Economic Impacts of Landcare in the Central Philippines: A Preliminary Report

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Abstract

Watershed degradation is a major environmental concern in the steeply sloping uplands of the Philippines. Land use in these upland regions is dynamic and there is growing interest in how livelihood strategies bring about land-use change in the uplands, with impacts on other resource users elsewhere in the watershed. The Landcare Program has helped develop conservation farming practices that both mitigate against the degradation process and have a positive impact on farm livelihoods. This paper explores the dynamics of land-use change in upland watersheds in Bohol Province as a basis for evaluating the economic impacts of the Landcare Program.

Introduction

While estimates vary, there is no disputing that the upland regions of the Philippines form a significant proportion of the country, accounting for around 40 per cent of the total land area (Catacutan and Mercado 2001). Land degradation in these often densely-populated upland areas represents a major environmental threat, resulting in significant on-site and off-site impacts. Several conservation farming systems have been developed to maintain the productivity of the landscape and to mitigate the external impacts of upland agriculture. However, in the past, adoption of these systems has not been rapid or widespread (Cramb 2000).

Landcare is a group-based approach to agricultural resource management that arose out of efforts in the 1990s to promote soil conservation innovations, particularly contour hedgerows, among farmers in the upland municipality of Claveria in Misamis Oriental, Northern Mindanao (Arcenas 2002, Sabio 2002).[1] Conservation farming practices have evolved from these early days into a diverse range of practices that are suited to the biophysical environment and socioeconomic constraints of the typically resource-poor farmers in this region. A low-cost farmer adaptation of contour hedgerows that used natural vegetative strips (NVS) was identified as an alternative to previously promoted methods, which required significant inputs of labour to establish and maintain the hedgerows (Mercado et al. 2001, Arcenas 2002, Sabio 2002). NVS technology was found to be effective in reducing erosion and resulted in the formation of terraces behind the vegetative strips within a few years. Agroforestry systems were also promoted as a beneficial land use that not only aids in reducing soil erosion but can also intensify and diversify the production system, improving rural livelihoods by providing an additional source of food and income. A diversified production portfolio also has additional benefits such as reduced risk of total crop failure and even nutritional supplies for farming families.

These innovations were widely adopted by Landcare farmers in Claveria. The success of Landcare in this municipality encouraged the introduction of the approach and technologies into similar biophysical areas in central and southern Mindanao from the late 1990s. The approach experienced similar success in achieving rapid and widespread adoption of NVS and other agroforestry systems in these areas. Then in 2000 the Landcare

[1] Landcare in the Philippines arose independently of the Australian Landcare Program.

Program was further introduced into the contrasting biophysical environment of Bohol in the central Visayas. As opposed to the relatively deep, acid upland soils in the regions of Mindanao where the program had first evolved, Bohol is characterised by typically highly degraded, shallow, calcareous soils (OIDCI 2006). Furthermore, whereas in Mindanao the primary source of both subsistence and cash is maize, and maize-fields are where the NVS technology is mostly applied, in Bohol the primary source of subsistence is rainfed or irrigated rice, and the primary source of cash is coconut, hence sloping upland fields are of secondary importance in the farming system. It was not known how the uptake of the technology would be affected by these contrasting features.

This paper is a preliminary analysis of field work undertaken from August to December 2006. It uses a livelihood framework to explore the dynamic nature of agricultural land use in the upland region of Bohol. It attempts to understand the trends and shocks that farmers consider in their decisions about land use. Second, it explores how the introduction of a conservation program such as Landcare influences this pre-existing land use dynamic. It evaluates the success of the technology in the contrasting biophysical environment of the Visayas. Finally, a framework is presented for assessing the onsite and watershed impacts of land-use change as a means of evaluating the success of the Landcare Program

Conceptual issues

Land and watershed degradation

The term 'degradation' implies a 'reduction to a lower rank' (Blaikie and Brookfield 1987). Hence 'land degradation' involves a loss of value in the estimation of land users or other interested parties. While this can be the result of either human induced or natural processes, poor land management, or land-use practices ill-suited to the biophysical environment in which they are being carried out, can greatly exacerbate the problem. These processes will typically signify a temporary or permanent decline in the productive capacity of the landscape. This may include a reduction in the current and potential capability of the landscape to produce goods and services, both quantitatively and qualitatively (FAO 1983; ISO 1996).

The criteria used to evaluate a reduction in the 'productive capacity' of a landscape will greatly influence the extent and severity of the reported problem. 'Productive capacity' is a subjective term and will vary depending on the temporal and spatial scale from which it is measured and according to the perspective from which it is considered. For example, from an upland farmer's perspective, the conversion of forested land to cropland may not be perceived as degradation in the short term as this may increase the productivity of the landscape in terms of producing goods that can be consumed by the household or sold through marketing channels. However, from a social viewpoint, where the total value of all the market and non-market goods and services that the forest area previously provided is considered and any off-site damages resulting from agricultural activities are included, the long-term capacity of the landscape to produce goods and services may have declined dramatically.

