Chapter 10:
Grassroots Empowerment and Sustainability in the Management of Critical Natural Resources: The Agroforestry Tree Seed Association of Lantapan[1]

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Introduction

Quality germplasm, in this case seed, is the most significant input in farming systems, including agroforestry systems. Quality seed determines the upper limit of yield, the ultimate productivity of other inputs, transference of genetic information from one generation of crops to another, the basis of economic yield of the majority of crops and makes substantial contribution to productivity independent of other inputs (Sperling *et al.* 1996; Simons 1996; Cromwell *et al.* l993; Cromwell 1990; Thomas 1990). It is, therefore, an important source of innovation and intervention, particularly for farmers with small holdings of marginal lands, who have low capacity to absorb high losses and less resources for alternative inputs (Simons *et al.* 1994; Cromwell *et al.* 1993).

[1] We are indebted to the Sustainable Agriculture and Natural Resources Management Collaborative Research Support Programme, USAID, for financial support and partnership, and gratefully acknowledge the useful suggestions on the first draft of this paper from Dr. Gladys Buenavista and Dr. Ian Coxhead. This work was also made possible through the leadership of ATSAL management. We particularly acknowledge with profuse thanks the dedication and commitment of Alberto E. Ceballos, ATSAL's chairman, Alfonso Sagayan and Ricardo Labor, ATSAL's most supportive members.

The lack of quality seed has not only been identified as an impediment to the adoption of agroforestry technologies (Koffa and Garrity 1996), which the International Centre for Research in Agroforestry (ICRAF) is successfully disseminating through the Landcare Approach (Garrity and Mercado 1998; Campbell 1994) and participatory tree domestication initiatives (Weber *et al.* 2000) in Lantapan and elsewhere in the Philippines. It is also a major problem in the national quest to reforest millions of hectares of idle lands and problem soils in the Philippines for the protection of critical ecosystems such as nature reserves and watersheds. For instance, it costs just as much to establish tree plantations from poor (genetically inferior) seed as it does from seed of the highest genetic potential, but the difference in material and economic returns can be substantial. Poor quality seed has: (a) reduced storage capacity; (b) poor and non-uniform emergence when sown; (c) high incidence of abnormal planting stock, with high susceptibility to pest and disease attacks; and (d) often develops into plants of poor quality in terms of yield, form and growth rate.

In high-rainfall areas with steep slopes and nutrient-poor soils, as is true for the Manupali watershed and the buffer zone of the Mt. Kitanglad Range Nature Park (MKRNP), tree crops and tree-dominated agroforestry systems are the most stable forms of land use other than natural forests (Sayer 1991). The introduction of such agroforestry systems and component technologies in buffer-zones around protected areas has therefore been suggested as a credible technology option which may not only reduce pressure on forest resources, but may also improve the living standards of the rural population whose lives are almost exclusively dependent on such protected landscapes (Sayer 1991, van Orsdol 1987).

In nearly five decades of development work in the third world, U.S. (United States) institutions have developed and field-tested many approaches towards improved living standards for the poor but with varying degrees of recognized success. Outstanding among the lessons learned in these attempts is that development efforts, through participatory practices, must incorporate an appreciation and understanding of the priorities and constraints that shape the farmers' experience (SANREM-CRSP 1999). SANREM CRSP has embodied and employed this lesson in its work in Lantapan through the programme's four cornerstones of participatory research, inter-disciplinary teams, inter-institutional collaboration and a landscape scale of analysis of resource use challenges and opportunities.

This case study draws heavily on and employs the principles of participatory research and development and the building, and use of interdisciplinary teams of farmers and scientists to define problems and

identify and test potential solutions as partners in the management of a critical natural resource base. This paper discusses a strategy that attempts to give farmers the capacity to collect/produce, process and develop seeds of a variety of agroforestry tree species both as viable enterprises and for biodiversity conservation through the development of agroforestry systems and component technologies to manage the bufferzone of the MKRNP. Around the world, farmers currently depend upon more than 2500 tree species for construction materials, fence posts, firewood, charcoal, fibers, resins, waxes, fruits, medicines, fodder, poles and service functions such as soil conservation, boundary delineation and shade (Salim *et al.* 1999, Simons 1996). With these benefits the collection/production, development and marketing of quality tree seeds are potential alternative ways to promote local development so as to encourage improved natural resource management practices outside protected areas.

