

Enhancing Adoption of Soil Conservation Practices Through Technical and Institutional Innovations: NVS and Landcare¹

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Abstract

Sloping uplands in Southeast Asia are the most diverse, extensive, and fragile ecosystems. The development and dissemination of sustainable soil conservation technologies in these ecosystems is a formidable task.

ICRAF's research in sloping uplands in Mindanao and Visayas found that natural vegetative strips (NVS) is a farmer-led technical innovation based on contour farming that has provided a simple, low-cost solution to soil erosion. NVS unwraps the SALT package, is adaptable to the range of farmers' land use choices and often used as a starting point towards more productive agroforestry systems. Rapid adoption of NVS by farmers was achieved through the Landcare approach.

Landcare is based on partnership of Landcare groups (farmers), local government units (LGU's) and technical service providers and facilitators (ICRAF). As an extension approach for rapid and inexpensive diffusion of conservation farming, agroforestry practices and other natural resource management systems, it consists of appropriate technologies, community institution development, and partnership building. While the most practical benefit of the Landcare approach was the rapid adoption of soil conservation and agroforestry practices, the development of human and social capital is considered its most important impact. Successful adoption of soil conservation technologies for economic and environmental benefits thus depend on a proven set of flexible technologies and a parallel, farmer-led institutional innovation for education and support.

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1. Introduction

Sloping uplands in Southeast Asia are not only the most diverse, fragile and threatened ecosystems, but also the most geographically extensive. Garrity and Sajise (1992) estimate that sloping uplands cover 60% to 90% of the total land areas of each of the countries of the region. A major environmental hazard associated with agricultural production in these ecosystems is soil erosion. Rapid population growth and economic needs push farmers to cultivate steeper and more fragile lands, resulting in an annual loss of 50 to 200 tons of topsoil (Garrity, 1995). As a consequence, farm productivity is reduced to 200 to 500 kilograms per hectare per year (Fujisaka et al, 1995), and income levels of farm households fall to less than 50% of the poverty threshold level (Mercado et al, 2000). Soil erosion is found to be much more serious in Southeast Asia than in any other region of the world, with its river systems carrying 10 times more sediments than any other river system, reducing the service life of infrastructures, destroying marine resources, and reducing the quality of water supplies for domestic- and agricultural use (Milliman and Meade, 1988). These sediments undergo anaerobic decomposition that contributes to emissions of methane (CH₄), a greenhouse gas 23 times more potent than carbon dioxide over a 100- year time horizon (IPCC WG1, 2001).

The development and dissemination of sustainable soil conservation technologies for upland smallholder farming systems is a formidable task. Farmers who might use them generally have little investment capital and essentially have short investment horizons. Markets are often times inaccessible; transportation service is difficult and research and extension efforts are usually insufficient (Garrity, 1999). Successful natural resource management in these fragile lands rests on three fundamental pillars: i) upland technologies appropriate to resource-poor farmers; ii) strong community institutions, and; iii) proactive government support. Appropriate technologies enable upland farmers to sustain food production on sloping lands, and help them in their gradual evolution towards tree-crop and/or livestock-based systems that provide better income and maintain environmental services. Proactive and dynamic community institutions support effective participation of the rural population in taking decisions that impinge upon their livelihoods. Local government institutions can provide financial, technical, facilitation and policy support required for effective natural resource management.

In this paper, we relate ICRAF's experience in the development of technical and institutional innovations to address land degradation problems of resource-poor farmers in northern and central Mindanao and Visayas, describing our work on enhancing adoption of conservation farming and agroforestry practices through the Landcare approach for sustainable agriculture and natural resource management.

2. Farmer-led technological innovation for soil conservation: Natural vegetative strips (NVS)

Soil conservation technologies have been widely introduced to farmers in the sloping uplands of the Philippines. These included mechanical methods such as terrace construction, to biological erosion control using planted multipurpose tree and grass

hedgerows (Garrity, 1999). Among the vegetative measures, contour hedgerow intercropping with leguminous trees has been widely promoted by government agencies and non-government organizations (NGO's) and became the focus of research and extension programs for sustainable agriculture on sloping lands (Nelson et al, 1998). In the Philippines, this has become synonymous with the Sloping Agricultural Land Technology (SALT). ICRAF has been involved in participatory on-farm research on contour hedgerow technologies in Claveria, Northern Mindanao for the past decade, assessing the management strategies to address key technical constraints of this system. We found that despite numerous reports of the positive effects of contour hedgerow intercropping on soil loss and yield levels of annual crops, adoption of this system by farmers was not widespread. We identified the drawbacks to the use of this system as follows (Mercado et al, 2001):

- High labour requirements to establish and maintain hedgerow;
- Limited improvement of farm income;
- Unanticipated problems in soil fertility because of competition of hedgerow species with annual crops for nutrients, particularly in phosphorus-deficient soils;
- Irregular width of alleys which makes inter-row tillage using animal traction difficult;
- Reduction in area available for cultivation because of hedgerow spacing, poor species adaptation, and lack of suitable planting materials, and
- Insecure land tenure.

