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Conserving Tropical Biodiversity Through Local Initiative: It may be essential, but can it be done?[1]

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The SANREM Program aims to develop a new paradigm of research for Sustainable Agriculture and Natural Resources Management: A paradigm that includes people, communities, and local government bodies as reviewers, partners, and implementers of research with a depth and continuity of involvement that is quite unconventional. It is a paradigm that takes the whole landscape and lifescape of a watershed as the basis for formulating the questions and for resolving them. This approach seemed well suited to tackling some of the really difficult issues in protecting the natural habitats of unique tropical biodiversity in the face of inexorable human pressure. The Biodiversity Consortium of SANREM set out to see how it might apply this framework to develop tools and approaches that would increase the chances of conserving biodiversity with the active involvement of the communities that live near, and draw economic sustenance from, those habitats. This paper reviews that experience. It focuses on what was done and why, and analyzes the implications. But beyond that it attempts to convey how our conceptual approach evolved over the few short years we have been working together. The story may therefore convey the iterative nature of trial and adjustment that are fundamental to such experiments at the interface between research and development.

Outsiders represent the interests of the global and national stakeholders in biodiversity conservation. They invariably enter with naïve ideas and little understanding of how complex the local biophysical, social, economic, and political situation actually is. The broad perception is that some type of participatory approach is the only feasible way forward. Examples of successful approaches are therefore essential in order to derive cost-effective methods for wider scale adaptation. Experiments are expensive; but they are certainly cheaper than the many huge development programs that had a flawed design because no research was done beforehand. The paper will report progress in scientific research, and in evolving processes to achieve participatory mechanisms to conserve the natural habitat of Kitanglad Range Nature Park, and the surrounding natural areas in the agricultural landscape. The processes are still at a formative stage. Sustained outside support will be required for some years to ensure their success.

The Global Experience

Two decades ago it was commonly thought that protecting the environment would entail a significant drag on economic development. But in recent years the global consensus has shifted toward the view that environmental conservation is not in conflict with development,

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but rather is a crucial element of sustainable development. The conservation of biodiversity has now become a widely shared goal among nations, leading to the implementation of many projects to attempt to save natural areas from degradation or destruction.

The classical method of preserving a natural area has always been to declare it off-limits and enforce exclusion. Boundaries are set and guards patrol. This often results in conflicts of interest and hostility between the enforcement agency and the local communities. Enforcement seldom worked because population pressure on the land was too great or the costs of enforcement were too high. The modern approach of integrated conservation-development suggests that enforcement ought to be linked with some form of compensation to the communities that are directly affected by the presence of the natural area, to enable them to recover some benefits from foregoing their use of the protected area. Conservation would only be ensured if the management of protected areas is reconciled with the social and economic needs of local people.

During the past decade there has been a rapid expansion in integrated conservation-development projects (ICDPs). However, the concept is so novel that the implementers of such projects have little experience to go on. Most ICDP projects are being implemented by institutions that have not done this before. In the Philippines, the passage of the National Integrated Protected Areas System (NIPAS) Act in 1992 has been heralded as one of the most progressive attempts in the tropics to embody into law scientifically-advanced principles of establishing protected areas that have wide scientific support. But implementation presents an exceedingly complex challenge.

The NIPAS Act comes none too soon. The Philippines' biodiversity heritage is globally valued in terms of its very high endemism. The country's species inventory includes about 13,000 species of vascular plants (8,500 species of flowering plants, 3,800 trees), which is about 10% of the world total; 556 birds (6% of the world total), and 210 mammals (4% of the world total). However, 60 per cent of the endemic Philippine flora are already extinct, and a great many other species are endangered. Despite a logging ban on virgin forests, and the presence of 64 national parks and 19 wildlife sanctuaries, the on-the-ground protection for these areas is nominal at best. The NIPAS Act aims to remedy past deficiencies by focusing on scientific development of resource management plans for 100 priority sites, and mobilizing resources at the local level to implement them. Resource profiles and resource management plans are to be developed for each protected area. The first stage is focused at ten sites distributed across the country: Mount Kitanglad Range Nature Park is one of these ten. As this enormous effort gets underway, DENR, national and local NGOs, local governments, and the other stakeholders are grappling with the ways to proceed in uncharted waters.

The SANREM Biodiversity Consortium began its work by drawing on the lessons learned from the global experience with ICDPs as distilled in the excellent review by Wells and Brandon (1992). That review examined the experiences of 23 ICDPs from around the world. All these projects were attempts to reconcile the management of protected areas with the social and economic needs of local people. The following paragraphs indicate some of the key lessons learned.

Cooperation and support of local people is the key. Communities near protected areas frequently bear substantial costs as a consequence of their proximity to these areas, and yet gain little in return. Local residents are usually poor and quite remote to normal government services. Their perception is that the protected area restricts their ability to earn a living, and they often see encroachment as a means to rectify this. International recognition of these realities gradually intensified through the Man and Biosphere Program of UNESCO in the 1970s, the World Conservation Strategy (1980), the World Commission on Environment and Development (1987), and was vigorously affirmed by the Rio Conference on Environment and Development in 1992. It is no longer politically feasible or ethically justifiable to exclude the poor from reserves without providing them alternative means of livelihood.

