THE 'LANDCARE' APPROACH TO SOIL CONSERVATION IN THE PHILIPPINES: AN ASSESSMENT OF FARM-LEVEL IMPACTS

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1. Introduction

Agricultural land degradation is a widespread problem in the Philippine uplands that has persisted despite 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 emerged in the mid-1980s in Australia (Campbell 1994; Lockie and Vanclay 1997; Cary and Webb 2000) and in the mid-1990s in the Philippines (Mercado et al. 2001; Arcenas 2002) as an important strategy for developing collective action at the local level to deal with problems of agricultural land degradation. The approach centres on the formation of community Landcare groups, supported to varying degrees through partnerships with government and non-government agencies. Such groups identify problems at the local level and mobilise information, 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. In the early 1990s the International Centre for Research in Agroforestry (ICRAF) began to conduct field trials on contour hedgerow systems in Claveria and 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). An extension team was formed to promote the NVS technology to other farmers. The interest was such that group sessions were organised and at one such session in 1996 the farmers 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 success of Landcare in Claveria encouraged ICRAF in 1998 to introduce the approach at its Central Mindanao field site in the municipality of Lantapan as well as other locations that shared similar conditions and farming systems (Cramb and Culasero 2003; Cramb et al. 2003; Catacutan 2005). This paper describes the implementation and assesses the impacts of the Landcare Program in Lantapan. It is based on four main sources of data: project reports and statistics; interviews with project 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.

2. 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, along with three recently established banana plantations. Moving upslope, sugarcane phases out and maize is the dominant crop. 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 has caused the loss of forest biodiversity as well as the degradation of soil and water 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 Lantapan Landcare program initiated in 1998 built on ICRAF's experience in Claveria and the prior interventions of an array of organisations. ICRAF introduced the technique of natural vegetative strips (NVS) in the mid-1990s, soon after it began to catch on in Claveria, and found a good response among farmers. Hence 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. The training involved half-day or whole-day sessions that usually began with hands-on training in establishing NVS or nursery management. This training was supported by visits to farms where the practices had been adopted. The first Landcare group was formed six months after the information campaign, in May 1999.

From this point there was rapid formation of local (sub-village) Landcare groups and a Landcare Association. The formation of a Landcare group usually followed the first training event. 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.

3. Assessing the Impacts of Landcare

Impact of Landcare on Adoption

The recorded rate of adoption of NVS and tree planting associated with the implementation of the Landcare Program was impressive. By the end of 2002 there were about 400 adopters of NVS or 7% of all farm households (Fig. 1). In addition, by 2002, 64 community nurseries had been established and 162,000 trees planted on farms (Fig. 2). 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.

Combining adopters of the two main conservation measures – contour barriers and agroforestry – there were about 862 adopters by the end of 2002, or 16% of the total number of farm households in Lantapan (though not all households were potential adopters). The total area under conservation measures was about 1,150 ha (43% under NVS and 57% under agroforestry). This was 7% of agricultural land, 14% of maize and vegetable land, and 23% of 'environmentally critical' land, suggesting a significant impact at the landscape level.

Of course, the counterfactual question must be asked: What would the rate of adoption have been 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. 1 and 2). However, most of the subsequent adoption can be attributed directly or indirectly to the Landcare program.

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 (Cramb 2005). 'Landcare participation' was included in the model along with a number of other independent variables (Table 1). Participation in Landcare was measured by an index with a scale of 1 to 4. Those who both undertook the farmer-based training in contour measures and were members of a local Landcare group (18%) were scored highest. Those who had not participated in training but were group members (9%) were ranked next. Those who had participated in training but had not joined a group (16%) were ranked third, given that one-off training was likely to be less effective than on-going participation in a group. Those who did not participate in either way (57%) were ranked lowest.

The results are presented in Table 1, reproduced from Cramb (2005). The equation was significant at the 1% level and provided an acceptable fit of the data.