However, we found that the concept of contour hedgerows was popular among the farmers. In the late 1980's to the early 1990's, independent from formal research on hedgerow intercropping with leguminous trees and fodder grasses, farmers started to modify the introduced contour hedgerow technology to minimize labor inputs and reduce competition between crop and vigorous hedgerow grass and trees. They started to lay out contour lines in their field and leave these unplowed during land preparation to let natural vegetation grow, without planting trees or fodder grasses (Fujisaka, 1993). Other farmers tested the concept by placing crop residues in lines on the contour to form 'trash bunds', which rapidly vegetated with native grasses and weeds and soon formed stable hedgerows with natural front-facing terraces (Figure 1). Our research found this farmer adaptive strategy to be simple, low-cost, and effective in controlling soil erosion. Several hundred farmers in Claveria established these natural vegetative strips (NVS) on their sloping fields without outside extension efforts. It soon became the preferred soil conservation technology in the area for the following reasons (Stark and Itumay, 2002):

- NVS require minimal labor and zero cash inputs in establishment and maintenance;
- NVS are very effective in reducing soil loss. The research we have been conducting in Claveria since 1995 has shown that narrow strips of natural vegetation reduce sediment loss from cultivated hillsides of 25% to 45% slope by up to 95%;
- NVS cause minimal competition on adjacent row crops, as long as they are pruned at least once before- and once during a three- to four- month cropping period;

- The technology is adaptable to the range of farmers' landuse choices and often used as a starting point towards the evolution from bare and degraded sloping land to more productive agroforestry systems, and
- The technology is also acceptable to tenant farmers since it requires very minimal investments.



Figure 1. Natural vegetative strips (NVS) technology. The topmost picture shows newly established NVS with corn planted in the alleys. Below is an NVS system showing terrace development and integration of fruit trees that are planted just above the strips.

Nelson et al (1998) modeled the long-term trends in maize yields, and found that the yield advantage of NVS increased annually to about 0.5 t ha^{-1} . The NVS system is not a new technology that developed only in Claveria. We learned that in Leyte and Bohol in the central Philippines, the NVS system is an indigenous technology that has been independently practiced by farmers without any outside intervention for at least four decades (Stark, 2000).

A limitation of NVS is that strips produce only little pruning biomass that could be applied as mulch or green manure (oven-dry mass of about $1 \text{ t ha}^{-1}\text{yr}^{-1}$). NVS do not fix and cycle nitrogen, as is attributed to hedgerows of leguminous trees. However, in the phosphorus-limiting environments of the Asian uplands, tree-based hedgerows themselves were found not to be effective in cycling phosphorus in amounts sufficient to meet crop demand (Garrity, 1999). The NVS system thus depends on external nutrient inputs to maintain crop yield on the cultivated alleys.

Another observation is the so-called “scouring effect”- the development of a fertility gradient caused by the redistribution of topsoil and nutrients from the upper zones of each alley down to the lower parts (i.e., erosion of sediments caused by runoff water and plowing in the upper zone and deposition within or above buffer strips). The process was studied in Northern Mindanao and strategies were identified to minimize its effect, including application of more mineral fertilizer, lime or plant residues on the degraded upper alley zones (Stark, 2000), and reducing the number of land cultivations on the alleys (Thapa, 1997). Increasing the vertical interval between NVS from 1 to 1.5 m (usual recommended distance) to 2 to 4 m was also recommended (Mercado, 1999) to strikeout a balance between the need for the farmer to reduce soil loss one side, and the need to minimize crop area loss, on the other. Most farmers also believed that the positive effects of increased overall yield from contoured field and the increase in the value of land due to contouring outweighed the negative effects of depression in yield in upper zones in the alleys and crop area loss, and compensated for the labor invested for installing and maintaining the NVS (Stark, 2000).

ICRAF’s research to validate and refine low-cost natural vegetative strips on degraded calcareous hillsides complemented our findings on the performance of this system on deep acidic soils in Mindanao. On-farm trials on NVS conducted in Leyte indicate that the technology is as least as effective in reducing soil loss from cultivated slopes in shallow calcareous soil environments as under deep acidic soil conditions (Figure 2). Even hillsides with slopes up to 60% can be successfully stabilized. At the highest NVS density (1-m vertical interval), soil loss was reduced by more than 80%. Rapid terracing of contoured slopes was observed and is attributed to soil movement during land preparation. Improvements in crop yield (maize), especially in treatments with the highest NVS density compensated for the 20% loss of crop area to the vegetative strips.

Farmers also observed the scouring effect and recognized that the effect may not be overcome in the short run, but did not consider this a problem. However the shallowness of the soil in this environment has resulted in the exposure of rocks on the upper zones of cultivated alleys, which calls for narrower alley spacing and reduced tillage to minimize soil movement (Stark and Itumay, 2002).

The trials also indicate that installation of NVS may not be sufficient to raise soil fertility and crop yield levels since they produce only a small amount of biomass. Complementary practices are needed to enhance soil fertility on cultivated slopes under the low-external input conditions typical for most of the Central Philippine uplands. ICRAF has encouraged farmers to make use of buffer strips by planting forages, trees or other crop perennials on the NVS (Figure 1). Work started on identifying measures to further improve soil fertility on the cultivated alleys. The intercropping of maize with leguminous crops - a strategy based on local practice - is one option tested to maintain and improve soil fertility. While this technical option requires further observation and promotion, other practices should be explored, such as improved fallows and minimum tillage (Stark et al, 2003).

