

Comparative Analysis of Plant Diversity, Productivity and Tenurial Security of Farms with or without Input Support in a CBFM site in Subic, Zambales, Philippines

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INTRODUCTION

Philippine watersheds contain patches of production farms managed mostly by subsistence farmers who have shifted to growing more cash crops such as high-value vegetables. As such, development efforts aimed at poverty alleviation among these smallholders may not prosper unless they are effectively linked to the lowland consumers of their products (Chiong–Javier as cited by Catacutan *et al.* 2012). Francisco (2004) also observed that a big part of the uplands has been increasingly converted into settlements and agricultural lands.

To partly address these concerns, development of livelihood and enterprises in forestlands, and the conservation, protection and sustainable utilization of resources are among the measures in the second decade of Community–Based Forest Management (CBFM) Strategic Plan. Under this plan, agroforestry is one of the alternatives.

The Subic–Cawag Upland Farmers’ Association (SCUFA), a CBFM People’s Organization (PO) is recognized to have made significant strides in the development of its CBFMA area through the introduction of agroforestry. This traces back when most of the members were awarded Certificates of Stewardship Contract (CSC) in 1986, issued by the former Bureau of Forest Development (now Forest Management Bureau or FMB) under the Integrated Social Forestry Program. Historically, the area

ABSTRACT

The study compares the plant diversity, productivity and tenurial security of farms with and without government support in a Community–Based Forest Management area of the Subic–Cawag Upland Farmers’ Association in Subic, Zambales, Philippines. Using Shannon–Weiner Index, plant diversity was evaluated through field surveys of farms with input support and without input support, and was compared if there was a difference. Individual analysis was done in five nested plots, i.e., 20 x 20m plot as perennial, 4 x 4m plot as intermediates, and 1 x 1m plot as underbrush. Plant diversity in areas with input support was consistently higher than in areas without input support. Productivity and tenurial security were evaluated based on the results of a survey of 52 farmers, with 37 farmers under the “with input support” and 15 farmers under the “without input support”. For productivity, the group of respondents with farms that received input support had a higher average net present value (NPV) at 12% discount rate of PhP 328,582 ha⁻¹, compared to the group without input support that had an NPV of PhP 185,682 ha⁻¹. Finally, the study found that the issuance of long-term tenure does not guarantee security, ownership, and social equity due to economic reasons, but is dictated by economic status and the farmer stakeholders’ regard on how important the land entrusted to them is.

Keywords: CBFMA, diversity, productivity, Shannon–Weiner Index, sustainability, tenurial security

was once dominated by grassland. When migrants came in the 1980s, they gradually planted timber, fruit trees and cash crops in the area mainly to cater to the needs of the community.

One of the issues recognized in crafting the CBFM Strategic Plan for 2008–2017 is land conversion and biodiversity loss due to the establishment of large-scale monoculture plantations such as banana and exotic trees that caused anxiety among community-based forestland managers. In recognition of the importance of biodiversity as an indicator of sustainable forest management (DENR–FMB & ITTO 2003), the study sought to compare plant diversity, productivity, and tenurial security of farms in a CBFM area with and without government support. This was achieved by determining the floral abundance and richness of the representative agroforestry farms (plant diversity), estimating the net benefits and associated economic impacts of the agroforestry farms in the area in terms of yield/farm produce and financial worth (productivity); and identifying the facilitating, constraining and threatening factors affecting the decision of farmers to keep their farms (tenurial security).

METHODOLOGY

Location and Background of the Study Area

The study was conducted in 2015 in an area located in Sitio Malingao, Barangay Cawag, Subic, Zambales (Figure 1). The

