Economic Growth and Watershed Management: Drivers of Research and Development Innovations

DC Catacutan, CE Duque, RE Margate, and LJ Arbes
World Agroforestry Centre (ICRAF-Philippines)
delia_icraf@yahoo.com

Abstract

The Municipality of Lantapan is wholly contained in the Manupali Watershed, Bukidnon province, in the Southern Philippines. Lantapan's economy, landscape, and political environment exemplified tensions between rapid population growth, economic changes, and environmental stress. Recent growth in agribusiness spurred changes in landuse and economic and social structures. This paper discusses the research innovations and lessons learnt from the World Agroforestry Centre's (ICRAF) collaboration in the Manupali watershed. Initially, ICRAF's study focused on assembling the elements of a realistic bufferzone management of Mt. Kitanglad Range Natural Park (MKRNP) on the northern border of Lantapan. Agroforestry intensification and community-endorsed social contract were important elements of effective bufferzone management. The Landcare approach, which centres on formation of landcare groups, was used to rapidly disseminate agroforestry and conservation farming technologies, with apparent success. 18 % of farming households adopted conservation technologies, covering 17% of cultivated lands and 23% of critical areas of the watershed. However, landcare groups backslide a year after it started due to availability of off-farm employment in the agribusiness sector and the ambivalent support of the municipal government, which encouraged the proliferation of agribusiness to boost the rural economy. To address this dramatic change in farmer decisions and local government priorities, ICRAF refocused its research activities on multiple functions of trees, environmental services, and policy innovations. The lesson learned is that economic growth and watershed management goals are key drivers to Research and Development (R&D) innovations. Rooted in adaptive management, R&D organizations must learn and adapt their programs to local needs.

Key words: *Landcare, agroforestry, adaptive management*

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1.0 Introduction

The Philippine watersheds, which comprise more than half of the country's total land area, provide vital economic and environmental services and livelihood support to more than 20 million Filipinos living within these watersheds. In the Philippines, "watersheds" are generally characterised as "uplands", and both terms are often, interchangeably used.[1] Population growth and the lack of ability of the urban economy to absorb excess labour prompted lowlanders to migrate to the uplands. As a result, upland migration continues, exerting more pressure on land and forest resources. Hence, 80% of Philippine watersheds have been declared "critical" by the Department of Environment and Natural Resources (DENR). The availability of cheap labour and land resources has also made the uplands an ideal abode for investments in corporate farming and agribusiness. This pushed rapid urbanization, and promoted changes in economic and social structures (Catacutan 2005). While there is scope for economic growth in the uplands, there is more pressure on the natural capital, as a result of competition in the use of natural resources by smallholders and the agribusiness sector. Hence, upland dwellers undergo dramatic change as they explore new economic opportunities brought about by the agribusiness sector (Catacutan 2002). Forest encroachment and expansion of intensive agriculture and unsustainable farming practices are only few examples of the many complex issues confronting the uplands (Garrity et al 2002). Biophysical conditions in the uplands vary with soil types, fertility, climate, topography and vegetation within small areas and shorter distances. Hence, diversity, complexity and change characterized the Philippine watersheds (Catacutan & Mercado 2002).

Issues surrounding watershed management are ecologically, socially, economically, and politically complex. This complexity together with limited understanding of watershed management issues and the unpredictable nature of many natural (Taylor et al. 2006) and human-induced events, including land use change and development trends, contribute to uncertainty of management decisions and research and development (R&D) outcomes.

[1]The Philippine Department of Environment of Environment and Natural Resources (DENR) has defined upland areas in the Philippines as landscapes of slopes equal or greater than 18 per cent including the table land and plateaus lying at higher elevations which are not normally suited to wet rice (Stark 2000 p. 26). However, there is inconsistency on what constitutes an upland area, depending on the agency or the kind of project involved (Sajise & Ganapin 1990 p. 35). Nonetheless, Cruz & Cruz (1990) estimates the upland area to be 55 per cent of the total land area of the Philippines (Stark 2000 p. 26) (Catacutan 2005).

Changing local priorities further increase uncertainty and contribute controversy in the way watershed resources are managed. Increasingly, adaptive management is suggested as a strategy for addressing rapid environmental and social change (Taylor et al. 2006; Bormann 2006). Adaptive management was first introduced for use in natural resource management by Holling (1978). It is a systematic process of continuous improvement of practices by learning from the outcomes of operational programs and responding to changing demands of the environment where the program operates. Feedback and adjustments are key elements of adaptive management (Bormann 2006). The implication is that, rooted in adaptive management, R&D organizations must learn to adjust their programs, to address dynamic changes in social, economic and environmental settings.

Based on a decade of ICRAF's collaboration in the Manupali watershed, in the southern Philippines, this paper discusses how economic growth and watershed management issues in rapidly growing economies, influence or drive R&D innovations of assisting organizations. Although, ICRAF did not have an explicit management experiment, it consciously adapted and adjusted its R&D programme to local realities, through action-oriented research and development interventions, without losing focus to its institutional priorities and mandate.