The Strategy

The strategy that was implemented involved continuous interaction between researchers and farmers during the identification, testing and extension of agroforestry technologies. This enabled us to establish a strong partnership with farmer partners, understand their practices and find ways to improve and enhance such practices. Our strategy also included assisting a grassroots organization through capacity building to support the project's research and extension activities and build a mechanism for the organization to sustain and extend its activities within the Manupali watershed and beyond. To follow is a detailed description of the strategy.

Creating an Interactive Participatory Research Process

In about a year of research and extension work with farmers in nurseries and on farms to improve the management of tree-based production systems, we learned that seed was collected by and exchanged among relatively few farmers, while others sold seed for cash in Lantapan and nearby municipalities. However, nothing was known about the appropriateness of the seed collection and the processing (extraction, cleaning, drying, storing, packaging) methods used, the quality of the seed exchanged or sold and the attendant constraints farmers were facing. A case study (Koffa and Roshetko 1999) was undertaken to address these and related issues and concerns.

The case study mainly focused on assessing the seed collection, processing and diffusion practices and systems of smallholders, so as to understand these systems and to improve and use them to serve as channels for producing and disseminating quality tree seed. The study indicated, among other findings, that while farmers showed commitment and had an entrepreneurial spirit in seed collection and processing, serious knowledge gaps existed as to standardized methods for seed collection. Most farmers, for example, collected seeds from only 1-5 trees. Collecting seeds from such a limited number of trees often result into the production of seeds of limited genetic base. Seed with a limited genetic base develops into trees that are highly likely to suffer from inbreeding depression. Inbred trees grow very slowly, develop poor form (*i.e.* branchy, shrubby and crooked stem) and are susceptible to pest/ disease attacks. Farmers, by and large, are quite familiar with cereal crops, which are generally self-pollinating and therefore breed true. Cereal crops differ greatly from tree crops, which are preferentially outcrossing (Dawson and Were 1997; Simons *et al*. 1994). Tree seeds must be collected to maintain a broad genetic base, and this is accomplished by collecting seeds from the minimum of 30 trees, which are about 50/m apart. The seeds are then bulked and mixed properly (FAO 1995). The requirement to maintain a broad genetic base is especially important if inbreeding depression in future populations of trees (in this case, on-farm) is to be prevented, and if an adaptive capacity in this genetic resource is to be provided to meet the ever changing and increasing needs of smallholders and the diverse micro-environmental and socio-economic conditions under which they must operate. Assessing and understanding farmers' seed collection/ production and diffusion practices and systems was a prerequisite to improving them.

In a workshop arranged to share these findings with farmers in 1997, the 15 seed collectors who attended said they were not aware their methods were inappropriate and welcomed the findings. At the end of the workshop, this group of farmers decided, with ICRAF's facilitation, to organize themselves into a seed collector/producer association that is now known as the Agroforestry Tree Seed Association of Lantapan (ATSAL) (Fig. 10.1).

Institutionalization of Farmer-managed Seed Production Systems

Germplasm supply systems can either be formal or non-formal and the two often co-exist in the tropical developing world (Simons 1996). The formal seed system has recognized or licensed seed programmes. In

Fig. 10.1. A lunch break of farmers who attended the "feedback" workshop during which ATSAL's formation was decided.

sharp contrast, the non-formal system is composed of unaccredited seed collectors or unlicensed seed traders who, generally, are not concerned about the quality of their products and services. This is the major source of seeds in developing countries. The formal system sustains its overall activities and assures the quality of its products and services. However, due to high production and distribution costs it delivers an insignificant proportion of the seed requirement of small, scattered, diverse and risky markets such as those found under smallholder conditions in developing countries (Cromwell *et al*. 1993; Cromwell 1990; Garay 1990). Our working experience indicates that smallholders, in Lantapan, in particular, and in the Philippines, as a whole, largely depend on the non-formal system for agroforestry tree seed.

