philippine economy can be expected to raise the opportunity cost of farm labor; and this is expected to diminish incentives to expand the agricultural area in spite of technical progress in agriculture. Price, trade and wage policies can be used as instruments in promoting sustainable resource management. The labor-using soil conservation technologies that the Philippine government has promoted do not seem feasible in general, as costs are high. How then can one reconcile the aim of achieving higher incomes in commercial upland agriculture and sustaining the productivity of the resource base?

At least two sets of policies could influence the behaviour of farm household members in promoting sustainable resource management in the uplands. One is a package of incentives from the local government units (LGUs) in terms of tenure security and other economic and non-market incentives. The other is to explore the incentive package that could attract investments by the private sector in the local areas on small village enterprises.

The LGUs can use both economic and non-economic policy instruments to promote sustainable resource management at the local level. One approach is to provide for tax credits for farmers practicing contours and hedgerows. The LGUs could also lobby to the banking sector to give interest discount on loans for farmers planting perennials or adopting agroforestry in their domain.

On the other hand, farm workers do not have to migrate to the urban centers for non-farm employment. Small or micro level village enterprises (SMEs), located in the rural areas could take out farm labor from intensive agriculture, while at the same time, preventing an exodus to the urban centers. In Lantapan, there are some small businesses, but mostly, input stores and small *sari-sari* stores that are not labor intensive. The perception by some that it is very expensive to put up a small business in the Philippines' municipalities reflects the magnitude of transaction costs that prevails and that constrains the growth of the SMEs.

Concluding Remarks

In the long run, upland agriculture should veer away from intensive cultivation without soil conservation techniques. But in the shorter run, policies are needed to influence farmer behaviour. Growth in non-farm

jobs could cause labor to be withdrawn from intensive agriculture without sacrificing household incomes. A desirable scenario is one in which there is growth of SMEs, together with higher non-farm wages, and accompanied by better remuneration for on-farm employment as the level of employed farm labor declines. This is expected to attract shifts to more labor saving crops; *i.e.* perennials and labor saving soil conserving technologies.

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