There must be explicit linkages between project components. Linkages Between Project Components Between Project Components Practitioners of ICDPs widely assume that people made better off by a development project will refrain from illegal exploitation of a reserve area, even if no enforcement is practiced. Wells and Brandon's global study found absolutely no evidence to support this. attention to enforcement alone, or to development activities alone, has not provided sufficient success in ecosystem protection (Brandon and Wells, 1992; Kramer et al, 1997). An integrated approach with balanced attention to both is essential. However, there are very few good examples of effective application of explicit linkages between enforcement and compensation so far. This omission was seen as a serious weakness in most projects. In order to achieve the goals of protecting biological diversity and helping to improve the welfare of the people living near the protected area, it is necessary to pay very explicit attention to how the rural development activities directly support the objective of protection. In many projects an indirect relation is inferred, but is usually unconvincing.

Why is the linkage missing or obscure? Making an explicit linkage is difficult for a number of reasons. Often, when the project begins, particularly ones implemented by NGOs with a bottom-up approach, there is a clear need to build trust and confidence between the implementation staff and the local people. Sometimes this must be done in light of an environment of significant prior mistrust. In such situations, there are obvious advantages in implementing confidence-building activities in which the village community senses a clear positive gain. Negotiated linkages with park protection regulations are deferred until later. In other projects it appears that the institutions involved (being oriented toward development) are uncomfortable or ignorant about how to link enforcement with development. This process involves negotiations, and some form of agreement between outside institutions and local institutions about rights and responsibilities. This issue of linkages in the circumstances of Kitanglad poses a major challenge to SANREM.

Another difficulty is that many prospective development initiatives that are strongly advocated by the target population can themselves increase the pressure on the reserve rather than decrease it. Growth in agricultural productivity or construction of a road are examples. Introduction of practices or technologies that raise agricultural productivity will elevate land values, and may make it more attractive than ever to encroach on to reserve land. Implementation of such 'double-edged' changes must be assessed carefully, and must be linked with clear and effective enforcement mechanisms. The lesson is that the development aspects of the ICDP approach does not mean that direct enforcement is no longer needed. Rather, they justify making traditional enforcement mechanisms more effective. Enforcement from within the community may take a number of avenues. Our initial concept was that conservation agreements on a village-by-village basis appeared most likely to succeed (Garrity, 1995). This was later supplemented by much more comprehensive framework involving the natural resource management at the municipal, natural park, and ancestral domain levels.

Alternatives in Promoting Local Development. Compensation to communities may take many forms. The ICDPs that were reviewed by Wells and Brandon employed a diverse range of such mechanisms. Efforts to promote local development included: Improved natural resource management outside protected areas, agroforestry practices, crop intensification & irrigation, conservation farming practices, community forestry, and others. Most projects attempted to encourage improved natural resource management practices in the areas outside the reserve. The objectives were to increase people's incomes, and to intensify the production systems away from the more extensive systems currently practiced. Agroforestry alternatives were emphasized in many projects.

Biodiversity Protection in the Manupali Watershed

The Biodiversity Consortium attempted to develop an integrated approach to conservation within the framework of the SANREM landscape approach. The lifescape of the Manupali Watershed in Bukidnon, Philippines, is a microcosm of farm families and communities whose diverse vocations exert pressures on both the natural and managed ecosystems, particularly on the remaining protected forest of the Kitanglad National Park. The national park is a relatively small ecosystem of approximately 50,000 hectares, but is of the highest conservation value because of the high endemism of the vascular flora (Amoroso et al. 1996; Pipoly and Masdulid, 1995). It is also the site of the greatest diversity of mammals and birds in the Philippines (Heaney, 1993). It was recently found to have the highest tree density among tropical forests (Pipoly and Masdulid, 1995). This combination of a small, manageable size, and of a rich, singular biodiversity conforms to the type of protected ecosystem that Sayer (1995) proposes to receive the most determined attention in tropical biodiversity protection.

The present landscape of the upper reaches of the Manupali watershed consists of essentially three belts of land:

1) *The national park*, consisting mostly of pristine forested land existing at high altitudes (>1200 masl) with few current household land claims and National Park status,

2) A belt of land surrounding the park that is managed by the Department of Environment and Natural Resources (DENR): *the external buffer zone* of the park. This is land on the fringe of the forest and has now been partly converted to agricultural fields interspersed with *imperata*-dominated grassland. The encroachment here has been partly sanctioned through the expectation of social forestry stewardship contracts and eviction is not a tenable management option, and

3) *Privately owned agricultural land* that is further downslope from the public DENR lands. These landholdings comprising a mosaic of agroforest, crop, and fallowed fields, with remnant forest existing in the steep ravines which border the streams that drain the national park.