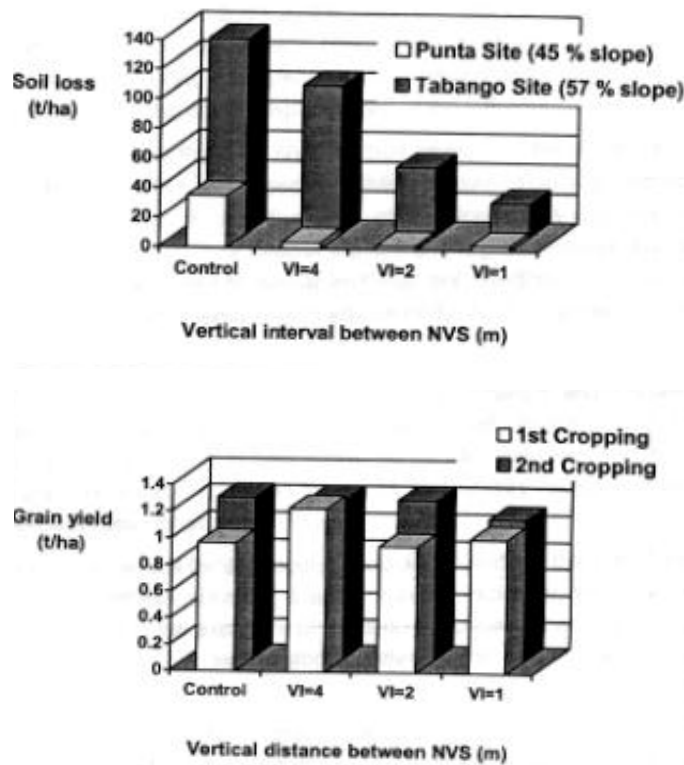


Figure 2. Effect of NVS on soil loss and grain yield at different vertical intervals (source: Stark and Itumay, 2002).

A deeper understanding of the low-cost NVS practice and its combination with valuable trees in agroforestry systems will provide the necessary scientific base that will allow its wide-scale dissemination for meeting the economic needs of resource-poor farmers as well as larger environmental concerns. The findings derived from research on deep acidic soils in Northern Mindanao and shallow calcareous soil in central Visayas will support extrapolation of the NVS technology from ICRAF's

research sites to major soil environments of the Southeast Asian uplands. (Stark and Itumay, 2002).

NVS is a technical innovation that opens up possibilities for sustained farming on quite steep slopes, thus expanding the land base of food crop agriculture (Garrity, 1999). Farmers appreciate the role of NVS in controlling soil erosion, and are maximizing the benefits of NVS by planting fruit and timber trees, fodder grasses and legumes, and other cash perennials such a coffee and pineapple on or above the NVS. Working with farmers and other partners, we continue to search for means and ways to enhance the productivity and sustainability of these systems as farms and ultimately, landscapes undergo the transition to the agroforestation phase. Examples of work currently being done are examining the effects on above-and below ground interactions and tree- and crop yield of interplanting nitrogen-fixing trees with fruit trees on NVS; evaluating the performance of timber-based hedgerow intercropping involving simultaneous and sequential or fallow phases, and diversifying tree species for agroforestry and improving planting material delivery pathways.

Through these developments, farmers' initiatives has been a driving force in the whole research process, from identifying problems to disseminating technological solutions. The participatory learning process is reinforced by strengthening researcher- and farmer interaction, with focus on the identification and validation of local farmer practices This has been accompanied by institutional strengthening and capacity-building of farmer groups, as well as encouraging interaction with local government units (LGU's) and partner institutions. Later this participatory technology development and dissemination has come to involve all sectors concerned about rural upland development: farmers, researchers, extensionists, LGU's, and other institutions, eventually giving rise to what is now known as the Landcare approach to sustainable natural resources management.

3. The Landcare approach: Institutional innovation for sustainable natural resource management

Landcare can be viewed both as a development approach and a community-led movement. Operationally, Landcare can be looked at as an extension approach for rapid and inexpensive diffusion of conservation farming, agroforestry practices and other natural resource management systems among upland farmers, based on their innate interest in learning and sharing knowledge about new technologies that provide higher farm incomes and environmental benefits (Garrity and Mercado, 1998; Mercado et al, 2000). It also refers to a group of people who are concerned about land degradation problems and interested in working together to do something positive for the long-term health of the land.

Landcare is seen as a partnership in triad composed of grassroots Landcare groups, local government units (LGU) and technical service providers (NGO's, Government line agencies/NGA's) and facilitators (ICRAF) (Figure 3). The success of Landcare as an approach is dependent on how these three key actors interact and work together. The grassroots approach is now recognized as a key to success in all community development endeavors. Groups respond to issues that affect them and are more

likely committed to find and implement solutions on their own ways, than those imposed by external agencies. It is about people and the key to success is based on a mature social capital and a close bond among these partners.

There are three interrelated and interdependent elements or facets in the Landcare approach. These are *appropriate technologies*, *community institution development*, and *partnership building*. Each element or facet has its tools or techniques to enhance the impacts of that particular element.

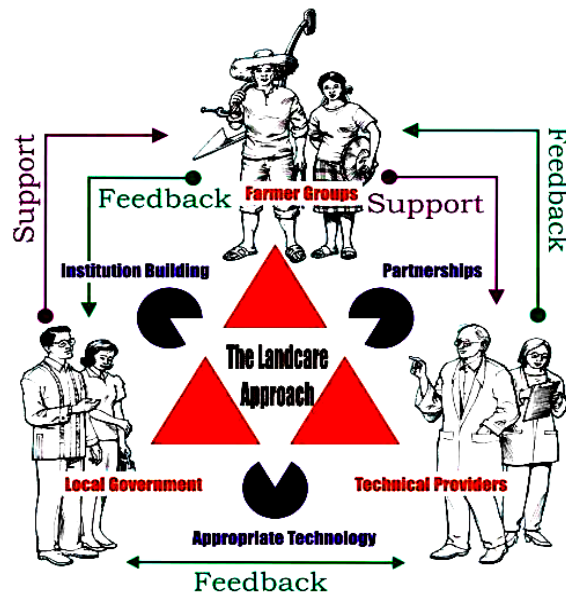


Figure 3. The interdependence of the different stakeholders in a triad doing respective complementing roles in the Landcare approach.

Element 1: Appropriate technology dissemination, adoption and adaptation

In the complex, diverse and risk-prone upland environments, appropriate farming technologies are those that can be easily *adapted* by resource-poor farmers to specific bio-physical and socio-economic contexts, and are also easily *adopted*, i.e., profitable, technically feasible, and agreeable with farmers’ values and farmers’ valuation of benefits (Franzel et al., 2002). Evaluations of upland projects in the Philippines based on the SALT system found that limited adoption was partly due to the attributes of the technology package, and partly due to social- economic and institutional constraints in the environments in which it has been promoted (Cramb, 2000).