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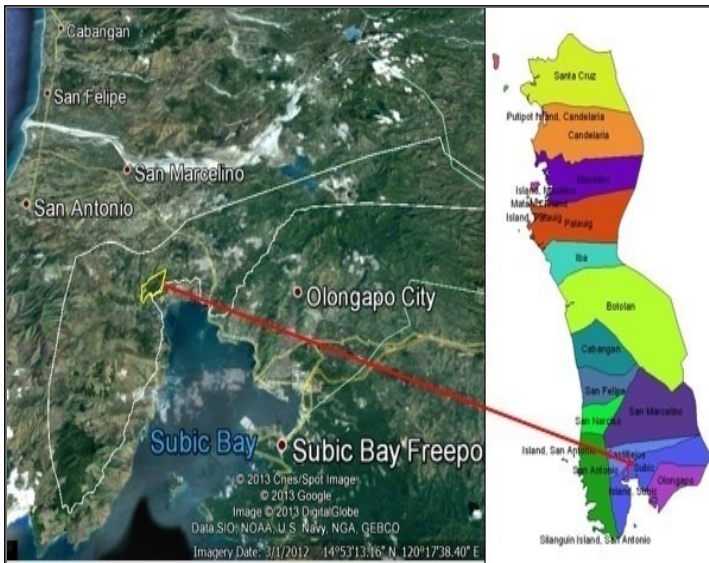


Figure 1: Location of the study site

slope of the study area ranges from 18 to 30%, which is generally rolling to moderately steep. It has an elevation ranging from 50 to 200 masl. According to the Modified Corona Classification of Climate, the municipality of Subic belongs to Type 1, which has two pronounced seasons: dry from November to April and wet during the rest of the year. Before the arrival of migrants in the 1980s, the area was basically a grassland. Currently, its land use can be classified as cultivated with a mix of planted cash crops, underbrush and grasses, several tropical fruit trees, fast-growing tree species and few naturally growing trees.

Based on the testimonies of beneficiaries, timber poaching and fuelwood gathering from the remaining natural stands were rampant before the Integrated Social Forestry Program (ISFP) was introduced in the area in the early 1980s. Through the ISFP, CSCs were awarded to program participants in 1986. The participants were also provided with mango and forest tree seedlings. In 1994, the ISFP was devolved to the local government unit (LGU) of Subic, Zambales. Based on the account of the PO President, the LGU likewise provided few tree seedlings as support for the continued development of the area.

In 1999, the Cawag Upland Farmers' Association (CUFA), now Subic CUFA (SCUFA), was formed, with members mainly coming from ISFP beneficiaries. In 2000, SCUFA entered into a CBFM Agreement with DENR, which entitled them to manage, develop and protect an area of 232 ha for a 25-year period. From two families residing in the community before the ISFP, the Malingao community now consists of 121 households with almost 300 individuals, representing 6% of the 2,000 households of Barangay Cawag.

Sampling design

A total of 52 respondents were interviewed for the study, coming from farmers "with input support" and "without input support" from the government. Of this number, 37 respondents had input support, while 15 respondents did not have input support.

The sample size for respondents with input support was determined using Slovin's sampling technique at 10% error term, as presented below:

$$n = N / (1 + Ne^2)$$

where: n = sample size

e = error term

N = total population (using the list of farmer project beneficiaries as sampling frame)

This resulted in a sample size of 37 respondents, who were then randomly selected from the total number of 60 beneficiaries. These farmers were given support by the local DENR and local government in the form of seeds, seedlings and other planting inputs.

The other group consisted of 15 farmers "without input support", who were purposively selected since this number represented about 95% of the farmers doing farming within CBFMA area who did not receive support from the government. These farmers used their own personal financial resources to develop their respective farms.

Data gathering

The study involved the collection of both secondary and primary data. The secondary data gathered include project reports and other documents (work and financial plan, accomplishment, database), which were used in developing survey and farm validation instruments. Primary data were gathered through focus group discussions (FGDs) among SCUFA members and non-members, interviews, and actual field measurements. Information gathered from the interviews included socio-demographic background of the respondents, crop and farm management practices, labor and material inputs, quantities and values of farm outputs, local economic situation, and an assessment of PO and DENR support.

Aside from interviews, physical validation of respective agroforestry farms was also conducted to cross-check the data gathered from interviews and to get more detailed information that could not be provided by the project participants from mere recall during interviews. Actual field measurements were undertaken to evaluate plant diversity.

The criteria for selecting sites for plant diversity were: 1) they should represent the whole land-uses of the CBFM such as farms and brushland areas that are communally managed, and 2) they should represent the lower, middle, and highest elevation, *i.e.*, the location of the plots should be evenly distributed/located.