The question our project addresses is: "How can the biodiversity of the Manupali watershed region be best protected under the social and economic realities?" Our goal was to elucidate a more fundamental understanding of the people-ecosystem interactions that would lead directly toward development of practicable natural resource management plans. Our research was directed to develop the necessary elements of a workable *social contract* between buffer zone communities and the non-local stakeholders at the national and international levels concerned with resource protection. We asked: "What is a practicable social contract? And, what are the processes leading to its successful implementation?" We hypothesized that there are two essential conditions for sustainable buffer zone management and biodiversity conservation in the Kitanglad National Park, and other protected areas in the tropics:

1) Community-endorsed and -supported enforcement of the boundaries of the natural forest ecosystem, and

2) Agricultural/agroforestry intensification in the buffer zone in order to enhance income growth on static land resources, complemented by other forms of off-farm employment generation in the local and national economy.

Our work focused on both of these aspects. The first concerns institutional development based on local and national realities. The second is research that induces appropriate technical change suited to the biophysical and socio-economic conditions of the buffer zone. The Consortium sought a model of buffer zone management that works, and that could be extrapolated to other protected forest situations. The social contract underlying the model links the provision of assistance in intensifying agriculture to local responsibility for park boundary protection.

It is commonly assumed that the interests of local communities living in the environs of protected ecosystems are diametrically opposed to those of outside stakeholders concerned with global biodiversity (Wells and Brandon, 1992). Our research in the first phase of the project has provided evidence that this is an overly pessimistic assumption, at least in the context of Manupali (Cairns, 1996). There is, in fact, significant self-perception among communities on the boundary of Kitanglad National Park that the protection of the natural biodiversity is in their own self-interest, particularly among the Tala-andig indigenous people, who regard the public lands as their ancestral domain. These values are articulated by local people as protection of the hydrological resources of the upper watershed for water supplies, and of the spiritual and cultural values of the forest, among others. The current failure to protect these resources appears to be due in large part to the lack of institutional mechanisms that provide a framework for management of these systems; mechanisms that explicitly include local interests, and address practical local needs for alternative livelihood directions. Lack of secure land tenure by the households residing in the buffer zone outside the park boundaries is a critical limitation to generating among them a perceived stake in park protection.

The Participatory Learning Landscape Appraisal (PLLA), and the follow-on research during the past four years, has documented the land use practices in the forest margins of Kitanglad National Park, and the high rate of slash-and-burn farming in the remaining forest (COPARD, 1996, Banaynal, 1996). This work highlighted the urgent need to develop an integrated sustainable buffer zone management program for the Manupali Watershed that can be extrapolated to the remainder of the national park and to other protected areas. The working assumption underlying our approach to development of a practicable social contract for the Manupali Watershed includes the belief that a *whole-landscape approach is essential* in dealing with the existing realities. The SANREM CRSP's participatory approach recognizes that the interests and actions of the end-user communities within the interdependent ecosystems will ultimately determine the fate of the protected forest and the agroecosystems that extend outward from it. The three project objectives were:

1) Develop and test the elements of a practical social contract for successful buffer zone management at the Kitanglad National Park, and a municipal natural *resource management plan that will guide land use decisions for all zones of the landscape from the park boundary to the lowlands.*

2) *Develop elements of <u>enhanced agrodiversity</u> and better livelihoods in the Kitanglad National Park buffer zone and the adjoining private lands in Lantapan through the participatory development of improved agroforestry systems.*

3) *<u>Characterize, protect, regenerate, and expand the natural biodiversity</u> of the Kitanglad National Park and the buffer zone, and incorporate this information into a realistic natural resource management system for the upper watershed.*

The three objectives translated into three subprojects whose results are the elaborated further in this paper.

Assembling the Elements of a Social Contract for Biodiversity Conservation

Our work on natural resource management strategies and policy had two components. The first focused on assembling the information needed to guide the development and implementation of a natural resource management plan for the Municipality of Lantapan. The second aimed to analyze the ancestral domain claim of the Tala-andig people in relation to the natural resource management issues of the natural park and the surrounding municipalities. It became clear that the interactions between these three domains (the Park, the ancestral domain claim, and the municipalities) must be clarified and reconciled. The work aimed to provide options leading to a consensus that would meet the various stakeholders' concerns.

The foremost policy issue facing the SANREM project is overlapping land rights and management priorities. While buffer zone research and conservation activities related to the Kitanglad park make up the majority of the SANREM work plan, much of the project area falls within the constitutionally protected indigenous rights of Tala-andig communities. Tension between Tala-andig control over the management of ancestral areas and the conservation priorities expressed by local government and park management is a critical consideration as efforts to promote sustainable resource management evolve. Of all aspects of the promotion of community-based natural resource management, dealing with the question of resource rights is perhaps the most difficult. Regulatory frameworks in most forested countries heavily favor the granting of large concession areas to forest industries or set aside wide tracts of land for conservation. This is often done at the expense of local communities that have internationally recognized rights to lands covered by these areas. In many parts of the Philippines, local people are actively resisting the expansion of forestry and conservation activities into their traditional lands they depend upon to survive.

