TECHNICAL AND INSTITUTIONAL INNOVATIONS TO CONSERVATION FARMING AND AGROFORESTRY : COMPONENTS OF SUSTAINABLE WATERSHED MANAGEMENT[1]

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Abstract

Sustainable watershed management is one of the focal issues in the debate about sustainable rural development in the Philippine uplands, where 18 million people eke-out a living on a slope above 30%. Contour hedgerow farming with leguminous trees is viewed as an important agroforestry technology that ensures food security, alleviate poverty, and protect the environment. This paper relates our experiences in participatory approach in developing agroforestry technologies, and facilitation of institution-building for wide-spread adoption and harness support from different service providers, at the ICRAF research site in Claveria, northern Mindanao, Philippines. For several years we focused our efforts in assessing the management strategies to address key technical constraints of the contour hedgerow system. We observed that adoption by farmers is low. The reasons for this include; high labor in establishment and maintenance of the hedgerows, resource competition above and below-ground between the hedgerows and associated crops, limited value-added from the hedgerow prunings, and poor species adaptation.

We therefore refocused our efforts toward finding alternative system that will address the technical and social issues of conservation farming. We found that natural vegetative filter strips (NVS) provide simple solution to the technical and social constraints of soil conservation on sloping lands. These are buffer strips that are laid out on the contour in which the natural vegetation is allowed to grow into a thick and protective cover. NVS also provide a foundation for farmers to evolve into complex agroforestry systems with fruit and timber trees. We now see a tremendous surge of adoption of this system. Adoption has been enhanced by the Landcare approach. Landcare is a movement of farmer-led organizations supported by the local government that share knowledge about sustainable and profitable agriculture on sloping lands while conserving natural resources. As NVS evolve to complex agroforestry by planting fruit and timber trees, the role of leguminous trees as nurse trees becomes important. They may provide a favorable micro-environment and increase the availability of nitrogen in the system. But, these roles have not been sufficiently understood or quantified. Our future research aims to understand the prospective positive interactions in these more complex species combination.

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Introduction

Watershed is defined as any surface area from which rainfall is collected and drained through a common point. It is synonymous with a drainage basin or catchment area. A drainage basin, however, can involve several towns or regions and even countries. There is no definite size for a watershed as it may vary from a few hectares to several thousands of hectares. In fact, even an individual field can be considered as a watershed provided there is an independent drainage point. Watershed sizes are classified into three, namely: **micro**, **mini** and **macro** watersheds. A combination of **micro watersheds** makes a **mini watershed** which forms part of the **macro watershed** which form part of the **macro watershed** before finally discharging into the **sea or ocean.** It is a system divided into 3 components namely; upland, lowland and coastal ecosystems. Each ecosystem has its distinct functions and characteristics. The upland is the main water catchment and flow regulator. The lowland is the main distributor and water consumer, and coastal ecosystem functions as the main resource system. The linkage between these ecosystems made the watershed a hydrological unit. Thus, the watershed is a natural ecosystem and a logical unit that integrates the social and economic forces as well as the biophysical factors that have led to environmental degradation and food insecurity.

In the Philippines, about 60% of the total land area of 30-M hectares is considered uplands. More than 18 M people live in the upper watershed (>30% slope). Constrained by poverty and technology, their pursuit of arable land, food, fodder, etc. to meet their welfare needs has profound effects on the land and water resources of both upland and lowland areas. Mounting pressure on human and animal population is leading to severe environmental degradation

Major watershed problems

About 70% of the total land area of the Philippine's 30 M hectares is considered as watershed. Over 5 M hectares of these watersheds are unproductive due to environmental degradation. As of 1991, 59 watersheds were officially proclaimed. Of these, 49 or about 83% have been classified as critical. These watersheds have these major problems:

- Loss of agricultural productivity due to severe soil erosion. Soil erosion has posed a major problem to sustainable agriculture. Soil erosion has been estimated to range between 40-300 tons per hectare per year. The total nutrient loss amounting to P2,037.00 to P12,425.00, and with potential yield of 23-50 tons of grain amounting to P41,500.00 to P50,000.00. In general, yield declines 60% on average with first 5 cm of top soil lost, 65% after the loss of 10 cm and 80 percent following the loss of 20 cm (Doolette and Smyle 1990).

- Deforestation - In 1950, just over 100 million hectares of forest had been cleared, but 30 % of global land was still covered by forest, half of it tropical. By 1975, the cleared area had more than double, and the area of tropical forest had dropped from 15 to 12% of the land, and is likely to be less than 7% of the land by the end of this

century. The Philippine estimated remaining forest is about 750,000 hectares out of 30 million hectares of the total land area or just 2.5%. Most of the upper watershed have been over exploited for timber, fuel and fodder, and now many areas are no longer forested and in other areas the forests are extremely degraded that contributed to severe soil erosion.

- **Population and poverty** - the recent estimate of upland population in the Philippines is 18 M or 3.5 M households. Upland farmers are the poorest among the poor. In the Philippines, it is estimated that recent immigrants to the uplands have an average per capita income of 2,168 (1989), well below the official poverty line. (Doolette and Magrath, 1990)

- **Downstream sedimentation**. The deposition of eroded materials in reservoirs, irrigation systems, rivers systems, and coastal areas is a major problem. Milliman and Meade (1983) estimated 1.2 B tons of annual sediment discharges to the different water systems in Southeast Asia, which is much higher magnitude from comparable sized areas anywhere else in the world. It is clear that sedimentation imposes a high cost in terms of shortened investment life, maintenance requirements and reduces services of infrastructure.

- **Flooding.** Although floods are a natural feature of the lowland areas, they impose severe hardship on local population and national economies. This is due to lack of vegetative cover in the upper watershed that infiltration capacity of the soil has been impeded, thus enhancing surface runoff and flooding in low lying areas.

- **Low dry season stream flows**. A direct consequence of excessive surface runoff that contributes to flash flooding is the reduced temporary storage of water in the soil profile and ground water acquifers. Some of this stored water would normally have rejoined the surface water and contributed to stream flow in the dry season. Redcued dry season stream flow has serious consequences on downstream uses for power, irrigation and municipal supplies.

Conservation farming innovation

Conservation farming is a very important component of watershed management strategy to address the problem on soil erosion which is the most important serious environmental problem in the watershed that has significant on site and off site effects.

Contour hedgerow systems using nitrogen fixing trees have been widely viewed and promoted as important component of conservation farming on sloping farms in Southeast Asia that minimize soil erosion, restore soil fertility, and subsequently improve crop productivity. Although positive results have been observed and reported in a number of experimental and demonstration sites, farmer adoption is poor. This low adoption is associated with constraints of high labor requirements in establishing and managing

hedgerows; poor adaptation of leguminous trees in acid upland soils; unavailability of sources of planting materials; and above and below ground competition favors the hedgerows and may reduce crop yields.

The SALT (Sloping Agricultural Land Technology) technology is based on the conventional contour hedgerow or alley cropping concept. It has been husbanded for the last 2 decades to sustain crop production while maintaining the ecological integrity of the uplands. The SALT syndrome has created the impression among upland farmers that soil and water conservation are labor-intensive management system only intended for small-sized farms (<1.0 ha), absorbing family labor when off-farm employment is not feasible in densely populated rural areas. However, in the frontier areas, like most areas in the tropics, farmers do not face severe land scarcity. Soil and water conservation technology that requires intensive labor and capital (planting materials) are often ignored by the farmers because it is unsuitable to their land-labor circumstances.