2.0 The Context: Manupali watershed, Bukidnon, Philippines

The municipality of Lantapan is located in a river valley that is crossed by Mindanao's major north-south highway some 15 km south of Malaybalay, Bukidnon's provincial capital, and 100 km southeast of Cagayan de Oro City, the closest city and port (Coxhead & Buenavista 2001) (Figure 1). The left bank of the Manupali River bounds Lantapan on the south, and a major protected area, the Mt. Kitanglad Range Natural Park (MKNRP) on the north. Several sub-watersheds drain from Mt. Kitanglad Range across the extensively cultivated lands to the Manupali River, which runs into a network of canals operated by the Manupali River Irrigation System (MANRIS), servicing about 4,395 hectares of rice farming area (Rola et al 2004; Coxhead and Buenavista 2001). The whole system ultimately drains into the Pulangi reservoir, utilized for hydroelectric power generation by Pulangi IV, the largest hydroelectric power facility in Mindanao located about 50 km southeast of Lantapan (Catacutan 2005). Hence, Lantapan is wholly contained in the Manupali watershed, which was declared "critical", by DENR in 1992.

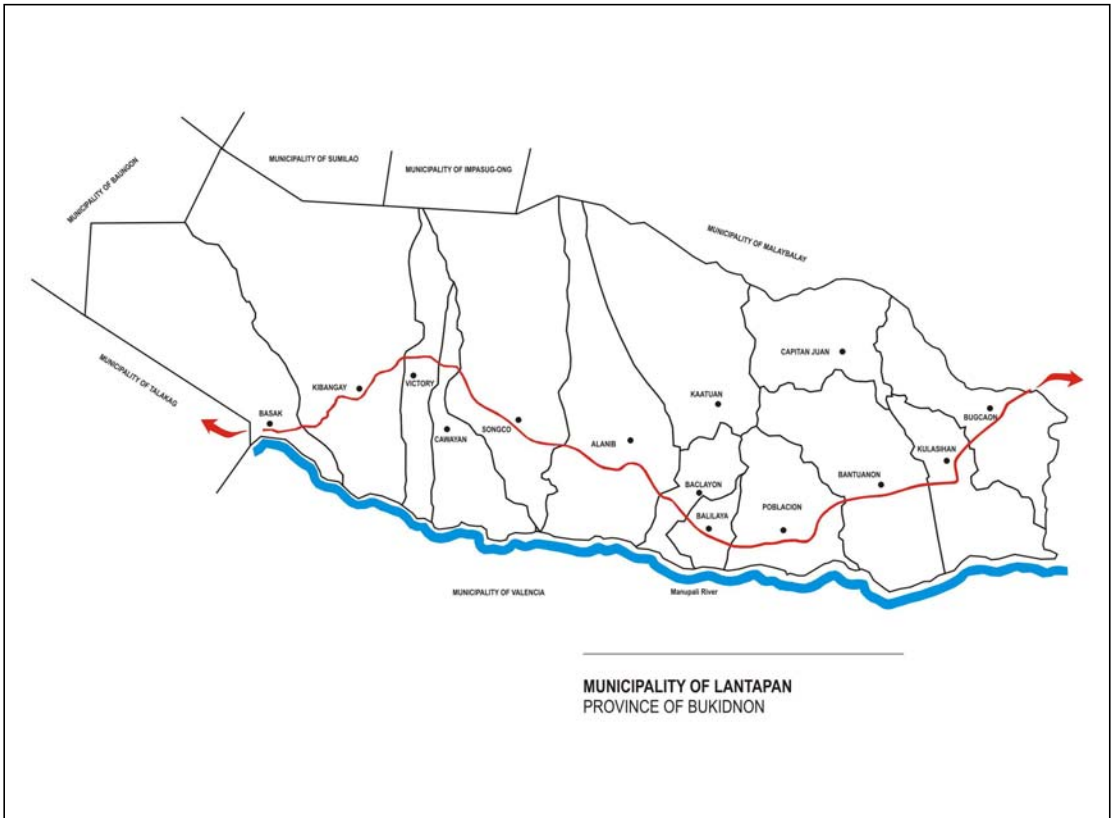


Figure 1 Municipality of Lantapan, Bukidnon, showing barangay boundaries
Source: ICRAF database, Lantapan

The watershed is also part of MKNRP, which is the habitat of many endangered, endemic and economically important species of animals and plants. MKNRP is one of the most important biodiversity reserves in the country (Amoroso et al 1996; Pipoly and Masdulid 1995; Heaney et al 1992), and one of the world's 25 biodiversity hotspots. The species richness and density of a square kilometre, including endemism is comparatively higher than any same area in America or European intact forests (Acosta 2001).

Furthermore, the watershed has a unique ecological diversity characterised by a combination and interplay of connected landscapes with high natural biodiversity, intensive agricultural practices, economic and developmental impacts across the landscape, resource-poor upland communities, presence of various interest groups (SANREM-CRSP PLLA 1995), and its contribution to the national economy and heritage. Communities living within the watershed depend mainly on agriculture, many of whom are indigenous peoples known as *Talaandig*. Major agricultural products include temperate vegetables, rice, maize, sugarcane, banana and others. Majority of farmers are cultivating on small farms averaging about two hectares for subsistence and commercial purposes.