The Philippine community forestry program is designed to address the needs of the nation as a whole as well as those of local communities that depend upon and have clear rights to forest resources. Central to this approach is the development of a package of options government now offers local communities, a package that in many ways is not unlike what is offered forest industry. Foremost is the right to exploit forest resources in selected secondary forests. But unlike the forest industry, many local communities have long-term traditional rights over their land classified by the state as forest --- rights that must be considered during the development of tenurial instruments for local people.

Villagers, universities and NGOs in Indonesia and the Philippines have developed a two stage approach to promoting secure tenure for communities that hold ancestral rights. The first entails work within the state regulatory framework and promotes the granting of limited use and management rights to local individuals or communities. This responds to the immediate need for halting the conversion of ancestral lands to large-scale forest concessions while at the same time supports sound management of these areas. The second stage is a long-term legal and political struggle by local people to gain legal recognition that their lands have been misclassified as state forest zone and that in fact private rights are attached to these areas.

The community forestry program also includes opportunities for local people to be central players in the management of protected areas, particularly national parks. The National Integrated Protected Areas System (NIPAS) enabling legislation explicitly supports the rights of Indigenous Cultural Communities (ICCs) who are living within NIPAS sites. While this law has opened the door for ICCs to participate in the development and implementation of conservation areas within their ancestral areas, many questions, such as the processes that will lead to complementary management approaches remain unanswered (Dagondon et al, 1997).

In 1994, a group of Tala-andig Datus (community leaders) prepared and submitted a Tala-andig ancestral domain claim covering more than 40,000 hectares. The claim includes the entire Kitanglad Park and surrounding buffer zone. In May of 1996, the Provincial Special Task Force on Ancestral Domain, chaired by the DENR and responsible for the recognition of ancestral domain claims and the awarding of Certificates of Ancestral Domain Claims (CADC), delayed action on the Tala-andig claim by requesting an endorsement of the claim by the Kitanglad Park Area Management Board (PAMB), a group made up of local government officials, community leaders, government line agencies, and non-governmental organizations. After considerable deliberation, the PAMB opted not to take action, sending the claim back to the PSTFAD without an endorsement. As this nine month process unfolded, several mayors of municipalities bordering the park began to promote a process that would lead to ancestral domain claims that are based upon municipal boundaries, as opposed the one unified claim. The PAMB, apparently moving outside its mandate, organized a consultative process aimed at determining the best way for the Tala-andig to proceed with their ancestral claim. Some Tala-andig leaders assert that PAMB and local DENR used consultation formats that have favored efforts to promote municipal-based claims. As organizing on both sides of this issue continues, no aspect of SANREM community-based research and the IPAS community organizing work is unaffected. There is a need for clear guidelines for how consultations with local communities are conducted. It is possible that such guidelines could draw from similar work that is being done on how best to determine when "informed consent" of local communities has been genuinely gained.

Native belief that nature is controlled by a hierarchy of spirits whose wrath must be avoided, guides the tribes in a respectful attitude to the environment (Cairns, 1996). Indigenous practices such as safe havens for wildlife, preservation of keystone tree species, and restricting swidden size indicate a conservation approach to resource management. The tribes reacted to the degradation of their ancestral lands in 1993 by organizing and creating a network of 'tribal guardians' to maintain vigilance on the forest margins. Some seizures of poached lumber have been made and the initiative appears to be gaining momentum. The community-based park protection (CBPP) that is evolving spontaneously in these forest margin villages is internally-driven and has been enabled by reviving and strengthening existing tribal institutions. This determined and highly organized surveillance of the forest warrants recognition by DENR, and argues for further empowerment of these communities by formally decentralizing forest protection to their control.

The tribes' demonstrated commitment to conservation suggests that granting them ancestral domain would not be antagonistic to National Park objectives. Rather, it could form the basis of a contractual agreement in which the tribes would guarantee protection of the forest margins in exchange for commensurate development programs. The cultural diversity of the tribes has contributed to maintenance of the park's biodiversity, suggesting that cultural conservation should be an integral goal in National Park protection. Our findings indicate that while both Tala-andig and migrant settlers are guilty of park and watershed encroachment, Tala-andig communities represent the best bet for implementing sustainable land use systems that protect the integrity of the park. Research among a number of Tala-andig communities has revealed indigenous traditions and experience in implementing land use systems that aim at maintaining a balance between natural resource extraction and forest conservation. Consensus has emerged that the policy question that now needs the greatest attention is: "How does the Tala-andig ancestral domain claim and the management of lands under the claim relate to the conservation objectives of the Kitanglad National Park?"

