Building the Smallholder into Successful Natural Resource Management at the Watershed Scale·

DENNIS P GARRITY, AGUSTIN MERCADO JR, and MARCO STARK

International Centre for Research in Agroforestry

Southeast Asian Regional Research Programme

P.O. Box 161, Bogor 16001, Indonesia

Tel.: 62-251-625415 Fax: 62-251-625416

Spontaneous adoption (without persuasion, without coercion, without subsidy) is the real test of a technical innovation in conservation farming. This paper explores the issues surrounding successful conservation farming as a process defined by spontaneous adoption. It assesses the components of a low-labor hedgerow system as an approach to a technical solution, and addresses the issue of how to disseminate information about a conservation technology cost-effectively at a sustainable rate. We observed rapid adoption of a low-labor, zero-cash-cost conservation practice based on natural vegetative strips in Claveria, northern Mindanao, Philippines, that led to examination of each component of the process of establishing and maintaining low-labor hedgerow practices. We responded to farmer interest by combining our technical expertise with the extension skills of a technician from the Department of Agriculture, and the practical knowledge of a motivated farmer adopter to provide meaningful extension services. This Contour Hedgerow Extension Team (CHET), composed of these three individuals, initially worked with individual farmers who requested their assistance. This evolved into backstopping a peoples' conservation organization (Land Care Association) that took on the main responsibility for technology dissemination. Local government got involved in supporting the effort financially, with active involvement of the village leaders (a local-government-led process). We are currently planning to scale-up the effort to the watershed and regional levels, and evaluate whether it is practical in the context of agroecological domains.

· Garrity, D.P., Mercado, A. Jr. and Stark, M. 1998. Building the Smallholder into Successful Natural Resource Management at the Watershed Scale. In: de Vries, P., Frits, W.T, Agus, F. and Kerr, J. (Eds.) Soil Erosion at Multiple Scales: Principles and Methods for Assessing Causes and Impacts. CABI and IBSRAM, 1998. (in press)

During the deliberations of the Managing Soil Erosion Conference there were several occasions in which it was stated that the technical problems of soil conservation were effectively solved; that excellent methods to control erosion had been identified. The problem was how to get farmers to adopt them. Unfortunately, this is not the case. Identifying practices that control erosion is NOT solving the technical problem. The technical problem is solved only when a soil erosion practice is sufficiently cheap and requires so little labor and management, in addition to being effective, that it is likely to increase short-term farm profitability. This is proven only by witnessing farmers spontaneously adopting the practice. Spontaneous adoption (without persuasion, without coercion, without subsidy) is the real test of a technical innovation in conservation farming. But it is rare. We've been fortunate to have had the chance to observe this in Claveria. The lessons learned have been enlightening.

Two other companion papers in this meeting discussed aspects of the natural vegetative strip technology in Claveria. Pandey et al discussed the adoption issues, and Nelson et al examined modeling outputs to assess the longterm profitability and conservation issues. This paper carries on from these important analyses by delving further into the issues of:

1) what are the components of a very low labor hedgerow system as an approach to a technical solution (as defined above)? And when you are fortunate enough to have a system that works, then...

2) how do you disseminate information and backup about a conservation technology cost-effectively at a sustainable rate?

Contour hedgerows of pruned leguminous trees have been promoted for almost two decades in several countries in Southeast Asia as a solution to the problems of sustainable crop production in the uplands. This farming system aimed to provide effective soil erosion control, organic fertilizer to the companion annual food crops, fodder for the ruminant animals, fuelwoods for the farm families, restore water quality and quantity in watershed and others. Despite of these benefits farmers adoption has not been widespread. After years of on-farm research and working closely with farmers we identified some key constraints 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
- insecure 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 legume hedgerows. If we had we might still be a couple cycles behind in where we are now in our learning experience. Working with farmers on experiments superimposed on contour hedgerows they installed themselves 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 with the concept by placing their crop residues in lines on the contour to form 'trash bunds'. These 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 in them. These lines evolved into natural vegetative strips (NVS), which we later observed were superb in soil erosion control and reduced maintenance labor to a minimum (Garrity, 1996; Agus, 1993; Fujisaka, 1989; Fujisaka et al, 1995).