The primary on-site (or private) impact of agricultural production on sloping lands that are not well-suited to intensive cultivation is the loss of fertility and associated yield decline that occurs as a result of soil erosion (Catacutan and Cramb 2004). In some areas of the Philippines a combination of the biophysical environment and land-use practices have caused levels of soil erosion so extreme that the entire soil profile has been washed away and the underlying bedrock has been exposed, creating an environment that can no longer support cropping. This has led to large areas of land being abandoned, which not only has implications for the immediate livelihoods of farmers but also places additional pressure on the remaining agricultural land and may lead to the shortening of traditional fallows or the further conversion of forested land into agricultural land.

Agricultural activities on the upper slopes may also have both a direct and indirect influence on farming activities at lower elevations. For example, anecdotal evidence from farmers in Bohol suggests that land degradation in the uplands may lead to a reduction in infiltration generating an increased amount of runoff after rainfall events that causes flood damage to areas further down the slope, particularly to rainfed rice plots. According to Gesite et al. (2006), eroded soil deposited down slope can inhibit or delay the emergence of seeds, bury small seedlings, and necessitate replanting in the affected area. When the lower parcel is cultivated by the same farmer these impacts are internalised in management decisions. However, in many cases, a farmer's parcels are not contiguous and these impacts impinge on the productivity of other neighbouring farms.

In addition to these direct concerns, an array of off-site damages or social costs can be attributed in some part to the land-use activities on smallholder upland farms. These externalities include the siltation and sedimentation of downstream irrigated farming systems, reductions in the performance and life expectancy of hydroelectric facilities, and degradation of coastal environments (Catacutan and Mercado 2001). Further, increasing land degradation coupled with population pressure has contributed to encroachment into the declining forested regions. The conversion of forested land to agriculture may result in changes in other ecosystem services, such as a net increase in carbon emissions, with the impacts incurred beyond the national borders.

All agricultural land use will have some impact on the surrounding environment, whether a direct impact on the productivity of the land itself or an indirect impact as a result of lateral flows causing externalities elsewhere in the watershed. However, reducing land degradation to zero is neither a physically possible nor an economically desirable outcome. It is generally accepted that to maintain the productivity of agricultural landscapes some form of soil conservation will be required, but the argument that investing in soil conservation is worth whatever it costs is a fallacy (Seckler 1987). In economic terms, there exists an optimal level of degradation where the benefits of resource use (increased short term agricultural production, for example) equal the costs incurred in the long term. However, there may be a significant difference between the private and social optimal level of degradation. Hence a watershed approach is necessary to ensure that the benefits of degradation that typically accrue to landowners are not being subsidised by a loss in welfare to the wider community. Scaling up the analysis to the watershed level is required so that the full spectrum of impacts of agricultural land-use change can be included and the benefits of an intervention program such as Landcare can be evaluated.

While evaluating impacts at this broader scale is highly desirable, Landcare targets the adoption of conservation practices at the plot and often sub-plot level. Given the large number of farmers cultivating small, scattered upland parcels, this piecemeal approach is the only realistic alternative; the kind of watershed or catchment planning implemented in Australia would face prohibitive transaction costs in this setting. Therefore, before any assessment can occur at the watershed scale, an understanding needs to be established of the existing land-use dynamics and the environmental, economic and social pressures that drive land-use change at the household level. It is here that the livelihoods approach is relevant.

Sustainable rural livelihoods

Land use in the uplands is dynamic, with the mosaic changing over time as farmers respond to a variety of trends, shocks and seasonal conditions. To fully understand the impacts of an intervention program such as Landcare on farmers' incomes and the surrounding environment, it is important first to understand the factors influencing their land-use decisions. The sustainable rural livelihoods framework is a useful tool to organise and understand the various factors that constrain or provide opportunities for upland farmers, and the interaction between them (Fig. 1). According to Ellis (2000, p. 10), "a livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (determined by institutions and social relations) that together determine the living gained by and individual or household." Further, the Department for International Development (DfID) states that a livelihood becomes sustainable when it can "cope with and recover from stresses and shocks ... while not undermining the natural resource base" (DfID 2001, Section 1.1). Figure 1 illustrates how the livelihood activities (Column E) pursued by upland farmer households are carried out in the context of the social and institutional arrangements (Columns B and C) that govern their access to the resource base (Column A). Importantly, as illustrated in Column F, the choice of livelihood activities has consequences for a range of livelihood security and environmental objectives. In this paper the livelihood framework is used to help explain the various influences affecting land-use decisions of upland farmers and to examine how these factors are affected by a program such as Landcare that seeks to improve rural livelihoods.