Data collection and measurements were done in each of the five agroforestry farms "with input support" and five areas (including brushland areas) categorized as "without input support". The agroforestry farms with project support were randomly selected from among the clusters of farms based on their location (*i.e.*, on lower, center, and upper elevations), while those farms with no project support were purposively selected considering the location criterion. As adopted from the study of Casas (2009), three categories of species were measured: tree/perennial, intermediate, and undergrowth. Tree/perennial plants are those plants with a diameter of at least five cm. Intermediate plants are those whose diameter is below five cm diameter but whose height is at least one meter. Undergrowth plants include all plants whose height is below one meter such as seedlings, grasses, shrubs, and vines.

The sampling design and location of sample plots used were a modification of Casas (2009), Ragas–Abucejo (2012), and ERDB (2011). For each agroforestry farm lot, a 20m x 20m plot in three replicates was established starting from the lower portion of the farm, at the center, and top portion. Within the 20m x 20m plot, a 4m x 4m sub-plot was established/nested at the right corner. Similarly, a 1m x 1m plot was established at the right corner of a 4m x 4m plot.

Data Analysis

Plant diversity in three plot categories with and without input support was compared using the Shannon–Weiner Index. Each category was represented by five farm lots.

The biodiversity value computed and analyzed were species importance value (IV) and Shannon Weiner Index of General Diversity (H), using the following formulas:

1) Species Importance Value Computation:

$$\text{Frequency (F)} = \frac{\text{No. of plots in which } i \text{ occurs}}{\text{Total no. of plots}}$$

$$\text{Relative Frequency (RF)} = \frac{\text{Frequency of species } i \text{ occurrence}}{\text{Total frequency values of all species}}$$

$$\text{Density (De)} = \frac{\text{No. of species } i}{\text{Total No. of plots}}$$

$$\text{Relative Density (RDe)} = \frac{\text{Density of species } i}{\text{Density of all species}}$$

$$\text{Dominance (Do)} = \frac{\text{Density of species } i}{\text{Total area of measured plots}}$$

$$\text{Relative Dominance (RDo)} = \frac{\text{Dominance of species } i}{\text{Total dominance of all species}}$$

Species Importance Values (IV):

$$\text{For Trees: } IV = RF + RDe + RDo$$

$$\text{For Intermediates and Undergrowth: } IV = RF + RDe$$

2) Shannon Weiner Index of General Diversity (H):

$$H = -\sum_{i=1}^n n_i/N \log n_i/N$$

where:

H = Shannon index of general diversity

n_i = Importance value of species i

N = Sum of all importance value of all species

The three plant categories were subjected to plant species diversity and evenness index and were further analyzed based on the following standard ratings used in Casas (2009) as shown in Table 1.

Farm productivity was measured through ex-post financial analysis expressed in net present value (NPV) on a ha⁻¹ average.

Table 1. Descriptive rating for plant species diversity (Shannon–Weiner).

Diversity Index (H)	Descriptive Rating
≥ 3.5	Very High Diversity
3.0 – 3.49	High Diversity
2.5 – 2.99	Moderate Diversity
2.0 – 2.49	Low Diversity
1 – 1.99	Very Low Diversity

The NPV was determined by getting the present value of net benefits of both groups of respondents' farms. Further, the associated economic impact of the farm was determined by getting the respondents views whether or not they have benefitted from their farm.

For tenurial security, the level of importance of agroforestry in providing sustainable benefits as a measure to keep their tenure and resist offers against land speculators was analyzed. This looked into the following: 1) Whether the presence of industries, commercial activities and expansion of settlements was seen as a threat to the respondents' tenurial security; 2) Whether there were speculators who offered to buy their farms; 3) How valuable having long-term tenure of their agroforestry/farm was to the farmers; 4) Likelihood of selling/foregoing their farm lots if there were reasonable offers; and 5) Level of reliance on DENR in ensuring tenurial security of the CBFMA.