The coefficient for the Landcare participation variable was significant at the 1% level and indicated a large effect, the odds of adoption increasing by a factor of 2.7 for each increment on the participation index, controlling for the other variables in the model. The other significant factors were age, full-time farming, farm size, and slope, all positively affecting the likelihood of adoption. This confirms the fundamental importance of the practical, farmer-to-farmer, group-based training facilitated by the Landcare Program and the positive effect of participation in a local Landcare group. An analysis of factors affecting adoption of agroforestry would give a similar result.

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 no perceived 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 agroforestry as NVS were progressively enriched with productive crops, including timber species.

Bioeconomic modelling was used to assess the impacts of NVS adoption on soil erosion, yield, and net returns in a maize-maize cropping system (Mariano 2005). Maize was the dominant crop in Sungco and maize farmers were more likely to adopt the NVS technology. The SCUAF model (Young et al. 1998) was employed within a benefit-cost framework. Biophysical data (soils, climate, biomass yields) were collected from a variety of experimental and field studies. Data on maize inputs, outputs, prices and costs were collected from 10 farmer-informants.

The model predicts that annual soil erosion is reduced from around 15 tons/ha to under 5 tons/ha in the first year of adopting NVS (Fig. 3). This accords 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 tons/ha by Year 20. Again, such rates have been measured in field experiments in Lantapan (Midmore et al. 2001).

However, the impact on yield is not so marked (Fig. 4). 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 outweighs any differences attributable to NVS, making it difficult to demonstrate a statistically significant effect. As mentioned above, while farmers report a clear effect of NVS on soil erosion and terracing, they are less clear about the 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. 5). 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.

4. 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) persuaded 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), meaning that farmers with sufficient land were able to offset the early loss of output due to

NVS by increasing the gross area in production. In effect, they were converting fallow-land rather than cultivated land into NVS, thereby minimising the opportunity cost of NVS.

Finally, adoption of NVS was seen as a first step in a process of farm development, culminating in the establishment of increased areas under tree crops. This occurred both within the cultivated field (NVS enrichment) and on steeper, fallowed land.

5. Conclusion

The case study thus shows that, with good on-ground technical support from skilled and committed facilitators, 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. Even though the NVS technology did not provide early benefits, hence was not privately profitable when viewed in isolation, many farmers were persuaded to adopt in order to reduce soil erosion and provide the basis for a transition to a more diversified and profitable farming system incorporating agroforestry.

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References

Arcenas, A., 2002. Farmer-Led Soil Conservation Initiative in a Developing Country Setting: The Case of the Claveria Land Care Association in Claveria, Misamis Oriental, Philippines. PhD dissertation, Michigan State University.

Campbell, A., 1994. *Landcare: Communities Shaping the Land and the Future.* Sydney: Allen and Unwin.

Cary, J., and Webb, T., 2000. *Community Landcare, the National Landcare Program and the Landcare Movement: The Social Dimensions of Landcare.* Canberra: Bureau of Rural Sciences.

Catacutan, D., 2005. Scaling Up Landcare in the Philippines: Issues, Methods and Strategies. PhD thesis, University of Queensland.

Coxhead, I., and Buenavista, G., 2001. Seeking sustainability. In Coxhead, I., and Buenavista, G., eds. *Seeking Sustainability: Challenges of Agricultural Development and Environmental Management in a Philippine Watershed.* Los Banos: PCARRD, pp. 1-30.

Cramb, R.A. 1998. Environment and development in the Philippine uplands: the problem of agricultural land degradation. *Asian Studies Review* 22: 289-308.

Cramb, R.A., ed., 2000. *Soil Conservation Technologies for Smallholder Farming Systems in the Philippine Uplands: A Socio-economic Evaluation*. ACIAR Monograph No. 78. Canberra: Australian Centre for International Agricultural Research.

Cramb, R.A., 2005. Social capital and soil conservation: evidence from the Philippines. *Australian Journal of Agricultural and Resource Economics* 49: 211-226.