An important characteristic of rural livelihoods in upland regions is that they need to be able to adapt livelihood strategies to changes in assets, access, trends and shocks in order to survive (and, hopefully, get ahead). It is this maintenance and continuous adaptation of a highly diverse portfolio of activities that is a distinguishing feature of rural survival strategies in upland regions of poor countries such as the Philippines (Ellis 2000). Below-average or unseasonal rainfall, the death or pregnancy of a draught animal, changes in government policy, or the illness of a household member are examples of factors that can quickly alter a household's level of assets and hence the available activities (Column C in Fig. 1).

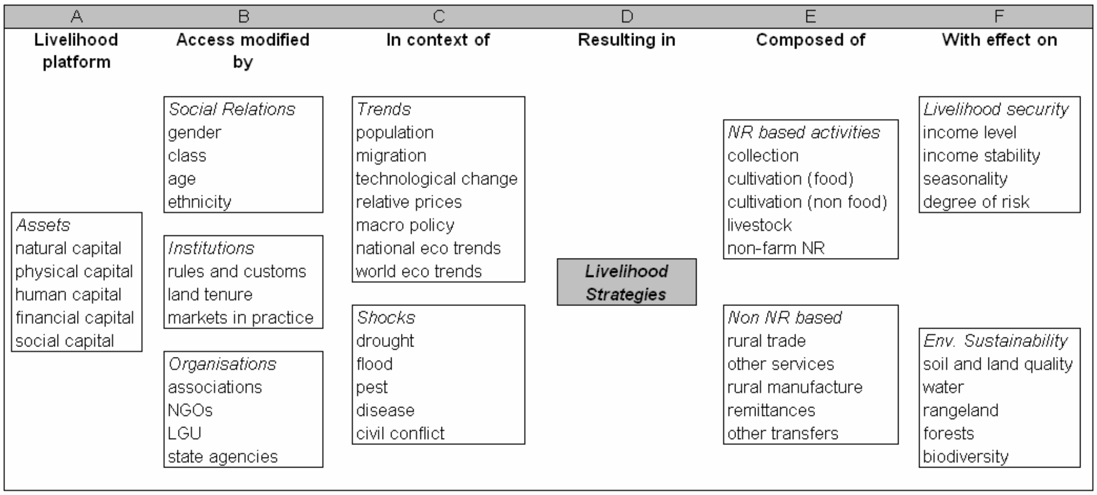

Figure 1 Livelihood Framework Source: Ellis (2000 p. 30).

The access to these assets can also be altered by changes to the rules and social norms that govern the ability of various people within the community to own, control, or make use of them (Column B in Fig. 1). Programs such as Landcare can influence the access to assets by improving human capital through farmer-based training; improving access to physical capital such as agroforestry planting materials; and improving social capital through the formation or strengthening of farmer groups and federations, and forging partnerships with Local Government Units (LGUs).

The outcomes of the Landcare Program throughout the central and southern Philippines include a change in the mix of livelihood activities employed by farmers. This has often included a diversification of farming activities and the cultivation of crops with higher commercial value such as bananas, pineapples, vegetables, and tree crops. Rural livelihood diversification is the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive or improve their standard of living (Ellis 2000). Evidence from recent surveys suggests that it is through this diversification of livelihood activities that Landcare is leading to improved livelihood outcomes for upland farmers in the central Philippines, similar to those reported by Cramb and Culasero

(2003) in southern Mindanao. A livelihood approach ensures that all the outcomes of reallocating household resources between various enterprises (subsistence crops to cash crops, for example) are considered when evaluating the success of the program.

Landcare and livelihoods in Bohol

The island province of Bohol is located in the central portion of the Visayas between Cebu to the northwest and Leyte to the northeast. Approximately 66 per cent of the island is utilised for agricultural production, with the major activities including rice, maize, coconut, oil palm, vegetables, and root crops. Land with slopes of 8-18 per cent accounts for around 29 per cent of the island and is typically utilised for coconut, maize, and root crops. There are also extensive areas of idle *Imperata* grasslands which are often severely eroded (OIDCI 2006).