RESULTS AND DISCUSSION

Plant Diversity

According to the respondents, the species in the area before they started developing their farmland in the early 1980s included binayuyo (*Antidesma ghaesembilla* Gaertn.), ipil–ipil (*Leucaena leucocephala* (Lam) de Wit), and akleng parang (*Albizia procera* (Roxb.) Benth), which are mostly pioneer species. Aside from being dominated by grass species, the respondents recalled the presence of species like binunga (*Macaranga tanarius* (L.) Muell–Arg.), balinghasai (*Buchanania arborescens* (Blume) Blume), tibig (*Ficus nota* (Blanco) Merr.), Antipolo (*Artocarpus blancoi* (Elmer) Merr.), duhat (*Syzygium cumini* (L.) Skeels), kamiring (*Semecarpus philippinensis* Engl.), bolong–eta (*Dyospyros pilosanthera* Blanco), palosapis (*Shorea palosapis* (Blanco) Merr.), and lauau (*Shorea contorta* Vidal). Table 2 shows the results of the plant species diversity assessment.

There is a marked difference in species diversity between farm areas with input support and areas/brushland without input support. The Shannon Diversity Index under tree category with input support was 3.00 and was close to the 2.91 Shannon Diversity Index of Ragas–Abucejo (2011), who also compared two agroforestry projects in three categories of trees/perennials, intermediate, and undergrowth. According to Magurran (2003 as cited by Mertes 2011), the index values usually ranged from 1.5 and 3.5, and rarely exceeded 4.5. On the other hand, the undergrowth species in areas with input support, mostly grass species, were not affected by the trees and intermediates as evidenced by higher diversity compared to those without input support. The floral diversity of intermediates and undergrowth

Table 2. Biodiversity indices in sample plots.

Biodiversity Indices	Trees/Perennial (20m x 20m)		Intermediate (4m x 4m)		Undergrowth (1m x 1m)	
	With Input Support	Without Input Support/ Brushland	With Input Support	Without Input Support/ Brushland	With Input Support	Without Input Support/ Brushland
No. of Plots	15	15	15	15	15	15
Number of Species	36	12	31	9	25	6
Frequency	6.73	2.40	3.87	1.53	4.47	2.07
Shannon Diversity Index	3.00	1.97	3.22	1.76	2.70	1.09

Note: >3.5–Very High Diversity; 3.0 to 3.49 – High Diversity; 2.5 to 2.99 – Moderate Diversity; 2.0 to 2.4 – Low Diversity and 1.00 to 1.99 – Very Low Diversity

in developed areas with input support was minimal, which may be due to the relatively frequent cultivation and tillage. While species diversity in the developed area is higher, Honnay *et al.* (1999 as cited by Labutap 2013) concluded that attaining a high species diversity and quality in plantations can take a hundred years, while the study the area was only approaching 30 years.

One factor that may have contributed to the gradual increase in diversity in developed farms was the possible attraction of birds that could have acted as seed dispersal agents. This may be associated with the initial introduction of fruit (*e.g.* mango) and forest tree species (*e.g.* *Acacia auriculiformis*) in the late 1980s. These were later found to be serving as shelter for birds and other wildlife species, and may have facilitated seed pollination and dispersal. Rice (2010) and Schroth *et al.* (2004 as cited by Millard 2011) noted that the semi-forested make-up of an agroforestry farm, compared to a monocrop plantation system without trees, provides a habitat for migratory birds and a secondary habitat for species that tolerate a certain level of disturbance that will facilitate biodiversity enhancement. This suggests that there is an emerging complementation of fruit and forest tree species to increase biodiversity as facilitated by faunal wildlife species particularly birds. Along this circumstance, the nurse trees may have helped in the improvement of vegetation to become favorable for growth and emergence of native species.

Table 3 shows the dominant species having the highest importance value. The dominant species indicate that they occupy the biggest portion, and are abundant and widely distributed within the CBFM area.

It appears that the farms with input support have a lower incidence of pioneer species like binayuyo and akleng parang compared to those without input support. This suggests that the farms without input support are not yet fully developed, and cogon (*Imperata cylindrica* (L) Raeusch), talahib (*Saccharum spontaneum* L) and creeping peanut (*Arachis pintoii*) are still dominant. On the other hand, despite the introduction of species like mango, mahogany, and *Acacia auriculiformis* in areas with input support, undergrowth such as grasses and shrubs are still present, although they are no longer bushy compared to those without input support.