ICRAF has been conducting research on contour hedgerow technologies for the past decade in Claveria. Intensive examination of many facets of contour hedgerow systems has led to the following conclusion: Hedgerow systems of leguminous trees consistently increase maize yield by 20-30%, but reasonable yield cannot be maintained without external nutrient supply (particularly P) in addition to the tree pruning. However, increased labor required in establishing and managing the tree hedgerows are not sufficiently compensated by the yield increase. Thus, marginal returns under this management are usually low. The result is that, tree hedgerow systems are usually abandoned after several years of trial.

This does not imply that farmers are not concerned about soil erosion. In fact, soil erosion was one of the top concerns among farmers in our surveys. What it implies, is that, any adaptable technology must have minimal cost to the farmers as well as to the public institutions supporting the program.

Traditionally, these farmers have been the escape- goat of non-adoption for being inept in the soil degradation that is happening right in their nose. However, most of these soil conservation technologies in the past do not consider the production objective of the farmers - that every effort should relate to a bowl of food or cash to be able to meet their basic needs for survival. In this regard, Scientists must consider that most of these farmers are marginal and resource poor and that, they do not have enough resources to be able to plan or implement labor and capital intensive conservation programs that usually involved technologies that do not provide immediate benefits.

Agroforestry or soil conservation technologies must be within the context of the socio-economic and bio-physical environments of marginal farmers. Socio-economic environment includes, among others; land, labor and capital. It considers farmers' inability to absorb or digest complex and new information about state-of-the-art conservation measures because they are generally of low literacy compared to their lowland counterparts. The bio-physical environment includes; soil, climate and vegetation. Agroforestry or soil conservation technology must consider the bio-physical context of the upland farmers to include, soil characteristics that are usually, marginally

poor and varies from site to site. The hedgerow species to be recommended should adapt to the soil's physical and chemical characteristics. Therefore, there is a strong need to develop options of upland conservation technologies that address such complexities.

This paper focuses on two issues: 1.) The elements of a low-labor and low-cost contour hedgerow system as a technical innovation to conservation farming in the uplands that can potentially evolve to complex agroforestry system; and 2.) the institutional innovation that empowers the community and the local government to think, initiate and

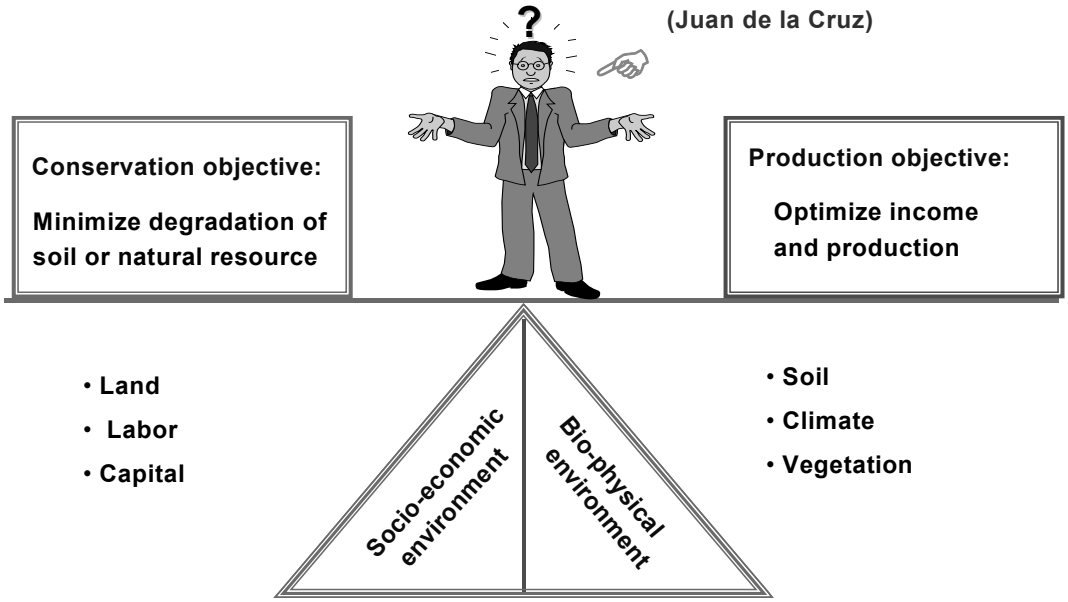

Figure 1. Balancing production and conservation objectives in the context of sustainable resource management in the uplands.

implement programs, and to effectively and inexpensively disseminate conservation farming and agroforestry practices in a sustainable manner.

Among farmers in Claveria, the perception that soil erosion is a serious problem is widespread. Most are clearly aware of the reasons for declining crop yields and possible strategies to combat the soil degradation process. Sloping fields in Claveria experience up to 200 t/ha of soil loss (2200 mm/year rainfall). About 59% of the cropping (mostly corn and some vegetable farming) occur on lands of more than 15 % slope (Garrity and Agustin 1994, Fujisaka et al., 1994). As is typical for the majority of cultivated upland areas in Southeast-Asia, soils in Claveria are degraded and acidic (pH 4.5 - 5.2) with low available P (Table 1).

Contour hedgerows of pruned leguminous trees or Sloping Agricultural Land Technology (SALT) had been promoted in Claveria since early of 1980's by the Philippine

Department of Agriculture (DA) as a solution to the problems of sustainable crop production in the uplands. This farming system aimed to provide effective soil erosion control, use of organic fertilizer to the companion annual food crops, fodder for the ruminants, fuel woods for farm families, restores water quality and quantity in the watershed and others. In spite of these benefits, farmers' adoption were not widespread. After years of ICRAF's on-farm research and working closely with farmers, we identified some key constraints to low adoption and their solutions.

The constraints include:

- high labor requirements to establish and maintain the hedgerows,
- limited value-added to the farm income,
- unanticipated problems in soil fertility due to hedgerow competition,
- irregular width of the alley,
- too dense hedgerows in moderately to steeply sloping farms,
- poor species adaptation and lack of planting materials, and
- unsecured land tenure.

We were probably very fortunate when we started working in Claveria in 1985 to have had no experiment station upon which we might have conducted our trials on tree leguminous hedgerows. If we had, we might still be a couple cycles behind, where we are now in our learning experience. Working with farmers on experiments superimposed on contour hedgerows made it clear that pruned tree hedgerows were too labor intensive, and productive forage grass hedgerows were too competitive with the associated crops. Adoption of both technologies was not taking off. However, we saw that the concept of contour hedgerows was a popular idea. We saw that some farmers experimented the concept, by placing their crop residues in line with the contour to form 'trash bunds'. These bunds were rapidly revegetated with native grasses and weeds and soon formed stable hedgerows with natural front-facing terraces. Other farmers tried laying out contour lines but didn't plant anything on them. These lines evolved into natural vegetative strips (NVS), which we later observed, to be superb in soil erosion control and reduced maintenance labor to a minimum (Garrity, 1993; Agus, 1993).

These latter innovations caught the attention of many more farmers. By about 1994 it was estimated that over 250 farmers have adopted contour hedgerow systems, while the number of pruned tree hedgerow fields decreased after 1990. The new wave of hedgerow system was predominantly natural vegetative strips. We also observed a broad-based change in tillage systems: When research had first begun in Claveria in 1985 virtually all farmers plowed up and down the slopes. Contour plowing was then unheard at that time. By 1995, it was evident that nearly all farmers had converted to practice contour plowing, or were at least attempting to do so.