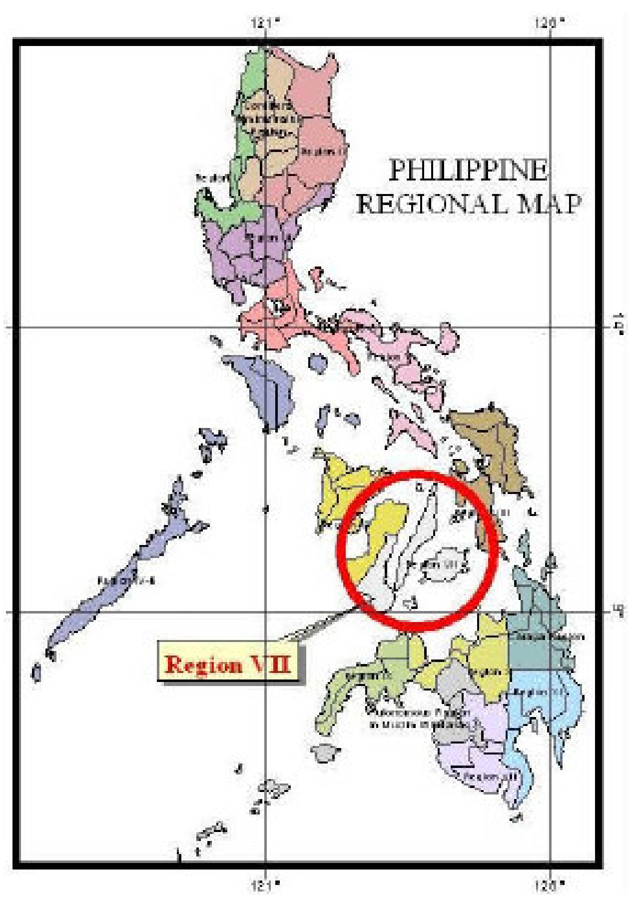

Figure 2 Location of Bohol (easternmost island) in the central Visayas

The typically shallow, calcareous soils throughout the island results in meagre to zero soil cover, with exposure of the underlying bedrock occurring even at lower elevations. Due to increasing population and economic pressures, areas with slopes greater that 18 per cent have been cultivated, particularly for subsistence agricultural purposes (OIDCI 2006). A combination of the shallow soils, intense rainfall events, and traditional land-use practices results in high levels of erosion and land degradation. Soil fertility on upland farms is declining as a result of soil movement, with commercial inorganic fertilisers often beyond the economic means of resource-poor upland farmers.

Rice is the staple food in Bohol, mainly produced by smallholder farmers. It serves as the primary source of subsistence and income for around 28 per cent of all households in Bohol (OIDCI 2006). The percentage of households depending on rice production for subsistence is far greater in the upland regions targeted by Landcare, where most production is either consumed by the household or used as planting material for the subsequent season and very little is sold for cash. Maize is the second staple after rice and is an important crop for many upland farmers, especially those who do not have access to rice land. Spatially, coconut is the most extensive land use in Bohol and for the majority of upland farmers interviewed is also the primary (and often only) source of income.

The Landcare Program is currently operating in the upland barangays (villages) of three municipalities in Bohol – San Isidro, Alicia, and Pilar (Figure 3). Farmers in these steeper sloping regions have traditionally been cultivating maize, cassava, and other root crops. The majority of households are also cultivating a small area of either rainfed rice in the uplands or in some cases have access to an irrigated plot elsewhere in the watershed.

Surveys were conducted in October-November 2006 with 102 farmers within the Municipalities of San Isidro and Pilar. The questionnaire included sections on household composition; farming activities and the relative importance of these activities in terms of household consumption and cash income; land degradation; adoption of conservation practices; benefits and costs of adoption; and establishment of timber and/or fruit trees.

