Philippines-Australia Landcare Project

Farm-Level Impacts of Landcare in Lantapan

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PREFACE

The Philippines-Australia Landcare Project Working Paper Series is intended to disseminate the results of research undertaken in the course of two successive action research projects funded by the Australian Centre for International Agricultural Research (ACIAR):

- ASEM/1998/052 *Enhancing Farmer Adoption of Simple Conservation Practices: Landcare in the Philippines and Australia* (1999-2004)
- ASEM/2002/051 *Sustaining and Growing Farmer-Led Landcare-Type Approaches to Natural Resource Management in the Philippines and Australia* (2004-2007).

For further information about these projects contact the project leader, Noel Vock, at Noel.Vock@dpi.qld.gov.au and about the working papers and other research outputs contact Rob Cramb (r.cramb@uq.edu.au) or Noelyn Dano (noelyn_dano@yahoo.com).

This Working Paper evaluates the on-farm impacts of the Landcare Program in Lantapan, drawing on the survey of Barangay Sungco. We are grateful to Edith Tajeda and Josephine Liu for assistance with data collection and to Arnold Garcia for advice in the application of SCUAF. A shorter version of the paper was presented as a poster at the 26th Conference of the International Association of Agricultural Economists, Gold Coast, 12-18 August 2006. This version is forthcoming as 'The Landcare approach to soil conservation in the Philippines: an assessment of farm-level impacts' in the *Australian Journal of Experimental Agriculture.*

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ABSTRACT

'Landcare' is a group-based approach to the promotion of conservation farming. A case study of the Landcare program in Lantapan in the southern Philippines is presented to assess the farm-level impacts of this approach. The program was successful in promoting the formation of Landcare groups and a municipal Landcare association, resulting in rapid and widespread adoption of conservation practices, particularly among maize farmers. This in turn significantly reduced soil erosion, though the impact on crop yield and income was somewhat delayed. Adoption was thus not motivated primarily by short-term returns but by a concern to reduce soil erosion and provide a basis for diversification into agroforestry.

INTRODUCTION

Agricultural land degradation is a widespread problem in the Philippine uplands that has persisted despite several decades of conservation farming projects (Cramb 1998; Cramb et al. 2000). More recently, the Landcare approach to promoting conservation farming has shown considerable promise. This approach has been a feature of Australian agriculture since the mid-1980s (Campbell 1994; Lockie and Vanclay 1997; Cary and Webb 2000) and emerged independently in the mid-1990s in the Philippines (Mercado et al. 2001; Arcenas 2002; Catacutan 2005). The approach involves the formation of local Landcare groups, supported to varying degrees through partnerships with government and technical agencies. These groups meet to identify problems, access improved technologies, and mobilise community effort and finances to help improve the management of their soil, water, vegetation, and other natural resources.

Landcare in the Philippines grew out of efforts by a succession of agencies to promote soil conservation innovations, especially contour hedgerows, among smallholder maize and vegetable farmers in the upland municipality of Claveria in Northern Mindanao (Fig. 1). In the course of conducting field trials on contour hedgerow systems in Claveria in the early 1990s, staff of the International Centre for Research in Agroforestry (ICRAF) identified a low-cost, less labour-intensive farmer adaptation of contour hedgerows – the use of natural vegetative strips (NVS) (Fujisaka 1993; Nelson and Cramb 1998; Stark 2000; Mercado et al. 2001). Group training sessions were organised to introduce the NVS technology to other farmers and at one such session in 1996 those present decided to form the Claveria Landcare Association (CLCA) to promote the technology throughout the municipality.

By early 2000 the CLCA had grown to include 16 village-level groups, 105 sub-village groups, and about 800 individual farmer-members. Adoption of NVS technology increased dramatically as a result. The early success of Landcare in Claveria encouraged ICRAF in 1998 to introduce the approach at its field site in the municipality of Lantapan (Fig. 1) as well as other locations that shared similar conditions and farming systems, with a correspondingly favourable response from farmers (Cramb and Culasero 2003; Cramb et al. 2003; Catacutan 2005).