As the SANREM Biodiversity Consortium pursues its work to develop methods for buffer zone management, it was judged opportune to hold a national meeting through which the Consortium could help synthesize the current status of such work elsewhere in the country, and share its experiences with others facing common concerns. The workshop, held in 1995, reviewed the principles and experiences in buffer zone management and agroforestry, identified lessons that could applied in current and future buffer zone management programs, fostered closer linkages, and planned follow-up action that will accelerate the successful implementation of buffer zone programs in the Philippines (Garrity, 1996).

The development of a natural resource management plan for Lantapan was not conceived as an initial objective of SANREM. The concept emerged as a result of two streams of converging issues: The imperative for the overall SANREM project to focus its many activities toward a clear, tangible goal; and a vision that emerged during discussions with the mayor, Mr. Teddy Pajaro, that the municipality would benefit from materially from having a plan that could incorporate all the scientific outputs that had been assembled. The decision to launch a municipal natural resource management planning process was made in 1996. A multi-sectoral Natural Resource Management Council was formed, with participation from individuals representing the various economic, social, and religious segments of the community. The draft plan was circulated and subjected to public hearings, and finally enacted by the Municipal Council in early 1998. The plan, and its process of development, are discussed in detail in another presentation at this conference.

Enhancing Agrodiversity: Agroforestry Systems for Sustainability, Livelihood, and Building a Social Contract

Agriculture is the dominant livelihood of people living in the villages near Kitanglad Park and most other protected areas in the tropics. Intensification of the agricultural systems in the vicinity of the park is crucial to reducing encroachment pressure in the park. Agroforestry land use practices are favorably suited to the boundary zones of protected areas. Complex agroforestry systems, particularly mixed perennial systems, are an attractive model for buffer zone management (Michon, 1993; Michon and de Foresta, 1990). Such systems may provide more stable and sustainable returns than monoculture systems of food crops or perennial crops, particularly under low input management (Garrity, 1994). They may also greatly enhance the level of biodiversity protection in agroecosystems, and may extend natural plant and animal biodiversity outward from the protected ecosystem into the agricultural landscape, as is evident in the case of the resin, rubber and fruit agroforests in Indonesia (de Foresta and Michon, 1994). Agroforestry practices provide a variety of ways in which agriculture can be intensified, tree cover can be enhanced, and biological diversity can be extended on the outside of protected areas. There is growing interest in the development of more intensive land use systems for forest margins all over the world. ICRAF is coordinating a global research program on Alternatives to Slash and Burn that seeks to identify policy and technology directions to guide national efforts (van Noordwijk et al., 1995).

The boundary area of Kitanglad Park is located at an elevation (600-1700 m), where temperate vegetable crops (including potatoes, cabbages, and tomatoes) are quite productive. Vegetable production is expected to further expand dramatically in the future. Our analysis indicates that the most likely future trajectory for farming systems in the buffer zone will be toward continuous vegetable production on a portion of the farm (0.1-1.0 ha), with perennials (timber or fruit trees) grown on the remaining farm area, particularly on the steeper parts. A farming systems survey including 67 families in three villages provided a picture of the current farming systems in the buffer zone (COPARD, 1996). During the training exercises that were held in each village, farmers drew a diagram of their current farm layout and enterprises. Later they constructed a new diagram of their vision of their farm in the form of a plan for gradual implementation: The most common plans were for the establishment of contour hedgerows on the annual crop areas of the farm, and increasing the area of fruit and timber tree crops. We developed a farmer-participatory research effort to backstop this self-perceived vision. The consortium focused on <u>three technology-related initiatives:</u>

- Enabling environment for smallholder tree production
- Participatory contour hedgerows initiative
- Intensifying indigenous fallow management

These research activities were implemented to develop sustainable agricultural systems in the upper watershed. They were seen as key components of the evolving social contract. The following sections describe the activities specific to each of these initiatives.

Building the Enabling Environment to Enhance Smallholder Tree Production Systems

We hypothesize that public sector support to build the enabling environment for smallholder tree production is a superior way to advance national, international, and private objectives for watershed protection compared to support for contract reforestation or large-scale plantations. Enhancing tree production would also increase rural income and reduce risk, and improve equity and participation in development. Contract reforestation, however, continues to be a dominant paradigm for public sector involvement in forestry. It has failed to deliver on expectations (Byron, 1998). An underlying assumption is that farmers don't want to grow trees, and if you want to encourage tree production among smallholders you'll have to pay them to do so.