An alternative system of an intermediate nature between the formal and non-formal systems is critical if farmers' needs for seed are to be met cost-effectively and sustainably. One means to address this concern is to involve farmers directly as more than mere recipients of seed but as active participants in an entire spectrum of activities, ranging from seed collection or production to seed processing and marketing. This requires building the capacity of smallholders to collect/produce their own seed on-

farm, adhering to standardized methods developed for this purpose and to exercise some degree of control over their production systems. Self-managed seed production systems are extremely important because these poor farmers cannot afford the cost of quality seed produced by the formal system or may not accept such seeds on account of the questions they usually raise about their quality .

Upland farmers have limited access, either directly or through extension services, to information and technologies generated to improve their lot. Their limited capacity to tolerate risks reduces their willingness to experiment and to adapt technologies to their own circumstances. Most importantly, perhaps they are rarely well-organized or powerful enough to pressure research systems to understand and meet their demands. If relevant technology is to be developed and adopted, farmers must be given a voice in the research process. In Lantapan, ATSAL has provided that voice because it enables farmers to pool their talents and limited resources together in a working relationship with researchers to serve their interests. As a strategy towards empowering farmers, the process of institutionalization consists of the following elements:

Building Capacity for Grassroots Associations in Agroforestry Management.

In workshops and village-wide assemblies organized to identify training needs, farmers were advised to signal their interest by listing their names, addresses and the themes/areas each would wish to learn more about as far as seed collection, processing and development in nurseries and management on farms. Those who provided this information attended a planning meeting to discuss their availability for training and training mechanics and schedules. Our training activities combined informal interactions and hands-on exercises. In the series of hands-on training exercises, the participants collected and processed seeds of varying sizes (small, medium, large) from a variety of agroforestry tree species, administered treatments to enhance germination of seeds of selected species in nurseries and undertook tree planting and management work on their farms.

The training activities lasted a little over three months, which spread over two years, as interested farmers could afford to put in only three days of training in each of the three months. Because farmers could not find the time to undergo training in three continuous months, this arrangement of training time was thought necessary and enough for them to have acquired adequate knowledge about and participate in every aspect of the activities involved in the management of tree crops. These

activities ranged from seed collection and processing to nursery and plantation establishment and management. Ten carefully selected members of ATSAL attended these training activities. Hundreds of other farmers also participated, but they did not put in as much time as the selected ATSAL members. The ten farmers were chosen on the basis of their demonstrated interest to learn more, their ability to teach others and their willingness to put in more time in practical work with researchers.

Some training sessions were rotated among villages as requested by the trainees. This was particularly done for seed collection and processing exercises, as well as for tree planting and plantation maintenance (fertilizing, pruning, replanting, thinning, weeding) in farmers' fields.

The goal of training was to strengthen the capability of ATSAL members and to create the environment for changing the state-driven approach to forest management away from a narrow focus on farmers as passive adopters ("beneficiaries", in government parlance) of imposed forest management schemes and practices, to a broad focus that accepts, respects and works with farmers as partners in the management of forests and other critical natural resources.

The specific objectives of the training, therefore, were to: (a) initiate or foster self-reliance and self-determination in resident smallholders within the buffer-zone to make informed and practical tree-planting and management plans and decisions; and (b) help scientists to develop, nurture and expand strategic alliance with smallholders as a means by which to strengthen private initiative in the management of forest and other critical natural resources within the buffer zone and beyond, thus protecting the MKRNP and similar landscapes throughout the Philippines. Through training we have developed and are working with a pool of talented farmers. On several occasions, this team of trained farmers was requested to train fellow farmers in other municipalities of Bukidnon on nursery management and tree planting activities.

The association, by the contacts it has established through the training it provided for other farmers, has broadened its markets and has sold seeds and seedlings to managers of various reforestation and community forestry projects in some provinces in Mindanao and the Visayas. In 1998, for example, ATSAL supplied seeds to the European Union-Agrarian Reform Support Programme's farm forestry projects in the Philippines, the Community-based Forest Management Programme of the Philippine Department of Environment and Natural Resources and exported seeds to Kenya.

ATSAL's current membership is comprised of 63 smallholders (as households and individuals). These members are residents of 10 out of the

14 villages of Lantapan, located across the landscape at upper elevations (Alanib, Cawayan, Songco, Victory) and relatively lower elevations (Baclayon, Balila, Bantuanon, Bugcaon, Kulasihan, Poblacion).