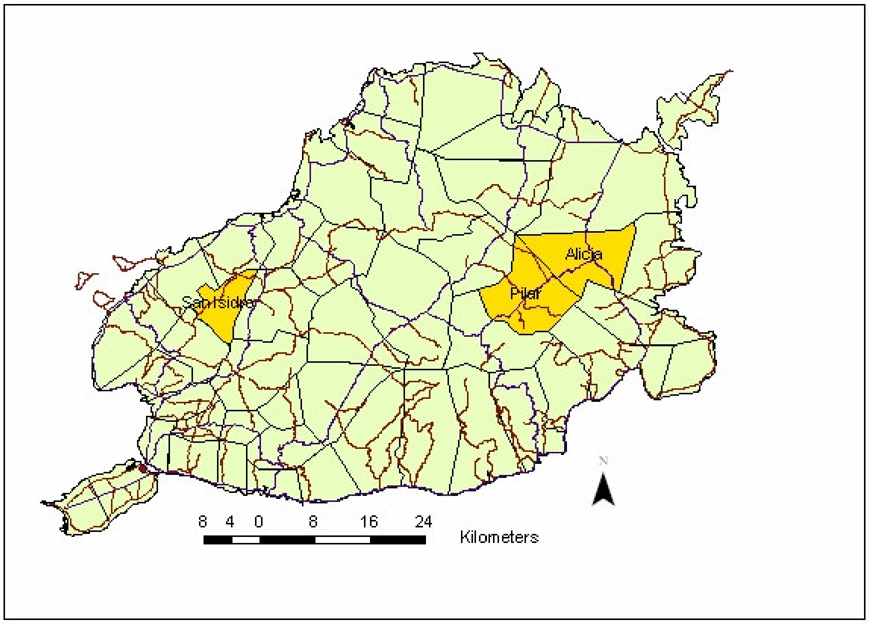

Figure 3 Province of Bohol showing Landcare municipalities

Of those farmers interviewed, a high percentage (68% in San Isidro and 90% in Pilar) reported that erosion was a problem on their farms, often to the point that in some places the entire soil profile had been removed, exposing the underlying bedrock (Figure 4). Soil erosion was described as affecting soil fertility, resulting in declining productivity of crops and an increasing need to apply other inputs to the soil. In many cases soil productivity had fallen to a level where cultivation had been discontinued as external inputs such as inorganic fertilisers were not an option, given the current access to financial capital. The dramatic decline in productivity coupled with the physical exposure of the underlying bedrock has meant that soil erosion is easily identified by farmers as a major problem. In other areas of the Philippines, where the soil profile is deeper, soil erosion can go undetected for some time as the cause of productivity decline, or indeed no productivity decline may be occurring. It is perhaps this acute awareness in the Bohol sites that has contributed to a rapid uptake of NVS technology as a method of soil conservation once initial extension has been provided.

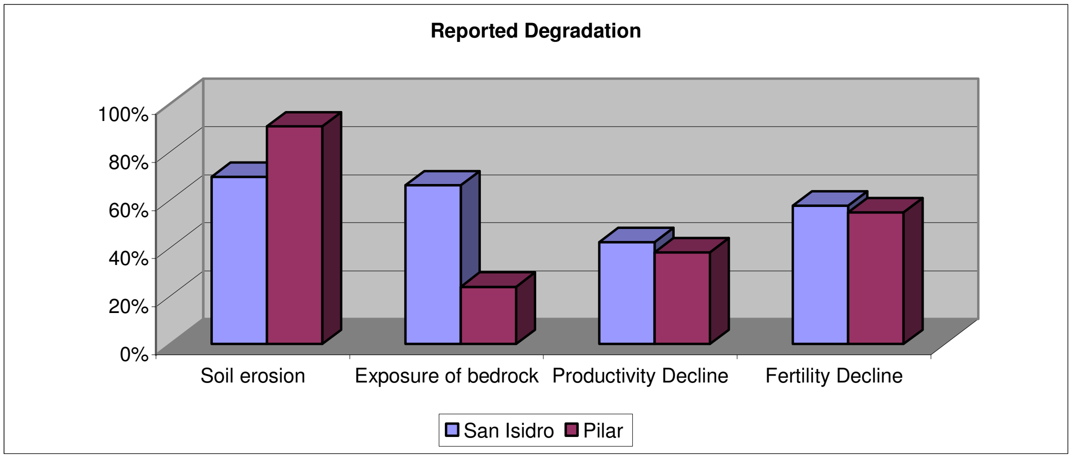

Figure 4 Percentage of respondents reporting degradation problems

Those farmers who had adopted some form of soil conservation reported having higher incomes as a result of adoption. In San Isidro and Pilar the median cash income of adopters surveyed was approximately 80 per cent and 60 per cent higher than non-adopters, respectively. While it should be noted that this increase was from a very small base (less than PHP 12,000 or AUD 310 on average), the evidence supports the claim that Landcare has changed the production mix, with farmers pursuing other activities with higher commercial value, such as vegetable production (stringbeans, okra, Chinese cabbage (*petchay*), and bitter gourd (*ampalaya*)), bananas, and fruit and timber trees (Figure 5). Little of the increase in cash income was generated directly through increased sales of crops traditionally grown in the area, such as maize, cassava and other root crops. This evidence suggests that the adoption of the NVS technology creates a stable platform on which other livelihood activities can be built. That is, once farmers have a reliable source of food being generated on the plot of land on which adoption occurs, other activities that have a higher commercial value can be pursued. This process of farm development that gives rise to diversification of upland farming systems is having a positive impact on livelihood security.