A four-year action research project was commissioned by the Australian Centre for International Agricultural Research (ACIAR) in 1999 to support the Landcare program in selected sites and to evaluate its impacts. Measuring ultimate impacts on poverty and the environment was considered infeasible. Instead the approach was to trace 'impact pathways' (Douthwaite et al. 2005) – from Landcare activities (training days, group formation), to changes in farmers' attitudes and knowledge, to changes in farmers' practices (adoption of NVS and agroforestry), to impacts on soil erosion, to impacts on crop yield and farm income, to off-site impacts. These impact pathways are of course not unilinear but multi-branched and recursive. Nevertheless, evidence regarding key points along a pathway can be used to build a plausible picture of overall impacts.

In this paper econometric and bioeconomic modelling methods are used to assess the farm-level impacts of the Landcare program in Lantapan. The analysis draws on four main sources of data, mostly obtained during a period of fieldwork from July to December 2002: project reports and statistics; interviews with project

Fig. 1 Location of principal landcare sites in Mindanao, Southern Philippines

staff and other key informants; a questionnaire survey of 104 farm households in one village (Sungco); and case studies of 12 community Landcare groups (Cramb et al. 2003). Additional data were obtained during subsequent field visits in January and July 2005. The context and progress of the Landcare program in Lantapan are first described. This is followed by an analysis of the impact of Landcare on adoption of conservation measures (particularly NVS), and the impact of adoption on soil erosion, crop yields and farm income. An overall interpretation of these results is provided and preliminary conclusions drawn regarding the effectiveness of the Landcare approach.

BACKGROUND

The Lantapan environment

Lantapan Municipality comprises 33,000 ha of sloping uplands, bordered by the Mt Kitanglad Range to the north and the Manupali River to the south (Coxhead and Buenavista 2001). The landscape rises from river flats at 400-600 m, through a rolling middle section at 600-1,100 m, to steeply sloped mountains at 1,100-2,200 m, with an average elevation of 600 m. Almost half the area has slopes greater than 10%, with one fifth greater than 20%. Soils are generally well-drained, with clayey topsoil and subsoil, slightly to moderately acid, low in organic matter, low in cation exchange capacity, and with a high capacity to fix phosphorus. Annual rainfall is 2,470 mm and is well distributed throughout the year.

The population of Lantapan has grown rapidly from 668 in 1948 to 43,406 in 2000 due to high rates of natural increase and in-migration (Paunlagui and Suminguit 2001). Hence the population density in 2000 was 136 persons per sq. km and the availability of arable land averaged only 0.4 ha per person. Indigenous and migrant groups each comprise about half the population. Most of the 5,500 farm households remain largely dependent on agriculture and live close to the poverty line.

Forty per cent of the land area is designated as forest-land, half of which falls within the ecologically significant Mt Kitanglad Range Natural Park. Encroachment on Lantapan's forest was initially due to logging and forest fires, but in recent decades agricultural expansion has resulted in the replacement of forest and permanent crops such as coffee by annual crops (Coxhead and Buenavista 2001). The current pattern of land use is that maize and sugarcane predominate on the lower slopes. Moving upslope, sugarcane phases out and maize is the dominant crop, along with three recently established banana plantations. At higher altitudes, maize is cultivated along with temperate-climate vegetable crops – beans, tomatoes, cabbages, and potatoes.

The encroachment of farmers into Lantapan's forest lands and the changing pattern of agricultural land use have caused the degradation of soil, water and forest resources. Coxhead and Buenavista draw two conclusions from a major environmental research project in Lantapan: 'First, the natural resource base of the Manupali watershed is undergoing degradation of a nature and at a rate without modern precedent, with potentially serious consequences especially for water quality. Second, much if not most of the degradation can be attributed directly or indirectly to the spread of intensive agricultural systems based on corn and vegetables, without the concurrent adoption of appropriate measures for the prevention of soil erosion and land quality deterioration' (2001: 26-27).

The Landcare program in Lantapan

The progress of the Lantapan Landcare program is described in Cramb et al. (2003) and Cramb (2005) and is briefly summarised here. The program, which was initiated in 1998 and continues to operate, built on ICRAF's experience in Claveria and the prior interventions of an array of organisations in Lantapan. ICRAF introduced the technique of natural vegetative strips (NVS) in the mid-1990s, soon after it began to be adopted in Claveria, and found a good response among farmers. Hence training in the NVS technology became a major focus of the Landcare program, along with agroforestry (nursery techniques, seedling establishment).

The ICRAF Landcare team comprised two experienced facilitators and four 'intern' facilitators. The program began with a broad information campaign on conservation issues and technologies (especially NVS) in all 14 villages of the municipality. A survey was then conducted to determine the level of farmers' interest, after which seven villages in the middle and upper slopes were given priority. Major activities included slide shows, cross-farm visits, and training days. The latter usually began with hands-on training in establishing NVS or nursery management, supported by visits to farms where the practices had been adopted.