Cramb, R.A., and Nelson, R.A., 1998. Investigating constraints to the adoption of recommended soil conservation technology in the Philippines. In Penning de Vries, F., Agus, F. and Kerr, J., eds. *Soil Erosion at Multiple Scales: Principles and Methods for Assessing Causes and Impacts*. Wallingford: CAB International, pp. 99-120.

Cramb, R.A., Garcia, J.N.M., Gerrits, R.V., and Saguiguit, G.C., 2000. Conservation farming projects in the Philippine uplands: rhetoric and reality. *World Development* 28: 911-928.

Cramb, R.A. and Culasero, Z., 2003. Landcare and livelihoods: the promotion and adoption of conservation farming systems in the Philippine uplands. *International Journal of Agricultural Sustainability* 1: 141-154.

Cramb, R.A., Culasero, Z., and Catacutan, D. 2003. *Landcare in Bukidnon,* ACIAR Landcare Project, Evaluation Report No. 2. Brisbane: University of Queensland.

Fujisaka, S. 1993. A case of farmer adaptation and adoption of contour hedgerows for soil conservation. *Experimental Agriculture* 29: 97-105.

Lockie, S., and Vanclay, F., eds., 1997. *Critical Landcare*. Wagga Wagga: Centre for Rural Social Research, Charles Sturt University.

Mariano, K., 2005. Bioeconomic modelling of the adoption of a contour farming practice in the Philippine uplands. MNatResEcon thesis, University of Queensland.

Mercado, A.R., Patindol, M., and Garrity, D.P., 2001. The Landcare experience in the Philippines: technical and institutional innovations for conservation farming. *Development in Practice* 11: 495-508.

Midmore, D.J., Nissen, T.M., and Poudel, D.D., 2001. Making a living out of agriculture: some reflections on vegetable production systems in the Manupali watershed. In Coxhead, I., and Buenavista, G., eds. *Seeking Sustainability: Challenges of Agricultural Development and Environmental Management in a Philippine Watershed.* Los Banos: PCARRD, pp. 94-111.

Nelson, R.A. 1996. Bioeconomic Analysis of Hedgerow Intercropping in the Philippine Uplands. PhD thesis. University of Queensland.

Nelson, R.A. and Cramb, R.A. 1998. Economic incentives for farmers in the Philippine uplands to adopt hedgerow intercropping. *Journal of Environmental Management* 54: 83-100.

Nelson, R.A., Cramb, R.A., Menz, K., Mamicpic, M. 1998. Gliricidia, napier and natural vegetation hedgerows. In Menz, K., Magcale-Macandog, D., and Rusastra, I.W., eds. *Improving Smallholder Farmikng Systems in Imperata Areas of Southeast Asia: Alternatives to Shifting Cultivation.* ACIAR Monograph No. 52. Canberra: Australian Centre for International Agricultural Research, pp. 95-112.

Paunlagui, M.M., and Suminguit, VG., 2001. Demographic development of Lantapan. In Coxhead, I., and Buenavista, G., eds. *Seeking Sustainability: Challenges of Agricultural Development and Environmental Management in a Philippine Watershed.* Los Banos: PCARRD, pp. 69-93.

Poudel, D.D., Midmore, D.J., and West, L.T., 2000. Farmer participatory research to minimize soil erosion on steepland vegetable systems in the Philippines. *Agriculture, Ecosystems & Environment* 79:113-127.

Stark, M., 2000. *Soil Management Strategies to Sustain Continuous Crop Production between Vegetative Contour Strips on Humid Tropical Hillsides.* Bogor: Southeast Asia Regional Research Program, International Centre for Research in Agroforestry,

Young, A., Menz, K., Muraya, P., and Smith, C., 1998. *SCUAF Version 4: A Model to Estimate Soil Changes under Agriculture, Agroforestry and Forestry.* ACIAR Technical Report No. 41. Canberra: Australian Centre for International Agricultural Research.