Prior attempts to reforest the buffer zones of protected forests in the Philippines have tended to focus on the public sector (DENR) and the planting of large blocks of trees with local wage labor. These tree plantations were then guarded against fire and encroachment. Such a project was implemented in the Manupali watershed not long before SANREM began. Like so many other such top-down attempts, it was a failure. The plantations were burned out, often by local smallholders across whose land the trees were planted. Only remnant stands remain in the reforested area. Meanwhile, there is mounting evidence that smallholders will enthusiastically plant trees on their own farms if they have some semblance of tenurial security. There is increasing acceptance of the idea that smallholders are the key to future reforestation efforts in the tropics (Pasicolan, 1995; Garrity, 1994). Research in northern Mindanao (including Lantapan) has documented an enormous transformation toward smallholder timber tree production in this region in response to market development (Garrity and Mercado, 1994). The evidence from many countries now shows conclusively that smallholders have a strong affinity to grow trees for market if there is a demand for them (Arnold, 1997).

The approach we are testing is to ensure that the demand for trees and tree products is strong, that market infrastructure is adequate to keep marketing costs low, that price information is available, that improved germplasm is widely available of a variety of species to enhance yield and reduce risk, and that best management practices suited to local farm circumstances are in place. If these conditions are in place, smallholder farmers will grow trees on a substantive scale. They will not need to be paid to do so; in fact, paying them to plant trees will be counterproductive. If these conditions are not in place, these enabling conditions should be the focus of public sector efforts, not tree-planting subsidies. The research program is testing the 'enabling environment' hypothesis as the basis of our work in smallholder timber production systems. What are the most conducive and cost-efficient ways to enable wide-scale planting of trees by farmers? For cost-efficiency we look toward:

(1) Better germplasm diffusion: Cheap, effective methods of setting up large numbers of community and household nurseries.

(2) Species diversification: Ways of diversifying the species that farmers plant through
- expanding the market for species that are not currently grown
- evaluating alternative species for a range of soil and elevation conditions
- developing new indigenous species

(3) Improved tree management: Refining the management practices for the major species

Many studies have indicated that forest-based communities need to be empowered in the planning and implementation of natural resource management projects (Wynter, 1993; Fisher, 1994; Gakou and Force, 1996; Prein and Lopez, 1995) that employ tree-planting as an approach to forest replenishment (Postel and Heise, 1998; Rao, 1985; Cernea, 1989; Koffa and Garrity, 1996). They argue that smallholders will plant trees on their land if they have some form of rights to the trees and land, and have a suitable supply of adapted tree germplasm with a ready market (Garrity, 1994; Garrity and Mercado, 1994). Our initial work focused on determining an appropriate mix of species of interest to farmers, and testing diffusion strategies to incorporate them into farming systems rapidly and cost-effectively. The model that emerged for reforestation of the buffer zone was reliance on the self-interest of smallholders to plant trees on their own farms.

A farming systems survey (COPARD, 1996) and our previous training exercises (Koffa and Garrity, 1996) indicated that farmers in the buffer zone and private lands are very interested in expanding the area of timber trees grown on their farms. The constraints to accelerating the process are inavailability of low cost and convenient seedling supply, knowledge of appropriate tree management, and availability of a wider range of tree germplasm to diversify risk.

Farmers currently have a very limited repertoire of potential timber species to choose from, due to inadequate knowledge of recent developments in tree germplasm development, and lack of planting materials of new tree options. We developed a comprehensive database on multipurpose tree species performance by elevational belt in the upper watershed based on participatory rural appraisal methods (Glynn, 1996).

The first step was to understand the performance of the species and provenances currently grown by households along the elevation gradient. We designed a survey that captured the observations of smallholders, and tested a method that hybridized participatory and more conventional mensuration approaches (ICRAF, 1997). An identification of the major perennial species followed a vigorous literature search to summarize existing information on their performance by elevation based on other data sources . We then conducted an informal survey (Glynn, 1997) across the watershed in January 1996 to make a more accurate separation of watershed classes, estimate sample sizes needed and sampling design, select the best candidate species for a more formal survey, define the parameters to be measured, and develop the interview protocol . On the basis of the informal survey the watershed was broken down into six elevation strata (later aggregated into four zones). From the original list of 38 species for which observations were recorded, those for which frequencies were impractically low were discarded. The resulting performance patterns of the remaining species were then compared to the elevational ranges as given in the existing literature. Those species exhibiting strong correlations with their reported range and whose ranges were not suitable to the midland/highland climate, were also dropped from further analysis. The literature review had highlighted some species whose climatic suitability greatly depended on variety. These cases distinctions were made on the basis of variety. Additional species were added to the remaining list at the recommendation of the local enumerators. This yielded a priority list of nine timbers and 17 fruit species for the formal survey.

In the formal survey informants were asked to rate (on the basis of other specimens of the species they had observed elsewhere) the rate of girth thickening, rate of vertical growth, and timber quality of the bole of the trees o their own farm. The enumerators measured the girth and height of each tree and noted the slope and elevation where it was planted. The survey revealed that there was very little variation in fertilizer application practices among farmers (93% did not fertilize), or in planting materials (100% used seedlings). A tree spacing of 2 to 3 meters predominated (86%). The spacing variability showed no association with elevation. Seventy-three percent of the sample population was on land of 0-3% slope. There were no significant differences in the slope of the locations sampled between zones. There was substantial variability in source of the germplasm, used by farmers, with the majority obtained casually and locally (73%). Line planting was the dominant planting pattern (81%). Pruning and weeding practices were the strongest potential sources of performance variability. Pruning was done on sixty-three percent of the observations. Weeding was done on 43%. Frequency of pruning was higher in the lower strata.