Lantapan has a total land area of 35, 465 hectares. Of this, 21, 215 hectares are classified as alienable and disposable (A&D) lands, while 14,250 hectares are public lands. The municipality is divided into 14 barangays. Lantapan has an average elevation of 600 metres, which increases as one proceeds northwest to MKNRP to a maximum of 2,938 metres. About 70 per cent of the area has slopes greater than 10 per cent. Soil types are generally classified as Adtuyon and Kidapawan clays, which are mostly well drained, have clayey surface and subsoil horizons, are slightly to moderately acidic with low organic matter and high P fixation capacity, and have a low capacity to retain nutrients (Coxhead & Buenavista 2001). The average annual rainfall is 2,470 mm, and air temperature and solar radiation decrease with elevation (Laurente & Maribojoc 1997).

Lantapan's population has revealed a rapid increase since the 1970 census. Until 1980, the annual average growth rate was 4.6 per cent, much higher than the national average of 2.4 per cent (Paunlagui & Sumingit 2001). In 1995, the National Statistics Office (NSO) recorded a total population of 36, 943, which increased to 42,383 in 2000. Given this rate, it was projected that the present population would triple in the next 15 to 20 years. Paunlagui & Sumingit (2001) computed the man-land ratio in Lantapan, suggesting an increasing scarcity of agricultural lands for production at 0.15 ha per person, given the projected population of 114,198 in 2030. The ethnic groupings include 25 per cent indigenous Talaandig, 14 per cent Bukidnon, 51 per cent Dumagats (lowland migrants), and 10 per cent Ifugao from Benguet Province in northern Luzon. Since the Dumagat migrants are the majority, the dominant language is Cebuano or Visayan. As of 1995, the literacy rate was recorded at 92 per cent for those aged 5 to 35 and over.

Lantapan has an agriculturally based economy. Until recently, ninety per cent of the households have been dependent on smallholder farming. However, this changed since Mt. Kitanglad Agriventures Inc. (MKAVI) and Dole Skyland Philippines, two large corporations for highland banana production, started to operate in the late 1990s. The LGU estimated that about 60 per cent of the total labour force of Lantapan was now employed in these companies, and in commercial swine and poultry farms, while others had seasonal employment in large corn farms, sugarcane plantations, and in vegetable farms. The ongoing shift to large-scale commercial agriculture by large corporations and rich farmers pushed the smallholders to farm in much smaller plots in less productive and more environmentally fragile areas. Table 1 shows the different crops planted in Lantapan.

Table 1. Crops and area planted in Lantapan

Crops planted	**Area (ha)**
Corn (HYV, OPV white & traditional variety)	**4,081**
Irrigated rice	**698**
Vegetables	
Tomato	58
Brocolli	27
Ampalaya *(Momordica charantia L.)*	1
Cabbage	104
Carrots	13
Cauliflower	22
Sweet pepper	21
Sweet peas	16
Squash	27
Beans	17
Chayote (Sechium Edule)	19
White beans	6
White potato	51
String beans	1
Chinese cabbage	73
Singkamas (*Pachyhizus erosus*)	3
Sub-total	**459**
Coffee	**396**
Fruit trees (Lanzones & Mango)	**45**
Rubber	**42**
Banana	**2,000**
Sugarcane	**3,046**
Cassava	**2**
Abaca	**27**
Total	**10,796**

Source: Municipal Agriculture Office (MAO), 2003

Corn is grown everywhere in the landscape, but with corporate banana farming on prime lands, corn and vegetable production have been pushed towards the lower footslopes of MKNRP. The lower eastern boundary, which was irrigated by MANRIS used to be grown exclusively with rice, but farmers are shifting to corn and sugarcane due to poor price support for rice.

Two sugar milling companies about 30 kilometres southeast of Lantapan encouraged sugarcane production even in upper elevation areas. At middle altitudes, corn is grown with coffee as a secondary crop along with banana, root crops, and fruit and timber trees, while in higher elevation areas corn is planted alongside temperate vegetable crops such as potatoes, cabbage, cauliflower, lettuce, beans and tomatoes. With reference to the Philippines' primary vegetable production area in northern Luzon, Lantapan is considered the vegetable basket of the south. Lantapan's pattern of agricultural expansion involved the replacement of forest and permanent crops by annual crops, and the spread of annual cropping in high altitude and steeply sloping areas, pushing back the forest frontier. According to Lal (1990), this type of agricultural expansion and the intensification of cultivation in sloping lands are found to cause dramatic increases in soil erosion rates in humid tropical areas, causing further land degradation.

The inhabitants of the Manupali watershed exert pressures on both the remaining protected forests and managed ecosystems. Recent inventories of Heaney and other conservationists (cited in PENRO 2002) revealed that the number of birds and mammals has decreased. Amoroso (1997) also noted an alarming rate of habitat destruction due to human activities, including shifting and conversion of forestlands into agriculture production. Natural growth and in-migration resulted to farmers cultivating in steeper slopes and poorer soils, leaving lands in shorter fallow periods. The growth of agri-business also exacerbated the situation.

The conditions of the Manupali watershed are not necessarily unique to many Philippine watersheds. The interplay of economic issues and watershed management problems lends itself to greater interest for scientific studies, aimed at contributing to a body of knowledge that informs decision makers, and guides the decision-making process of local communities.