Evolving the components of a successful conservation farming system

Interest in NVS continued to increase. Since it is quite uncommon for an effective soil conservation structure to be adopted by large numbers of farmers

spontaneously, and without public subsidies, we took note that perhaps we were witnessing the kind of low-labor, zero-cash-cost alternative that might have widespread applicability. We began to examine each component of the process of establishing and maintaining low labor hedgerow practices. The establishment of natural vegetative strips (NVS) requires only a fraction of the needed labor compared to the conventional contour hedgerow of tree legumes. The only labor required is the laying out of contour lines (about 2 person-days per hectare). NVS are narrow contour strips of field area left unplowed and allowed to vegetate naturally. The total amount of time required to plow is reduced accordingly to the proportion of the unplowed strips thus offsetting the labor spent for laying out these contour strips. The amount of labor required to prune or maintain the NVS is proportionate to the density of hedgerows per hectare. Mercado et al 1997 found out that NVS spaced at 6 meters apart dominated by *Chromolaena odorata* required 15 person-days per cropping per hectare or 30 person-days per year..

Table 1. Chemical and physical properties of a soil profile at Claveria, Misamis Oriental.

Analyses	**Profile Depths (cm)**		
	0-11	**11-21**	**21-56**
pH (1:1) 1N KCL	4.1	4.1	3.9
0.01 M $CaCl_2$	4.3	4.3	4.3
NaF	9.3	9.2	9.8
Org. C (%)	1.84	1.71	0.56
Total N (%)	0.19	0.18	0.08
Exch. Cations (m.e/100g)			
Na	nil	0.02	0.02
K	0.10	0.09	0.03
Mg	0.69	0.52	0.18
Ca	2.74	2.78	1.05
CEC (m . e. /100g	10.6	10.5	8.0
Bray P (ppm)	9.8	8.7	9.7
Olsen P (ppm)	6.1	3.7	3.2
Avail. Zn (ppm)	1.3	1.2	0.8
Exch. Al (m . e / 100g	0.58	0.52	1.27

Particle size (%)

Clay	75	61	84
Silt	**22**	**36**	**14**
Sand	3	3	2

Field Classification: Fine, mixed, isohyperthermic, Ultic Haplorthox

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This was less than a quarter of the time required for conventional tree-legume based contour hedgerow systems (ICRAF 1996). For low-statured NVS like *Paspalum spp* or *Digitaria spp*, they require even less (3 to 10 days per cropping season) (Mercado et al, 1997; Stark, 1997, unpublished data).

Survey of farmers who have not yet installed contour hedgerow systems but desired to do so, indicated that their over-riding reason for not contouring, was that they lacked the technical know-how to do it right. We had recently uncovered an extremely simple and practical means of laying out contours without an equipment as sophisticated as an A-frame: The cow's back method (ICRAF, 1997). The cow's back method is done by plowing across the slope and maintaining the angle of the cow's back on the level. When the animal is heading upslope its head is higher than its back; when it is off-course downslope, the rear part of the animal is elevated compared to the front. Stark et al (1996, unpublished data) found that this cow's back method was on the average less than 2 % off the real contour compared to either A-frame method or hose level method. This is plenty good for practical purposes, particularly in light of the fact, that most farmers don't bother with A-frames at all, but simply eyeball their contours (which is much less accurate).

Feedback from farmers isolated another factor that causes many smallholders to hesitate in installing contour hedgerow systems: conventional recommendations that hedgerows be separated by only 1 to 1.5 meter drop in elevation. On steep slopes the crop area lost may be 15 to 20 percent or more. Crop yields cannot be expected to increase enough to counter-balance this much lost area. This is compounded by the increased labor in establishing and maintaining many hedgerows in each field. We therefore conducted trials, to determine how reducing the density of hedgerows affects the expected control of soil loss. We found out, that hedgerows spaced at 4 meters vertical drop are still effective in reducing soil loss (Mercado et al 1997). Even a single NVS strip placed on the contour halfway down a 60-meter slope reduces soil loss by 40% than that, of soil loss on the open slope (Figure 3). We conclude that farmers could space their hedgerows at much wider intervals than the conventional rule-of-thumb recommendation, to even up to 8 to 12 meters apart on such slopes. Erosion control will not be quite as good, but the adaptability of the practice is greatly increased. More hedgerows can always be added in-between the original ones after the farmer has gained more confidence on the effectivity of the practice. This wider spacing is also particularly

appropriate when the farmer intends to improve his or her NVS with fruit or timber trees. In Claveria, there is a growing interest among farmers to establish fruit and timber trees on their NVS. The evolutionary stages of the agroforestry system in Claveria, Misamis Oriental, is presented in figure 5. In a sloping cultivated field, farmers establish soil conservation using the natural vegetative filter strips on their farms. After they have established contours, they raised seedlings of timber or fruit trees. Introduction of trees come during the 2nd or 3rd year after the establishment of NVS. Tree canopies start to close 3-4 years after planting of trees. By this time it is no longer feasible to plant annual crops at the alley because it is already too shady for them, but farmers introduced ruminants under the trees. Farmers having wider alley (8-12 meters wide) can still plant annual food crops between the rows of the trees, and grow fodder grass between trees along the row. A wider spacing of NVS is very useful for farms where it is desired to continue growing food crops as the fruit and timber trees mature. However, farmers with larger farm sizes tend to opt for somewhat closer hedgerow spacing, and move food crop cultivation to other parcels once the tree canopies shade the annual crops. These fast growing timber tree systems have a 6-8 year cycle.

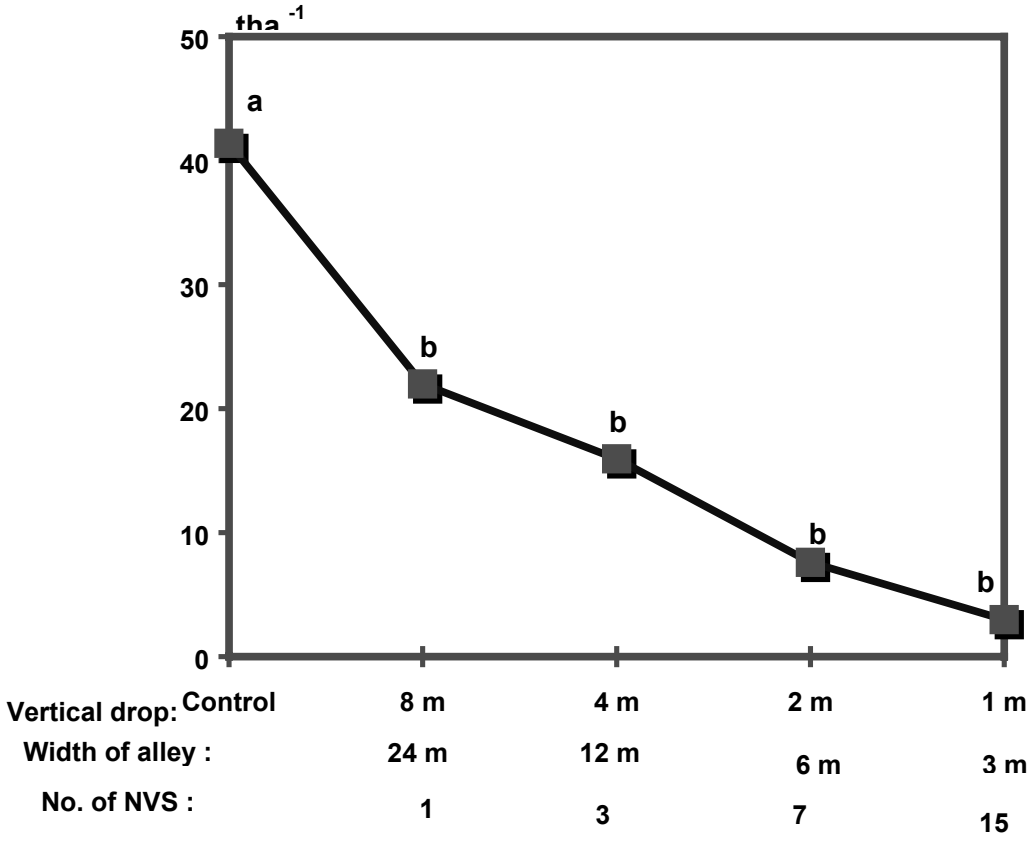

Figure 3. Annual soil loss as affected by different natural vegetative filter strips (NVS) density. Claveria, Misamis Oriental, Philippines. (Mean of 3 years)