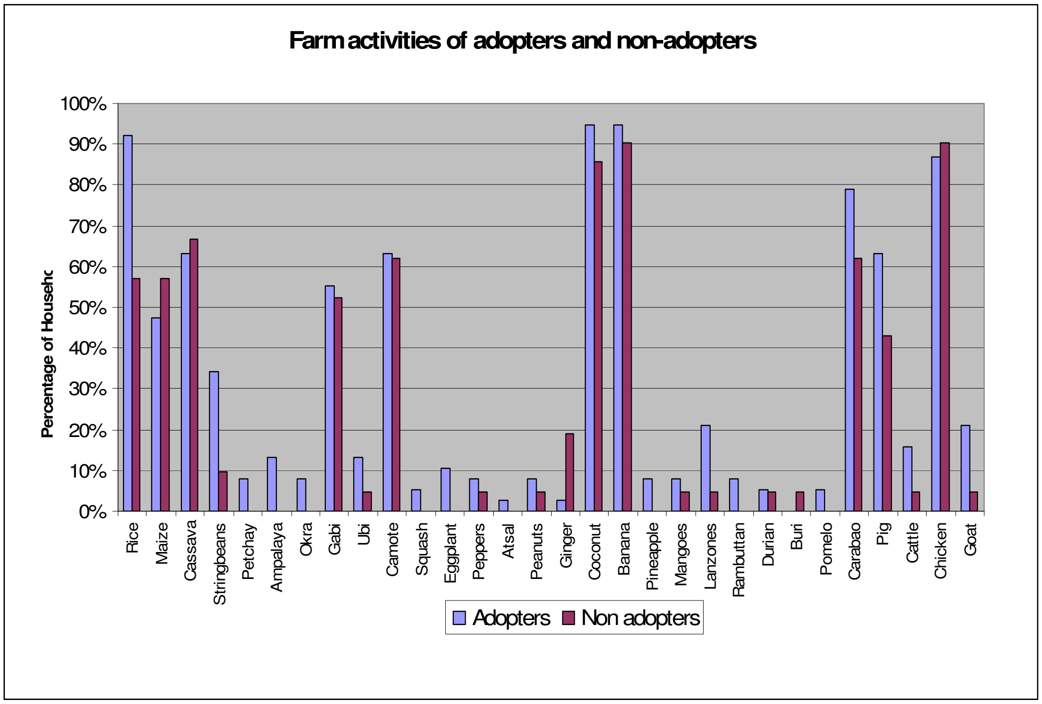

Figure 5 Farm activities of adopters and non-adopters

One of the major advantages of the NVS technology is that the time lag between adoption and when other commercial crops can be incorporated is relatively short. For example, often perennial crops such as bananas and pineapples can be adopted simultaneously with or soon after the establishment of NVS, with a harvestable crop possible within one year. Other vegetable crops also become feasible once soil erosion and runoff have been reduced, and particularly once terrace formation occurs.

As indicated above, compared to most areas in Mindanao where the Landcare Program operates, Bohol presents some interesting contrasts. The survey revealed that rice production was considered the major activity, both in its importance for household consumption and typically utilising the majority of household labour. Of those households interviewed, almost all adopters (92%) had a rice parcel while only (57%) of non-adopters were producing rice. Respondents also indicated a high dependence on copra, harvested from the coconut palms three times a year, as a source of cash income. In San Isidro copra sales accounted for over half of cash income on average (Figure 6). For many farmers, copra and banana sales were often their only source of income.

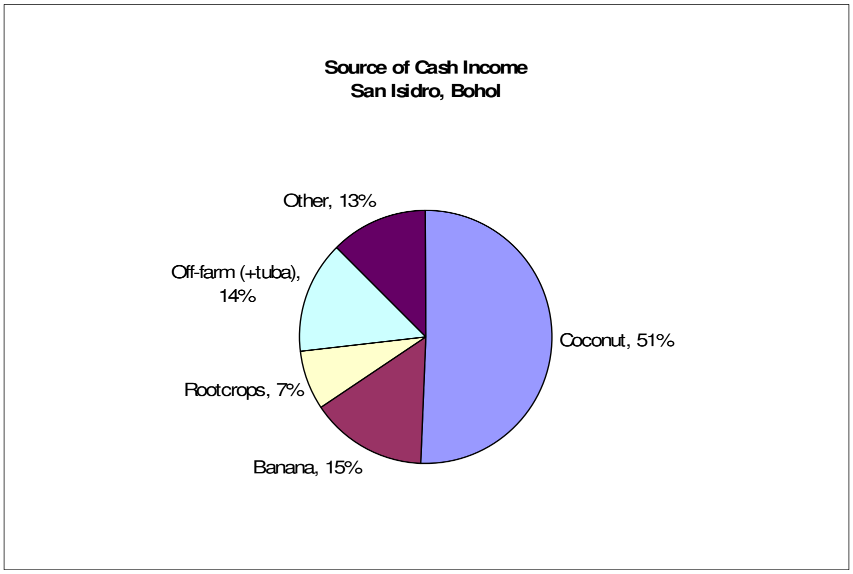

Figure 6 Sources of cash income in San Isidro, Bohol

In other locations in the Philippines where the major household activity is maize production, the introduction of the Landcare technologies typically imposes short term costs in terms of foregone production, as land used for vegetative strips is taken out of production. Simulation modelling reported by Cramb et al. (2006) for an area in Lantapan showed that, although the adoption of NVS technologies significantly reduced soil erosion, the foregone production from the cultivated area converted to the vegetative strips resulted in the benefits not being apparent until the eleventh year after adoption, making the technology not economic at any discount rate without the integration of some other form of agroforestry. However, the adoption of the Landcare technologies in the highly degraded soils of Bohol has often been used as a means of rehabilitating land that has already gone out of production, rather than as a technique for maintaining current yields (although many farmers suggest this is also the case). Therefore, in contrast to other areas, the adoption of NVS requires little upfront investment and in most cases does not result in an initial decline in subsistence output or income.