Ragas–Abucejo (2012) cited several studies that found plant density to be influenced by factors like site elevation, soil type, human interventions, and dominant and associated species. Furthermore, Ragas–Abucejo (2012) cited studies that showed

that the presence of a remarkable number of species indicates the richness of the area with respect to species and families. This can be attributed to the selection of species planted in the reforestation area with regard to their ecological limitation and economic importance. Harvey *et al.* (2007 as cited by Jose 2009) noted that a higher number of trees/shrubs leads to higher diversity, and concluded that reforestation coupled with the introduction of agri-crops and fruit trees contributes to the enhancement of biodiversity.

Interestingly, the agroforestry farms of respondents who could afford to pay labor to do brushing activities resulting in relatively well-maintained farms, had less occurrence of native species especially those of low commercial value. This can be attributed to the frequency of cultivation and weeding during maintenance activities that likely eliminated less favored species. Likewise, farmers with well-maintained areas appeared to have lower concern for the biodiversity of the area and tended to favor fruit trees and forest trees with high economic value. These are the areas where frequent removal of underbrush was practiced.

Productivity

At 12% discount rate with a 15-year period, the group of respondents who received input support had a combined NPV of PhP 328,582 ha⁻¹, while those without input support had a combined NPV of PhP 185,682 ha⁻¹.

This suggests that there was a certain degree of confidence to further develop the area with support from the government particularly from DENR as mandated by Executive Order 263.

Table 3. Dominant species with the highest importance values by plant category in farms with and without input support.

Category	Farms with input support	Farms without Input support
Trees/perennial	Banana, Mango, Mahogany and <i>Acacia auriculiformis</i>	Banana, Binayuyo and Akleng Parang
Intermediate	Kamiring, Ipil–ipil and Mahogany	Binayuyo, Kakaute and Mangium
Undergrowth	Talahib, Karau–karau and Sarat	Cogon, Talahib and Creeping Peanut

This implies that if farmers who did not receive input support invested in agroforestry, there was a good chance that they would have benefited from it. The positive outcome of the project corroborates the study of Francisco (2004) in selected CBFMA areas. Furthermore, the GIZ and West Visayas State University (2012) emphasized that the successful promotion of agroforestry systems requires that farmers are convinced themselves about its benefits and potential to improve their livelihoods. It was suggested that it was only through this way that newly established agroforestry systems could be sustained in the long run and bring its benefits to both farmers and society.

While the analysis resulted in positive NPV for both groups of respondents (with and without input support), most of the farmers still practice subsistence farming. The farmers revealed that they were not currently benefiting much from the agroforestry farms since majority regarded the farms as the least source of income. This could be attributed to the relatively low production or yield, lack of market, and lack of marketing skills. This could also be explained by the prevalence of thieves, threats of fire, and onslaught of typhoon. The results validate Rasul's findings (2006) that the lack of market access and inability to market such products drive the farmers not to seriously pursue enterprising activities. Likewise, GIZ and West Visayas State University (2012) suggest that even when crop productivity and quality improved, marketing of commodities could become a challenge for farmers because of poor infrastructure and absence of supply chains.

While farm production is low, the developments introduced in the farm and the presence of housing or real estate development in the vicinity have contributed to the increased market value of the area.

Security of Tenure

Table 4 shows the perception of the respondents on whether the presence of industries, commercial activities, and expansion of settlements are threats to the tenurial security of the CBFMA or their farms. Majority (59%) of the respondents with input support regarded them as fairly a threat, while 38% regarded them as not a threat and only 3% regarded them as a high threat. The respondents without input support regarded these industries, commercial activities, and expansion of settlements as not a threat (40%) and fairly a threat (40%). Only 20% responded that these are a high threat.

Table 5 shows the respondents' view on the importance and value attached to tenure in furthering development in their farms. Both groups of respondents regarded it as valuable.

In the past, the PO had an informal mechanism or policy on transferring the farm lot to another. Members who intended to transfer their farm lots for one reason or another may transfer them to members only; otherwise, the acquisition of land by non-members would be invalidated by SCUFA leadership. This is in compliance with the provisions of CBFMA on the transfer and conveyance of lands to existing members only.

Most of the respondents agreed that tenurial security not only encouraged the growing of trees but also ensured their legitimacy and the recognition of their rights, especially those who were able to secure CSC. Others were encouraged to plant trees not for their long-term benefits but for the environmental

Table 4. Respondents' perception on whether the presence of industries, commercial activities and expansion of settlements are threats to the tenurial security of the CBFMA or their farms.