The first local (sub-village) Landcare group was formed six months after the information campaign, in May 1999. From this point there was rapid formation of local groups. The Lantapan Landcare Association, linking these groups at the municipal level, was registered in June 2000 with 840 members (about 15% of all households). By 2001, 58 Landcare groups had been formed and four existing farmer groups were affiliated with the Landcare Association, making 62 groups in all.

These groups were an important source of information on conservation practices for their local community and encouraged members and others to work together, especially in the establishment and maintenance of communal Landcare nurseries. Many groups became inactive once the initial adoption of NVS and/or tree planting had occurred, especially where plantation development and other agribusiness ventures had impinged on smallholder farming. Nevertheless, the Lantapan Landcare Association remained an active partner with ICRAF in implementing the Landcare program.

ASSESSING THE IMPACTS OF LANDCARE

Impact of Landcare on adoption

The rate of adoption of NVS and tree planting associated with the Landcare program was impressive. By the end of 2002 there were about 400 adopters of NVS or 7% of all farm households (Fig. 2). In addition, by 2002, 64 community nurseries had been established and 162,000 trees planted on farms (Fig. 3). This reflects the particular interest of farmers in the income-earning potential of various fruit and timber tree species and hence the early emphasis on training in nursery management techniques. Of the NVS adopters, about 27% had 'enriched' the contour strips with agricultural crops (pineapple, banana, root crops, etc) and 14% with trees (Cramb et al. 2003).

Fig. 2 Adoption of contour barriers in Lantapan, 1990-2002

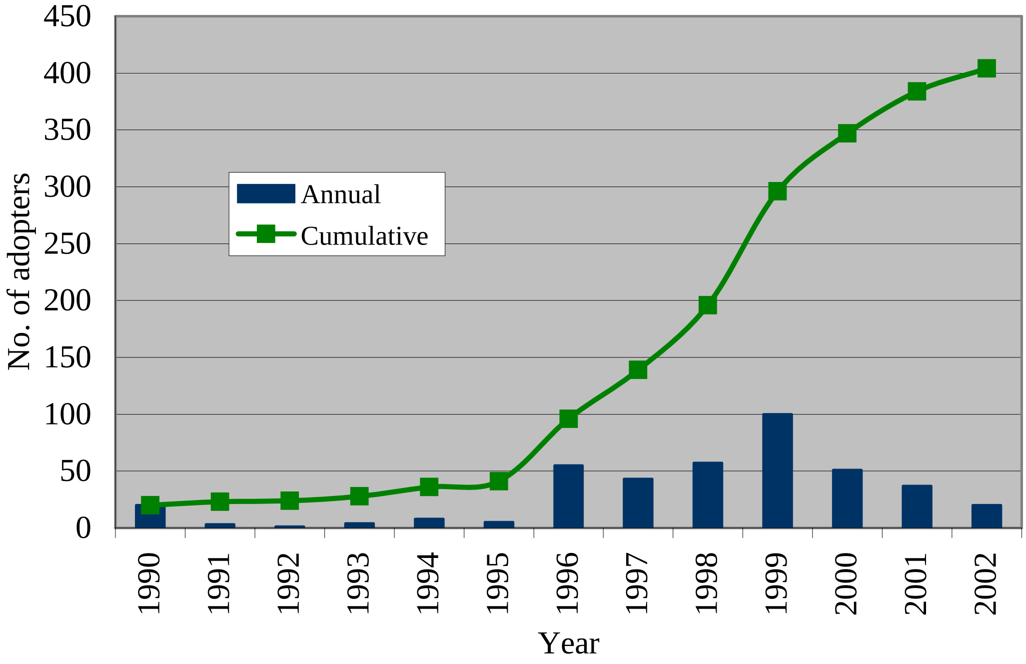
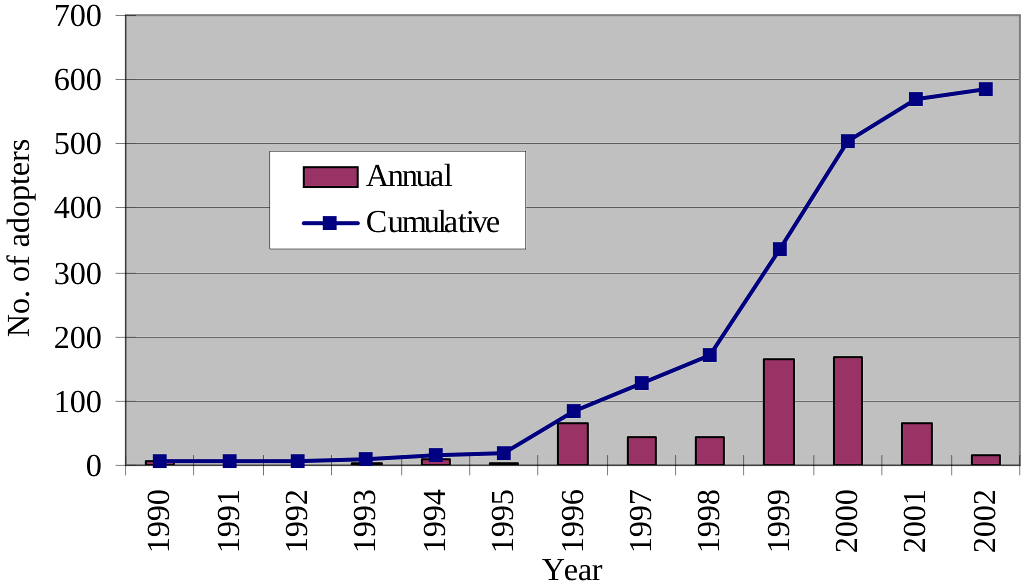