3.0 Research and Development Framework

At the height of popularity of participatory watershed management approaches in 1993, the Sustainable Agriculture and Natural Resource Management (SANREM), a USAID-funded Collaborative Research Support Program (CRSP) embarked its global effort to develop a new model for research on sustainable agriculture and natural resource management (Hargrove et al, 2000). The Manupali watershed was one of SANREM's three global sites. During the first phase of SANREM (1993-1998), R&D interventions were concentrated in Lantapan since it encompasses more than half of the Manupali watershed. Drawing on the Brundtland Commission report (Coxhead and Buenavista 2001) and lessons learned from the global experience with ICDPs (Wells and Brandon 1992; McNeely 1995), SANREM's research approach was built on participation, interdisciplinary collaboration, and multi-stakeholder cooperation at various social, economic, political and biophysical scales of the watershed.

The World Agroforestry Centre (or ICRAF) was then, leading the Biodiversity Consortium of the Philippines under the SANREM project.

The Participatory Learning/Lifescape Appraisal (PLLA) methodology and ICRAF's research during the initial years (1993-1996) documented the land use practices and interactions among community stakeholder across the landscape (COPARD 1996; Banaynal 1996). Research report revealed the need to develop an integrated and sustainable buffer zone management program. The research report stated that local communities in the Manupali watershed can become effective partners in watershed management activities. The protection of the environment for spiritual, cultural and livelihood purposes was innate in indigenous peoples' culture (Cairns 1996). Environmental stress in the watershed was attributed to lack of appropriate technologies and inadequate institutional arrangements that provide a framework for management of these systems.

3.1 ICRAF's R&D Innovations

ICRAF's work in the Manupali watershed concentrated on espousing a more fundamental understanding of people-ecosystem interactions to guide the development of natural resource management (NRM) processes (Garrity et al 2002). Research activities were aimed to develop the elements of a workable framework on economic growth and watershed management between local communities and outside stakeholders. The research hypothesized, that there are two aspects of sustainable bufferzone and management:

1. Agricultural intensification through a range of agroforestry systems in the watershed to enhance income growth, complemented by other forms of off-farm employment generation in the local and national economy; and
2. Community-supported enforcement of the boundaries of the natural forest ecosystem.

ICRAF's research activities focused on both aspects, implemented in succeeding phases. The first phase focused on agricultural intensification through agroforestry and conservation farming. The second phase was more to do with inducing institutional innovations to better improve NRM, which resulted to the development of grassroots organizations, namely the Agroforestry Tree Seed Association of Lantapan (ATSAL) and Landcare associations. The current phase focused on examining economic outcomes and ecosystem services in intensive agroforestry systems and institutional arrangements and mechanisms for rewarding ecosystem service. These R&D innovations are implemented progressively.

3.1.1 Phase 1: Agroforestry intensification

ICRAF researchers were investigating appropriate technical options suited to the biophysical and socio-economic conditions of the watershed population. This included tree farming practices and conservation farming with annual crops that have been widely adopted. Both researcher and farmer-managed on-farm experiments were conducted. Component technologies in agroforestry systems such as soil conservation practices (Mercado et al, 1999) and tree domestication were the technological facets of ICRAF's scientific queries.

ICRAF studies found that Natural Vegetative Filter Strips (NVS) are effective in controlling soil erosion, and could be a superior low-cost technology in the uplands. The NVS evolved as a variant of the SALT (sloping agricultural land technology) system when farmers experimented with the hedgerow concept by placing crop residues along the contour lines and leaving the native weeds to re-vegetate in the unplanted strips, eventually forming stable natural barriers to erosion (Garrity & Mercado 1994; Sabio 2002; Stark 2000; Catacutan 2005). It was found that NVS provide minimal below and above ground competition effects, and are effective in filtering field run-off by more than 90 per cent in a sloping farm of 40-60 per cent slope (Garrity et al. 2002; Garrity et al. 1998; Catacutan 2005). The advantages of NVS were summarised as follows: (1) they control soil erosion by more than 90 per cent and improve water infiltration during heavy rains; (2) they have low labour and cost requirements for establishment and maintenance; (3) they provide minimal competition with adjacent field crops; (4) they filter pesticides, nitrates and soluble phosphorus from water runoff; (5) they make subsequent land preparation and crop management easier; and (6) they provide a good foundation for farmers to develop agroforestry farms to increase productivity.

Parallel to this, ICRAF researches also experimented on various agroforestry tree species best suited to the different landscape positions in the watershed. The aim was to provide best-bet tree species for farmers to select (see Table 2). Once the NVS were in place, many farmers enriched them by planting timber trees, annuals or perennials on or above the NVS to compensate for the lost crop area, and to improve total farm productivity. Farmers planted timber trees including *Eucalpytus spp*., *Acacia spp*. and *Gmelina arborea*, and fruit tree species such as mangoes, rambutan, durian, citrus, and jackfruit. Spacing of trees depended upon the farmer's future plan for his farm. With closer spacing, tree canopies started to close between three to four years after planting, thus limiting the penetration of sunlight to the alley crops. Except when farmers opted for shade-tolerant plants or introduced ruminants under the trees, this system was no longer feasible for continuous cropping in the alleys. Wider alleys allowed farmers to plant annual food crops between the rows of the trees and grow fodder grasses between trees along the row. A wider spacing of NVS was found to be very useful for farmers who desired to continue growing food crops as the fruit and timber trees matured. Cash perennial hedgerows, like pineapple, banana, guava and coffee were also experimented with by farmers, who found that they earned more from cash crops than from the corn or annuals planted in the alleys. As a consequence, farmers progressively reduced the spacing of hedgerows in order to have more rows for cash crops. Forage legumes like *Flemingia congesta* and *Desmodium rensoni* were also planted by farmers. ICRAF described this process as the evolution of smallholder agroforestry.