Table 1 Logistic regression of adoption of contour barriers, Sungco (n=104)[a]

Variable	Coefficient	Standard error	Odds ratio
Constant	– 7.765**	2.266	0.000
Age 20-29	1.449	1.179	4.258
Age 30-39	2.032**	1.038	7.632
Age 40-49	1.389	0.917	4.010
Age 50-59	1.717	1.089	5.567
Education	0.080	0.095	1.084
Indigenous	– 0.313	0.617	0.731
Full-time farmer	1.442**	0.632	4.228
Land owner	0.650	0.774	1.084
Farm size	0.263*	0.137	1.301
Location	0.582	0.431	1.789
Slope	2.131***	0.639	8.423
Landcare participation	0.977***	0.331	2.658
Model chi-squared		50.014***	
Nagelkerke R^2		0.516	
H-L chi-squared		5.758	
% correct		79.8	

[a] Estimated with Statistical Package for the Social Sciences Version 11.5
* significant at 0.10 level; ** significant at 0.05 level; *** significant at 0.01 level.

Fig. 1 Adoption of contour barriers in Lantapan, 1990-2002

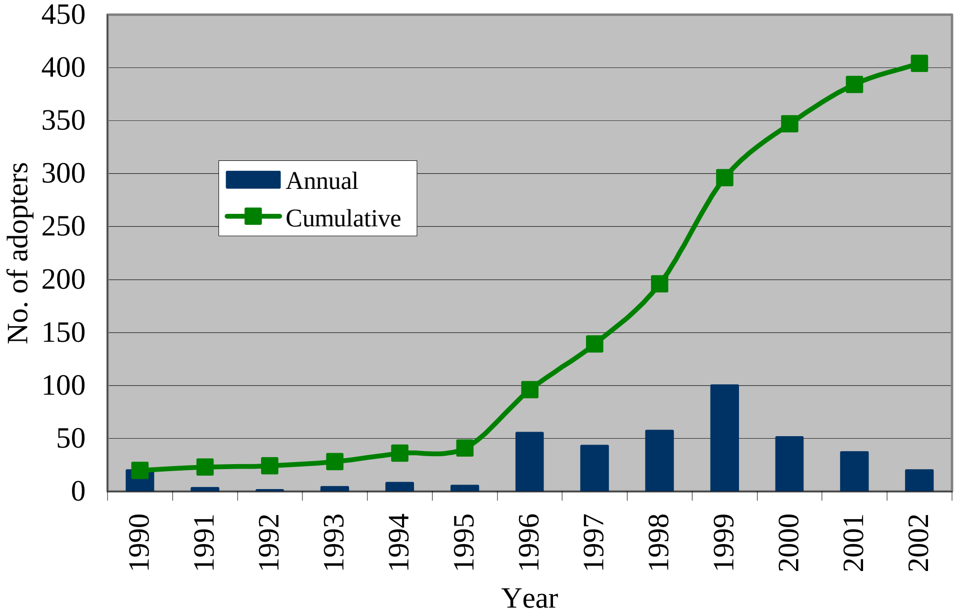

Fig. 2 Adoption of tree planting on farms in Lantapan, 1990-2002

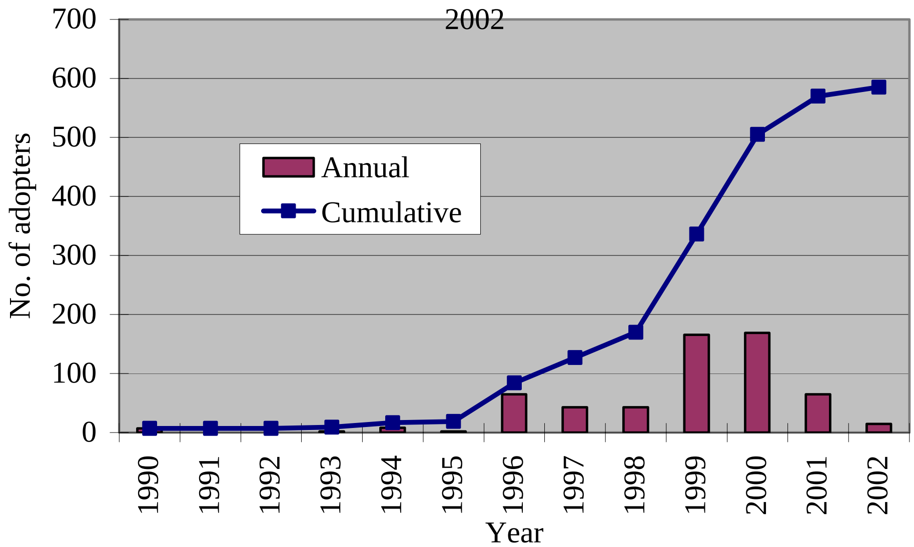

Fig. 3 SCUAF Simulation of Effect of NVS on Annual Soil Erosion

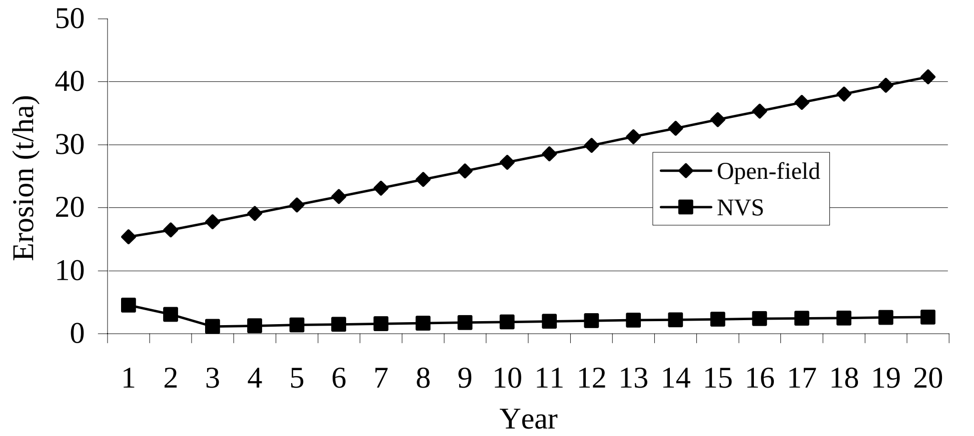

Fig. 4 SCUAF Simulation of Impact of NVS on Annual Maize Yield

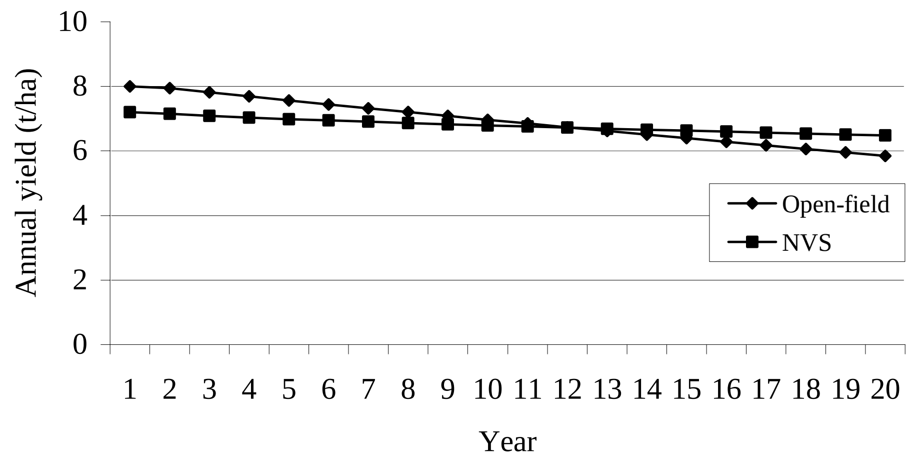

Fig. 5 SCUAF Simulation of Impact of NVS on Annual Net Return from Maize