In promoting conservation farming and agroforestry practices in the uplands of northern Mindanao we learned that stepwise technology dissemination was more effective than introducing complex technology packages. Technologies must be simple and testable, anchored on fundamental conservation principles (e.g., contour farming) and should provide opportunities for innovation or adaptation based on

farmers' biophysical and socio-economic resources. We found that blanket technology recommendation was not appropriate as appropriate technologies are generally site-specific. Technologies should also be profitable and low-risk, and must have short- and long-term impacts. Farmers should be involved in technology generation, verification or adaptation, up to dissemination and role-modeling. The formation of more technological learning sites and knowledge-sharing venues and opportunities should be encouraged. However, project-funded or supported model farms should be avoided for they will tend to create an impression among would-be adopters that the technologies promoted cannot be adopted or extended without external subsidies or support. Appropriate model farms are those that evolve from farmers' adoption and adaptation of technologies based on their own resources. External facilitation is needed to provide technical backstopping and link farmers to information and other resources and networks.

The adoption of contour farming is enhanced with NVS technology because it unwraps the SALT package, allowing farmers to adopt individual components in a flexible, step-wise process and enabling them to pursue alternative adoption pathways (Catacutan and Cramb, 2004). Since 1996, more than 6,000 farmers have now adopted the NVS practice on their farms in the upper watershed areas in many parts of Mindanao and Visayas.

Planting fruit and timber trees, fodder grasses and other cash perennials on or just above the NVS enhances the productive, protective and aesthetic functions of farm lands, and interests in planting trees among farmers became widespread. We facilitated technical backstopping to Landcare groups who would like to establish nurseries for fruits and timber trees. Later on, Landcare groups have also been involved in an extraordinary range of on-farm and off-farm community activities, including farmer cross-visits, farmer field schools, group work programs, public land rehabilitation, Waterwatch type programs, schemes for sharing plants and propagating materials, animal dispersal program and Landcare festival, fund raising, micro-savings mobilization, local competition, and participatory monitoring and evaluation (PME).

To enhance these adoption and adaptation of the different conservation farming and agroforestry practices and community and domestic activities, a number of tools or techniques were employed, such as information, education and communication (IEC), cross-farm visits, farmer-to-farmer knowledge sharing among Landcare groups, and implementing a conservation team approach in new sites.

Element 2: Community institution building

ICRAF became involved in participatory development and dissemination of soil conservation measures in 1993 in Claveria, where evaluation of contour tree hedgerow systems and continuous monitoring and documentation re-directed research focus on buffer strips consisting of natural vegetation. As more farmers became aware of on-going researches, an increasing number of people approached ICRAF with requests for training on soil conservation technologies. In response, ICRAF, together with the municipal government formed a Contour Hedgerow Team (CHET) in 1996,

composed of a trained farmer, a DA technician and an ICRAF staff member. The team provided orientation and hands-on training to individuals and farmer groups. The farmers' response was enthusiastic, that by the end of the first group training, participants (farmers from seven villages where CHET was working) founded a farmer association, with the goal of uniting themselves in efforts to improve and sustain upland farming and make more productive use of natural resources. The members named the organization the Claveria Landcare Association or CLCA (Stark, 2000). The CLCA proceeded to set up Landcare groups in the villages to help promote NVS. The LGUs soon became involved, forming the three-way partnership between the CLCA, the LGU and ICRAF, which came to be known as the Landcare triangle. To promote adoption of soil conservation practices, information campaigns, cross-farm visits and training sessions were implemented (Catacutan and Cramb, 2004). The Landcare members use the organization as a mechanism for learning and sharing information and scaling-up conservation practices. CLCA has also become a venue for addressing issues and solving problems that farmers encounter. It became the arena for articulating needs and mobilizing resources from the local government and other support agencies. The farmers now occupy a "driver's seat", steering the wheel of extension and learning according to their desired direction.

In Claveria, more than 5,000 farming families are involved and have successfully extended conservation farming technologies to more than 2,000 farmers. They have also established more than 300 communal and individual tree nurseries (Mercado et.al., 2000). Hundreds of thousands of fruit and timber tree seedlings were planted on NVS, on farm boundaries, on the buffer zone of protected areas, and on riparian areas.

The initial success of the Landcare approach raised the possibility of scaling up to other Philippine sites. With additional funding from the Australian Centre for International Agricultural Research (ACIAR) and the Spanish Agency for International Cooperation (AECI), Landcare was scaled up in the southern and central Philippines, with currently about 10,000 farmers and 15 partner institutions involved (Catacutan and Cramb, 2004). Today, there are more than 600 Landcare groups in Mindanao and Visayas, Philippines.

Most of these Landcare groups are organized as sub-chapters at the *sitio* or *purok* level (a community of 20 - 30 households). This small groups-formation draws more participation as the organization is decentralized down to the level where farmers can frequently meet and discuss farming issues and ideas that promote camaraderie and knowledge-sharing, enhancing knowledge, awareness, skills and appreciation (KASA), thus building human and social capital in the process. Each Landcare group is self-governing, with its own set of officers. These officers initiate and provide leadership in the different Landcare activities. The groups plan and implement their activities, enabling leadership development and participation in the efforts towards sustainable agriculture and natural resource management. Landcare subchapters are federated into chapters at the village (*barangay*) level, each chapter consisting of 8-12 *sitio*-level Landcare groups. Similarly, the chapters are federated at the municipal level. This creates the information machinery to bring up issues from the household to the municipal level and vice versa. This innovative organizational set-up provides vertical and horizontal information mechanisms for dissemination, sharing and learning (Figure 4). Landcare in Leyte and Bohol started with groups of farmers

already organized by other NGO's, such a PROCESS BANGON and Community-Based Resource Management project (CBRMP). Such organizations do not bear the name "Landcare", but they adapt and mainstream the approach into their plans, programs, in partnerships with LGU's and other agencies.

