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Exploring Gender Preferences in Farming System and Tree Species Selection: Perspectives of Smallholder Farmers in Southern Philippines

ABSTRACT

Although agroforestry has been promoted in the Philippines through various programs and policies, the adoption of this practice is slower than expected. Determining the underlying reasons for the slow and declining adoption of agroforestry is vital, especially within the combined context of food insecurity, agricultural intensification and climate change. Using Analytic Hierarchy Process (AHP), this study identified the selection criteria and the priority farming systems and tree species of smallholder farmers in Lantapan, Bukidnon. Findings showed that financial benefit was the main consideration of both male and female farmers for crop selection along with other aspects of well-being (i.e. regulatory services, food security). Results indicated that both groups perceived crop-based farms as more beneficial than tree-based farms. In terms of tree species, women preferred plantation crops and timber trees, while men favored fruit trees. These results showed that it is important to ensure that promotion of agroforestry will translate to tangible economic benefits for farmers. The criteria identified will serve as inputs for crafting a gender-sensitive co-investment scheme to support the promotion of climate-smart, tree-based agriculture in the area. Funds generated from this scheme could compensate farmers for the opportunity costs of shifting gradually to tree-based farming systems.

Key words: *agroforestry, tree-based farming, analytical hierarchical process, crop selection*

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INTRODUCTION

Over the last few decades, the value of integrating trees into agricultural landscapes has been receiving much attention. The need for more sustainable agricultural production systems is especially pronounced in developing countries, where the growing demand for food drives the intensification of agricultural production, further resulting in deforestation and land degradation (*CCAFS 2014*). This is particularly relevant in the context of Southeast Asian developing countries like the Philippines, where poor families dependent on agriculture and natural resources face the rising costs of production and marketing (*Balisacan et al. 2005*), together with the negative impacts of climate change (*Lasco et al. 2011*). Agroforestry – the practice of deliberately incorporating trees with crops and livestock to achieve a range of benefits from their interaction (*Nair 2013*) – is among the land use strategies being employed in diverse settings to address rural poverty and at the same time, contribute towards environmental conservation and rehabilitation (*Garrity 2004*).

Years of research established the scientific basis for promoting agroforestry adoption at a wider scale (*Jose 2009*). There is an increasing body of knowledge on the environmental functions of agroforestry (*Guillerme et al. 2011*), including biodiversity conservation, regulation of physical and chemical fluxes in ecosystems, and mitigation of pollution (*Nair 2008; Lasco et al., 2014*). They also enhance the resilience of poor farming households to risks and external shocks by serving as sources of livelihood and income, and facilitate higher and more stable crop yields leading to increased system resilience, as well as improved livelihood and food security (*Branca et al. 2013*). In the Philippines, the study of *Magcale-Macandog et al.* (*2010*) in the municipality of Claveria, Misamis Oriental found that fruit trees supplemented farming families' food supply during lean periods in the cropping calendar. Integration of trees (hedgerows) with certain annual crops (like corn) can actually increase and stabilize yields.

Smallholder farmers recognize the range of benefits that they derive from ecosystems, including those provided by trees and agroforestry systems (C*erdán et al. 2012, Lasco et al. 2015, Muhamad et al. 2014*). However, in spite of these benefits, barriers to adoption and sustainability of tree-based farming remain. Owing to their resource constraints, smallholder farmers usually choose to plant

crops with high economic benefits to ensure steady flow of income. On the other hand, those who have ample food sources and are more willing to make investment risks are usually more likely to incorporate trees into their agricultural production systems compared to food-insecure, risk-averse farmers (*Jerneck and Olsson 2013*). Farmers' level of awareness on the ecosystem services of farms also affects their management decisions, and ultimately affects the productivity of their farms, and the quantity and quality of ecosystem services from the surrounding landscape (*Cerdán et al. 2012*). In the province of Bohol, a recent study found that farmers feared that integrating trees on their farms would have negative effects on soil quality and crop productivity (*Lasco et al. 2015*). *Martin & van Noordwijk* (*2011*) also cited three barriers to agroforestry adoption of smallholder farmers in the Philippines- farmers' perception that timber products generate low economic incentives, current policies, and macroeconomic conditions in the country.

Agroforestry has been promoted in the Philippines through various upland development programs (e.g. Community- Based Forest Management, Upland Agroforestry Program, National Greening Program) because of its potential to provide socio-economic opportunities while ensuring environmental stability (*Visco 2011*). The municipality of Lantapan in the province of Bukidnon is one of the areas in the Philippines where agroforestry has been promoted for decades. However, despite consistent efforts to encourage farmers to integrate trees on their farm, agroforestry areas in the municipality shrunk by 60% from 1990-2007 while area covered by crop-based farms has continued to rise (*Pillerin et al. 2010*). This was also the case in other parts of the country, particularly in Northern Luzon, where adoption of seasonal crops (e.g. high-yielding rice and corn varieties) has been rapidly increasing despite the efforts of the government to promote integration of fruit trees in upland farming systems (*Snelder et al. 2007*).

Although agriculture used to be a male-profession, women's participation is increasing as they already comprised almost half of the agricultural labor force in Africa and Asia (*Koirala et al. 2015*). As noted by *Lu* (*2010*), Filipino women were also equally and actively involved in agriculture. However, there is an unequal access to resources and opportunities between men and women farmers (*Quisumbing et al. 2014, Koirala et al. 2015*). *Layton and MacPhail* (*2013*) argued that women farmers receive less agricultural training and credit in the country. For this reason, gender-sensitivity is now being considered in designing current agricultural programs.

The three-year project of the World Agroforestry Centre (ICRAF) entitled Climate-smart, tree-based, co-investment in adaptation and mitigation in Asia (Smart Tree-Invest) aimed to improve the livelihoods and resilience of smallholder farmers through the promotion of climate-smart, tree-based agriculture. However, given the current state of agroforestry adoption in the Philippines, this goal would more likely be achieved by making tree-based farming attractive for smallholder farmers. For this reason, a co-investment scheme, one form of Payment for Ecosystem Services (PES), will be developed to aid male and female farmers in transitioning gradually to tree-based farming by providing assistance which could be financial or in kind. However, prior to the development of this scheme, perception of smallholder farmers should be captured and considered. It is important to expose the underlying reasons for the slow (and sometimes declining) application of agroforestry among smallholder farmers, especially within the combined context of food insecurity, agricultural intensification, and climate change. Hence, this study explored the selection criteria and the priority farming systems and tree species of smallholder farmers in Lantapan, Bukidnon. More specifically, it examines the major considerations of female and male farmers in their selection of farming systems (i.e. primary crops/crop combinations), and identifies their priority farming systems based on their own criteria. In addition, it also studied the criteria for selection of tree species for tree-based farming and/or agroforestry, and the priority tree species.

MATERIALS AND METHODS

Site Description

The study site is located in the municipality of Lantapan, a first class municipality in the mid-portions of the province of Bukidnon in southern Philippines. It is approximately 65 km (aerial distance) southeast of Cagayan de Oro City and is situated between Valencia and Malaybalay City. It also lies at the foot of Mt. Kitanglad, one of the country's Key Biodiversity Areas (KBA), an Important Bird Area (IBA) and an ASEAN Heritage Park. Based on the Modified Corona's Classification of Climate, the municipality has Type IV climate that is characterized by more or less evenly distributed rainfall throughout the year and indistinct dry and wet season. Its elevation ranges from 320 to 2,938 masl wherein most parts of the area have topography of slight to moderately elevated terrain and hills. It has a volcanic soil belonging to the Adtuyon and Kidapawan clay which are highly suitable for agriculture.

The study was focused on the three largest sub-watersheds of the municipality of Lantapan, namely, Tugasan, Alanib, and Kulasihan. They were referred to as "cluster" sites in this project representing landscapes with

interrelated ecological processes. The sub-watersheds drain into the Manupali River, and consequently into the Pulangui River (Pulangui IV Reservoir)- an important source of irrigation and electric hydropower in Bukidnon (*Rola et al. 2004*). Aside from watershed services, these clusters contribute to the food security of the entire region. Farming is the primary source of income of majority of the residents. In addition, large agricultural companies were operating in the municipality, particularly in Alanib and Kulasihan clusters.