ATSAL serves as a unifying body that brings to bear farmers' collective will, skills, talents and efforts in meeting six key objectives relating to sustainability. These are: (a) to collect and process quality tree seed to meet household tree planting needs and for the markets; (b) to establish, develop and manage tree nurseries and tree planting activities efficiently and cost-effectively; (c) to harvest, process and market trees and tree products and to produce wood for home consumption; (d) to train other farmers in the collection and processing of tree seeds, and the establishment and management of nurseries and plantations; (e) to serve as a channel for disseminating and diffusing quality germplasm of promising agroforestry tree species from other countries; and (f) to conserve steeply-sloped areas of farmlands by undertaking low cost , efficient soil erosion control measures, employing the independent or combined effects of grasses, shrubs and trees on contours to stabilize soils and check erosion. ATSAL is a chapter of the Landcare movement in Lantapan, active in the collection, processing, diffusion and marketing of tree seeds, which are important inputs of agroforestry systems and component technologies (Fig. 10.2).

Developing Management Efficiency

The production, development and management of quality seed and the income accrued as a result are in themselves significant achievements. However, these are only a part of the whole picture of tree resources management. Unless quality seed is developed in nurseries and introduced and managed on-farm, it cannot become a component of an agroforestry system or an agroforestry technology from a practical standpoint. Working with ATSAL, efforts are made to get farmers to engage not only in the establishment and management of nurseries and plantations, but to perform these tasks efficiently.

Nurseries are managed to raise uniform and healthy planting materials for the highest plantation output(s) at the least possible cost in terms of cash, labor, space and time. Our participatory research and development efforts are contributing to learning from and with farmers, particularly in the work in decentralized nurseries (those managed by individuals or group of individuals). Management of decentralized nurseries, a continuing effort, implies a situation in which rural people themselves, as individuals, households or group of households, raise seedlings of species they prefer, primarily for their own needs and the

Fig. 10.2. A seed processing session of the workshop that followed a series of seed collection activities (in the field). Note the arrangement of seeds of four tree species with respect to size (large, medium, small:L-R)

local market. The various plant materials involved in ATSAL's work in nurseries include landraces, exotics and indigenous tree species.

Decentralized nurseries are more appropriate for the smallholders than centralized types (those run by corporations, cooperatives, etc) for the following reasons:

a) **Distribution and management efficiency**. Because smallholders in Lantapan generally live in villages isolated by distance and rugged terrain, production and transport of seedlings is convenient, safe and made easier only by establishing and managing small-scale nurseries in or close to these villages;

b) **User sensitivity**. Better provision of seedlings for a range of farmer-preferred tree species is made possible in decentralized

nurseries, where farmers can and do engage in production for and by themselves at any time convenient to them;

c) **Equity**. Decentralized nurseries provide a wider distribution of the economic and related benefits from raising seedlings. Because these types of nurseries require relatively low inputs and can be established on small plots of land around homesteads, they are an enterprise in which socially isolated and economically disadvantaged people can participate to improve their lot; and

d) **Sustainability**. The management of decentralized nurseries is a credible approach to sustainability in developing forest resources, as this means transferring the means of production to end-users. When this happens, sustainability is highly likely to be a reality.

There are now 28 nurseries managed by ATSAL members across Lantapan. These include one central nursery where farmers work together to produce seedlings of various species (including native and exotic timber and fruit trees) to meet their marketing and on-farm tree planting needs. About 56 small-scale woodlots (0.15-0.5 ha) planted in blocks, boundaries, *etc.*, have been established on-farm with seedlings propagated by the smallholders, with technical assistance from ICRAF.

While there are standard procedures for tree propagation that can be applied with minor adjustments at different levels of production, creating a management system that could be conducive to sustainable production on the smallholder level is more problematic and remains a challenge. Such a system answers a host of methodological questions and, hence, contributes to fostering wide-scale adoption of agroforestry technologies and sustainability in production. Our work with farmers in decentralized nurseries is a step towards building such a management system, because this approach enables researchers to identify areas for improvement in farmer-managed nurseries, which cannot be diagnosed by conventional data collection methods such as interviews and surveys (Fig. 10.3).