Respondents' Group	Not a Threat		Fairly a Threat		High Threat	
	Freq.	%	Freq.	%	Freq.	%
With Input Support from DENR/LGU	14	38	22	59	1	3
Without Input Support	6	40	6	40	3	20

Table 5. Value attached by respondents to tenure in further developing their farm.

Respondents' Group	Very Valuable		Valuable		Fair/Average		Not Valuable		Not very Valuable	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
With Input Support from DENR/LGU	8	22	23	62	5	14	1	3	0	0
Without Input Support	1	7	11	73	0	0	2	13	1	7

benefits trees provide, and their capacity to minimize the proliferation of grasses that adversely affect their crops. There is also a growing interest from members and non-members alike especially those who are capable of developing open areas and abandoned farm lots by inactive farmer members in the CBFMA area. The PO leadership however, is not bent on allowing this as it might encourage encroachment especially in areas that have already been abandoned by inactive farmer members. This may not be a concern for non-members as there is no move from the PO leadership to expand membership.

Further, under the existing CBFMA policy, individual PO members can formally acquire tenure for the development of potential farm lots within the CBFMA area upon endorsement of the PO to DENR for the latter's approval. However, this was not vigorously pursued and is only secondary in the priorities of DENR under the CBFMA Strategy.

Table 6 shows that less than half of respondents in both groups were unlikely to sell their farm, while one-third of the respondents or less were on the average side. The value of "owning" land and the attachment they put to the land was the main reason cited by the respondents. The possibility, however, of selling their farm lot cannot be discounted.

The study of Milagrosa (1997) found that tradition and the type of society influence the farmers' decision to stay and cultivate the land despite setbacks and losses. Attachment and pride in owning the land also persisted in the farmers' psyche. Pulhin *et al.* (2008) noted that while tenurial security of local communities

Table 6. Respondents' likelihood of selling their farm lot if there are reasonable offers.

Respond- ent's group	Very unlikely		Unlikely		Fair/ Average		Likely		Very Likely	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
With Input Support from DENR/LGU	3	8	18	49	10	27	6	16	0	0
Without Support	2	13	6	40	5	33	2	13	0	0

protected them against land grabbers and speculators compared to the time when tenure instruments have not yet been issued, it could also become a mechanism to loosely pass on their land to those who resorted to selling their farm lots to speculators for reasons dictated mainly by economic considerations.

Table 7 shows that a large majority of both groups of respondents were fairly reliant on DENR in ensuring tenurial security. This implies their dependence on DENR in securing tenure, and their high hopes on the CBFMA's ability to ensure that their tenure over their farms will be secured. The respondents were confident that even if speculators were interested in the area, there was an assurance that they would continue to have rights over the land.

Staff from the Community Environment and Natural Resources Office (CENRO) revealed that there were instances when they were consulted by clients who intended to, or were offered to buy parcels of land by CSC holders. In some cases, the CENRO was consulted only after the transactions or selling have been consummated. Buyers were concerned about the legality of selling CSC and the possibility of transferring the rights to them, but they were advised not to engage in such transaction because it was not legal. However, monitoring the selling of rights or stewardship contract between individual holders and buyers was difficult because it was done in secret.

The SCUFA has a policy that if a farm area or portion thereof is not planted or developed, the leadership can negotiate to pass on the area from the current holder to members who are capable of developing such area. This is the reason why almost 90% of the 232-ha CBFM area of SCUFA has been developed.

Furthermore, incidents of land speculation, encroachment, grabbing, and buying and selling have been documented. In some instances, a policy issuance was used to justify a transfer, sale or conveyance, specifically Section 4 of the Department Administrative Order (DAO) No. 98-45: Guidelines Governing

Table 7. Respondents' level of reliance on DENR in ensuring tenurial security.

Respond- ents' Group	Not reliant		Low reliance		Fairly reliant		Very reliant		No Opinion	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
With Input Support from DENR/LGU	0	0	0	0	22	59	15	41	0	0
Without Support	1	7	0	0	10	67	4	27	0	0

the Issuance and Transfer of Certificate of Stewardship (CS) Within CBFM Areas. It states that "the CSC, including those issued prior to this Administrative Order, may be transferred, sold or conveyed in whole or in part".