Sampled villages (barangays) were chosen in each cluster to represent the upland, midland, and lowland areas. The Alanib cluster is comprised of barangays Songco, Alanib, and Balila while barangays Kaatuan, Bantuanon, and Kulasihan represented the Kulasihan cluster. Meanwhile, the Tugasan cluster was composed of only one village- barangay Kibangay (**Figure 1**).

Data collection

The data collection followed the Capacity Strengthening Approach to Vulnerability Assessment (CaSAVA) method which uses participatory approaches to collect gender-disaggregated information, while strengthening the awareness and capacity of the respondents to think and articulate latent problems in the community (*Dewi et al. 2013*). Focus group discussions (FGDs) on tree and farming systems (TFS) were conducted in each cluster to assess the crop and tree species preferences of smallholder farmers. Two groups of participants were invited wherein one group was composed of all male smallholder farmers, while female smallholder farmers formed the other one. The Department of Agriculture (DA) technicians in the covered barangays helped in identifying and inviting potential FGD participants. At first, the target participants were at least 30 years old and have been residing in the area for a decade. However, because of unavailability of older farmers, they were replaced by younger farmers who have been living in the area for more than a decade. Considering that the participants were not randomly selected and FGD was used to solicit information, the results of this study is site-specific and may not be generalized.

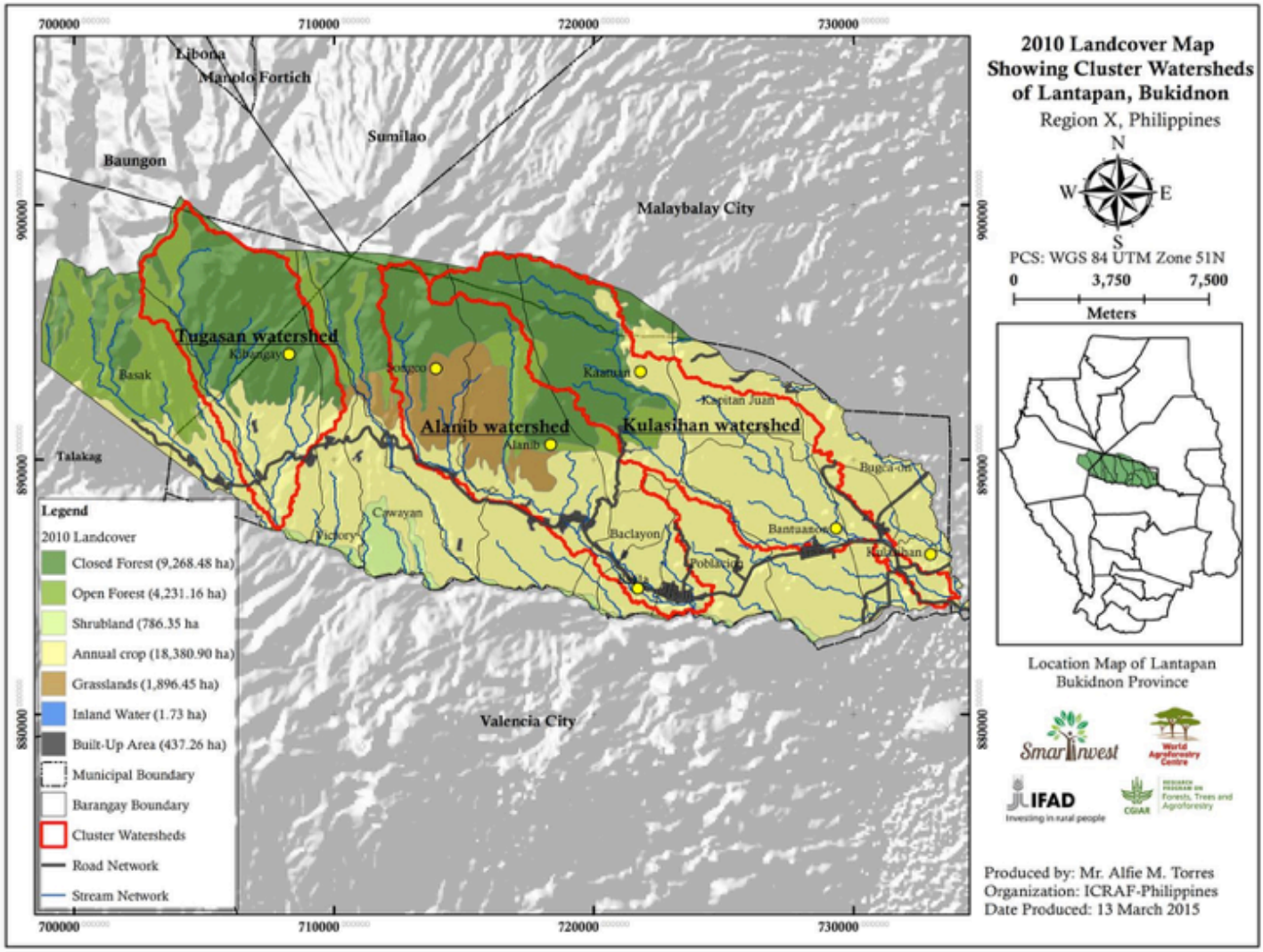

Figure 1. Land cover map of the study site in Lantapan, Bukidnon, Philippines.

The FGD on TFS was patterned from two tools namely, gender perspectives in selecting tree species (G-TreeFarm) and tree and farming system resilience to climate change and market fluctuations (Treesilience) (*van Noordwijk et al. 2013*). It aimed to assess the resilience of most dominant tree species and farming systems to extraordinary events related to climate and market. It also discussed how these species and systems will be used for environmental conservation planning and in coping with any shock that may occur in the cluster.

Data analysis

To understand how farm decisions on crop selection were made, the main criteria of female and male farmers in selecting farming systems and tree species were ranked using Analytic Hierarchy Process (AHP). This tool for decision-making uses pairwise comparisons and relies on expert judgment to derive priority scales (*Saaty 2008*). Farmers' knowledge of benefits and constraints of growing certain crop species was valuable in identifying the best alternative (farming systems and tree species) for the cluster.

For this study, AHP was done in two levels (**Table 1**). The first level focused on assigning weights to the criteria: participants were asked to enumerate their top three to four major considerations in selecting farming systems. An AHP matrix was used to compare these criteria depending on their importance to the farmers. The second level of analysis involved determining the most preferred farming systems. In order to derive the overall score and ranking of farming systems, they were compared in terms of each criterion then the results of the per criterion analysis were combined. Similar process was followed in determining the priority tree species of smallholder farmers.

RESULTS

Socio-economic characteristics of FGD participants

A total of 63 smallholder farmers participated in the six FGDs, with roughly 40-60 representation of male versus female respondents. Majority of them were members of the Talaandig tribe, one of the seven tribes of Bukidnon. Participants' ages range from 20 to 84 years old and most of them reached secondary education (**Table 2**). On the average, male participants owned larger land parcels, and also earned more than double the gross annual income of female participants. As argued by *Villamor et al.* (*2015*), female farmers generally manage smaller parcel of land near their houses because of limited labour availability and time constraints. Aside from farm activities, most of them still need to perform their gender-related roles (e.g. domestic tasks), thereby reducing their time in the farm. Meanwhile, almost all respondents derived income from on-farm activities, although others also had off- and non-farm livelihood sources. Female respondents had lower mean percentage of on-farm income in relation to total household income compared to male respondents, indicating that though women had lower gross annual income, they tended to diversify their sources of income (i.e., off- and non-farm) more than men.

Criteria for selection of farming systems

In selecting farming systems, smallholder farmers considered several factors, although seven criteria were identified to be the most important (**Figure 2**). The combined results of AHP in the six FGDs indicated that most of the main considerations of smallholder farmers had to do with profit maximization, with the exception of 'food consumption'. The first priority– early maturity of crops (i.e. shorter growing period)– was essential to ensure faster return-on-investment. Following this, respondents also preferred to plant crops with reliable marketing channels (i.e. easy to market) to lessen the risk of financial loss. They argued that it was not wise to invest in high value crops unless they could easily access the market for these products. The third priority, 'high income', is consistent with the first and second criteria, since ultimately, the desired end-result of the first two priorities was to generate the highest possible income from on-farm activities. In line with this, farmers also valued the contribution of crops to household food supply (i.e. food consumption), although profitability indicators once again emerged as the fifth (low capital requirement) and sixth (high selling price) priorities. Last among their main considerations was 'high frequency of harvest', which was said to be important for ensuring continuous flow of income during each harvest season.