Farmers who have established cash perennial hedgerows (like pineapple) tend to want a closer-spaced hedgerows in order to have more rows of these cash crops, as they often earn more from the hedgerow component than from the maize or other annuals planted on the alleys. NVS can evolve into many forms of agroforestry systems. Farmers in Claveria are planting fodder grasses and legumes, timber trees and fruit trees, and other cash perennials on their NVS fields. The fodder grasses used include *Setaria* spp, *Pennisetum purpureum*, and *Panicum maximum*. The forage legumes include *Flamingia congesta*, and *Desmodium rhinzonii*. Timber species planted include *Gmelina arborea*, *Eucalyptus* spp, *Sweitienia* spp, *Ptericarpus indicus*, and others. The fruit species include mangoes, rambutan, durian. Other perennial crops grown in or just above the strips include pineapples, bananas, and coffee. The groundswell of enthusiasm among hundreds of farmers and the rich store of farmer experience with a wide range of prospective contour hedgerow management options stimulated consideration of how the public sector research and extension institutions might evolve to more effective techniques to diffuse NVS technology rapidly to much larger numbers of interested farmers within the municipality and elsewhere. The adoption and technology modification process has been well-documented by IRRI staff (Fujisaka et al.1988, Cenas and Pandey, 1995), but aside from documentation and wider sharing of experiences, very little extension follow-up was undertaken thereafter. Extension methods can be basically classified as either the individual / household approach or the group approach. The individual approach is most effective for activities to be undertaken within the full control of the individual farmer or household (e.g. establishing contour hedges), while working with groups or the community at large is more suitable concerning matters related to the whole community (e.g. post-harvest public grazing) or if activities will be undertaken (more cheaply) by a group (e.g. group nursery). The group approach is particularly suitable where group work is common, like the Philippine *Bayanihan*, the farmer groups, worked based on voluntary work to contribute a common benefit.

Towards effective technology dissemination: the evolution of an innovative extension strategy

In addition to conducting applied research resulting in the development of appropriate technologies for the area and for sites of similar bio-physical and socio-economic conditions, ICRAF has recently initiated a technology dissemination program to ensure that derived innovations will reach to user groups. Although, not its explicit mandate, ICRAF has undertaken the commitment to develop an effective extension program to strengthen existing government programs and to help technology dissemination develop into a self-perpetuating farmer movement in the area towards highly productive, resources-conserving agroforestry-based farming systems.

ICRAF has been instrumental in developing a farmer-led approach to technology development and dissemination, which has resulted in an unexpected boost in farmer adoption of soil conservation technology and agroforestry practices. The key institutional innovation for effective conservation farming technology dissemination is the Landcare approach: a process that is led by farmers and community groups, with support by the

local government and technical backstopping from ICRAF or Department of Agriculture (Figure 4).

What is Landcare?

Landcare is a method to rapidly an inexpensively diffuse agroforestry practices among upland farmers, based on the farmers' innate interest in learning and sharing knowledge about new technologies that earn more money and conserve natural resources (Garrity and Mercado, 1998). It is a group of people, concerned about land degradation problems and who are interested in working together to do something positive for the long-term health of the land. It evolved as a participatory community-based approach and grounded model designed to effect change in complex and diverse situations (Sweet-Kelly, 1998).

The core of the Landcare model is two folded: effective local community groups and partnership with government (Campbell and Siepen, 1996). This grassroots approach is generally recognized as a key to success in all community development activities. Groups are to respond to the issues that are locally important to solve problems on their own way. In other words, Landcare depend on self-motivated communities responding to community issues, to issues imposed by any external agency. Approaches that use well-grounded theory (where participants determine the key issues rather than these being pre-determined) are more likely to effect permanent and positive change.

Landcare groups are supported by government and are networked to ensure ideas and initiatives are shared and disseminated. This is a partnership between local communities and the government – working together to change the way the land is used. This is the important feature of Landcare.

Steps involved in Landcare approach

Based on the gestation and evolution of Landcare during the past several years in Claveria, the major principal steps in developing this approach are identified (Garrity and Mercado, 1998) and are summarized below.

1. **Select sites with good potential**

   This is to bring conservation farming technologies to where it is needed most – on sloping lands where soils are prone to erosion and degradation. This initial step also involves meeting with key leaders in the local government units (municipal or province), interested farmers, and other stakeholders. Their understanding of the issues that need to be addressed, as well as their willingness to support and complement the program are very crucial to the success or failure of Landcare at a given site.

2. **Expose key farmers to successful technologies and organizational methods.**

The aim is to develop strong awareness among prospective key actors – especially innovative farmers and farmer leaders-of the opportunities, to effectively address production and resource conservation objectives through technologies derived from Participatory Technology Development. The success of the activities can be measured through the development of enthusiasm to adopt the technologies within the community. Exposure activities include:

- Organized cross visits to the fields of farmers who have already adopted and adapted the technology successfully into their farming systems.
- Provide training experience for farmers in target communities to learn about the practices through seminars in their Barangays.
- Provide opportunities for farmers to try out the technologies on their land through unsubsidized trials to convince themselves that it works as expected. If so, these farmers become the core of a 'conservation team' to diffuse the technology in the municipality.

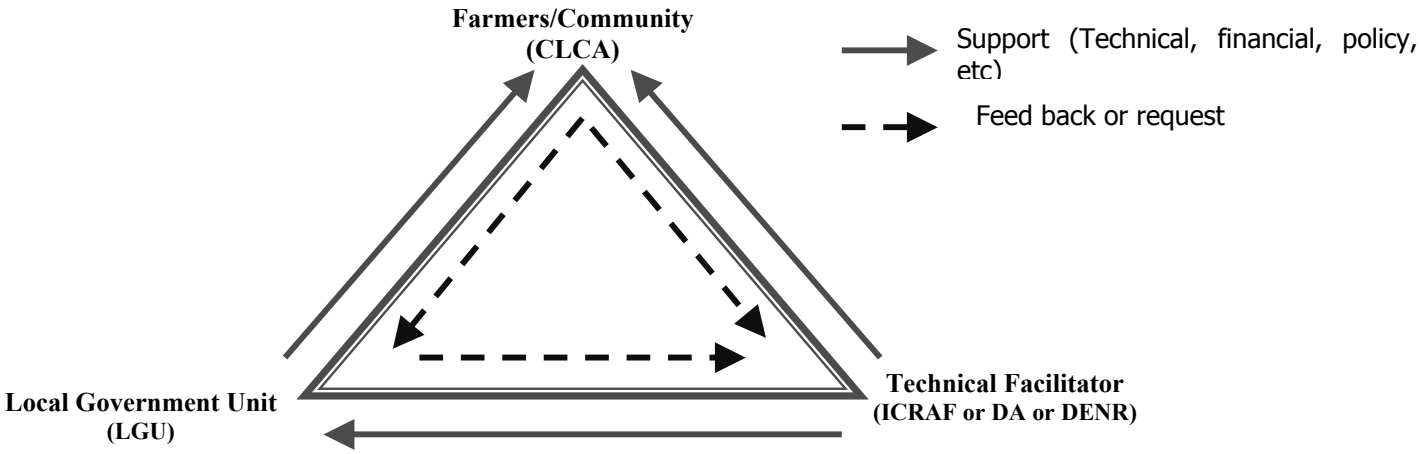

Figure 2. The triangle of Landcare approach: grassroot organization (CLCA), local government unit (LGU), and technical facilitator (ICRAF/DA). The success of Landcare as an approach is dependent on how these 3 groups interact and work together