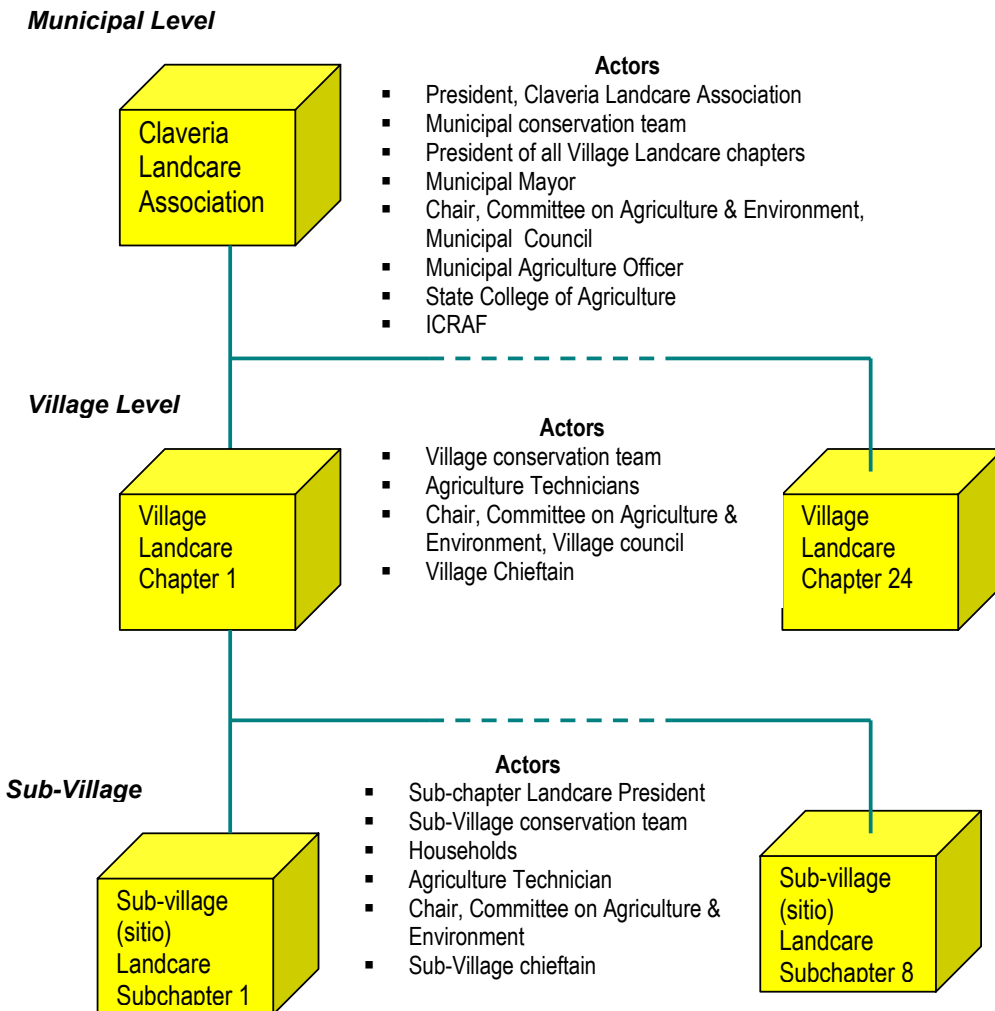


Figure 4. Innovative organizational structure of Landcare association in Claveria which encourages participation at all levels.

Across sites, more than 300 tree nurseries have been established by Landcare groups or individual Landcare members, contributing hundreds of thousands of fruit- and timber tree seedlings into the rural landscape. These did not only have positive impacts on land degradation but also allowed farming households to diversify their cropping systems and in some cases improve incomes. Although the impact of this on

reducing long-term rural poverty remains unclear, the change in outlook of many Landcare members and the mobilization of shared community action on a range of livelihood issues both offer some optimism for greater impact in the future.

The following approaches and activities were implemented in building an active and coherent organization for technology dissemination and adoption:

- Small groups - formation (*sitio*-based groups)
- Promotion and support of networks for broader knowledge-sharing (federation at the *barangay* and municipal level)
- Facilitation of Landcare groups in order to have a clear objective, direction and understanding of their problems
- Promotion of collective planning and action in activities such as communal nursery, exchange labor, fund raising, savings mobilization, emergency funds, etc in order to build human and social capital along the process.
- Training on organizational development and strengthening, e.g. leadership skills, and team building.
- Promoting transparent leadership and fiscal management
- Livelihood projects and roll-over schemes, e.g. animal and seed dispersal, apiculture, and cut flowers
- Participatory monitoring and evaluation (PME) to monitor progress and assess issues and concerns.

Element 3: Partnership building - the triadic approach

The collaboration among actors of the Landcare triad emanated from performing their respective non-duplicating, but complementary roles (Figure 3). The Landcare group's role was primarily the adoption or adaptation of technologies being promoted to address land degradation and achieve sustainable agriculture and natural resource management. LGU's can provide crucial political and sustained financial support to Landcare Associations. The municipality can be encouraged to develop a formal natural resource management plan which can help guide the allocation of environmental funds. Barangays can allocate financial resources from their regular internal revenue allotment (IRA) through the Human Ecological Security (HES) program, which represents one-fifth or 20% of the total development funds. These funds can be used to organise the conservation teams and assist Landcare Association activities and support training activities.