Table 1. Analytical hierarchical process (AHP) comparison scale used in the study.

Intensity of importance	Definition
1	Two options have equal importance
3	Moderate importance of one over another
5	Strong importance of one over another
Reciprocals of above	If factor *i* has one of the above numbers assigned to it when compared to factor *j*, then *j* has the reciprocal value when compared with *i*

Source: Saaty 2008

Table 2. Descriptive statistics of FGD participants in Lantapan, Bukidnon, Philippines, 2015.

Characteristics	Male n=26	Female n=37
Cluster (count)		
Tugasan	7	12
Alanib	10	17
Kulasihan	9	8
Age (yrs)		
Mean	47.1	43.6
Range	21-84	20-65
Highest education attainment (%)		
Elementary level/graduate	30.8	28.1
High school level/graduate	42.3	50.0
College level/graduate	26.9	21.9
Land holdings (hectare)		
Mean	1.5	0.9
Range	0.0-5.0	0.0-2.5
Gross annual income, in PhP (USD)		
Mean	34,192.31 (744)	16,419.35 (357)
Has on-farm income (%)	96.2	96.9
Has off-farm income (%)	23.1	59.4
Has non-farm income (%)	19.2	40.6
Percentage of on-farm income in relation to the total household income (%)		
Mean	76.0	60.4
Range	0-100	0-100

Note: Official exchange rate is 1PHP= USD 45.98 as of 15 October 2015, available at http://www.bsp.gov.ph/statistics/sdds/exchrate.htm

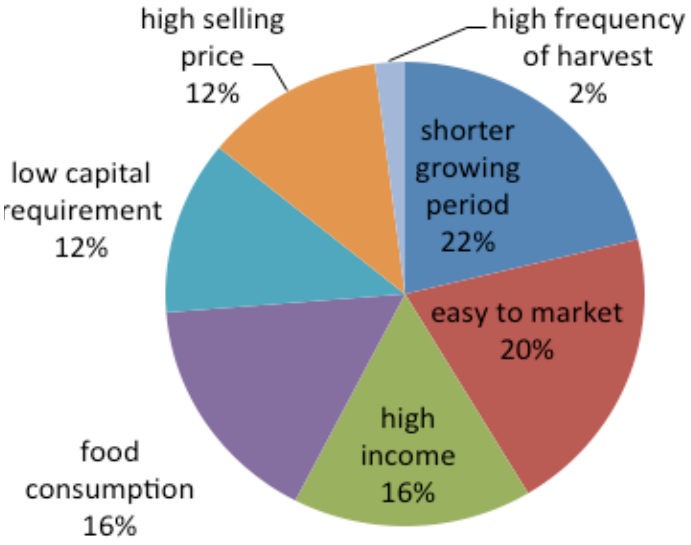

Figure 2. Smallholder farmers' criteria for selecting farming systems (with computed weights), Lantapan, Bukidnon, Philippines, 2015.

Women's criteria for selection of farming system. Economic factors and food supply were both important to women (**Table 3**). In the Tugasan cluster, equal weights were computed for 'high selling price' and 'low capital'. Women also preferred to plant crops with shorter growing period to ensure steady flow of income for the family through faster return-of-investment. Meanwhile, majority of female farmers in Alanib Cluster preferred farming systems which could be reliable sources of food for the household. They reported that the entry of multinational companies in the area resulted in a shift of livelihood among male farmers – some of whom decided to work in the companies and pass the responsibility of managing their farms to their wives. Since farming then became only a secondary source of income of the family, the women prioritized its contribution more for augmenting household food supply than household income. They also considered 'high income' and 'high frequency of harvest' important in their selection criteria. Similarly, female farmers in the Kulasihan cluster also highly preferred farming systems that could generate high income. These included commodities with high selling price yet with low input costs. Ease of marketing farm products and contribution to household food security were also important to women belonging to this cluster.

Men's criteria for selection of farming system. Among male farmers, the set of criteria for selecting farming systems varied across the clusters. Men are more concerned about factors that directly and indirectly affect farm production and on-farm income (**Table 4**). For farmers in Tugasan, the main criterion was access to market of their products. The farmers pointed out that even though some crops have high selling price and low input costs, they could still suffer financial loss if products could not be sold immediately. Since there were no post-harvest facilities in the village, delay in selling of products could damage the quality of crops, hence reducing their income. In the Alanib and Kulasihan clusters, some men preferred producing commodities that had shorter growing periods. As the providers of their families, they expressed that they wanted

Table 3. Female groups' criteria for selection of farming systems, Lantapan, Bukidnon, Philippines, 2015.

Criteria (female)	Tugasan	Alanib	Kulasihan	All clusters	Rank
high income		0.22	0.58	0.27	1.0
food consumption		0.65	0.14	0.26	2.0
low capital requirement	0.45			0.15	3.5
high selling price	0.45			0.15	3.5
easy to market			0.28	0.09	5.0
high frequency of harvest		0.13		0.04	6.0
shorter growing period	0.10			0.04	7.0
Total	1.00	1.00	1.00	1.00	

Table 4. Male groups' criteria for selection of farming systems, Lantapan, Bukidnon, Philippines, 2015.

Criteria (male)	Tugasan	Alanib	Kulasihan	All clusters	Rank
shorter growing period		0.66	0.52	0.39	1.0
easy to market	0.64		0.30	0.31	2.0
low capital requirement	0.10	0.16		0.09	3.5
high selling price	0.26			0.09	3.5
high income		0.18		0.06	5.5
food consumption			0.18	0.06	5.5
high frequency of harvest				0.00	7.0
Total	1.00	1.00	1.00	1.00	

to plant crops which could generate regular income, and be harvested within the span of a year. Interestingly, only male farmers from the Kulasihan cluster accounted for household food consumption considerations among their selection criteria.

Priority farming systems of smallholder farmers

Using the weights generated through AHP, the preferred farming systems across the clusters were compared and prioritized. Most of the preferred farming systems were crop-based, with multiple cropping systems of corn and banana given the highest priority (**Table 5**). Monocropped rice and corn were likewise important, while most of the other primary commodities were vegetables. Meanwhile, only nine out of the 25 priority farming systems were tree-based.

Women's preferred farming systems. Crop-based farms were highly preferred by female farmers in the three clusters. The Tugasan and Kulasihan clusters, all the preferred farming systems were crop-based farms (**Figure 3**). It was only in Alanib cluster that different types of tree-based farms were identified. This result could be partly attributed to the presence of successful agroforestry farms within Alanib cluster. ICRAF, together with other organizations such as Landcare Foundation of the Philippines, has been promoting agroforestry in the area for more than a decade. Female farmers, especially those who are residing in barangay Songco, have been actively participating in these programs for years. The Binahon Agroforestry Farm, a demonstration site for agroforestry practices, is also located in the said cluster. Also, there have been several beneficiaries of the National Power Corporation (NAPOCOR)'s Family Approach to Reforestation and Agroforestry Development Project in the area.

Female farmers in the three clusters had different priority commodities. Most of the favored farming systems of women in Tugasan were monoculture plantations of vegetables, with sweet peas given the highest priority. This was because relative to other priority commodities, sweet peas was said to have the highest selling price, shortest growing period, and was ranked by respondents as having the second lowest capital requirement (next to lettuce). In the Alanib cluster, female farmers generally preferred multiple cropping of perennial crops, where coffee was a common commodity. Respondents explained that this was because coffee was easier to maintain, and required less labor compared to other crop types. In spite of this, multiple cropping of corn and banana was still the most preferred farming system, mainly because it ranked highest for the criteria 'food consumption' and 'high income', and second highest for 'high frequency of harvest' (next to banana-abaca-root crop systems). Meanwhile, in the Kulasihan cluster, rice was the most preferred commodity because respondents believed that it generated the highest income, could be sold easily, and also contributed to household food security. Staple crop corn was also important, whether intercropped with banana, or planted on its own. Vegetables and sugarcane were likewise important commodities in this cluster. On the other hand, only Kulasihan cluster produces rice in the entire municipality of Lantapan.