Encouraging Product Diversification

Because of the multiple needs of farmers and the vagaries of markets and the physical environment, product diversification to avert risks is very important. ATSAL members are not only collecting seeds of timber trees to meet their tree planting requirements and for cash, they have

Fig. 10.3. Transplantation of young plants from seedboxes to plastic bags. This is an extremely important activity in seedling production. Participants in this training exercise also include farmers who are not members of ATSAL.

also been trained to produce seedlings of fruit trees for their own use and for the market. The association is also in the process of establishing silvopastoral systems in backyards where fodder trees and animals (rabbits and goats in particular) are to be integrated and managed. This, of course, will require cash for each household to buy at least a pair of these animals.

In the past, research focused on producing broadly uniform technologies, which were widely applicable across a range of conditions. The Green Revolution is a concrete example. With resource-poor farming systems, research must produce multiple products tailored to the identified needs of diverse client groups and production systems (Merrill-Sands *et al.* 1991). Thus, when research addresses the needs of resource-poor and risk-averse farmers, it must generate a number of different technologies, enhance their adoption in a wide range of conditions and evaluate them according to the broader range of criteria that farmers use. Product diversification contributes substantially to the generation of

different technological options. It also contributes significantly to meeting the changing and specific needs of small, poor farmers.

Linking Farmers to Markets

There is evidence worldwide that agroforestry systems and component technologies have raised productivity of smallholders, whose production has largely been subsistence. Chief among the problems farmers face in Lantapan in this regard is the lack of adequate market and marketing information to sell their products or to profitably dispose of any excess that must have been produced as a result of improved agroforestry systems and technologies. A study was conducted to assess the market and marketing channels for smallholder-produced trees and tree products in Lantapan (Koffa and Garrity 1999). Information has been gathered on potential markets for ATSAL's seeds, seedlings, timber, poles and lumber. ATSAL's representation in national tree farmers' congresses and workshops has also been facilitated. This has helped the association identify more markets for its seeds, seedlings, timber, poles and lumber.

Tree seeds generate income and employment faster and probably to a greater extent than wood, particularly for tree management systems like those in Lantapan where timber production is the primary objective. Tree seed production affects soil stabilization because it reduces the frequency with which trees must have been harvested within the buffer zone, on steeply- sloped lands where intensive farming of cereal crops and vegetables is ongoing. This also means more wood can be produced and hence more income generated, since more wood is expected to be harvested with the longer rotation age made possible by seed harvesting and marketing. What the latter statement assumes is that as farmers earn from seed sales, they are likely to be able to afford to wait a little longer before harvesting their trees for cash.

As of November 2000, ATSAL had earned $29,591.00 from the sale of tree seeds and seedlings. The processing and marketing of these forms of germplasm is managed by the association's germplasm collection, handling, development and marketing committee. Figure 10.4 shows a group of ATSAL members visiting one of the lumberyards and sawmills where lumber is sold.

Fig. 10.4. A group of ATSAL members visiting a lumberyard and a small-scale sawmill. There are three of these in Lantapan and dozens in the municipalities of Malaybalay and Valencia. These establishments are markets for smallholder-produced wood (sold here mainly as sawn timber)

Discussion

Advantages of farmer-managed seed production systems

There have been a large number of seed projects and programmes in many third world countries; the actual successes of these, as they affect the smallholder, appear relatively limited and the processes by which the seed reaches the farming community are not documented (Garay 1990). In working directly with farmers we realize that opportunities exist to increase the impact of tree domestication efforts and, hence, to improve agroforestry systems and component technologies, by elucidating effective diffusion mechanisms at the farmer level through the capacitating of self-seed production systems.

The smallholder-managed scheme has several positive features: (a) farmers do the work themselves; (b) the seed is available where the investment required is minimal; and (c) farmers have good knowledge of the potential of the seed; and (d) the seed can be tested by farmers themselves, under the diverse micro-environmental conditions under which they operate. This user-driven approach to seed supply and diffusion is efficient and cost-effective as farmers become extensionists and researchers at the same time. ATSAL members collect seed mostly from exotic plantations established about two decades ago and patches of natural forests that are not necessarily owned by the association. As such, these are not sustainable seed sources. On-farm trials of indigenous and mostly exotic tree species, established three years ago to select the best species mix on varying elevations, are being transformed into seed production areas to respond to farmers' demand. Seed have already been collected from three of these trials (Fig. 10.5).