External donor agencies can best support Landcare development by allocating resources for leadership and human resources development, communications equipment, and transportation (for example, motorcycles) to enable the Landcare leaders to make maximum use of their time. In connection with efforts to scale up Landcare, ICRAF has established partnerships with at least 30 local, national, and international organizations, including funding agencies from 1996 to 2003 (Catacutan, 2004).

LGU's extended financial, policy, and moral support to Landcare groups generating internal responsibility and accountability to monitor and supervise the projects and activities of the latter. In turn, Landcare groups had to ensure the judicious use of

LGU contributions by making sure that soil and water conservation programs are successfully implemented. Thus, mutual expectations and obligations emerged from the interaction. The gains and shortcomings of one stakeholder became a shared indicator of performance by the other party. Furthermore, the extension and technical assistance by ICRAF and other service providers, as technologists, were also reflected in the success or failure of the Landcare groups. The relationship turns out to be a ‘triangle in a balance’ such that when one party does not perform its role, the triangle will tilt to one side. Therefore, the efforts of the three stakeholders were geared toward attaining a certain degree of balance. A balanced triangle depicted a partnership that was working harmoniously with reciprocity in actions and outcomes.

There is significant evidence that the integrated approach we implemented has created an effective linkage between development and conservation. Through the efforts of the grassroots Landcare farmer groups, local government entities, and technologists, a conservation ethic has evolved and natural resource management is now viewed as a local responsibility. The partnership provided a mechanism for convergence of ideas, shared decision-making perception of risks, and pooling of common and private resources to achieve greater impacts and more benefits to the community.

More than 45 organizations outside of the core partnership are now actively involved in the Landcare program at three sites in Mindanao (Claveria, Lantapan, Malitbog). These include predominantly local government units (LGU’s) but also national government agencies, NGO’s and private agribusiness. Although involvement is variable within and between sites, promising signs are the enactment of local ordinances, provision of funding and materials to Landcare groups, and the inclusion of Landcare into Watershed Management Plans. The formation of an umbrella Landcare association at each of the three sites, representing Landcare groups throughout the target municipalities, has been influential in organizing training and other farmer capacity building exercises, and accessing resources from external support organizations. There appears to be significant opportunity for these farmer groups to assume greater responsibility for future farmer training and for development of specialized farmer-led business opportunities to tackle broader rural poverty issues.

Some approaches involved in partnership building included:

- Landcare groups lobbied for support from service providers such as line agencies (DAR, DENR, etc), local government units (LGU’s), academe and research institutions (ICRAF, MOSCAT), etc.
- The Landcare approach was integrated in the development plans of *barangays* and municipal governments, because Landcare members became a sectoral member of the municipal development council.
- Clarification of roles and responsibilities of farmers, LGUs and other organizations with regards to natural resources management and development.
- Involvement of service providers and policy makers in Landcare groups’ meetings and planning sessions
- Promotion of local achievement competition (*paligsahan sa barangay*) at the village level

4. Impacts and Scaling -up

The most practical benefit of the Landcare approach was the rapid adoption of soil conservation and agroforestry practices (Catacutan, 2004).

- Total number of NVS and agroforestry adopters (conservation farming technologies) in study sites in Mindanao and Visayas estimated at more than 8,000, representing approximately more than 3,000 has of cropped areas applied with conservation technologies (Table 1)
- Up to 60% of farmers in the sites in Mindanao have adopted soil conservation technologies on their farms. These are predominantly contour farming systems such as natural vegetative strips (NVS) and agroforestry. Collectively, this represents the protection of some 15 to 25% of the total farm area at the sites, much of which was at the extreme risk of degradation.
- On average, 60% of initial NVS adopters moved to agroforestry (involving planting of timber and fruit trees and perennial crops such as banana or coffee along the NVS, on farm boundaries, and in small woodlots
- In Claveria, we experienced an exponential rate of adoption of conservation farming technologies and production of tree seedlings. About three-quarters of these adoptions were done by the Landcare member themselves at the different levels of the organization (Figure 5).
- In ICRAF sites in Leyte and Bohol, 33 to 45% of sloping areas of farmer adopters are applied with conservation farming technologies, mainly NVS (83% to 91%), the rest with enriched NVS and rock walls.

However, we consider the improvement of human and social capital as the most important impact of Landcare- the change in the attitudes of farmers, policymakers, local government units, and landowners towards sustainable management of the land. There are now farmers who voluntarily share their time and efforts, and policymakers who urge farmers to adopt conservation farming practices, and support these efforts by allocating local government funds and enacting local ordinances to provide incentives. Parents, school teachers, out-of-school youths, church leaders are now advocating the need for conservation farming and natural resources management.

These are the important success indicators of the Landcare approach that enable local people to conceive, initiate and implement plans and programs that will lead to the adoption of profitable and resource-conserving technologies such as conservation farming and agroforestry practices. We thus see Landcare as an approach that provides a vehicle for interested farmers to learn, adopt and share knowledge about new resource-conserving and profitable technologies; a forum for the community to address issues relevant to their lives; a mechanism for local government to support, and a network for ensuring that ideas and initiatives are shared and disseminated.

The new *Philippines Strategy for Improved Watershed Resources Management* of the Department of Environment and Natural Resources (DENR, 1998) had incorporated

the Claveria Landcare approach into its key institutional elements and operational framework. As the strategy moves into the implementation phase, this provides a good opportunity to scale-up useful Landcare principles and experiences in other parts of the Philippines. However, this scaling up process must respect and adhere to the critical, underlying elements-such as farmer voluntary action and local government partnership- that made Landcare successful in Claveria.