Table 5. Most preferred farming systems of smallholder farmers in Lantapan, Bukidnon, Philippines, 2015.

Rank	Farming system	Overall weight	Rank	Farming system	Overall weight
1.0	corn-banana	0.171	14.0	Cabbage	0.021
2.0	rice	0.142	15.5	banana-cassava	0.018
3.0	corn	0.133	15.5	coffee- root crops	0.018
5.0	cauliflower-broccoli	0.054	17.5	coffee-Brazilian fire tree	0.017
5.0	cacao-banana	0.054	17.5	cassava-Brazilian fire tree	0.017
5.0	sweet peas	0.054	19.0	cabbage-Chinese cabbage	0.016
7.0	vegetables-corn-peanut	0.039	20.0	cacao-purple yam	0.015
8.5	vegetables	0.035	21.0	Squash	0.013
8.5	coffee-banana	0.035	22.0	Tomato	0.011
10.0	lettuce	0.034	23.0	coffee-falcata	0.008
11.0	purple yam	0.033	24.0	lanzones-coffee	0.007
12.0	coffee-abaca-root crops	0.026	25.0	sugarcane	0.006
13.0	turnip	0.023			
				Total	1.000

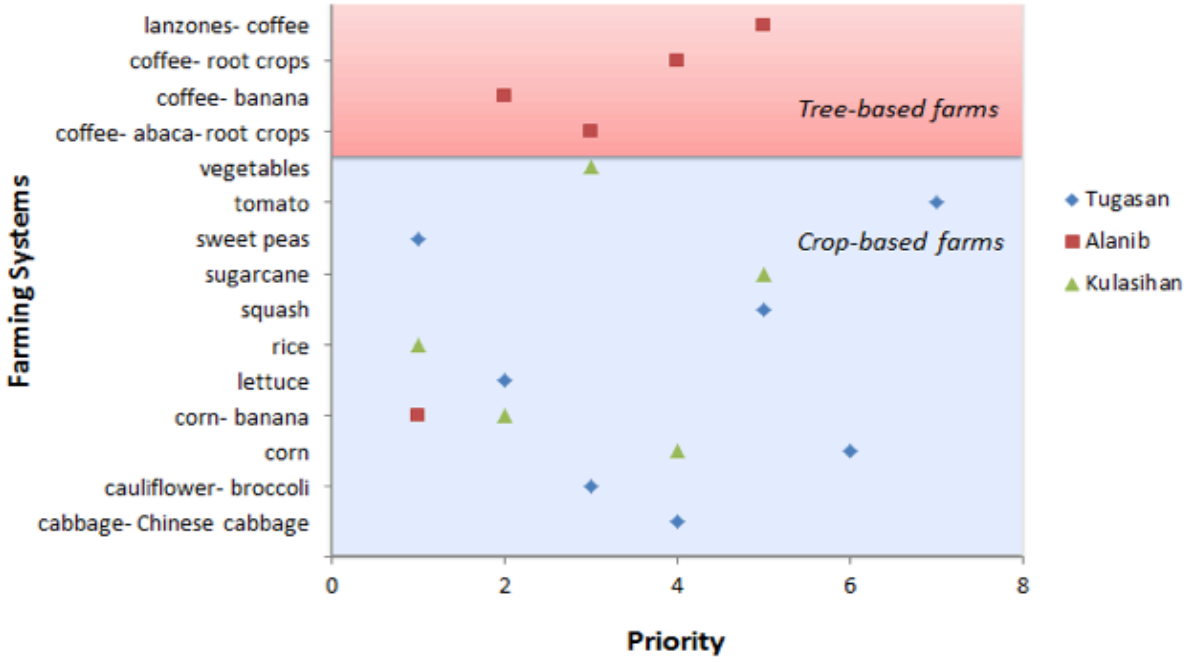

Figure 3. Priority farming systems of female farmers, Lantapan, Bukidnon, Philippines.

Men's preferred farming systems. Majority of the priority farming systems identified by male farmers were crop-based (**Figure 4**). Among 14 types of farming systems that were enumerated, only four had trees as the main commodity. In the Alanib and Kulasihan clusters, crop-based farms were preferred, yet they also favored some tree-based systems. However, in the Tugasan cluster, all of the preferred farming systems were purely crop-based. This indicates that male farmers belonging to this cluster perceived crop-based farming systems as having greater overall benefits (i.e. high selling price, easy to market, low capital) than tree-based combinations.

Corn production was the most desirable farming system for male farmers belonging to the Tugasan cluster, largely because corn was ranked first in terms of ease of marketing. This was not surprising, since corn, along with rice, is the staple food in these communities (*Rola et.al, 2007*). Although corn had low selling price relative to other farm commodities, it was still preferred by the majority of male farmers because it had low capital requirement. On the other hand, multiple cropping of cauliflower and broccoli offered the highest selling price. Male farmers in the Kulasihan cluster also preferred crop-based plantations, particularly monoculture plantations of rice and corn, since they had the shortest growing periods. Moreover, farmers said that these commodities contributed to household food supply, and at the same time, were easy to sell. The opposite was true in tree-based farms – participants reported that access to markets has been one of the major challenges among those with tree-based farming systems.

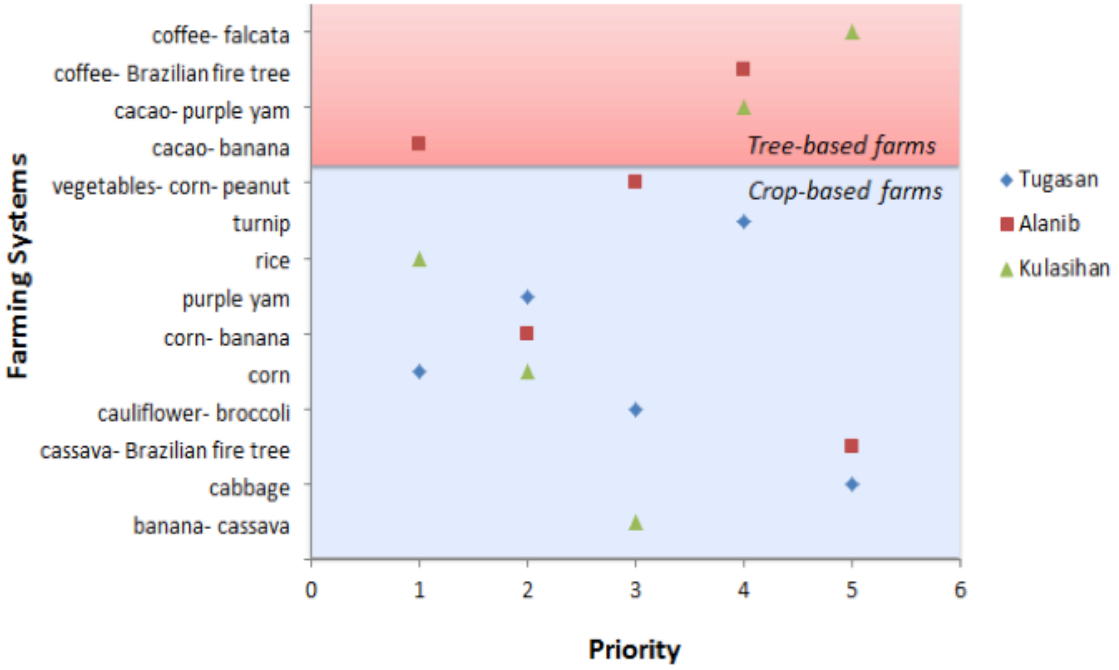

Figure 4. Priority farming systems of male farmers in Lantapan, Bukidnon, 2015.

In the Alanib cluster, respondents highly preferred multiple cropping of vegetables-corn-peanut, followed by mixed cropping of banana and corn. These types of farming systems were favored over tree-based farming systems because respondents believed that the former generated relatively higher income, and could be grown over shorter time spans than the latter. On the other hand, farmers perceived that maintenance of tree-based farming systems have lower input costs because they require less fertilizers and pesticides than crop-based. However, they generated relatively low income because of unstable prices of tree products and lack of buyers. Hence, to make tree-based farming profitable, farmers belonging to the Alanib cluster planted trees alongside with other, higher-value crops, such as banana and cassava.