Gmelina arborea Roxb. is the most commonly grown timber tree in Lantapan. The literature-recommended range for commercial production is less than 1000 masl. Our results showed a strong negative trend between elevation and girth thickening, height growth, and bole quality. Further testing detected a significant decline in perceived performance between the lower mid-altitude (701-1200 masl) and upper mid-altitude (1201-1400 masl) zones. Regressions for the measured relationship between *Gmelina* diameter at breast height (dbh) and age were different for the lowland and highland. The regression line showed an advantage of 5 cm after two years. The slopes of the regressions were not significantly different, indicating that this difference did not increase substantially with age. This implies that the major difference in growth performance by elevation occurs in the first 2 years. A regression of measured dbh values by age classified by farmer ratings of either 'good' or 'poor', may be conceived as farmers' perceived growth rates for these categories. The regression indicates that the average rate of girth thickening for trees rated as 'poor' was about 0.4 cm per year, while for those rated as 'good' it was about 2.5 cm per year.

Are farmers' opinions reliable indicators of species performance patterns? Farmer response by elevation patterns were similar to expected trends as gleaned from the literature, and at least two of these responses - 'good' and 'poor' -- appeared to reflect genuine differences in growth rates when quantitative data were plotted in response class series (Glynn, 1997; ICRAF, 1997). Where the participatory method fell short was in conclusively identifying underlying causes for performance differences ('why do they grow poorly?'). Enumerators reported respondents as accommodating and interested. Enumerators appreciated the flexibility of the sampling design (by species quota rather than number of respondents). This enabled them to customize interview time to suit the interest level of the respondent.

It appears that the best results for reconnaissance level research on species performance by elevation could be obtained by hybridizing the two approaches (farmer perception survey and tree growth measurements). Use of perceived performance as an indicator of actual performance may be a more efficient approach at a broad scale. Note that nine species were considered here for perceived performance patterns compared to one for measured observations. Calibration of the response classes to at least get a general estimation of growth rate will further strengthen the results (but slow the sampling rate). Careful sampling design and collection of at least the most rudimentary information regarding confounding performance variables would flag potential dangers of misconclusion. A perception survey could be a valuable tool in reconnaissance-level research, yielding scientifically credible results with the capacity to support technical research planning.

Site-compatibility trials based on these results have now been established for eight timber species on 14 farms across a range of altitude, slope, and aspect. This work is being complemented by investigations to domesticate a number of local species identified and used by farmers for timber.

The most common timber species planted in the upper watershed are *Pereserianthes falcateria, Gmelina arborea*, and *Eucalytus camaldensis*. Farmer experience indicates that *Eucalyptus* performs particularly well at the buffer zone elevation levels (Glynn, 1996). We introduced germplasm of a range of other fast-growing timber species, with emphasis on new accessions of *Eucalyptus deglupta* and others. Farmers expressed interest in the propagation of adapted local forest species on their farms. Constraints to their propagation were therefore investigated (Palis, 1997). This was followed by the development of a series of trials to evaluate available commercial species for performance by elevation. Experimentation with a model of smallholder private nurseries strengthened experience with tree propagation. Documentation of these ventures is developing insights on the appropriate model to tap the entrepreneurial and technical spirit of individuals or groups to allow a continuous and growing supply of tree materials for outplanting on farms in the buffer zone.

A series of consultative workshops were conducted in 3 buffer zone villages (Cawayan, Kaatuan and Songco). They identified timber tree species that farmers prefer, the uses that they have for these species, their production and management constraints, and the pertinent training needs. Forty species (exotic and indigenous) were identified and their uses, and production and management knowledge gaps, were determined. A nursery was established (in Songco) to mass propagate experimental seedlings of preferred and other tree species, and serve as an experimental and extension arena for training on propagating new or lesser known species. Eight village-based nurseries and 15 small-scale woodlots were established by neighborhood (hugpong) members. Farmers propagated ten thousand seedlings of the 9 species. Species-site compatibility is crucial to tree domestication, and the lack of knowledge on this aspect of forest regeneration is a factor why many reforestation projects failed. Species by elevation trials were established on 14 sites ranging in elevation from 350 to 1700 m. These trials are determining their growth response to elevation, and thus superior trees for different elevations. Thirty eight farmers have received hands-on training on pre-nursery (planning, etc.), nursery (seedling production and maintenance, etc) and post-nursery (plantation establishment and maintenance) management practices. They formed the core of new nurserymen in their villages, and are now trainors for much larger numbers of new nurserymen in other villages.