1. **Farmers or community (CLCA) -**
   - farmers (owner operator, tenants, etc)
   - usually resource poor
   - want to improve their livelihood
   - want to employ new farming techniques
   - would like to acquire ,and share knowledge and experience with other farmers
   - committed for resource conservation
   - create workgroups for nurserying, establishment of conservation farms, etc

2. **Local government unit (LGU)**

   - Provide policy support (institutionalization of conservation farming and agroforestry, creation of Municipal and Barangay ordinances)
   - Leadership (facilitating formation of Landcare groups and Landcare activities
   - Capacity building (initiate various trainings)
   - Financial supports (HES fund from municipal - P50,000.00/barangay/year ($1,250) and HES funds from Barangay =20% of the development fund)

3. **Technical facilitators (ICRAF or line agencies)**

   - Technology : soil and water conservation, agroforestry, nurserying, etc
   - Facilitation (facilitate formation of Landcare and Landcare related activities)
   - Germplasm

- Information and education campaign

3. Organize conservation team at the local level

Once it is clear that there is a critical threshold of local interest in adopting the technologies and a spirit of self-help to share the knowledge within and among the Barangays of a municipality, then the conditions are in place to support the implementation of a municipal conservation team. The team is composed of an extension technician from Department of Agriculture (DA) and DENR, an articulate farmer experienced in the application of the technology, and an outside technical facilitator (Figure 5).

The team will initially assist individual farmers in implementing their desired conservation farming practices. Later, they will give seminars and trainings at the Barangay level, if sufficient interest arises. During these events they will respond if there is interest in organizing more formally so as to accelerate the spread of agroforestry and conservation practices.

4. Evolve Landcare farmers organization

If and when, the preconditions are in place for a Landcare farmers organization, then, the facilitator may assist the community in developing a more formal organization. A key ingredient of success is identifying and nurturing leadership skills among prospective farmers in visioning and organizational development. This may involve arranging for special training in leadership and management for the farmer leaders and exposing them to other successful Landcare organizations.

Each Barangay (Barangay) may decide to set up its own Landcare Association chapter and Barangay conservation team. A Barangay may organize Landcare Association sub-chapters in their puroks or sitios (sub-Barangays). A purok conservation team usually includes a local farmer-technologist, the purok leaders, and the district kagawads (councilors). The purok-level teams are the front-liners in conservation efforts, providing direct technical assistance, training, and demonstration to farmer households. They are backstopped by conservation teams at the Barangay and municipal levels.

At the municipal level, the Landcare Association is a federation of all of the Barangay Landcare chapters. The municipal conservation team is part of the support structure, which also includes other organizations that can assist the chapters (e.g. DA, DENR, and NGOs). See figure 2 for the organizational setup of the Claveria Landcare Association (CLCA) is a PO registered as an association with the Philippine Securities and Exchange Commissions (SEC) in 1996.

5. Attract local government support

Local governments can provide crucial political support and sustain financial assistance to Landcare Associations to help them meet their objectives. The municipality has its own funds that are earmarked for environmental conservation. These can be targeted for Landcare activities that enhance natural resource conservation. The municipality can be encouraged to develop a formal natural resource management plan – such as the one in Lantapan described in the proceeding case study – which can help guide the allocation of conservation funds.

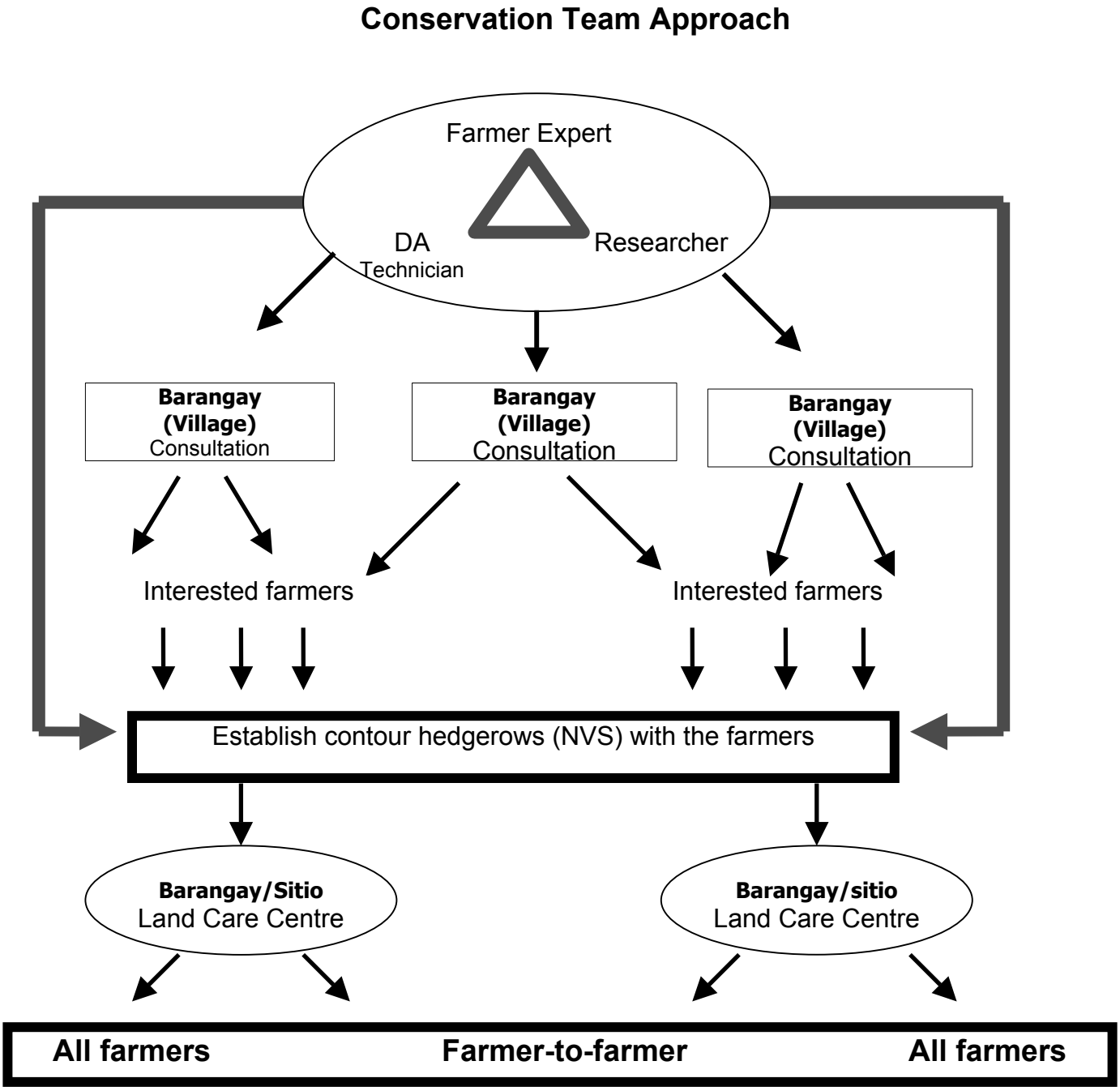

Figure 5. Conservation team as key component of Landcare approach.