Comparing women and men's priority farming systems. Among female farmers, corn-banana and pure corn were the only farming systems identified as high priority in two common clusters (**Table 6**). The rest of the priority farming systems identified in the women's groups were quite diverse. Among the male farmers, corn and rice farming systems were commonly important across the clusters, while multicropped banana was also considered highly important in the Alanib and Kulasihan clusters, in corn-banana and banana-cassava systems, respectively.

In the Tugasan cluster, although different weights were assigned, female and male farmers both identified corn and cauliflower-broccoli farming systems among their priorities (**Table 7**). Alternatively, corn-banana farming systems were highly important to both women and men from the Alanib cluster, as was multicropping of cacao-banana and coffee-banana, respectively. In Kulasihan cluster, rice farming was the highest priority of both women and men, with pure corn and corn-banana farming systems also considered highly important. In general, only among women and men from the Alanib cluster, and men from the Kulasihan cluster was there a distinctive preference for tree-based farms.

Criteria for selection of tree species for agroforestry

Combining the results of six FGDs, smallholder farmers identified nine major criteria in selecting tree species to be incorporated in their farms. In general, most of the criteria were of economic nature, with 'high income' given the highest priority (**Figure 5**). Aside from direct benefits that could be derived from trees, farmers also considered some regulatory services important, such as flood control, soil erosion prevention, and environmental protection.

Women's criteria for selection of tree species. Across the clusters, female farmers considered both the economic benefits and regulatory services of trees in selection of species (**Table 8**). Female farmers in Tugasan cluster greatly preferred trees with high economic value, but could prevent soil erosion at the same time. Since most of their farms were located in sloping lands, trees were usually planted along farm boundaries to hold the soil and increase infiltration, especially during heavy rains. Meanwhile, regulatory services were more valuable for female farmers in Alanib and Kulasihan clusters. In these areas, trees were also planted on farm boundaries to serve as windbreaks and to prevent flood. Female participants

Table 6. Priority farming systems of female and male farmers, by cluster, Lantapan, Bukidnon, 2015.

Farming system	Main commodities	Women			Men			Overall weight	Rank
		TUG	ALA	KUL	TUG	ALA	KUL		
CB	corn-banana		0.489	0.294		0.243		0.171	1.0
CB	rice			0.340			0.514	0.142	2.0
CB	corn	0.075		0.116	0.365		0.243	0.133	3.0
CB	cauliflower-broccoli	0.156			0.171			0.054	5.0
CB	sweet peas	0.323						0.054	5.0
TB	cacao-banana					0.324		0.054	5.0
CB	vegetables-corn-peanut					0.232		0.039	7.0
CB	vegetables			0.213				0.035	8.5
TB	coffee-banana		0.208					0.035	8.5
CB	lettuce	0.205						0.034	10.0
CB	purple yam				0.198			0.033	11.0
TB	coffee-abaca-root crops		0.155					0.026	12.0
CB	turnip				0.138			0.023	13.0
CB	cabbage				0.128			0.021	14.0
CB	banana-cassava						0.107	0.018	15.5
TB	coffee-root crops		0.016					0.018	15.5
CB	cassava-Brazilian fire tree					0.099		0.017	17.5
TB	coffee-Brazilian fire tree					0.010		0.017	17.5
CB	cabbage-Chinese cabbage	0.098						0.016	19.0
TB	cacao-purple yam						0.090	0.015	20.0
CB	squash	0.078						0.013	21.0
CB	tomato	0.065						0.011	22.0
TB	coffee-falcata						0.046	0.008	23.0
TB	lanzones-coffee		0.043					0.007	24.0
CB	sugarcane			0.037				0.006	25.0

Key: TUG – Tugasan, ALA – Alanib, KUL – Kulasihan, CB – Crop-based, TB – Tree-based

Table 7. Priority farming systems in the three clusters, by gender, Lantapan, Bukidnon, 2015.

Farming system	Main commodities	Women			Men			Overall weight	Rank
		TUG	ALA	KUL	TUG	ALA	KUL		
CB	corn-banana			0.489	0.243	0.294		0.171	1.0
CB	rice					0.340	0.514	0.142	2.0
CB	corn	0.075	0.365			0.116	0.243	0.133	3.0
CB	cauliflower-broccoli	0.156	0.171					0.054	5.0
CB	sweet peas	0.323						0.054	5.0
TB	cacao-banana				0.324			0.054	5.0
CB	vegetables-corn-peanut				0.232			0.039	7.0
CB	vegetables					0.213		0.035	8.5
TB	coffee-banana			0.208				0.035	8.5
CB	lettuce	0.205						0.034	10.0
CB	purple yam		0.198					0.033	11.0
TB	coffee-abaca-root crops			0.155				0.026	12.0
CB	turnip		0.138					0.023	13.0
CB	cabbage		0.128					0.021	14.0
CB	banana-cassava						0.107	0.018	15.5
TB	coffee-root crops			0.016				0.018	15.5
CB	cassava-Brazilian fire tree				0.099			0.017	17.5
TB	coffee-Brazilian fire tree				0.010			0.017	17.5
CB	cabbage-Chinese cabbage	0.098						0.016	19.0
TB	cacao-purple yam						0.090	0.015	20.0
CB	squash	0.078						0.013	21.0
CB	tomato	0.065						0.011	22.0
TB	coffee-falcata						0.046	0.008	23.0
TB	lanzones-coffee			0.043				0.007	24.0
CB	sugarcane					0.037		0.006	25.0

Key: TUG – Tugasan, ALA – Alanib, KUL – Kulasihan, CB – Crop-based, TB – Tree-based

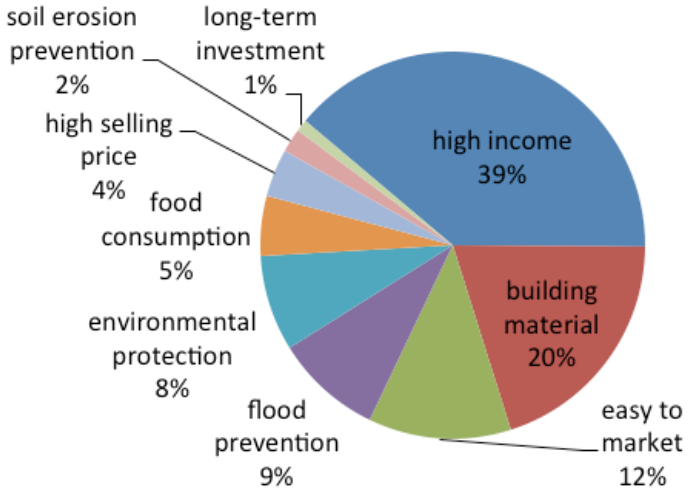

Figure 5. Smallholder farmers' criteria for selection of tree species for agroforestry (with assigned weights), Lantapan, Bukidnon, 2015.

belonging to the Kulasihan cluster reported that unlike vegetables, there was no steady market for tree products. As such, they stressed that access to market was a very important consideration in deciding whether or not to plant a particular type of tree species. In addition, both groups from the Tugasan and Alanib clusters preferred to plant trees which could be used as building materials.

Men's criteria for selection of tree species. Unlike female farmers, the major considerations of male farmers in selecting tree species for agroforestry were all economic attributes. The criterion 'high income' was the most important for the male farmers in the Tugasan and Kulasihan clusters, while in the Alanib cluster, usefulness as building material was the most important consideration (**Table 9**). Access to market was another key consideration for participants from the Alanib and Kulasihan clusters, while both groups from Tugasan and Kulasihan also preferred to plant trees which could be sources of food.

Priority tree species for agroforestry

A total of 13 priority tree species for agroforestry were identified in the three clusters. The combined results of FGDs with male and female respondents showed that in general, most of the preferred tree species were fruit trees. Rambutan and durian obtained the highest weighted average scores (**Table 10**). Several timber trees were also favored by the farmers, and these dominated the list of top ten priority species. Meanwhile, some farmers also preferred plantation crops such as coffee and rubber.