Fig. 3 Adoption of tree planting on farms in Lantapan, 1990-2002



If the two main conservation measures – NVS and tree planting – are combined, there were about 917 adopters by mid-2003, or 13% of the total number of farm households in Lantapan (though not all households were potential adopters). Seventy per cent of these had adopted since the commencement of the Landcare program. The total area under conservation measures was about 1,230 ha (43% under NVS and 57% under trees). This was 11% of the total cropped area, 14% of the area under maize and vegetables, and 18% of 'environmentally critical' land, suggesting a significant impact at the landscape level (Catacutan 2005). Extensive surveys in other parts of the Philippines indicate that such rapid and extensive adoption has been rare, except where facilitated by 'Landcare-type' programs such as that implemented by the Mag-uugamd Foundation in Cebu (Cramb 2000; Cramb et al. 2000).

Of course, the counterfactual question must be asked: What would have been the rate of adoption in the absence of Landcare? Clearly, adoption had already begun to accelerate by 1996 due to the activities of ICRAF and other agencies in Lantapan (Figs. 2 and 3). However, the rate of adoption increased sharply with the implementation of the Landcare program and most of the subsequent adoption can be attributed directly or indirectly to the Landcare activities.

To estimate the influence of Landcare on the likelihood of adopting NVS, the main technology promoted, a logistic regression model was estimated using data from the household survey in Sungco (Tables 1 and 2). The model in Table 2 is a revised version of the adoption model presented in Cramb (2005). As in the previous model, the dependent variable was defined as the natural logarithm of the odds of adoption, where the odds of adoption equal the probability of adoption divided by the probability of non-adoption, i.e., odds = Pr / (1 – Pr). In this version of the model participation in Landcare was measured by two variables rather than just one – participation in Landcare training and participation in a local Landcare group. An interaction term was also included. Only 18% of the sample had both undertaken training in contour measures and joined a Landcare group. A further 9% had not

Table 1 Summary statistics of survey households, Barangay Sungco, Lantapan (n=104)

Variable	Mean	Proportion
Age of household head (years)	44.1	
Gender of household head (male)		0.97
Education of household head (years)	6.1	
Origin of household head (indigenous to area)		0.55
Employment of household head (full-time farmer)		0.77
Tenure status (full- or part-owner)		0.80
Farm size (ha)	3.2	
Location of farm (upper catchment)		0.24
Slope of farm (moderate to steep)		0.67
Participation in Landcare training		0.35
Member of Landcare group		0.27
Adopter of NVS		0.60

Table 2 Logistic regression of NVS adoption on characteristics of household head, Barangay Sungco, Lantapan (n=104)[a]