Under the provisions of the CBFM Agreement, the CBFM-POs are responsible for the development and protection of the CBFM area awarded by DENR. Given the above circumstances and tenurial threats, Ram Dahal *et al.* (2011) found that tenure rights and their security alone are not sufficient conditions for achieving sustainable forest management and improved livelihoods. Other factors such as the regulatory framework, governance systems, and supportive institutions are also critical. Studies reveal that significant improvements in legal tenure right do not automatically result in improvement in people's livelihoods, forest conditions, or equity (Larson *et al.* 2010 as cited by Ram Dahal *et al.* 2011). Several cases illustrated that while forest conditions improved, certain community members or groups of people external to the community experienced times of hardship or decline in livelihoods. In some cases, the transfer of rights to local groups also entailed transfer of substantial responsibilities and burdens (Ram Dahal *et al.* 2011).

Attempts of spurious claimants to encroach portions of the CBFM area may not be regarded as a threat to their security of tenure owing to the reliance of the PO on DENR and strong leadership. However, there is uncertainty in tenurial security if the organization and its farmer members will not be vigilant and unified against spurious claimants and speculators.

The internal system of the PO in distributing the idle areas to qualified and willing farmers within the CBFM may have encouraged them to develop the area from grassland/idle land into an agroforestry area. The compliance of most farmers to have their farm lots covered by tax declarations from the provincial government may be regarded as a form of strengthening ownership and tenurial security.

CONCLUSIONS AND IMPLICATIONS

The paper compares plant diversity, productivity, and tenurial security of a CBFM area with and without government support. Specifically, the paper discusses the floral diversity of representative agroforestry farms; the farms' productivity in terms of yield and financial worth; and the facilitating, constraining, and threatening factors that affect the sustainability of the agroforestry farms. Primary and secondary data were used in the study. The secondary data came from reports, policy issuances, and other documents. Primary data were gathered through interviews, focus group discussions, and field measurements. Data analysis entailed the development of biodiversity indices, financial analysis, and identification of factors affecting the sustainability of agroforestry farms. The study found that the Shannon Diversity Indices of trees/perennial, intermediate, and undergrowth plants in plots with input support were higher than the indices of plots without input support. Areas with input support have been developed as agroforestry areas, implying that biodiversity can be enhanced through the gradual introduction of low stocking agroforestry crops as there is an opportunity for native species to grow in open spaces. Hence, grasslands or cultivated areas to be converted to agroforestry need not be closely spaced. Complementation of timber, fruit trees, and short-term agricultural crops that serve as a habitat and source of food of

wildlife creates a symbiotic relationship that enhances biodiversity.

The determination of NPV alone is not a sufficient measure of success. While financial viability of farms can be measured through NPV, it only provides a picture of the prospects of having a promising investment but may not capture the other impacts of the intervention on the welfare of the farmers in the context of this study. Even if production increases, the capacity to market such products remains a challenge for the farmers to increase their income. This study also found that agroforestry can co-exist in a developing rural-urban setting as a measure to mitigate the negative impacts of nearby industries.

On tenure security, the issuance of long-term tenure does not guarantee security, ownership, and social equity due to economic reasons. It is dictated by economic status and the farmer stakeholders' regard on how important the land entrusted to them is. Had the area not been developed, it could have been easily "accessed and owned" by the speculators with less resistance from the actual occupants. In other words, there is a moral obligation on the part of the farmer occupants to fight for the land they developed and not purely rely on PO and DENR support.

Tenurial security not only encourages the growing of trees but also ensures the legitimacy and recognition of farmers' rights. The proliferation of settlements and increasing industrialization adjacent to the CBFMA area make the area prone to land-use change for non-forest/agroforestry purposes that the CBFM area may eventually be a haven for the establishment of settlements and large-scale housing if farm maintenance and development will not be sustained. Hence, it is recommended for DENR to provide leeway to the PO, being the *de facto* manager, to allow capable members to develop open and abandoned areas for productive purposes. Recognition of ownership by DENR through issuance of CBFMA-CSC or similar individual tenure in the future can be formalized once the member has developed the area for productive purposes for tenurial security.

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