Women's preferred tree species. Female farmers assigned higher weights to timber trees (0.523) and plantation crops (0.305) compared to fruit trees (0.172) (**Figure 6**). In the Tugasan cluster, timber trees were given higher priority by female farmers because they perceived that such trees were more profitable, better sources of building material, and better in preventing soil erosion than fruit trees. Meanwhile, female farmers in Alanib cluster gave highest weight to coffee, followed by timber trees. They argued that although coffee generated the lowest income among their preferred tree species, it was still the best for flood control, and also ranked it second to Brazilian fire tree as a source of building material. On the other hand, female farmers from the Kulasihan cluster gave the highest weights to plantation crops, such as rubber and coffee. Rubber ranked first in terms of the criteria 'environmental protection' and 'high income', and it was also ranked second (next to coffee) as a 'long-term investment'. On the contrary, rubber

Table 8. Female groups' criteria for selection of tree species for agroforestry, Lantapan, Bukidnon, 2015.

Criteria (male)	Tugasan	Alanib	Kulasihan	All clusters	Rank
high income	0.68	0.18	0.29	0.38	1
building material	0.24	0.31		0.18	2
flood prevention		0.51		0.17	3
environmental protection			0.47	0.16	4
easy to market			0.17	0.06	5
soil erosion prevention	0.08			0.03	6
long-term investment			0.07	0.02	7
Total	1.00	1.00	1.00	1.00	

Table 9. Male groups' criteria for selection of tree species for agroforestry, Lantapan, Bukidnon, 2015.

Criteria (male)	Tugasan	Alanib	Kulasihan	All clusters	Rank
high income	0.53		0.69	0.41	1.0
building material	0.22	0.46		0.23	2.0
easy to market		0.33	0.23	0.19	3.0
food consumption	0.25		0.08	0.11	4.0
high selling price		0.21		0.07	5.0
Total	1.00	1.00	1.00	1.00	

Table 10. Priority tree species for agroforestry of smallholder farmers in Lantapan, Bukidnon, 2015.

Rank	Tree species	Weighted average score	Rank	Tree species	Weighted average score
1.0	Rambutan (*Nephelium lappaceum*)	0.14	8.0	Lanzones (*Lansium domesticum*)	0.06
2.0	Durian (*Durio zibethinus*)	0.13	9.5	Mahogany (*Swietenia macrophylla*)	0.05
3.0	Falcata (*Paraserianthes falcataria*)	0.12	9.5	Rubber (*Hevea brasiliensis*)	0.05
5.0	Gmelina (*Gmelina arborea*)	0.11	11.0	Santol (*Sandoricum koetjape*)	0.03
5.0	Eucalyptus (*Eucalyptus robusta*)	0.11	12.5	Musizi (*Maesopsis emenii*)	0.01
5.0	Coffee (*Coffea arabica*)	0.11	12.5	Mango (*Mangifera indica*)	0.01
7.0	Brazilian fire tree (*Schizolobium parahyba*)	0.07			
				Total	1.00

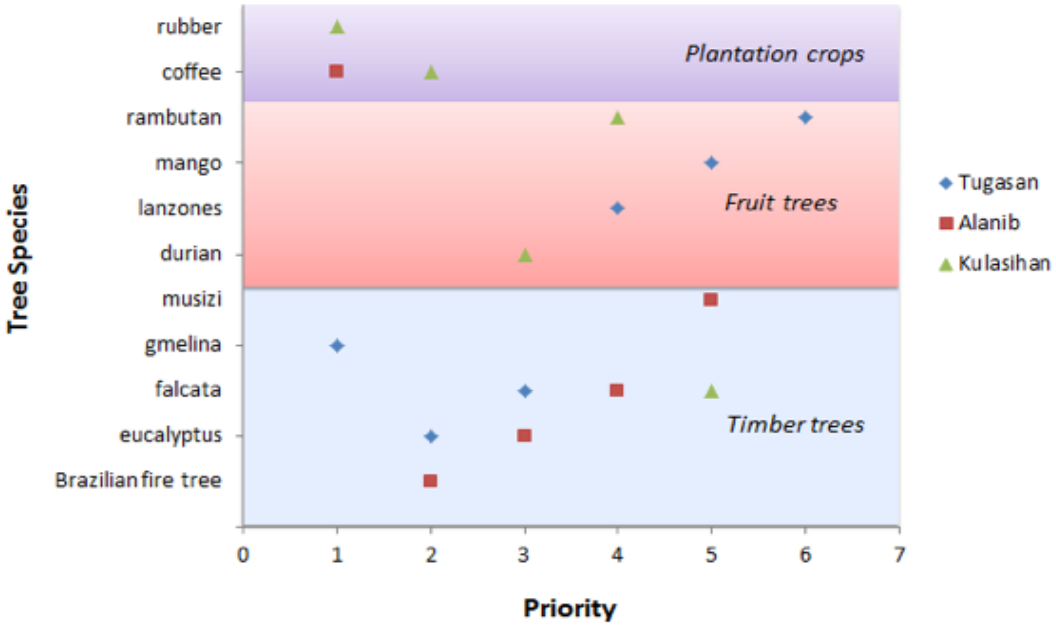

Figure 6. Priority tree species for agroforestry of female farmers, Lantapan, Bukidnon, 2015.

obtained the lowest rank for the criterion 'easy to market', because respondents observed that access to market was easier for fruit trees and coffee relative to rubber.

Men's preferred tree species. Male farmers generally preferred certain fruit trees over timber trees. The combined weights for fruit trees were 0.56 while timber trees only scored 0.44. The top two priority species in the Tugasan and Kulasihan clusters were fruit trees (**Figure 7**). Male farmers in Tugasan cluster perceived that fruit trees were more profitable than timber trees. Lanzones was the most preferred tree species, mainly because it was considered the most profitable, and also contributed to household food supply. However, it also obtained the lowest weight as a source of building material. In the case of Kulasihan cluster, rambutan was the most preferred tree species because it was considered the most profitable, easiest to market, and as having the highest contribution on household food security. Alternatively, male participants from the Alanib cluster preferred to plant timber over fruit trees, of which mahogany had the highest priority largely for its use as building material and high selling price. However, it also scored the lowest in terms of ease of marketing, which was considered easiest for fruit trees like durian.

Comparing women and men's priority tree species. Among women, falcata was a priority species across the three clusters, while coffee, rambutan and eucalyptus were identified as important in two common clusters (**Table 11**). Among the men, rambutan and gmelina were priority species in all three clusters, while durian, falcata and Brazilian fire tree emerged in two common clusters.

In the Tugasan cluster, women and men's priority tree species were quite similar (with the exception of mango and santol), whereas in the other two clusters, they were quite varied (**Table 12**). In the Alanib cluster, male farmers seemed impartial to non-timber versus timber trees, although women highly preferred timber trees, with the exception of coffee. Meanwhile, in the Kulasihan cluster, rambutan, durian and falcata were identified as priority species in both the male and female farmers' groups. However, in general,

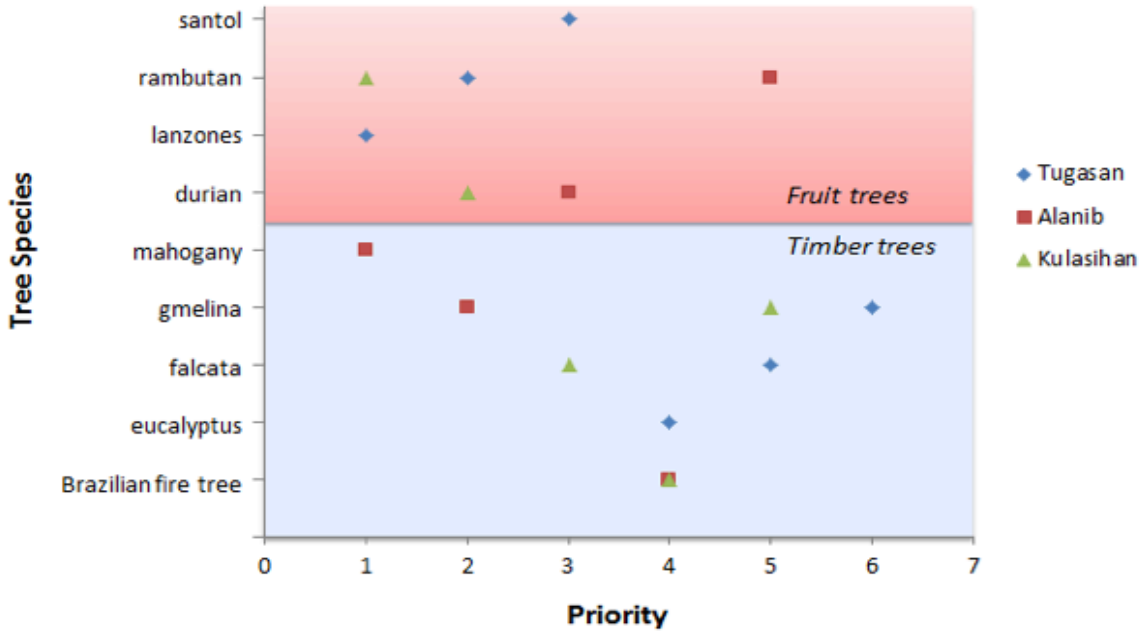

Figure 7. Priority tree species for agroforestry of male farmers, Lantapan, Bukidnon, Philippines, 2015.