Variable	Coefficient	Standard error	Odds ratio
Constant	– 6.349**	2.575	0.002
Age 20-29	1.807	1.304	6.090
Age 30-39	2.301**	1.148	9.988
Age 40-49	2.015*	1.039	7.498
Age 50-59	2.349*	1.257	10.472
Education	0.081	0.099	1.085
Indigenous	– 0.684	0.705	0.505
Full-time farmer	1.893**	0.782	6.637
Land owner	0.653	0.860	1.922
Farm size	0.274*	0.144	1.315
Location	2.128**	1.022	8.401
Slope	2.078***	0.714	7.986
Landcare training	3.520***	1.126	33.789
Landcare member	– 0.424	1.352	0.655
Training x member	– 1.644	1.894	0.193
Model chi-squared	61.687***		
Nagelkerke R^2	0.604		
H-L chi-squared	5.223		
% correct	84.6		

[a] Estimated with Statistical Package for the Social Sciences Version 14
* significant at 0.10 level; ** significant at 0.05 level; *** significant at 0.01 level

participated in training but were group members and 16% had participated in training but had not joined a group. More than half (57%) had not participated in either way.

The results are presented in Table 2. The equation was significant at the 1% level and provided an acceptable fit of the data. The coefficient for Landcare training was significant at the 1% level and indicated a large effect, the odds of adoption increasing by a factor of 34 for farmers who underwent training, controlling for the other variables in the model. That is, if the remaining variables are set at their mean or median values, the probability of adoption increases from 0.17 to 0.88 due to the influence of Landcare training.

However, the coefficient for Landcare membership was not significant at the 10% level, nor was that for the interaction term. Other research suggests that the prior existence of strong social bonds at the local level may reduce the importance of formal group membership in the adoption process (Cramb et al. 2003; Cramb 2005). The results in Table 2 lead to the conclusion that the practical, farmer-to-farmer, group-based training facilitated by the Landcare program had much more impact than merely belonging to a Landcare group.

The other significant factors in explaining adoption were age cohort (with farmers in the 30-59 year bracket more likely to adopt than either younger or older farmers), full-time farming, farm size, location in the upper watershed, and slope, all positively affecting the likelihood of adoption. (An analysis of factors affecting adoption of agroforestry may yield a somewhat different result, given the importance of group nurseries in the adoption process.)

Impact of adoption on soil erosion, crop production and income

Based on the household survey in Sungco, the perceived impacts of NVS adoption at the farm level were that soil erosion was reduced, soil fertility was maintained, and terraces were formed (Cramb et al. 2003). There was not a clear perception of short-term impact on crop production or farm income. In the longer term, these impacts were expected to come about, first, because yields of field crops were maintained relative to yields from unprotected land and, second, because of a transition to a more diversified and profitable farming system as NVS were progressively enriched with productive crops, including timber species (Cramb et al. 2003).

Bioeconomic modelling was used to assess the impacts of NVS adoption on soil erosion, yield, and net returns in a continuous maize-maize cropping system over a 20-year period (Mariano 2005). Maize was the dominant crop in Sungco and maize farmers were more likely to adopt the NVS technology (Cramb et al. 2003). While in practice continuous cropping for 20 years was uncommon, this was because of the soil depleting effects of such a system, forcing the land out of production for a period. The SCUAF model (Young et al. 1998) was employed within a benefit-cost framework. This is a process-response model in which the user specifies the physical environment, the land use system, the initial soil conditions (including depth, slope, reaction, organic matter status, N and P), the initial rates of plant growth, and the rates of operation of soil-plant processes. The model provides an annual simulation of changes in soil conditions (depth, organic matter, N and P) and the effects of soil changes on plant growth and harvest (including various crop and tree components). Biophysical inputs (soils, climate, plant growth) were based on data collected from a variety of experimental and field studies within the study site and reflected the environmental conditions described above. Data on maize inputs, outputs, prices and costs were collected from 10 farmer-informants. These data sources are described in full in Mariano (2005).

The model predicts that annual soil erosion is reduced from around 15 t/ha to under 5 t/ha in the first year of adopting NVS (Fig. 4). These rates accord well with ICRAF field experiments in Lantapan (Jun Mercado pers. comm.). The erosion rate continues to fall during the first three years as the slope within the alley is reduced due to terrace formation behind the NVS. In contrast, the model predicts increased annual erosion for the unprotected open-field system, rising to over 40 t/ha by Year 20. Again, such rates have been measured in field experiments in Lantapan (Poudel et al. 2000; Midmore et al. 2001). Though there is no experimental evidence of a steady increase in erosion rate as shown in Fig. 4, this occurs in the model due to the decrease in soil organic matter and crop cover over time.