Being confronted with scaling-up issues in different sites provided us the challenge to test new approaches and modalities for scaling-up Landcare. The Landcare program was implemented in different municipalities in Mindanao and Visayas through varying levels of technical and institutional support depending on the mode of scaling-up and the resources available to the actors involved, i.e., ICRAF, LGU's, government line agencies, NGO's. Modes of scaling -up include:

- a) Scaling up through the local development planning process. In this modality, LGUs are engaged in their local development planning process, resulting in the institutionalization of Landcare at the planning stage. Eventually, Landcare becomes embedded in the natural resource management and development plan (NRMDP) of the municipality.
- b) Scaling up through “integration” within the extension program of local government units (MAO) and line agencies (DA, DENR, DAR). This integrates Landcare concepts, contents and processes into the agencies' extension programs, providing human and financial resources.
- c) Scaling up through the local development planning process and integration in existing local programs. This requires consistent interaction with local champions and engagement in the LGUs' development planning process. Simply put, this modality is a marriage of the first two modes cited above.
- d) Scaling up through integration of Landcare into the programs implemented by government-line agencies and special local warm bodies at the provincial level. This mode requires a review of the different line- agencies and special warm bodies operating within a provincial scale and involves an understanding of their mandated programs and identifying committed local champions who can mobilize programs on a provincial scale. We realized that the best we can do is to try to enhance the awareness level of these agencies of the things we are doing.
- e) Scaling-up through networking, collaboration and integration in existing special projects implemented by both public and private sectors (*for provincial, regional to national levels*). This mode requires networking and engagement with provincial, regional or national warm bodies such as the following: Provincial and Regional Development Councils, Watershed Management Councils, Coalitions and Non-government Organizations which are by nature, composed of multi-sectoral groups and NGO's.

Table 1. Rate and extent of technology adoption of NVS and other conservation technologies (modified from Catacutan, 2004).

Sites	Period Covered (years)	Total cropped area ^a (ha)	Total cropped area applied with conservation technologies (ha) ^b	Per cent to cropped area	Total number of farming Households ^c	Total number of adopters	Per cent to farming households	Average rate of technology adoption per year	Per cent of total adoption per year
Claveria	7	16,543	1,820	11	6,233	1,656	27	236	14
Lantapan	4	10,797	1,229	11	5,550	712	13	178	25
Malitbog	5	4,983	390	8	3,274	504	15	100	20
Manolo Fortich	1	14,566	9 ^d	.06	3,872	100	3	-	-
South-Central Mindanao	2	No available data	No available data	-	35,355	3,641	10	1,820	50
Visayas (Leyte and Bohol)	2	No available data	1,176	-	No available data	1,493 ^e	-	-	-

^a Potential cropped area to be applied with conservation technologies.

^b Conservation technologies in this case are in the form of NVS and various agroforestry practices.

^c Potential adopters

^d Assuming that 9,000 trees were planted on farms with a density of 1000 trees/hectares.

^e includes adopters from CBRMP sites (where ICRAF mainly contributed technical backstopping through provision of trainings)

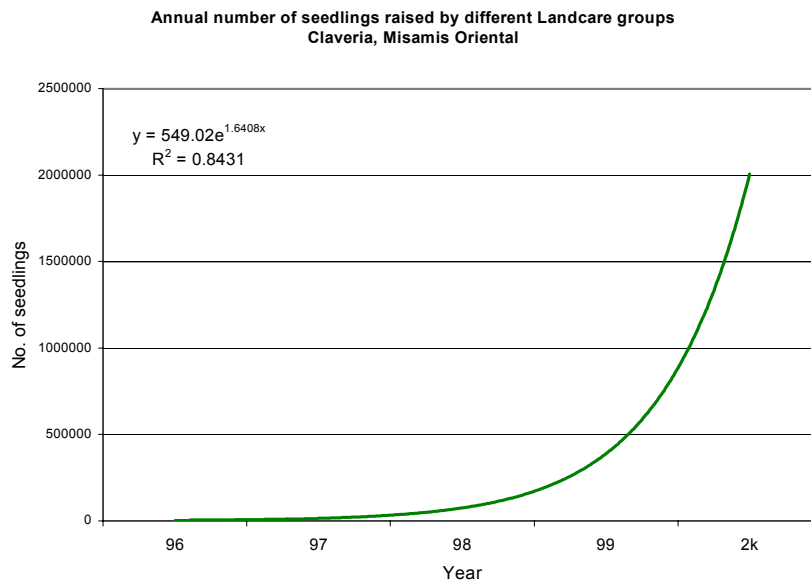
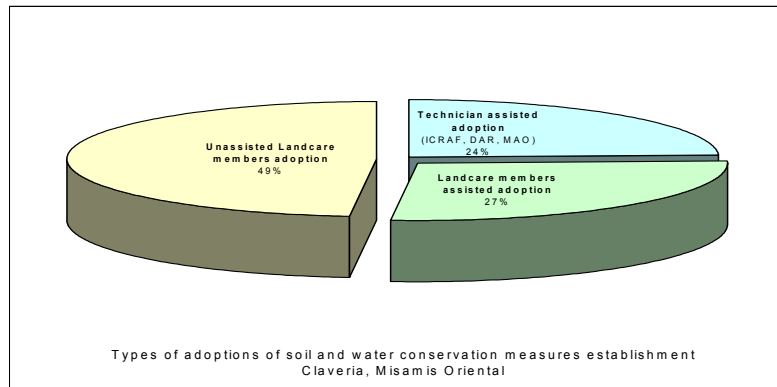
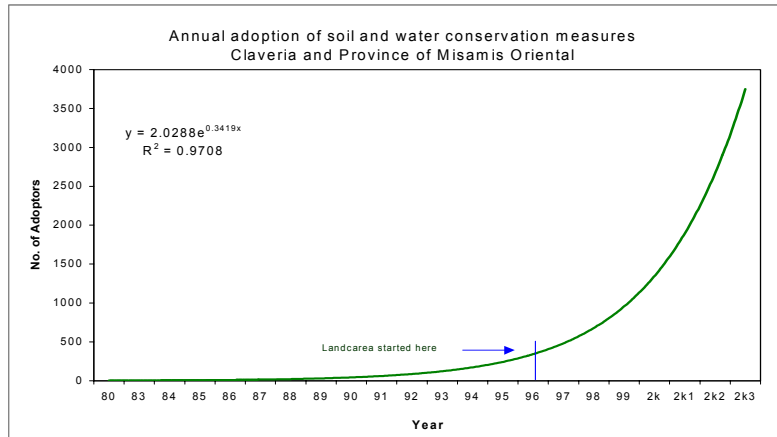