When analysing the impacts of the adoption of agroforestry, however, the impact on the entire livelihood system needs to be considered. This is particularly the case in regions like Bohol where adoption is occurring on areas that are often not the primary location of farm activity. For example, how does the adoption of agroforestry activities affect the amount of household labour available for rice production, and what does this mean in terms of overall food production and security for the household? The significant increases in cash incomes reported by adopters need to be evaluated within the livelihood framework so that all the livelihood outcomes are considered.

It may be the case in Bohol that idle labour and land resources are being utilised to pursue cash crop and agroforestry activities in the uplands and that these diversified cropping systems are increasing livelihood security and environmental sustainability without imposing many short-term costs. This is particularly likely in rice-coconut systems typical of the region, where the labour requirements are intensive for short periods around major cropping events such as rice planting and harvesting, and also three times a year when coconut palms are harvested for copra. It may also be the case that farm households with a relativity secure source of food coming from rice production and a low but secure source of income derived from coconut products are able and willing to experiment with Landcare practices on their upland parcels without exposing themselves to the risk of having inadequate food or income to survive.

Aggregating changing land-use activities at the watershed scale

The larger issue that needs to be considered in evaluating the impacts of Landcare is how changing land-use patterns at the farm or household level aggregate at the watershed level. A watershed can be defined literally as the dividing line between two catchments or drainage basins, but the concept has evolved to include the total area of land within a drainage divide that drains into a stream or other body of water (Magrath and Doolette 1990). It can be strongly argued that the watershed scale is the appropriate unit for conceptualising, implementing, and evaluating investments in development and natural resource management in rural areas. While plot-scale erosion and consequent productivity decline are recognised as a major aspect of land degradation, other processes that affect the productive capacity of the landscape at a watershed scale need to be captured. Changing land use in the uplands, including the adoption of conservation activities, has wider reaching implications than the direct affect on soil productivity and farm incomes. It is often the case that the implications of land-use change (both negative and positive) are more significant elsewhere in the landscape as a result of lateral flows, especially where water courses receive sediment, nutrients, and other contaminants in large quantities. Thus changes in the agrarian landscape are manifested in watercourses, where sediment and other agrochemicals "determine the aesthetics and productive characteristics of a watershed" (Deutsch and Orprecio 2005, p. 37).

The Municipality of Pilar lies within the Inabanga watershed, the largest watershed on Bohol (Figure 7). Over 60 per cent of agricultural land in the watershed has a slope exceeding 18 per cent. This coupled with an average annual rainfall greater than 2000 mm is resulting in sedimentation of the Malinao Dam, a source of irrigation for downstream rice farmers, significantly reducing its storage capacity and expected life. A report by the Bureau of Soil and Water Management (Philippines) concludes that there is a need to "provide alternatives to farmers to improve their present system of crop cultivation particularly in the corn/cassava areas to reduce sediment transport to Malinao Dam" (BSWM 2006). Sediment reaching the dam has impacts on water quality within the entire watershed and also reduces water availability to downstream irrigators, resulting in both social and private economic losses.