However, the impact on yield is not so marked (Fig. 5). The yield per *cultivated* hectare declines more rapidly in the open field system, from around 8 t/ha/y to under 6 t/ha/y in 20 years (these figures incorporating two crops per year). But the yield under NVS has to contend with the loss of 10% of the field to the contour strips. Hence the overall yield from the NVS system does not exceed the yield from open-field farming until Year 11. In field experiments the year-to-year fluctuation in yields due to variation in rainfall and other environmental factors outweighs any differences attributable to NVS, making it difficult to demonstrate a statistically significant effect within 5-6 croppings (Jun Mercado, pers. comm.). As mentioned above, while farmers report a clear effect of NVS on soil erosion and terracing, they are unsure about the short-term effect on yield.

A farm-level benefit-cost analysis shows that the impact of NVS on net returns is also less marked than might be expected (Fig. 6). The gains from implementing NVS include the higher maize yield in future years and the saving in labour and inputs due to a reduction in the area cultivated. The losses include the foregone production from the area under NVS and the extra labour costs of establishing and maintaining the NVS. The result is that the annual net return from the open-field system falls dramatically from around 28,000 pesos/ha to 13,000 pesos/ha in 20 years, while the annual net return from the NVS system falls much less rapidly. However, the up-front costs of the NVS system, mainly due to foregone productive area, are such that farming with NVS does not outperform open-field farming until Year 11. Hence the net present value (NPV) of switching from the open-field to the NVS system for a 20-year planning horizon is negative at any positive discount rate.