The Barangays can also allocate financial resources from their regular internal revenue allotment (IRA) through the Human Ecological Security (HES) Program, which represent one-fifth of the total development funds of the Barangay. These funds can be used to organize the conservation teams and Landcare Association activities at the Barangay and purok levels and support trainings and provide honoraria for resource persons if the required time commitment exceeds voluntary efforts. The municipality can also allocate the HES funds to compliment the Barangay budget. For 1998, the Claveria municipal government committed 50,0000 pesos (about US$1,250) to each Barangay to support Landcare activities.

External donor agencies can best support Landcare development by allocating resources for leadership and human resources development, communications equipment (e.g., handheld radio sets), and transportation (e.g., motorcycles) to enable Landcare leaders to make maximum use of their time.

6. Monitor and evaluate

Monitoring is a necessary tool to assess the program of activities, and use outputs for strategizing activities or planning actions to make the program more dynamic and relevant to the needs of the target community.

For monitoring purposes ICRAF has been keeping records of all those who have attended trainings or have been assisted in establishing NVS on their farms, as well as of farmers who requested assistance. Details on farming and conservation practices, training and follow-up needs are recorded in a *diagnostic card,* which is updated on regular follow-up visits by an ICRAF staff. The leaders of the CLCA chapters or sub-chapters have been supporting this activity by facilitating the distribution and collection of the diagnostic cards to and from the sub-Barangays and new CLCA members.

As a preliminary evaluation, a survey on the adoption and dissemination progress is now being conducted, with an emphasis on farmers' technology modification and the reasons behind their decision-making. This will occur approximately 1.5 years after the start of the extension program (Garrity *et al*., 1998).

Conservation farming technologies

The specific activities of the Landcare Association members will vary according to their needs and interest, as well as their biophysical and socioeconomic situations. Some of the many activities that have been or are being developed as focal areas for Landcare work include:

- Establishing natural vegetative strips (NVS) along the contour to reduce field or farm-level soil erosion. This was the initial farmer-generated technology that launched the organization of Landcare in Claveria.

- Planting perennial crops on or just above the NVS to increase the farmers' cash income and enhance soil and water conservation.
- Planting trees to increase family income through production of timber, fuel wood, and other tree products in farm forests, boundary planting or other arrangements,
  Planting high-quality fruit trees to provide income and better nutrition for the household while enhancing the environment.
- Adopting minimum-tillage or ridge tillage farming systems. Ridge tillage has been successfully adopted with the existing draft-animal cultivation practices, and is being further tested on farms.

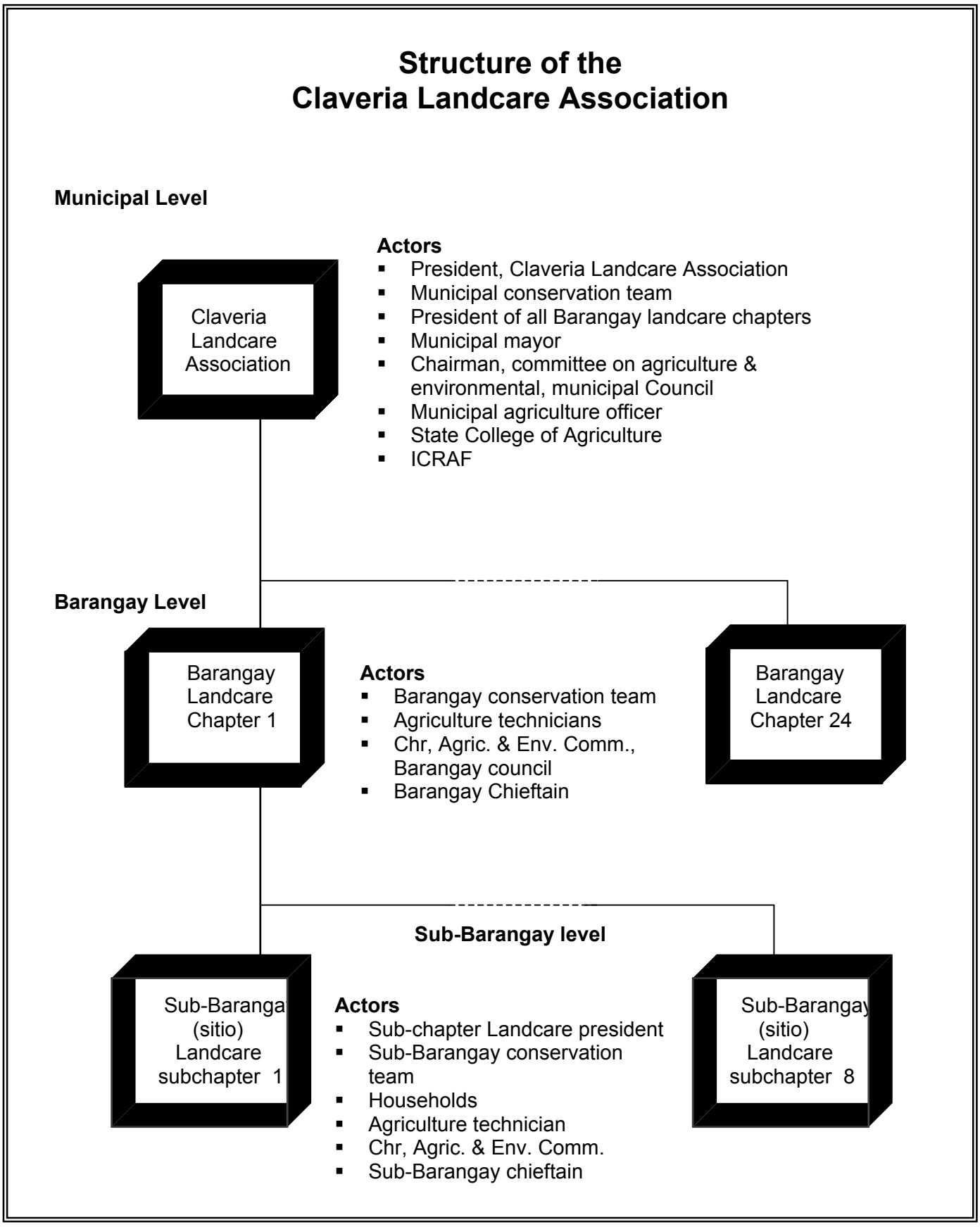

Figure 6. Organizational structure of Landcare in Claveria

The evolution from simple soil conservation practices to more complex agroforestry system occurs over time as farmers continually experiment, innovate and adopt technologies that are suitable to their conditions. Generally, farmers start with the establishment of natural vegetative filter strips. Next, they establish communal or individual nurseries, and plant perennials on or above the NVS. Farmers can cultivate annual cereal crops up to the fourth year, particularly if the strips are not too close to each other. When tree canopies shade out the crops, and it is no longer profitable to grow annuals, farmers graze livestock beneath the tree. The trees (mostly *Gmelina arborea*) can be harvested 8-12 years after planting, and farmers then resume annual cropping and begin the next cycle. This system earns more than the traditional practice of monocultural cropping (Magcale-Macandong *et al.* 1997).