These latter innovations caught the imagination of many more farmers. By about 1994 it was estimated that over 250 farmers had adopted contour hedgerow systems while the number of pruned tree hedgerow fields decreased after 1990. The new wave of hedgerow systems was predominantly natural vegetative strips. We also observed a broad-based change in tillage systems. Claveria is a rolling area of acidic (pH 4.5-5.0) soils, predominantly oxisols and ultisols, with cropping systems dominated by two crops of maize per year (annual rainfall about 2000mm) (Garrity and Agustin, 1995). When research had first begun in Claveria in 1985 virtually all farmers plowed up and down the slopes. Contour plowing was unheard of. By 1995 it was evident that nearly all farmers had converted to the idea of 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. 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 *Paspallum spp* or *Digitaria spp* it requires even less (3 to 10 days per cropping season) (Mercado et al, 1997; Stark, 1997, unpublished data).

Our surveys of those farmers who had 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 equipment even as sophisticated as an A-frame: The cow's back method (ICRAF, 1997).. The cow's back method involves 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 space 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 long slope reduces soil loss to 40% of soil loss on the open slope. We conclude that farmers could space their hedgerows at much wider intervals than the conventional rule-of-thumb recommendation suggests, even up to 8 to 12 meters apart on such slopes. Erosion control will not be

quite as good, but the adoptability of the practice is greatly increased. More hedgerows can always be added in-between the original ones after the farmer has gained more confidence in the effectivity of the practice. This wider spacing is also particularly appropriate when the farmer intends to convert his or her NVS strips into fruit or timber trees. There is now great interest in Claveria in establishing fruit and timber trees on NVS.

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. Farmers that establish cash perennial hedgerows (like pineapple) tend to want to have 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 in 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*, *Penisetum purpureum*, and *Panicum* maximum. The forage legumes include *Flamingia congesta*, and *Desmodium rinzonii*. Timber species cultivated include *Gmelina arborea*, *Eucalyptus spp*, *Sweitienia spp*, *Ptericarpus indicus*, and others. The fruit species include mangoes, rambutan, and durian. Other perennial crops grown in or just above the strips include pineapples, bananas, and coffee.

The groundswell of enthusiasm among hundreds of Claveria 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 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, 1998; Fujisaka et al., 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 work groups based on voluntary work contribution for a common benefit.

The Conservation Hedgerow Extension Team - the individual approach

Late in 1995 ICRAF was approached by farmers for assistance in installing contour hedges to prevent soil erosion. We responded by combining our technical expertise with the extension skills of a technician from the Department of Agriculture, and the practical knowledge of a motivated farmer. This Contour Hedgerow Extension Team (CHET) is composed of three individuals. They initially worked with individual farmers who requested their assistance (**Figure 1**). Subsequently, group trainings were conducted to reach more farmers: These involved 5-7 participants from each of the 7 villages in which the team was working. Before the end of the training the participants decided to organize themselves into a peoples' self-help organization on conservation farming. Officers were elected and the organization came to be known as the Claveria Land Care Association (CLCA).

Peoples Organization Model - the group approaeh

After the CLCA was formed, the participants grouped themselves according to the villages they represented. Groups of farmers from each individual village formed separate chapters, each chapter being a Land Care Centre (CLC), a sub-group of the CLCA. Chapters elected their officers and expanded their membership within their respective villages. Experienced chapter members spread the NVS technology to other neighboring farmers in their village. Subsequent group trainings were organized upon request from the chapters; these were conducted in the village where the requesting chapter was located. The newly trained farmers joined their respective village chapters, thus increasing the CLC membership. The Conservation Team's role shifted from working with individual farmers to backstopping the chapters as they pursued their objectives in disseminating the NVS technology.

Twenty-four chapters of the CLCA have now been activated in villages across the municipality. The CLCA has a monthly meeting attended by the chairmen of each of the different chapters. Chapter chairmen discuss issues and problems in their respective chapters, thus giving regular feedback to the CLCA and the Conservation team. The chapters each have regular meetings also.

One of the key issues that emerged in various meetings was the establishment of cash perennials on the NVS. Although, farmers appreciated the role of NVS in controlling soil erosion most want to optimize the hedgerow space. They are keen to establish timber and fruit trees on their NVS. *Gmelina arborea* has been widely planted, and farmers were looking for other species. We scheduled visits to a wood processors and tree plantations. After the visit farmers were interested in a new species, *Eucalyptus deglupta*, because of its better market potential for poles and lumber. The CLCA put up a central nursery. It was agreed that each chapter will contribute the labor required and costs of the establishment and maintenance. ICRAF provided the improved seed. Nursery establishment and management training was conducted with the chapter chairmen, select members, and barangay councilors. The training included lectures and hands-on experience with the very different nursery practices required for deglupta.