Table 2-Tree species evaluated in Lantapan (1998)

Scientific name	Common name
Acacia aulacocarpa	Aulacocarpa
Acacia auriculiformis	Auriculiformis
Acacia crassicarpa	Crassicarpa
Acacia mangium	Mangium
Albizia lebbeckoides	Black wattle
Eucalyptus deglupta	Bagras
Eucalyptus pellita	Pellita
Eucalyptus robusta	Robusta
Eucalyptus torelliana	Torelliana
Eucalyptus urophylla	Urophylla
Gmelina arborea	Gmelina
Grevillea robusta	Grevillea
Mesopsis eminii	Musizi

3.1.2 Phase 2: Community-endorsed watershed management strategies

The Municipal Government NRM Plan

In 1996, a local-level and demand-driven Natural Resource Management (NRM) planning process began in the municipality of Lantapan. At that time, the town mayor felt that it would be beneficial if they will make use of the assembled scientific and research outputs of existing research institutions in the municipality by incorporating these in a plan (Catacutan 2005). The alarming condition of the locality's environment as well as the availability of information and technical assistance from various research institutions prompted the local government to prioritize natural resource management as a core program in its agenda, thus, the development of the Natural Resource Management and Development Plan (NRMDP). The environmental research-based information from SANREM provided the meat of the plan. While the planning process was self-designed by the Local Government, ICRAF's significant contribution to the plan stemmed mostly from its research work on soil and biodiversity conservation. One remarkable feature in the NRM process in Lantapan was the creation of a local multi-sectoral body---the Natural Resource Management Council (NRMC) that was a representation of community-sector groups combined with technical persons and legislators. The local planning team was designated to develop the NRMDP. The NRMDP of Lantapan articulated their vision below.

A stronger community partnership towards a well managed natural resources and ecologically balanced environment for a sustained development in Lantapan by the year 2002.

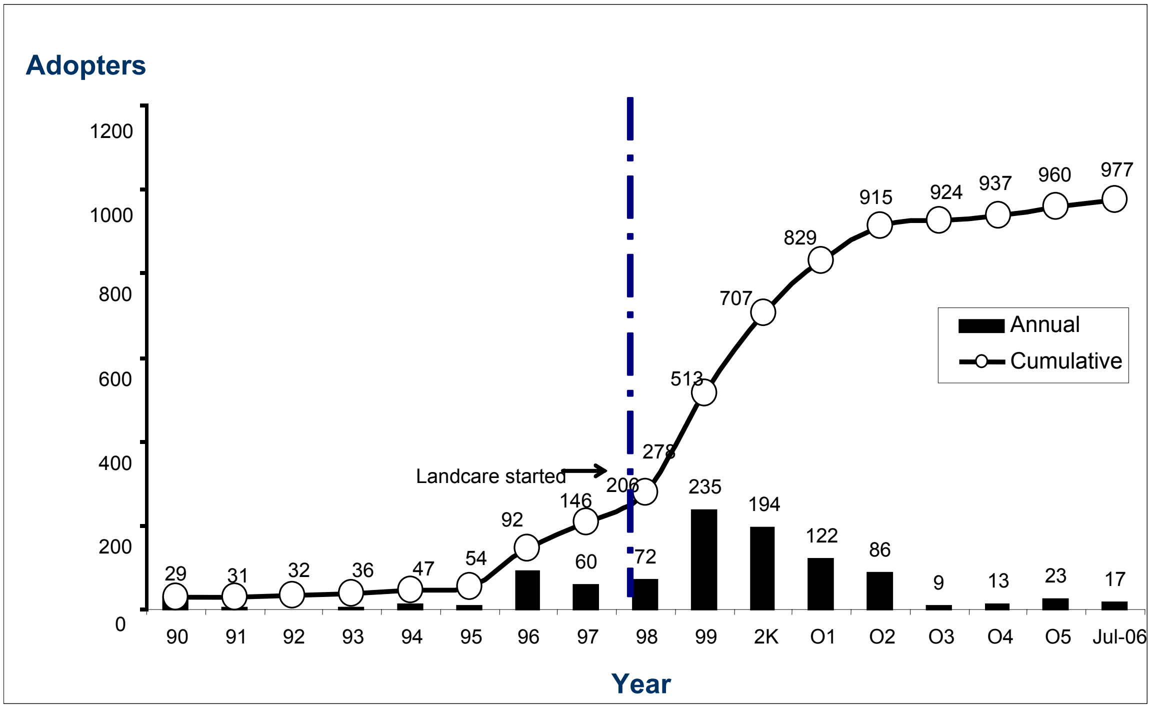
Three key pillars were identified to realize the vision; soil, water and biodiversity conservation. To support these, the NRMDP has also identified capability-building programs for the Council, the LGU, and the community people. Among others, ICRAF has maintained a strong partnership with the local government to help achieve mutual goals and benefits for the farmers of Lantapan. It is actively collaborating with the LGU in institutional development and working directly with the farmers for technology development, dissemination and adoption. Currently, ICRAF is leading a major dissemination effort under the NRMDP's biodiversity and soil conservation components. It employs the Landcare approach as a people-centered movement for dissemination, promotion and adoption of conservation farming techniques such as; NVS, which is considered an effective alternative to labor intensive soil conservation technologies, tree timber farm enterprise, entrepreneurial production of good quality planting materials for important tree species through nursery establishment and other improved agroforestry systems.