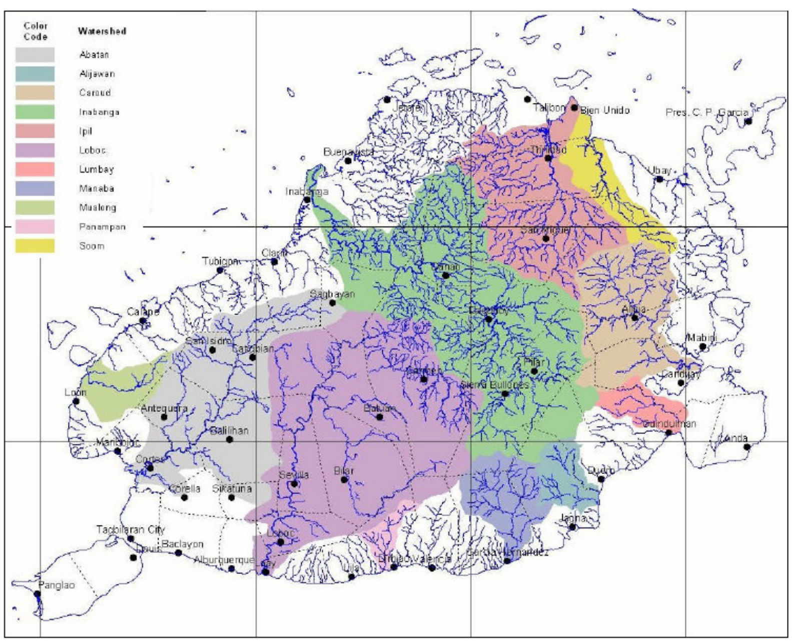

Figure 7 Watersheds of Bohol Province

Farmers in Pilar report widespread reduction is plot-level erosion after adopting NVS, and this is supported by empirical studies (Gesite et al. 2006). However, it is not a simple matter of summing these effects across the area in which adoption has occurred. Erosion pathways are complex, with filtering effects occurring from the point of origin to the point of deposition. Land-use change modifies not only the extent and severity of erosion but may lead to increased water utilisation in the uplands, having implications for land uses relying on runoff further downstream. For example, Gesite et al. (2006) report that in the Inabanga watershed about 57 tonnes of soil is being lost per hectare each year from traditional maize and cassava cultivation, as opposed to 0-5 tonnes from other cropping systems. At the same time, maize and cassava cropping resulted in runoff of 24 per cent while agroforestry systems were recorded at 18 per cent. Reductions in runoff can be the result of a combination of increased infiltration or increased utilisation by agroforestry systems. Therefore changing land-use may not only reduce sediment reaching downstream storage infrastructure but may also alter the amount and timing of water delivered as well. While not all sediment in the dam can be attributed to upland farms (or to agriculture for that matter), further research is required to determine the impact of Landcare-induced changes in livelihood activities in the uplands on the quantity of sediment reaching the dam; the impacts of sediment on downstream resource users, particularly irrigated rice producers; and the impact on the wider watershed.

The ultimate aim of this study is to compare the economic impacts of existing livelihood systems in the upper watershed with the economic impacts in areas where the influence of the Landcare program has brought about land-use change, including an increased rate of adoption of conservation practices and agroforestry systems. The conceptual framework for the study (Figure 7) illustrates the processes of data collection and crop, household, and watershed modelling required to determine the net economic impacts of Landcare. Plot-scale crop models will be nested in an analysis at the household or whole-farm level to determine the impacts of Landcare on livelihood security outcomes. Changing activities at the household level will be considered in the context of the physical characteristics of the watershed in a catchment or watershed model to determine the impact of changing land use on environmental outcomes, in particular, sediment delivery to Malinao Dam.

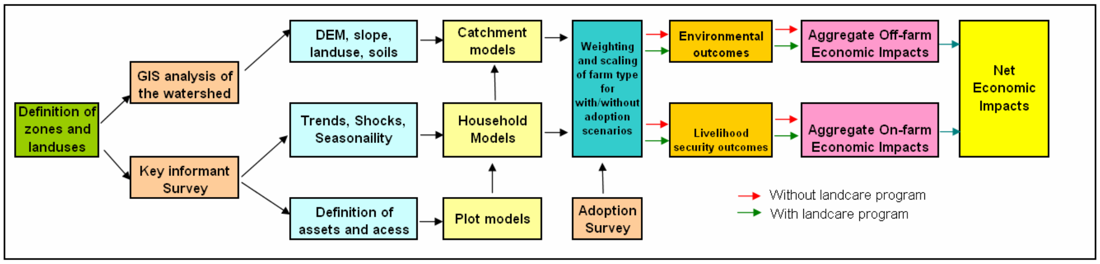

Figure 7 Flow chart illustrating the process of analysis

Conclusion

The potential of a Landcare approach to enhance the development, dissemination and adoption of appropriate conservation farming measures in the upland regions of the Philippines is easily observable. There is strong evidence to support the claim that Landcare has led to a significant increase in the adoption of conservation practices in those locations where it has been implemented. In this paper we have presented additional evidence to show that Landcare can also be highly effective in bringing about land-use change in the contrasting environment of Bohol.

Four key factors have been identified that distinguish the adoption of NVS and other Landcare technologies in Bohol from the same process in Mindanao, and that have contributed to Landcare's success in this environment:

- Shallow soils making soil erosion easily observable;
- Utililisation of land that is not the primary resource base for farm activities and that is often idle at the time of adoption;
- Utilisation of idle labour for upland development activities; and
- A reliable source of subsistence from lowland rice production and of income from copra sales, underwriting conservation activities in upland plots.

These observations highlight the importance of assessing Landcare interventions within the context of livelihood assets and activities.

What is harder to observe and measure is the outcomes of adoption in terms of livelihood security and environmental sustainability. The approach we are pursuing is to focus first on how Landcare technologies such as NVS and other agroforestry systems are affecting plot-scale productivity once adopted. The next step is to determine how the process of intensification and diversification induced by Landcare affects the overall livelihood outcomes of farm households, such as the level, stability, and risk of food output and cash income produced. Only when this dynamic is understood can the impacts at the watershed scale be evaluated.

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