Fig. 4 SCUAF Simulation of Effect of NVS on Annual Soil Erosion

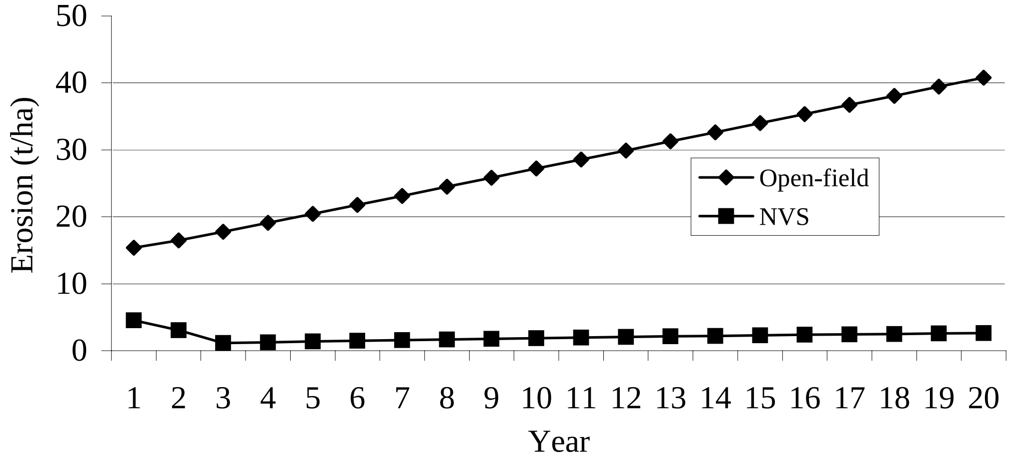


Fig. 5 SCUAF Simulation of Impact of NVS on Annual Maize Yield

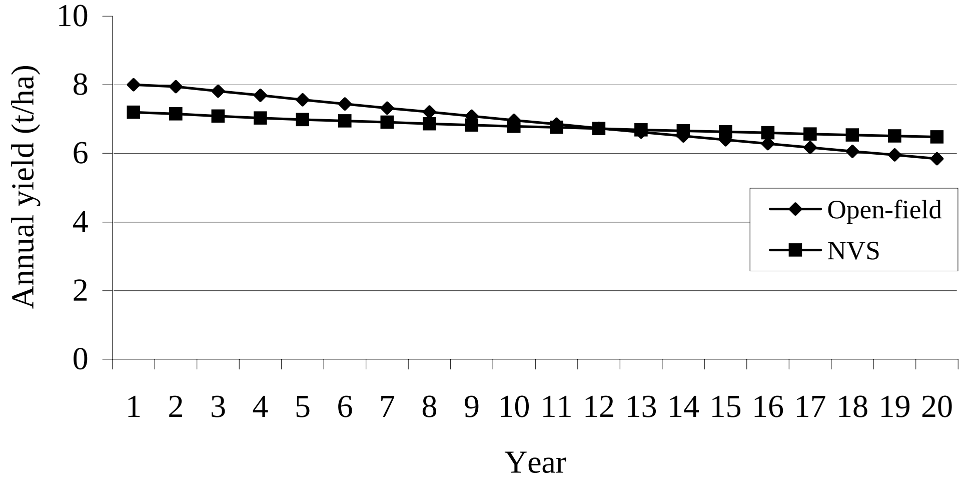
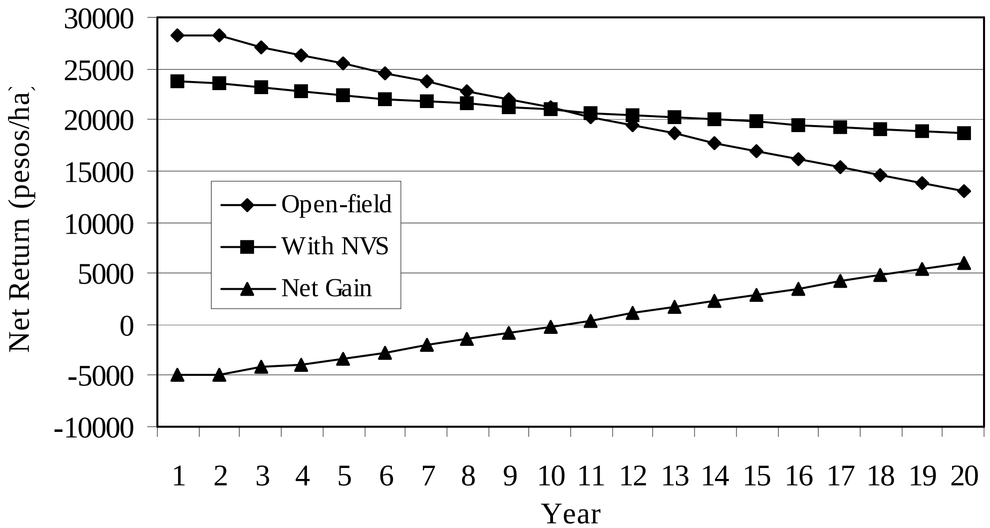


Fig. 6 SCUAF Simulation of Impact of NVS on Annual Net Return from Maize



DISCUSSION

These results, though based on simple modelling, accord well with both field experiments and farmers' observations. They also confirm the findings of similar bioeconomic research in Claveria (Nelson 1996; Nelson and Cramb 1998; Nelson et al. 1998). The question is why so many farmers in Lantapan have adopted NVS if the gains in production and net returns are delayed to such an extent as to make the practice appear unprofitable.

The answer would seem to be that the Landcare program (including extension, training, group activities, and the overall impact on attitudes and behaviour) convinced (and equipped) many farmers to adopt the practice because of its clear environmental benefits, on- and off-farm. That the practice involves no financial outlay, and a low additional input of time for training and implementation, significantly reduced the constraints to adoption of soil conservation practices identified in other studies (Cramb and Nelson 1998; Cramb 2000).

In addition, farm size was an important factor in adoption (Table 1). This suggests that farmers with sufficient land were able to offset the early loss of output due to NVS by increasing the gross area in production, thereby minimising the opportunity cost of NVS. This would imply bringing some unused land back into production, an action made worthwhile by the higher returns to investment in NVS-treated land. Further research is needed to verify this interpretation.

Finally, many farmers saw adoption of NVS as a first step in a process of farm development, culminating in the establishment of increased areas under high-value annual crops and tree crops. This occurred both within the cultivated field (NVS enrichment) and on steeper, less-productive land that could be progressively converted to tree lots once the hillsides were stabilised.

CONCLUSION

The case study of Landcare in Lantapan thus shows that, with good on-ground technical support from skilled and committed facilitators and adoptable conservation technologies, the Landcare approach can mobilise a large number of farmers in a critical upland environment to undergo training in conservation practices and work together to implement them on individual farms, whether or not they are formally members of a Landcare group. Even though the NVS technology as such did not provide early economic benefits, hence was not privately profitable when viewed in isolation, many farmers, especially those with somewhat more land, adopted the technology both to reduce soil erosion as an end in itself and to provide the basis for a transition to a more diversified and profitable farming system incorporating agroforestry.

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