<u>The Landcare approach</u>

Landcare commenced in Lantapan in 1998, fostered by the activities of ICRAF, with support from a project funded by the Australian Centre for International Agricultural Research (ACIAR). Landcare is a farmer-centred program involving farmer-to-farmer knowledge sharing, training, and capacity building. As conceived by ICRAF, the Landcare Program involved technical and institutional innovations, described as the "landcare approach", with three cornerstones, namely, appropriate technologies, institution building, and partnerships. The Landcare Program in Lantapan built on ICRAF's earlier experience in Claveria, Misamis Oriental to the north (Mercado et al. 2001; Arcenas 2002; Sabio 2002; Catacutan 2005) and the prior interventions of an array of organisations under the SANREM Program. The ICRAF Landcare team comprised two experienced facilitators and four "intern" facilitators. The program began with a broad information campaign on environmental issues and conservation technologies, especially natural vegetative strips (NVS), a low-cost contour-farming technology. This campaign was implemented in all 14 *barangay* (local government units) of the municipality. A survey was then conducted to determine the level of farmers' interest. As a result, seven *barangay* in the upper part of the municipality were given priority. Major activities in these *barangay* included slide shows, cross-farm visits, and training, often repeated at the level of the local community (*sitio*). The training involved half-day or whole-day sessions that usually began with hands-on training in establishing NVS or with training in nursery management. This training was supported by visits to farms where the practices had been adopted. The first Landcare group was formed six months after the information campaign, in May 1999.

The recorded rate of adoption of conservation farming during the implementation of the Landcare Program was impressive. Combining adopters of the two main conservation measures – contour barriers and agroforestry – there were about 977 adopters by the middle of 2006, or about 18 per cent of the total number of farm households in Lantapan (though not all households were potential adopters), of whom 789 had adopted during the Landcare Program (see Fig. 2). The total area under conservation measures was about 1,229 ha (43 per cent under NVS and 57 per cent under agroforestry). This was 17 per cent of cropped land, 14 per cent of land under maize and vegetables, and 23 per cent of "environmentally critical" land, suggesting a significant impact at the landscape level. However, these figures do not account for any "dis-adoption" (failure to maintain NVS or planted tree seedlings), the rate of which has not been measured.

Figure 2. Adoption of Natural Vegetative Filter Strips (NVS) and Agroforestry



There was also rapid formation of Landcare groups, usually at the *sitio* level, and a Landcare Association, soon growing to 62 local groups with 840 registered members (though in practice membership was quite informal) (Catacutan et al. 2006). These groups were an important source of information on conservation practices for their local community and encouraged members and others to work together, especially in the establishment and maintenance of communal Landcare nurseries. However, many groups became inactive once the initial adoption of NVS and/or tree planting had occurred, and especially in those locations where banana plantation development and other agribusiness ventures had led to the demise of smallholder farming (Catacutan et al. 2006). In 2000, two multi-national banana plantation companies had established in Lantapan, followed by another one in 2004. Many farmer-members of Landcare were either employed, or have rented their farms to these companies (see Table 3). The decline in Landcare activities was also aggravated by the inconsistent support of the municipal Local Government. Although, local government officials were appreciative of the Landcare Program, it didn't provide enough support to boast Landcare activities, since its focus was more to do with infrastructure and social development. The LGU expected that the presence of plantation companies will accelerate economic growth in the locality. The too-rapid expansion of the Program may also have been a factor in the decline of group activity, limiting facilitators' capacity to follow up existing groups. By mid-2003 the number of active groups had dropped to 12 (20 per cent), while 45 groups (73 per cent) were reported to have disbanded (though individual members may still have participated in Landcare activities and some groups had the potential to re-form around new activities). Nevertheless, the Landcare Association remained reasonably active and had the potential to take on more aspects of the Landcare Program, especially the provision of training to outside groups.

Table 3- Reasons in participation decline & group disintegration

Reasons	No. of Key Informants	Rank
Employment in the corporate and private sector	48	1
Transfer of residence (due to peace and order situation problems)	21	2
Lack of leadership	19	3
Out-migration in search for greener pasture	8	4
Personal dissatisfaction & frustrations (e.g unapproved livelihood proposals etc)	8	4
Others	2	5
TOTAL	106	

In a recent evaluation of the impacts of Landcare, its contributions to the improvement of the lives of the rural poor include increased farm incomes, increase access to credit, reduction of dependency on external farm input, diversification of farm operations and livelihood strategies, and enhancement of access to efficiently functioning markets and market information; while ecological impacts include maintenance of ecological integrity, protection and/or increase of biological diversity particularly of indigenous species, prevention of land degradation, and protection of air and water quality.