Fig. 10.5. A portion of one of the 15 on-farm trials involving 14 tree species, established on 10 sites of varying elevations. The trials (including this plot) are three years old.

Buffer-zone Agroforestry and Biodiversity Conservation

Buffer zone agroforestry has been ICRAF's principal approach to conserving biodiversity of the MKRNP. Genetic diversity is a critical component of biodiversity. The sources of genetic diversity in the gene pool of a given crop, including trees, include (a) wild relatives (natural processes unaided by humans); (b) landraces (crop evolution, selection and adaptation in farming systems of highly heterogeneous and often marginal environments); and (c) formal breeding (to create new genetic combinations on the basis of predetermined criteria) (Eyzaguirre and Iwanaga 1995).

While new technologies employed in mutation breeding programmes and some engineered genes (of those with enhanced herbicidal resistance) may introduce new variations, isozyme and molecular data on diversity in wild relatives, landraces and modern cultivars indicate that wild relatives and landraces remain the major sources of genetic diversity in crop gene pools (Miller and Tanksley 1990). The approaches to maintaining these principal sources of diversity in farming systems, while providing development options that support the continuity of populations of wild relatives and landraces, are to: (a) work directly with genetic resources which smallholders value and conserve; (b) create and conserve protected areas; and (c) provide smallholders with genetic diversity in the form of landrace germplasm from a range of sources (Ezaguirre and Iwanaga 1995; Maurya *et al.* 1988; Altieri and Merrick 1987).

ATSAL and Biodiversity Conservation

Our work with ATSAL and the rest of the farming community in Lantapan addresses the key elements for maintaining the three major sources of diversity, as discussed above, while paying attention to meeting the socio-economic and related needs of bufferzone residents. Complex agroforestry systems are being developed and are contributing to diversified and sedentary farming practices within the buffer-zone. This will not only curb further encroachment on the remaining forest of the park, but will also increase productivity and generate income and employment for marginalized buffer-zone farmers. These activities clearly link conservation with development.

Linking conservation to development, as a growing body of literature indicates, creates a situation in which local communities see themselves as genuine stakeholders in resource management and park protection (Colchester 1996; Wells and Brandon 1992; Maurya *et al.* 1988). For example, the cash benefits from the marketing of seeds and seedlings by

farmers themselves, in addition to enabling farmers to establish their own woodlots to meet their needs, create a social contract that links the welfare of these local resource users to park protection. This, in essence, gives birth to a viable enterprise that links development to conservation as well as sustained, decentralized management of Lantapan's critical natural resource base.

ATSAL and Grassroots Participation

Despite the recognized and established significance of grassroots participation in attempts to manage the critical natural resource base (see Gakou and Force 1996; Fisher 1994; Clarke 1991; Raintree 1991; Cernea 1989; Postel and Heise 1988; Rao 1985), in practice there has been limited improvement in the contribution of natural resource management projects and programmes to local development. The essential argument is that participation has largely been seen in terms of merely seeking involvement of local people in projects exclusively conceived and largely designed by outsiders, rather than creating an enabling environment for local control of resource management through the participatory development of the required skills on the grassroots level.

In the Philippines, the entirely outsider-driven approach to resource management has clearly manifested itself in the establishment of new organizations instigated by outsiders in a given rural community or beyond, or hastily organized by insiders, rather than carefully identifying and supporting local grassroots institutions. The underlying problem is that outsiders often ignore the existence of local institutions, either because they do not believe in their effectiveness or simply because they do not recognize them as institutions (Fisher 1994). Identification and recognition of grassroots organizations are key requisites to genuine participation. Interactive participation of farmers has been the central tenet of our work with them, including those who are not members of ATSAL.

The Future

ATSAL is barely two years old. Its members need more training in entrepreneurial skills, the management of small-scale wood processing and related industries, livestock husbandry and the propagation and husbandry of a host of indigenous tree species and non-timber forest products (abaca, bamboo, bee keeping, fodder, fuelwood, fruit trees). The association, with time, is expected to graduate into a tree-farmer cooperative that spearheads collection and production of quality tree seed

as well as its distribution and diffusion. ATSAL may also serve as a channel through which quality germplasm from sources in other countries may be introduced to a host of farmers and tested on-farm in the Philippines and other Southeast Asian countries. Training is also needed to develop skills for the collection of market and marketing information and to operate and maintain harvesting and processing equipment.