Figure 5. Various impacts of Landcare on adoption of conservation farming and production of fruit and timber tree seedlings, Claveria, Misamis Oriental, Philippines

An analysis of scaling-up activities of the Landcare approach was conducted by Catacutan and Cramb (2004) focusing on sites (Claveria, Misamis Oriental, and Lantapan and Manolo Fortich, Bukidnon) which typify the essential features of Philippine uplands, and had experienced a Landcare program but with progressively reduced technical and institutional input from ICRAF and differential support from local government (Table 2). Among the salient findings of their study was that technical merits of NVS were a major advantage in the scaling-up process, that promoted soil conservation technologies were more easily adopted than the Landcare process itself. This suggests that a proven set of flexible technologies is a key element in promoting conservation efforts. However, rapid adoption was also attributed to the triadic partnership in Landcare. Landcare had better prospects where local politics were stable, as demonstrated in Claveria, allowing for the triadic partnership to prosper. In cases where LGU was limited, a committed and highly competent external agency was an essential ingredient, temporarily offsetting the immediate need for LGU support. Other important factors that contributed to the success of the approach were ICRAF's role as catalyst in technology development and dissemination, the active support of Landcare facilitators; and provision of effective training programs.

Table 2. Resources used in Landcare sites (modified from Catacutan, 2004).

Sites	ICRAF's Resources	LGU/Line Agency Resources
Claveria	Full staff (ICRAF's first Research Site)	Medium to high level financial and human resources
Lantapan	Full staff (ICRAF's second Research Site)	Low level financial and human resources
Malitbog	1 full time Facilitator	Low to medium level financial support; High level human resources
Manolo Fortich	1 half time Facilitator	Low level financial and human resources
South-Central Mindanao	No Facilitator	High financial, technical and institutional support

They also found that scaling –up in multiple sites was possible with progressively reduced technical and institutional input from ICRAF at differing levels of LGU support, although implementation was met with issues and challenges. Landcare could only be partially scaled up where the conditions of the original site were not fully replicated, and found likely to succeed in areas where farmers were wholly focused on farming and free from competing economic interests and the ill effects of rapid urbanization (Catacutan and Cramb, 2004). The complex socio-economic and political environments of the Philippine uplands thus provide a formidable challenge to the scaling up process.

Our analysis indicates that the following needs to be done to further release the power of the Landcare concept. The public sector and non-government sector can assist in facilitating group formation and networking among groups, enabling them to grow, developing their managerial capabilities, and enhancing their ability to capture new information from the outside world. They can also provide leadership training to farmer leaders, helping ensure the sustainability of the organizations. Cost-sharing of different activities from external sources can also be provided. For this, the use of trust funds should be emphasized, where farmer groups can compete for small grants to implement their own local Landcare projects. This has been remarkably successful in the Australian Landcare movement. We envision that the Landcare approach may be suited to other locations in the Philippines and elsewhere, providing a national focus for the sustained management of resources by farmers with local government support.

5. Conclusion

Appropriate technologies are needed to enhance the economic and environmental services provided by sloping upland areas to resource-poor farmers and downstream-users. These technologies should be simple, affordable and adaptable to the diverse conditions of upland farmers and provide them with short- and long-term benefits. Work towards the refinement and elaboration of vegetative strips (NVS) into more productive tree- and livestock agroforestry systems is continuing. We put emphasis on participatory technology development, putting the farmer at the center of the research and development continuum in identifying important issues that lead to the development of these appropriate technologies. We are beginning to exploit the opportunities that Landcare provides for enabling major innovations in the way on-farm participatory research and development are done. We see the prospect for research and development to be carried out through-, and managed by, Landcare groups. This would multiply the amount of work and the diversity of trials that can be accomplished, ensuring a more robust understanding of the performance and recommendation domain of technical innovations.

Landcare, in a broad context, is a set of practices for appropriate land management systems. It is also an ethic and a principle used to describe the judicious utilization of natural resources. It can be viewed in two ways: as a development approach and a farmer-led movement that has evolved as a parallel institutional innovation for educating and supporting farmers for sustainable conservation farming. Our experience with Landcare, from its beginnings in Claveria through current efforts to scale-up to different sites in the Philippines shows that human and social capital are a fundamental resource in creating and adopting solutions to the multitude of farming environments in the Philippines

Formation of local institutions, such as Landcare groups, is encouraged. These institutions provide the venues where local people collectively learn and improve their knowledge and skills for sustainable natural resource management. Through these institutions, people think, plan and act together to address community and natural resources management issues and problems. Landcare encourages partnership among different stakeholders in the community. Through this, local Landcare groups are able to establish links and networks to resources and service providers, such as

government line agencies, local governments units, policy makers and potential markets who can provide enabling environment, support mechanism, resources and the information that farmers need. Through these elements, Landcare can be a rapid and inexpensive way of extension of conservation farming and agroforestry technologies in the diverse upland environments.

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