Twenty volunteer village nurseries have now been set up and are producing timber and fruit trees seedlings for the NVS.. The seedlings raised are *Eucalyptus spp* such as: *deglupta, robusta, camaldulensis*, and *torillana*. Chapter members provided the nursery sheds, fencing, cellophance bags, and potting material, and implemented all activities in the nurseries. Members rotated in maintaining the nurseries for tasks such as watering and cleaning. The nursery activities did not compete with hedgerow establishment. NVS are established during the land preparation period, which is therefore a seasonal activity only. The demands for NVS establishment assistance are high during the months of February, March, April, May, September and October. The NVS are proving to be a foundation for the evolution of more productive timber or fruit tree-based agroforestry systems.

The Local Government Model - towards self-reliance

As the barangay (village) officials became increasingly aware of the ongoing activities, interest grew to participate the program. With their involvement a local government unit (LGU)-led technology dissemination model was conceived (**Figure 2**). The decentralization programs of the national government gave increased power to the local government units (LGU's) to manage their natural resources. Many national government programs have been devolved to the municipal level such as: agriculture, health and nutrition, natural resources management, police, etc.. The barangays are given funds (called barangay internal revenue allotments (IRA)) to maintain administrative and infrastructure maintenance costs. One of the components of the IRA is for Human and Ecological Sustainability (HES). HES programs are skewed toward environmental related projects such as soil and water conservation, tree planting, wastes management, and others.

In the model for LGU-led technology transfer the conservation team at the municipal level trains or works with the barangay captains and barangay councilmen designated as chairman of the committee on agriculture, and with the other members of the council (a municipality is composed of 15-30 barangays). The conservation team ensures that these core people understand the technology through village meetings, slide showings, and subsequent small group trainings on NVS establishment in farmers' fields. These core barangay leaders then work with the sitio or zone leaders (a barangay is composed of 5-10 sitios [sitio is a sub-village]), ensuring that these sitio leaders understand and can be effective in advising their farmer neighbors in implementation. The sitio leaders disseminate new knowledge to the farm families within the sitio. A sitio is usually composed of 10-20 households.

This structure makes prospective spread of the technology occur on an ever radiating basis. The breakthrough in this new paradigm occurs when the community leaders assume their role in the diffusion of the technology transfer, as is now happening in Claveria. This new paradigm may be viewed as a structured radiation of the farmer-to-farmer extension method. In a farming community the leaders are farmers themselves. The conservation team is linked with core people who have resources and influence in the community. In the Claveria experience we found that it is easier and more effective to work in a community where there are core people rather than trying to conduct the extension tasks independently. We have been deeply encouraged to see how proud the farmer leaders are in turning in their lists of the names of the people they have assisted in establishing NVS. Soil and water conservation that includes tree planting are now a common topic during the barangay or sitio assemblies or meetings.

Building on past experiences: a two pronged approach

Both the LGU-led and people's organization (Land Care Association) models have both positive and negative aspects. The LGU model has financial and human resources, and can draw upon them as necessary for effective technology dissemination. But the LGU-led model is affected by political uncertainties (such as a change in political administration). The People's organization is more stable but has limited resources. It is more slow but sure.

The current dissemination efforts on NVS and establishment of village nurseries are done by the barangays and the CLCA Chapters in collaboration (figure 3). They compliment each other. The CLCA is getting support from the barangay. The conservation team works through both the people's organization and the LGU. There are now evolving two kinds of nurseries: one managed by the CLCA chapters (at sitio level) and the one managed by the barangay (barangay level). The CLCA is obtaining support from the barangays particularly on the nursery establishment.

There are two people's organization who recently joined the CLCA: the Angela - a group of ethnic people living on the forest margins; and the Claveria Tree Growers' Association (CTGA) - a local association of tree farmers. Each group is considered as another chapter. The interest of Angela in joining the association is for their members to gain more exposure on natural resource management through soil and water conservation and tree planting. The interest of CTGA to join the CLCA is for members to learn more about tree planting and silvicultural practices, and to share their experiences in tree growing. The participation of CTGA in the association is beneficial to the CLCA because CTGA members are mostly professionals who have a strong interest in tree planting and can share their managerial and leadership skills with the CLCA members who are taking a leadership role at the sitio level.

The need for monitoring and evaluation

For monitoring purposes ICRAF has been keeping records of all those who have attended a training or had been assisted with 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 on a *Diagnostic Card* which is updated on regular follow-up visits by the ICRAF staff. The leaders of the sitios or local land care centers (CLCA chapters) have been supporting this activity by facilitating the distribution and collection of the diagnostic cards to and from the sitios 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 be occur approximately 1 1/2 years since the start of the extension program.

Participatory technology development and dissemination – what's next?