Conclusion

Biodiversity conservation and management has been one of the programme components of the SANREM-CRSP. Its goal is to evolve community-based approaches/strategies to the conservation, management and utilization of existing biodiversity (fauna, flora) in selected regions in the tropics. In our bottom-line world, results tend to be equated with an immediate, tangible product, something that can be captured with a dollar sign or a snapshot. However, in a community-based approach to biodiversity conservation and management, today's successful product can become tomorrow's white elephant (in the form of abandoned hedgerow systems or abandoned community-based nurseries) if it is not a fruit of a genuine and broader participatory process. This is not, in the least, to suggest that the emphasis on results is misplaced. It is particularly vital today in the world of growing demand and dwindling resources.

The challenge on our hands, therefore, is to identify a community-based development strategy that will take into account both success in the short run and sustainability over time, in attempts to conserve critical ecosystems upon which the lives of smallholders directly depend. Improved agroforestry systems and component technologies, if developed through a credible participatory process, offer a lasting solution in these respects. In about two decades, agroforestry has re-emerged as a means to produce traditionally important goods and services, listed earlier in the body of this paper. As such, agroforestry can be viewed as an intervention to break the downward spiral of land degradation and rural poverty.

The forest and non-wood forest-based products whose simultaneous production agroforestry systems provide, can be used by smallholders in Lantapan to either generate cash with which to buy fertilizers to improve the yields of staple crops or as a profit-motivating incentive to promote the establishment of more trees on-farm. This, ultimately, will ameliorate soil depletion and land degradation across the landscape of the Manupali watershed and the forest margins of the MKRNP. Thus the vision now is of agroforestry as an integrated land use system that combines

productivity and income generation with environmental rehabilitation and diversification of agroecosystems. Central to the development of improved and efficient agroforestry systems are quality seeds and the processes involved in their appropriate collection/production, processing, development, dissemination and marketing.

ATSAL is a product of a farmer-oriented research and development process that encourages grassroots participation in conservation. This process initially identified seed collection and marketing activities which farmers themselves undertake towards improved living standards. Working with farmers, these activities are being improved and formation of a grassroots institution facilitated. This process creates and strengthens links between farmers and researchers in three basic ways that also promote interactive participation. First, it emphasizes feedback, and this helps to ensure that research is driven more by demand (responding to the needs of farmers) than by supply (reflecting mostly the interest of scientists). Farmers will actively participate in a process if they know that it genuinely takes their interest seriously. This attitude is highly likely to develop when "external" assistance identifies "internal" initiatives and interest with which to work and improve (if need be), rather than re-inventing the proverbial wheel. This approach is not only cost-effective; it also enhances interactive participation and ensures sustainability.

Second, the process performs three basic tasks that are critical to technology generation and adoption. These are diagnosis of real problems, design of relevant solutions and evaluation of technologies. Third, this client-oriented participatory research and development process enables researchers to monitor changing problems in farmers' situations, thus enabling research to take corrective action or respond more quickly to farmers' evolving needs. Evolving strategies for community-based resource management must be sensitive to farmers' evolving needs. About four years ago, the Manupali watershed was dominated by a single tree species, *Gmelina arborea*, planted mostly along boundaries. To date, a variety of other tree species has been introduced through the numerous woodlots farmers have established on their farms. There is therefore a greater tree cover within the watershed than it was four years ago. This increase of tree species in diversity and space is a living testament of increased experience and self-reliance of farmers, engendered by the research and training this project provides. What must be remembered here, however, is that research and training efforts were directed to strengthening technologies which farmers themselves genuinely felt could improve their standards of living.

Our ultimate partners, smallholders, are more concerned about the health and continuing productivity of their land than any salaried employee;

their survival depends on this. Concerned farmers, if properly trained and organized, will therefore react positively to technologies, which would improve their management efficiency, produce economic benefits and conserve the natural resource base upon which their lives directly depend. The collection/production of quality tree seed and its processing, development and marketing, integrate conservation with development. The ATSAL experience demonstrates that even in the most remote and apparently resource-scarce situations, it is possible to develop a viable production system that draws its strength from interactive participation.

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