Other strategies that enhanced Landcare approach

Below are the approaches on how to reach out more farmers inexpensively and in participatory way and in sustainable manner. These are the components of the Landcare approach.

1. **Information, Education and Communication (IEC)** - This is done by the landcare facilitators and volunteers. These are the following activities:

    a. **Sharing** - This is done by using the pictorials and hands-out of conservation farming and conservation farming guides. This is brought to the field everyday and explained thoroughly to the farmers in every opportunity to individual farmer, landowner or groups of farmer and landowner.

    b. **Slide showing** - This is done in mass of people in purok or barangay. A select good slides of conservation farming are used. These slides are similar to the pictorials distributed to Landcare facilitators and volunteers. At the end of the slide showing a question can be asked to those farmers who are having sloping farms, and if they are willing to adopt conservation farming, and would need further guidance. This is done in collaboration with local government units and the local landcare groups. These two groups as much as possible should play a vital role.

    c. **Training**. A structured training of conservation farming, timber and fruit tree production systems, and landcare organizational method have been developed that can be covered in two days. These training will give more weight to hands-on (about 70%) than theoritical. Farmers who have been accustomed to physical activities are having difficulty staying awake for a longer period of time in theoritical training.

    d. **Cross visits** - This enable interested farmers to see conservation farms and talk to the adoptors. Interactions with these farmers provide answers to so many question

and clarify some issues in conservation farming that the prospective adoptors have in mind. This has been creating a dramatic impact on farmers interests on adopting and adapting conservation farming technologies to his own farm. Cross visits is facilitated by the local government units and the local landcare groups. This is one of the monthly activities of the local landcare groups (chapter and sub-chpater). At purok level, between farms visit is facilitated. At barangay level, between puroks, and at municipal level, between barangays.

e. **Workshops** - This gives an opportunity to gather ideas from different farmers who have varied farm experiences and share with other farmers, and come up with a common solutions to a problem. This provides an opportunity for farmers ideas to be recognized and disseminated.

2. **Through friendly competition (Paligsahan**) - This is done to create change reaction in the community if properly planned, disseminated, and implemented. This is facilitated by the local government unit with strong collaboration with the local landcare groups. Prizes for this competition is sourced out from the HES of the barangay or from municipal. There are now number of barangays which are on it. Competition is done in categories such as:
   a. **By individual** - This is facilitated by Purok and the sub-chapter of local landcare group. This is to encourage farm households within the Purok to participate and compete with other farm households.
   b. **By purok** - (e.g. Purok encounter for sustainable development in the upland). This is facilitated by the barangay and the chapter of the local landcare groups (barangay level) participated by the different puroks within the barangay. The different criteria of this competition has been attached for your reference.
   c. **By barangay** - This is facilitated by the municipality and the municipal level landcare group. The criteria of this competition would be similar to the barangay level with a modest modification.

3. **Tapping Local Government Unit**
   a. **Policy** - The LGU can enact policy that will relate to the enhancement of adoption of conservation farming by institutionalizing it. One of the activities is the creation of municipal or barangay ordinances mandating sloping farmers to adopt conservation farming. They can also create policy to allocate financial resources from their regular internal revenue allotment (IRA) for training, cross visits and other activities like nurserying, and also to provide tax incentive to those farmers who are implementing conservation farming. They can also allocate human resources to facilitate and work on the implementation of conservation farming in the communities.
   b. **Financial** - The LGU can allocate 20% of the development fund for the implementation of the conservation farming. This can be used for training, cross visits and other activities in support of the activities in the community. Resources both from the municipal and the barangay can be tapped. The LGU can also lobby or request financial assistance from different donor agencies to promote conservation farming activities in their communities.

c. **Influence** - LGU officials in the different localities are farmers themselves. They can be set as models if they themselves adopt conservation farming. These officials are respected and can easily influenced people in the communities.
d. **Facilitation-** With the clout of the local officials they can easily facilitate activities that will relate to the promotion and adoption of conservation farming. They can facilitate in the formation of the local landcare groups and committees. They can also facilitate the different landcare related activities such as training, cross visits, and other information and education campaigns.
e. **Capacity building** - The LGU can create various training programs to capacitate farmers in the community to think, initiate and implement activities that will relate to conservation farming and increasing farm income and profitability.
f. **Leadership** - The LGU can provide strong leadership to promote conservation farming. People in the community always look upon the leadership to think, initiate and implement plans and programs that will promote, encourage them and provide incentive to people who are diligent in implementing conservation farming.

4. **Tapping People's organization-**. This is to mobilize local people to think, initiate and implement long and lasting plans and programs on conservation farming. There is always a great potential for a collective efforts to address sustainability issues in the community. In most cases this great potential resource is untapped. What it needs is the facilitation and guidance on how they will perform various activities that will relate to the enhancement of promotion and adoption of conservation farming that will create impact on protecting the resource base while increasing their food security and alleviating farm income. They can perform such activities like:
   a. **Sharing** - They can perform tasks that suppose to be done by the facilitators and volunteers at the local level either to individual or group of farmers
   b. **Training** - They can conduct and facilitate training at the local level. They can assist or initiate training activities in the community. The most effective one is having a farmer-to-farmer training strategy (e.g. Mr. Juban, he practically reaches out all his neighbors).
   c. **Models -** Landcare members adopted the conservation farming to showcasing it his neighboring farmers about the technology, and where farmers look upon. This is to address farmers attitude of "wait-and-see".
   d. **Facilitation** - The local landcare groups can facilitate training, cross visits, slide showing, work-groups and other activities that require collective efforts such as nurserying, establishment of contour farms, etc.
   e. **Workgroup -** the local land care groups form a workgoup to establish and maintain communal nurseries. Other Landcare groups organized a workgroup to go out once a month and assist non-member farmers establish conservation farms.
   f. **Influence –** Landcare members may influence people in the community to adopt conservation farming.
   g. **Sharing of experiences** - Farmers are conducting informal way of experimentation in their own farms. They are trying many things to improve their productivity and profitability, and this is sometime called "trial and error". These farmers are exposed to considerable risks. Landcare can be a forum in the

community to share farming experiences among farmers to be able to gain farm experiences of others. By doing so, farmers are learning the good experiences of others and could avoid bad experiences to happen again. This is a beneficial effect of interaction among farmers in the community.

5. **Tapping the youth movement (Katipunan ng Kabata-an) through the Youth Environmental Services (YES)**
6. **Inclusion of watershed management into Elementary and High School curriculum**
7. **Tapping other POs or cooperatives to be part of the Landcare movement**.

Impacts, scaling-up and scaling-out

In 1996, ICRAF supported dissemination activities in Claveria as a direct response to the farmers' request for technical assistance in conservation farming. The technical and institutional innovations led to the formation of the Claveria Landcare Association. Today, there are 85 Landcare groups within the 17 Barangays (Villages) in the municipality of Claveria. Most of these Landcare groups are based in the purok or sitio (sub-villages) where farmers interact with each other more frequently. There are now more than 2000 farming families involved.