We are comparing the pros and cons of three types of nursery systems and how they may be mutually reinforcing: private small-scale nurseries, neighborhood or hugpong nurseries, and village-level nurseries. By implementing nurseries with enthusiastic partners at all three scales we will develop case study experience and general guidelines to inform the private and public sector about more effective nursery development. The basic research question is: "Which approach is most effective in making tree-growing a smallholder culture?".

Boundary plantings to delineate the national park. Wells and Brandon (1992) noted that marking the boundary of a protected area with a band of trees was practiced in several projects. It proved effective in alleviating encroachment, when combined with other aspects. This experience suggests that such a practice ought to be considered as a component of any agroforestry initiative outside park boundaries in ICDPs. The Integrated Protected Areas System for Kitanglad National Park intends to delineate the national park boundary by planting recognizable species along the boundary. The Consortium is working with the National Park Director and the Kitanglad Integrated NGOs to link the boundary planting program with the smallholder nursery system in Lantapan. This will test and implement a mechanism by which smallholders are contracted to supply the seedlings, outplant them, and care for them during the initial years of growth. We intend to develop this as a model for such programs in other protected areas.

Developing Indigenous Species Alternatives. The declaration of the park as a protected area has virtually stopped illegal logging. Continued extraction of timber on a small scale by villagers has led to gradual decimation in number and diversity of species (Palis, 1996). Tree cultivation in the watershed relies on only a few fast-growing exotics. There is an urgent need to maintain a broader diversity of tree species to reduce production risks. This necessitates the development and use of lesser-known local species. Prospective species need to be identified, their properties and market potential assessed, and simple propagation methods developed to make them commercially viable alternatives. Initial surveys were done during the first phase through a series of meetings with the upland dwellers, coupled with ground fieldwork (Palis, 1997). They revealed that more than 50 local tree species are found in the mid-level of Mt. Kitanglad; of which 18 species were preferred by the local farmers for a number of economic uses such as material for house construction, furniture and fuel, among others (Table 1). A team composed of four members (2 each from Kaatuan and Sungco) volunteered to assist in locating the tree species. Fruits and/or seeds available during the field visits were collected. Stem cuttings were likewise collected from selected tree species whenever available, and tested for coppicing and rooting abilities. The main criterion favored by the farmers in selecting the trees is mainly based on immediate use rather sale. Farmers chose trees mainly for house construction followed by source of raw materials for furniture making and the least nutritional security, i.e., source of edible fruits. Incorporation of these trees in the farming and agroforestry systems can relieve some of the pressure on the forest protective zones. This will also broaden the diversity of tree species choices. The work complements that which focuses on the evaluation and dissemination of current commercial species.

Table 1. Indigenous Tree Species Identified and Selected by Farmers (from Palis, 1997).

Common/ Vernacular Name	Scientific Name	Family	Use(s)
• Panganga/ Kalaw-kalaw/ Malapotiokan	*Diecocalyx cybianthoides* (A.P.C.) Mag.	Myrsinaceae	lumber, furniture
• Dulitan/Sagasa	*Palaquim merrillii* Dub.	Sapotaceae	Lumber
• Mosisi/Musizi	*Maesopsis eminii* Engl.	Rhamnaceae	lumber,firewood, ornamental
• Kulasi/Malaruhat	*Syzgium nitidum* Benth	Myrtaceae	furniture, lumber
• Lamakan/Sidi	*Malicope triphylla* (Lam.) Merr.	Rutaceae	Medicinal
• Maniknik/Buga/ Sablot	*Palaquim tenuipatiolatum* Merr	Sapotaceae	Furniture
• Malataloto/ Kalamagan	*Pterocymbium macrocrater* Warb	Sterculiaceae	Source nectar
• Tambulian/ Lambiloan	*Eusideroxylon zwageri* Teijam & Binn	Lauraceae	Medicines
• Kalokoi/Hangilo	*Ficus callosa* Willd	Moraceae	Lumber
• Ulaian/Olayan	*Lithocarpus llanosii* (A. D.C.) Rebol	Fagaceae	lumber, firewood
• Balayong/Tindalo	*Afzelia rhomboidea* (Blanco) vid.	Caesalpiniaceae	post, wood
• Bangkal/ Pangalawagon	*Nauclea orientalis* L.	Rubiaceae	lumber,wood, furniture
• Kalingag	*Cinnamomum mercodoi* Vid.	Lauraceae	Medicinal
• Igem	*Podocarpus imbricatus* R. Br.	Podocarpaceae	furniture, wood, panelling
• Phil. Chestnut	*Castanopsis philippensis* (Blanco) vid.	Fagaceae	Food
• Gasa	*Castanopsis javanica (Blanco)* A. D. C.	Fagaceae	lumber, firewood, food (fruit)
• Hinuag/ Malakanyon	*Podocarpus philippinensis* Foxw	Podocarpaceae	furniture, panelling
• Kulambog/ Palali/Katmon	*Dillenia philippinensis* Rolfe	Dilleniaceae	lumber, food (fruit)