We have learned that making the conservation farming technology simpler, easier and convenient to the farmers, and disseminating it in a participatory way, optimizes the involvement of the members of the community at different levels to enhance rapid technology adoption. NVS has proven to be a foundation for sloping farmers to evolve into a wide range of sustainable agroforestry systems. The institutions providing technical backstopping to them need to provide a full basket of options that farmers can select from and adapt to their exceedingly diverse circumstances and objectives.

The participation of the CTGA to the CLCA provides a window for the members to learn managerial and leadership skills that are lacking on the village chapters. Further strengthening to the CLCA chapters is necessary so that they will become a coherent and sustainable group in the village.

We are currently planing to scale up our efforts to the villages in the upper watershed of Claveria and in adjoining municipalities that are requesting involvement. We see the need to continue to adapt the methods, and evaluate whether it is practical in the context of other areas. The conservation team role does not end when farmers establish the NVS, but it is the beginning of the long-term relationship. We need to answer the following questions: Will it be sustainable in Claveria? Can the method be extrapolated? It would be exciting to collaborate with IBSRAM and other networks to examine some of these issues in much more depth. We welcome the possibility of working more closely with the Sloping Lands Network and the MSEC Network in doing this.

References cited

Agus, F. (1993). Soil processes and crop production under contour hedgerow systems on sloping oxisols. PhD Dissertation, North Carolina State University, Raleigh, NC, USA. 141 p.

Fujisaka, S. (1989): The need to build upon farmer practice and knowledge reminders from selected upland conservation projects and policies. Agroforestry Systems p: 141-153, Kluwer Academic Publishers, Nairobi, Kenya.

Fujisaka, S. Mercado, A. and Garrity, D. (1995): Farmer adaptation and adoption of contour hedgerows for soil conservation. International Rice Research Institute, Manila, Philippines.

Garrity, D.P. and Agustin P.A. (1995). Historical land use evolution in a tropical upland agroecosystem. Agriculture, Ecosystems and Environment 53: 83-95.

Garrity, D.P. (1996). Conservation tillage: Southeast Asian Perspective. Paper presentation at Conservation Tillage workshop, Los Banos, Philippines, November 11-12, 1996.

ICRAF. (1997). Annual report for 1996. International Centre for Research in Agroforestry, Nairobi, Kenya.

Mercado, A.R., Garrity, D.P., Sanchez, N. and Laput, L. (1997): Effect of natural vegetative filter strips density on crop production and soil loss. Paper presented at the 13th Annual Scientific Conference of the Federation of Crop Science Societies of the Philippines held at Hotel Supreme, Baguio City.

Nelson et al., 1997 (paper presented on this workshop. Editor please put the right title)

Pandey et al., 1997 (paper presented on this workshop. Editor please put the right title)

Stark, M. (1997). Unpublished data.