These Landcare groups have successfully extended conservation farming based on NVS to more than 1,500 farmers and established more than 200 communal and individual nurseries that produce hundreds of thousands of fruit and timber tree seedlings that are planted on the NVS or along farm boundaries. They were also able to get funding for 75 draft animals for dispersal to Landcare members who have no animal.

The greatest success of Landcare is changing the mindset of farmers, policymakers, local government units, and landowners about how to use the land and protect the environment. It is not simply about the total length of NVS laid out, the number of nurseries established, the number of seedlings planted, or the number of Landcare members. The Landcare movement is re-orienting the minds, and attempts to influence changes in attitudes and practices of farmers, policymakers, and local government officials about the judicious utilization of land and water resources for present and future generations through voluntarily sharing of their time and efforts. There are also policymakers who urge farmers to adopt conservation farming practices, and support these efforts by allocating local government funds and enacting local ordinances. These are the important success indicators of the Landcare approach that enable local people to conceive, initiate and implement plans and programs that leads to the adoption of profitable and resource-conserving technologies.

Decentralization and devolution of natural resource management to the grassroots level enables local government to allocate resources and provide policy support to complement farmer-and community-led efforts to conserve resources for sustained production and utilization. The Landcare approach provides:

- A vehicle for interested farmer to learn, adopt and share knowledge about new technologies that can earn more money and conserve natural resources;
- A forum for the community to respond to issues that they see as important;
- A mechanism for local government to support; and
- A network for ensuring that ideas and initiatives are shared and disseminated.

Landcare is emerging as a method to empower local government and communities to effectively and inexpensively disseminate conservation farming and agroforestry practices. The experiences and lessons learned in Claveria provide a strong basis to scale-up to the regional and national levels, and to scale-out to other municipalities (see the vision for the national Landcare movements in Figure 3).

The adjacent Municipality of Malitbog, Bukidnon Province has approached the Claveria team to assist them in developing Landcare activities. Farmer cross visits and trainings were arranged and an ICRAF field extension staff has recently been posted to Malitbog. The local government has formed a conservation team to help start-up Landcare activities in 4 pilot Barangays (Saguinhon, 1998), and provided funds to assist landcare chapters, establish their nurseries, fund training and cross visits, and provide transportation allowances during monthly meetings. Based on specific request, various study tours and trainings have been organized for farmers, NGOs and LGUs interested in the Landcare approach.

The ICRAF-Lantapan team has also started applying the Landcare principles and approach to its work on decentralized NRM planning and implementation, as well as with the farmer agroforestry tree seed association in Lantapan.

The new *Philippines Strategy for Improved Watershed Resources Management* has incorporated the Claveria Landcare and the Lantapan NRM planning approaches 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 LGU partnership-that made Landcare successful in Claveria.

Future Plans

ICRAF will continue to work strategic research on agroforestry. The focal issue is the planting of fruit and timber trees on the NVS that evolve to a complex agroforestry system. The role of leguminous trees as nurse trees becomes important. They may provide a favorable micro-environment and increase the availability of nitrogen in the system. But these roles have not been sufficiently understood or quantified. Our future research aims to understand the prospective positive interactions in these more complex species combinations. This work requires strong collaboration with Philippine Nuclear Research Institute (PNRI) which will become the focal point for our long term collaboration.

Landcare is emerging as a method to empower local government and communities to think, initiate and implement programs that will enhance food security, alleviate poverty while enhancing environmental resilience, and effectively and inexpensively disseminate conservation farming and agroforestry practices at a sustainable rate. The experiences and lessons learned in Claveria provide a strong basis to scale-out to other municipalities and scale-up to the regional and national levels (Figure 7).

A Vision for a National Natural Resources Conservation System

based on public – private partnerships

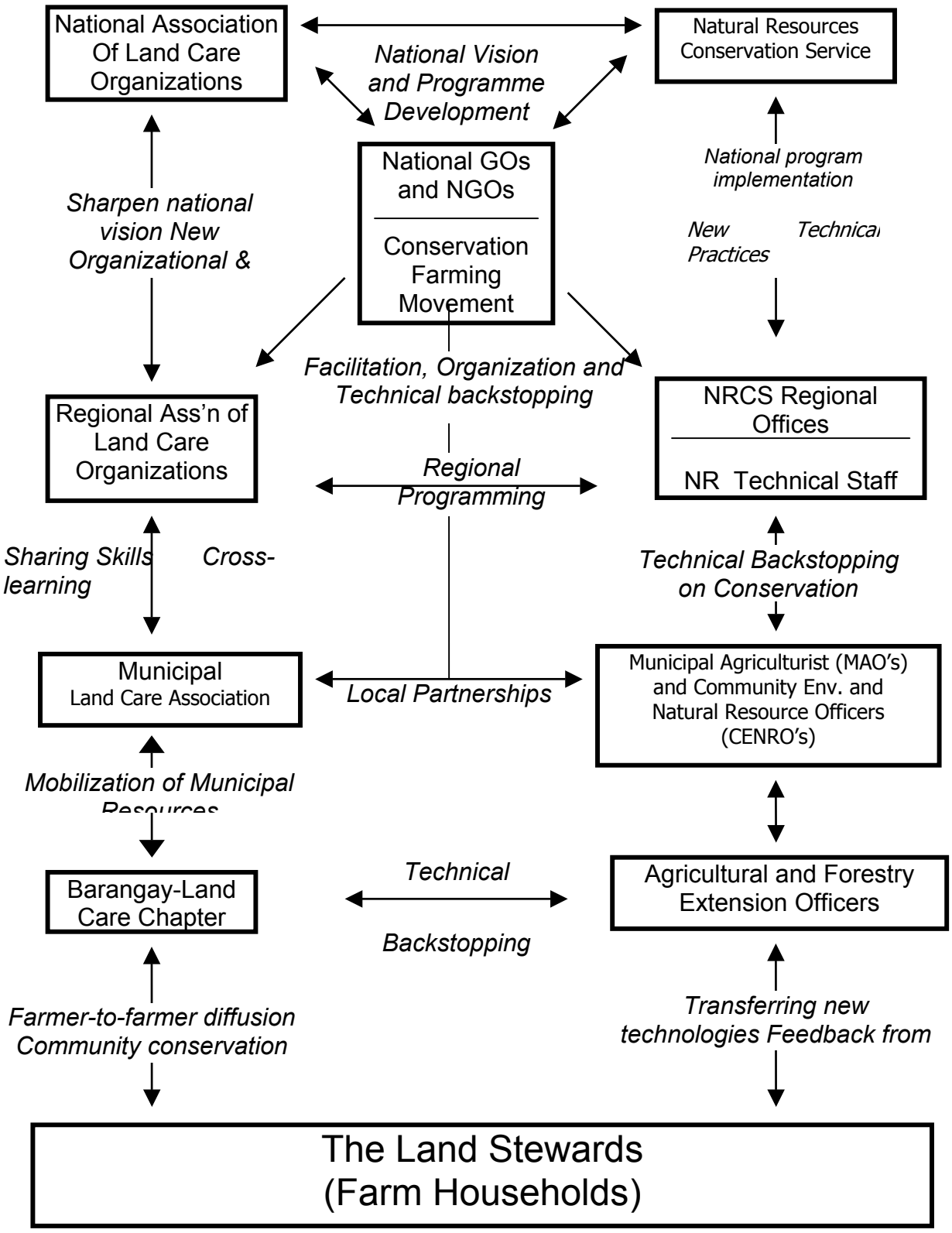

Figure 7. Conceptual framework of vertical scaling up of Landcare approach.

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