The Agroforestry Tree Seeds Association of Lantapan (ATSAL)

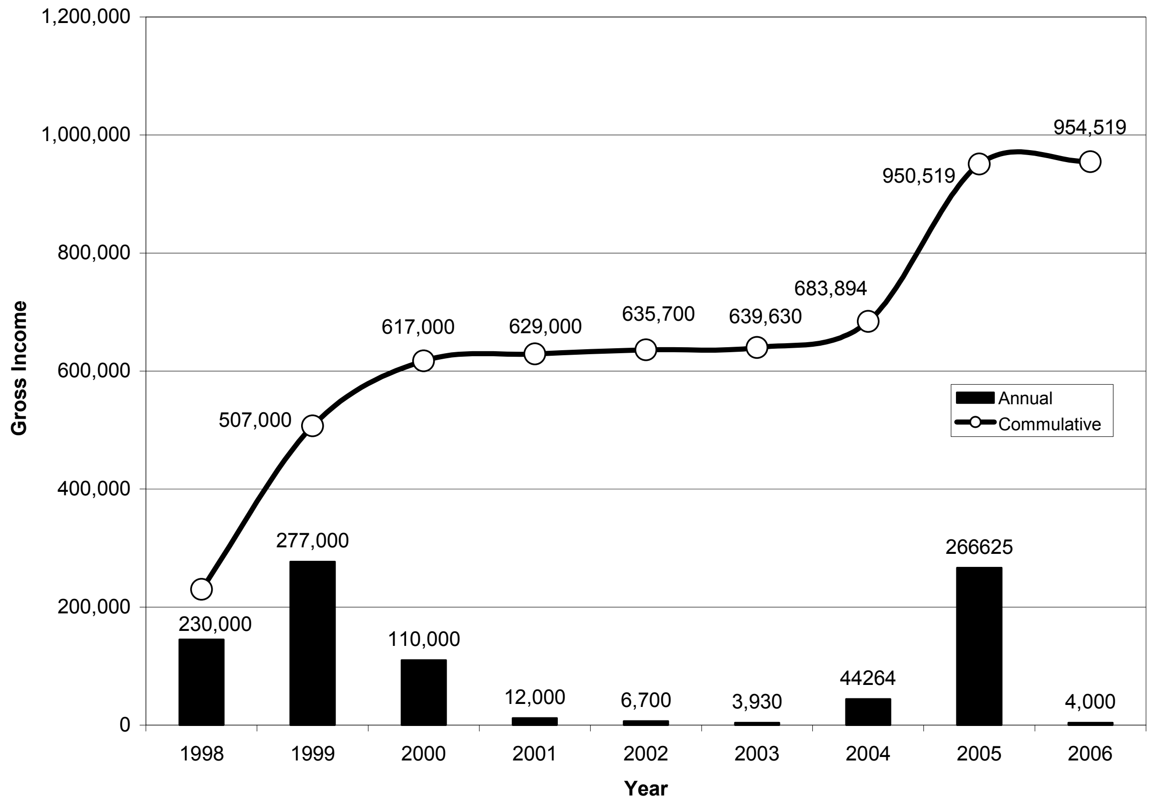
As mentioned earlier, on-farm trials were set up to evaluate the growth performance of various agroforestry tree species across different landscape positions in the watershed (see also Table 2). As part of a participatory research strategy, farmer-cooperators were involved in the selection of tree species to be tested, and were trained on seed collection and processing, seedling production techniques and nursery establishment (Catacutan et al. 2006).

In about a year of working with farmers in nurseries and on farms to enhance the diversity and improve the management of tree-based production systems, it became obvious that there were limited seeds or planting materials available to farmers. Commonly, small quantities of seeds of locally-grown trees were collected by, and exchanged among few farmers, and few others purchased seed or seedlings within and outside of Lantapan (Koffa and Garrity 2001). A case study conducted by Koffa and Roshetko (1999) to assess the seed collection, processing and diffusion practices of farmers in Lantapan found the major knowledge gaps in standardized methods for seed collection. The findings of this study were presented in a workshop attended by fifteen (15) farmer-cooperators (from the on-farm trials) and local seed collectors with an interest in learning about seed technology. After the workshop, the farmers decided, with facilitation from ICRAF, to organize themselves into an association of seed producers that is now known as ATSAL (Koffa and Garrity 2001).

ATSAL was organized to serve as a unifying body that harnesses collective will, skills, talents and efforts in meeting five key objectives: 1) to collect and process quality tree seeds to meet household requirements for tree farming and for the markets; 2) to establish, develop and manage tree nurseries and plantations efficiently and cost-effectively; 3) to harvest, process and market trees and tree products and to provide wood for home consumption; 4) to train other farmers in Lantapan and beyond with proper collection and handling of tree seeds, and the establishment of, and management of tree nurseries and plantations; and 5) to conserve steeply-sloping farmlands through the application of low-cost, efficient soil erosion control measures, employing the independent or combined effects of grasses, shrubs and trees.