Table 11. Priority tree species for agroforestry of female and male farmers, by cluster, Lantapan, Bukidnon, 2015.

Type of trees	Tree species	Women			Men			Overall weight	Rank
		TUG	ALA	KUL	TUG	ALA	KUL		
FT	rambutan	0.040		0.147	0.218	0.129	0.413	0.14	1.0
FT	durian			0.190		0.213	0.361	0.13	2.0
TT	falcata	0.141	0.145	0.116	0.118		0.095	0.12	3.0
TT	gmelina	0.350			0.071	0.216	0.050	0.11	5.0
TT	eucalyptus	0.331	0.189		0.125			0.11	5.0
PC	coffee		0.367	0.271				0.11	5.0
TT	Brazilian fire tree		0.191			0.133	0.082	0.07	7.0
FT	lanzones	0.077			0.287			0.06	8.0
PC	rubber			0.276				0.05	9.5
TT	mahogany					0.309		0.05	9.5
FT	santol				0.181			0.03	11.0
TT	musizi		0.107					0.01	12.5
FT	mango	0.061						0.01	12.5

Key: TUG – Tugasan, ALA – Alanib, KUL – Kulasihan, FT – Fruit trees, TT – Timber trees, PC – Plantation crops

Table 12. Priority tree species for agroforestry in the three clusters, by gender, Lantapan, Bukidnon, 2015.

Type of trees	Tree species	Tugasan		Alanib		Kulasihan		Overall weight	Rank
		Women	Men	Women	Men	Women	Men		
FT	rambutan	0.040	0.218		0.129	0.147	0.413	0.14	1
FT	durian				0.213	0.190	0.361	0.13	2
TT	falcata	0.141	0.118	0.145		0.116	0.095	0.12	3
TT	gmelina	0.350	0.071		0.216		0.050	0.11	5
TT	eucalyptus	0.331	0.125	0.189				0.11	5
PC	coffee			0.367		0.271		0.11	5
TT	Brazilian fire tree			0.191	0.133		0.082	0.07	7
FT	lanzones	0.077	0.287					0.06	8
TT	mahogany				0.309			0.05	9.5
PC	rubber					0.276		0.05	9.5
FT	santol		0.181					0.03	11
TT	musizi			0.107				0.02	12
FT	mango	0.061						0.01	13

Key: TUG – Tugasan, ALA – Alanib, KUL – Kulasihan, FT – Fruit trees, TT – Timber trees, PC – Plantation crops

it seemed that women in Kulasihan favored non-timber tree species, while men from the same cluster showed no distinctive preference between non-timber and timber trees.

DISCUSSION

Economic benefits of farming systems were major considerations of both female and male farmers

The main considerations of both male and female smallholder farmers in selecting farming systems were largely economic/profit-related factors. This was not surprising since the average male smallholder farmer was earning roughly only US$ 2.0 a day, while their female counterparts were earning short of US$ 1.0 a day. Furthermore, farmers in the study site only had average landholdings of 1.5 and 0.9 ha, for male and female farmers, respectively. As such, farmers valued the profitability of crops/trees (i.e. all factors that directly or indirectly affected income) more than their non-cash benefits (i.e. contribution to household food supply), although the latter was still considered important. This observation is in line with the results of *Guillerme et al.* (*2011*), who found that farmers' main objective was to maximize profit in the shortest possible time, especially given limited farm area. In Lantapan, the priority given by farmers to profit maximization in their selection of farming system could partly be attributed to their high dependence on on-farm income, and lack of alternative livelihoods. Since most farmers from the area obtained at least 60% of their household income from on-farm activities, profit was usually maximized by investing in crops with shorter growing periods.

Aside from this, nature of livelihood of household members in the study site also seemed to be associated with farming system preference. At the FGD, farmers reported that those who relied solely on on-farm income tended to invest in crops that could generate income quickly, so that the day-to-day needs of their families could be met. On the contrary, farmers who earned most of their income from off- or non-farm sources preferred to plant crops for subsistence. Another example of this was observed among female farmers from the Alanib cluster, who usually planted crops to contribute to household food supply. Since their husbands had other occupations, women were more concerned with the non-cash benefits of their farms, particularly food provision. Again, this was congruent with the findings of *Guillerme et al.* (*2011*), that lack of resources and nature of livelihood of household members influenced choice of farming practices.

Women and men's role in the family could influence their farming systems preferences

While profitability of farming systems was the foremost consideration of women and men, meeting the nutritional needs of the family also remained a key concern among female respondents. Female farmers assigned the highest weight to crops/crop combinations that could generate high income, but their secondary consideration was the contribution of those crops to household food supply. In Lantapan, female farmers either assisted their husbands in farm activities, or in case their husbands had other occupations, took charge of managing their farms. However, in either case, women were in charged of with the nutrition and care of household members, which might explain the priority assigned by women to contribution of farming systems to both household income and food supply. Male farmers, on the other hand, gave more weight to purely production-related farming system attributes, preferring crops with shorter growing periods, and reliable marketing channels. Their preference for productivity criteria could be attributed to their primary role as the providers of their families. Generally, male farmers were responsible for providing for the monetary needs of the household (i.e. to purchase food and pay for children's education, among others). Conversely, women and men did agree on their preference for crops with low capital requirement, and high selling price. These findings provide some insight into the prevailing gendered division of household labor, where men are mainly in-charge of the public (productive) sphere, while women are responsible for the private/domestic (reproductive) sphere, but can also simultaneously be engaged in productive work (*ILO 1998; Luxton 1983*).

Men were much more concerned about the marketability of crops than women. Male respondents emphasized that it was essential to have an established market for their commodities to lessen the risk of financial loss. This was consistent with the study of *Snelder et al.* (2007) who found that market incentives, as well as risk and uncertainty, affected the technological adoption behavior of farmers. As it was usually the task of male farmers to transport and sell their products to nearby provinces (such as Cagayan de Oro, Davao, and Cotabato), they were also more aware of the challenges related to accessing the market for their produce. Thus, men regarded marketability higher in their farming system selection criteria than did women. For instance, male farmers said that they transported their crops to Cotabato rather than in Cagayan de Oro, because prices in Cagayan de Oro were more prone to fluctuation.

Both female and male farmers preferred crop-based farms over tree-based farms

Smallholder farmers perceived that crop-based farms would generate higher economic benefits than tree-based farms or agroforestry. Although literature suggests that tree-based farming is more profitable in the long-run (e.g. *Snelder et al. 2007*), lack of access to markets, unstable prices of tree products, and restrictive government policies discourage farmers from incorporating trees in their farms. Indeed, *Lasco et al.* (*2014*) highlight that promotion of annual cropping and/or intensive monocultures on the basis of perceived higher economic gains and at the expense of agroforestry systems may yield more negative than positive outcomes (see also *Ziegler et al. 2009*). However, markets for vegetables and other annual crops have long been established in the municipality – which is considered the 'vegetable basket of the south' (*Catacutan and Duque 2006*) – consequently making crop-based farming more attractive to smallholder farmers. As argued by *Garrity* (*2004*), lack of enterprise development and marketing support mechanisms for tree products hinders the realization of what ought to be significant returns from tree-based production systems. This was particularly relevant in Lantapan, where farmers struggled to sell their tree products at reasonable prices. For example, male participants belonging to the Alanib cluster expressed that incorporating trees on their farms seemed impractical, since the prices of products from certain tree species (e.g. Brazilian fire tree, falcata) that they planted a decade ago have since dropped significantly. They also highlighted that the tedious process of securing tree-cutting permits from Department of Environment and Natural Resources (DENR) discourages many of them from planting more timber trees on their farms. This was also observed in India, where some government policies acted as deterrents for farmers to adopt farming systems that incorporated forest trees (*Guillerme et al. 2011*).