0107msec.pap

Conservation Team Approach

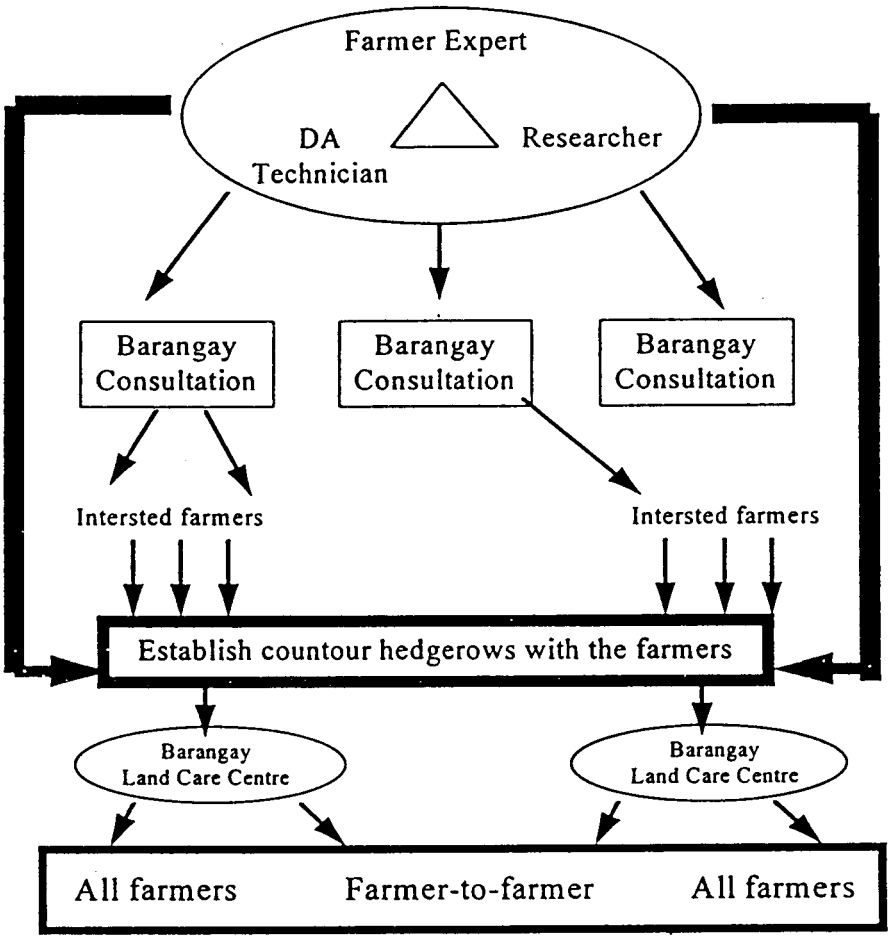
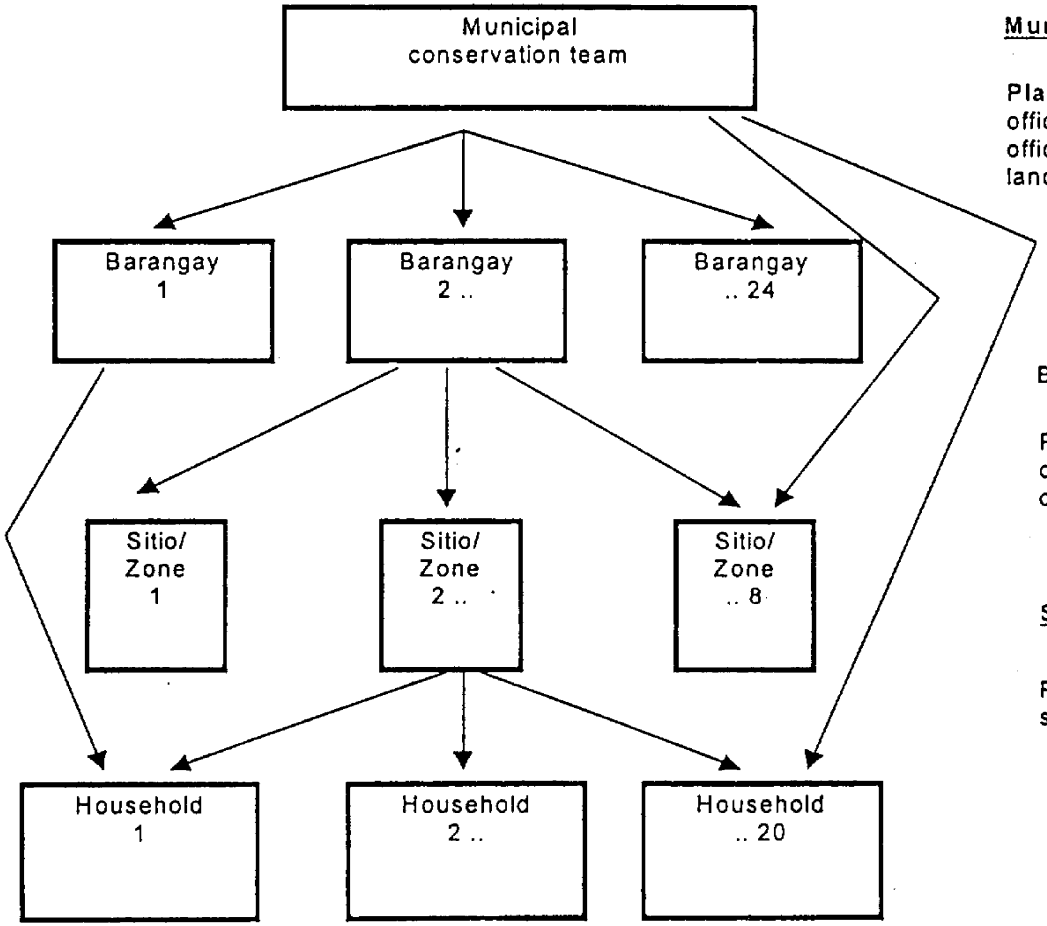


Figure 1

Figure 2



Municipal level - Mayor

Players: Conservation team, municipal ag office, municipal development and planning office, municipal councilmen (Kagawads), land care centers

Barangal/village level - Bgy. captains

Players: Barangay captain, councilman-chairman on agriculture, Local landcare center

Sitio/sub-village level-Sitio/Zone leaders

Players: Sitio/zone leaders, councilmen sitio level landcare centers

Local Government Unit-led conservation team