ATSAL performed quiet smoothly during its first two years of operation (1998-2000). The Association was specializing on production of quality seeds of mostly, exotic timber tree species, and was able to create a market niche primarily for non-government organizations (NGO), National Government Agencies (NGA) and LGU customers. From 1998 to mid 2006, the reported sales of various agroforestry seeds were more than 954,000 pesos (see Figure 4), suggesting a significant increase in farmers' income. In the Philippines, this record was unprecedented for a smallholder collective. The increasing sale of seeds during the first two years was attributed to its "prepared" market (buyers that had come to Lantapan) (see also Figure 4). For ATSAL, this was favorable because the transactions were locally negotiated, with almost no transaction costs involved. The leadership skills of ATSAL's President and the experience of the Marketing Officer were seen to have contributed to the remarkable sales.

Figure 4. ATSAL's gross income (1998-mid 2006)



By 2000, ATSAL had started to expand its market outside of Lantapan, particularly in the central Philippines, with initial success, but later failed to meet the demand of seeds and the logistical requirements for transporting seedlings. The transaction costs involved with external customers were a burden for ATSAL. The sales of seeds followed a double "S-pattern", increasing in the first two years and declining in 2000 and rising up only in 2005 (see also Figure 4). This pattern could be attributed to many factors, but the main issue confronting ATSAL was neither the lack of technical competence to produce quality seeds, nor the lack of "market" per se, but its organizational weakness to deal with internal conflict and marketing issues. For ATSAL, the timing of trainings and farm visits by various groups in Lantapan was propitious, giving them readily accessible customers, and creating for them, a niche within this market segment. Its expansion in the central Philippines was more to do with increasing the number of customers within the same market segment (NGA, NGO and LGU buyers). Hence it can be said, that over the years, ATSAL has maintained its niche in this particular market segment, and despite its organizational limitations, has gained a stronghold in the local and regional markets, making it renowned as a viable community-based seed and seedling producer. However, expansion to the bigger market, e.g., national or international scale, will require organizational stability and efficiency, hence for a smallholder collective like ATSAL, the odds to success at these scales of the market could be low, considering complex market forces, for which they have little, or no control. Even if smallholder collectives are strong, its long-term success and integration into bigger markets will thus require more mediation and support from external organizations.

Phase 3: Incentive-based policies for agroforesty adoption and production of ecosystems service

Despite the challenges encountered, farmers' response to agroforestry has been generally promising, hence, ICRAF's work now focuses on deepening the knowledge base of fruit and timber tree-crop interactions in agroforestry systems. Farmers in the upper watershed will not likely change their farming system, that is, vegetable production with tree integration component, as demand for commercial high-value vegetables and tropical fruit trees continue to increase. This will be prompted by government policy directions, designating the area for vegetable production. Vegetable-agroforestry (VAF) system is seen to be the most viable farming system with economic and environmental benefits. But, tree integration in vegetable production can be more technically complex, and entails a lot of policy issues that need to be addressed, if it is to be promoted. For instance, integrating timber trees would mean that farmers will have to register their planted trees with the local DENR, so that at harvest time, the farmer will not have difficulties to secure the "permit to cut", and transport the timber. Additionally, farmers also need to enjoy other economic benefits from integrating trees while waiting for harvest. One could be recognizing, and or rewarding their efforts by downstream users of environmental service produced, e.g., water for irrigation and hydropower generation-- The national irrigation and electric power authorities are key beneficiaries of such service. However, all these opportunities need to be explored more rigorously through policy-action research and on-farm experimentation to further understand the technical complexity of VAF system. In addition, there is a need for LGUs to vigorously promote VAF system through incentive-based policies and programs. Thus, technical improvement and incentive-based policies to promote VAF and reward ecosystem service are the current focus of ICRAF's scientific inquiry in the Manupali watershed.

4.0 Concluding comments

ICRAF's experience on the rise and fall of Landcare groups in Lantapan explains that the unavailability of financial capital, or delay in economic outcomes can result to a diminishing social capital and decline in the adoption of conservation farming technologies. This suggests that watershed management should be viewed in the context of sustainable livelihoods, where the promotion of conservation farming technologies is clearly linked to the people's livelihood activities. There is also a need for continuous expenditures in the "repair and maintenance" of social capital, if it is not to be depleted—this will be in the form of continuous training, bridging social distance, and facilitation. In addition, appropriate policy incentives maybe also needed to promote conservation efforts. Where the watershed economy is highly dependent on the resource base, local government decisions and priorities, and political considerations are key determinants to successful watershed management. Finally, watershed management can be sustainable with a) effective local government support with practices that are consistent to the intention of policies; and b) community-initiated change, involving a broad range of stakeholders (e.g., agribusiness sector), and with broader support from outside communities

The message behind this experience is that watershed management objectives and economic goals can be addressed through adaptive R&D innovations. This means that adaptive management is needed, to better design R&D innovations for effective and sustainable watershed management. This necessitates that the R&D institution's organizational practices are highly facilitative, and have the willingness not only to lead, but also be part of a joint learning process. This requires flexibility to change project goals and on-ground management strategies.

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