The inclination of smallholder farmers for crop-based farming was also evident in the land use change in themunicipality – agroforestry areas have been shrinking while crop-based farm areas have been expanding (*Pillerin et al. 2010*). A key informant reported that indigenous people from Luzon migrated to Lantapan in the 1980s and introduced vegetable farming to the local farmers. During that time, abaca and coffee were the most common commodities in the municipality, but more than two decades later, vegetable farms now take up most of the agricultural areas. At present, plantations of vegetables, corn, banana and sugarcane are the most dominant farming systems in the area.

Lack of resources also hindered farmers from investing in agroforestry. Farmers opted to maximize their profits by investing in high value crops that could be harvested in the shortest possible time. As such, they tended to invest in annual crops and other perennial crops – such as banana and sugarcane – which had shorter growing periods and thus, faster return-of-investment. Respondents perceived that planting trees entailed high opportunity costs, since trees would take up land area that could otherwise be allotted for production of crops with shorter growing periods. This concern for the tradeoffs in farm area allocation was also observed among farmers in a much earlier study in Indonesia and the Philippines (*Belsky 1993*). In addition, profits from trees also took time to materialize, since trees took years to grow, mature, and yield marketable products. Indeed, a study in Vietnam found that poor farming households considered agroforestry impractical because investment in forest (timber) trees like eucalyptus and acacia would not yield financial benefits until several years (i.e. 14 and 7 years, respectively) after establishment (*Nguyen et al. 2013*).

Women and men considered different aspects of well-being in selecting tree species

Women and men shared a common goal of maximizing income from investment in on-farm trees. Both also valued the utility of trees as sources of building material. However, they differed in their specific considerations of profitability – particularly in reference to timing/ frequency of income from the sale of tree products. As in farming system selection, the tendency of female and male farmers to value some attributes of tree species over others appeared to be influenced by the gendered roles they assumed within their homes, as well as the level of knowledge regarding the benefits of having trees on-farm. For example, it was established that female farmers usually assisted their husbands in farm activities, but at the same time were responsible for domestic tasks, including the daily nutrition and care of family members. Female farmers were thus concerned with multiple facets of the farming family's well-being, which may explain why aside from economic benefits (i.e. high income and source of building material), women also deemed the ecosystem services of trees as important. Additionally, one of the key informants highlighted that female famers were the usual beneficiaries of programs promoting environmental conservation. Since their husbands were often busy managing their farms, the women were the ones who participated in such programs on their behalf. This was also observed during the FGDs for this study – despite inviting a similar number of female and male farmers, more female than male farmers were able to participate. Some male farmers were not able to attend since they were on their farms on the day of the FGDs. For this reason, it seemed that female farmers possessed more

information on the ecosystem services of trees which could be linked to the value they associated with them, although this could warrant further study.

It was also established that male farmers were usually primarily responsible for providing for their families. As such, it was not surprising that in their tree species selection criteria, men were most concerned about ensuring maximum returns on investment in trees (i.e. high income). However – unlike the criteria in farming system selection – in tree species selection, men's occupation with addressing household needs was not limited to providing income, but also extended to housing (i.e. building material), and contribution to household food supply. Interestingly, female farmers did not identify (contribution to) 'food consumption' among their criteria for tree species selection, although it was their second most important consideration for farming system selection. This implies that women may not have appreciated trees as secondary food sources as much as men did, but also shows that women and men shared responsibility for ensuring that the household had sufficient food production and supply (*Magcale-Macandog et al. 2010*).

Female farmers highly preferred plantation crops and timber trees, while male farmers favored fruit trees

Women perceived that plantation crops and timber trees – such as gmelina, coffee and rubber – yielded greater economic benefits since their products could be sold at higher prices. Compared to fruit trees, female farmers said that they gave higher scores to gmelina, eucalyptus, Brazilian fire tree and falcata because they were perceived to generate relatively higher income, and to be better in providing regulatory services – such as flood control, soil erosion prevention, and environmental protection. Female farmers argued that they could generate higher profit from planting timber trees as the production cost was cheaper, largely because application of fertilizers and pesticides was not necessary. This affirmed the results of *Snelder et al.* (*2007*), who found that the costs of establishing and maintaining gmelina plantations in Luzon were lower compared to those for fruit trees like mandarin and mango. Men, on the other hand, said they preferred fruit trees– like rambutan, durian and lanzones– which provided income more regularly, implying that male farmers in the area linked profitability with sustainability of income. The priority timber tree species of male farmers were falcata, gmelina, and mahogany which were valued mostly for their usefulness as building material and profit generation. In terms of regulatory services, female farmers perceived coffee to be the most appropriate for flood control while eucalyptus for preventing soil erosion.

Furthermore, it was interesting to note that only female farmers preferred plantation crops such as coffee and rubber. Female farmers from the Alanib cluster argued that most of them (especially those of old age) preferred to plant coffee since its maintenance required less labor compared to that of other high value crops. Aside from coffee, rubber had also been gaining popularity in the municipality in recent years. However, only those with access to ample capital and/or alternative sources of income were able to shift from planting annual crops to rubber. As was also observed by *Guillerme et al.* (*2011*) access to off- and non-farm income was important to sustain the needs of the family while waiting for the rubber trees to become productive (which typically took three to five years). In all, this study found that smallholder farmers in Lantapan recognized the range of benefits that could be derived from different tree types (*Lasco et al. 2015*), but women and men's varied perceptions, and capabilities seemed to affect which species they ultimately prioritized.

CONCLUSION

Local perceptions of smallholder farmers influence their farm decision-making, particularly regarding crop and tree species selection. This study showed that economic benefits were the main consideration of farmers in selecting farming systems, but the contribution of those systems to household food supply was also important. Generally, male and female farmers preferred farming systems that maximized economic benefits, such as crops with shorter growing periods and established marketing channels. Contribution of farming systems to household food supply was also highly important to female farmers. These preferences seemed to arise from their economic condition, and in some cases, were also influenced by the varied roles of women and men in the family. Profit maximization also appeared to be the most distinct reason why the areas devoted to crop-based farms were rapidly increasing at the expense of tree-based systems. This remains as a challenge in conservation efforts where agricultural intensification has resulted to further degradation of Philippine watersheds. Indeed, this study also found that both female and male farmers prefer crop-based farms over tree-based farms.

In defining selection criteria for priority tree species, women and men's common interests in profit maximization and supply of building materials emerged. However, it was also apparent that beyond household income considerations, women and men were also concerned with the contribution of trees to different aspects of their families' well-being. Female farmers recognized the regulatory functions of trees, such as flood prevention, soil erosion prevention and environmental protection, while, male farmers valued trees

as secondary food sources for their families. Finally, results showed that although tree species selection criteria were similar for women and men, differences in perceptions and capabilities became apparent in their choice of priority tree species. Female farmers highly preferred plantation crops and timber trees, while male farmers assigned higher importance to fruit trees.

Based on the results of the study, despite farmers' knowledge of the regulatory services of trees, they are hesitant to integrate trees on farm because of unstable prices of tree products, limited access to marketing channels, and tedious process of acquiring tree-cutting permit. Hence, it is important to ensure that promoting the incorporation of trees into agricultural production systems translates to tangible economic benefits for the smallholder farmers. Through the development of a co-investment scheme in the study site, funds could be generated to support farmers, either financially or in kind, in the early stage of agroforestry adoption wherein trees are not yet productive. This scheme could encourage farmers to adopt tree-based farming systems which will not only benefit them in the long run but will also contribute to sustainable provision of environmental services to current and future generations. Thus, the criteria identified will serve as inputs for crafting a gender-sensitive co-investment scheme to support the promotion of climate-smart, tree-based agriculture in the area. Through this scheme, farmers and those who benefit from the ecosystem services from the watersheds (i.e., large agro-plantations, hydroelectric companies, and irrigators' association) will co-invest towards the conservation of the environment. While it is true that shifting to climate-smart, tree-based farming will incur opportunity costs and might not be appealing for farmers, funds generated from this scheme could compensate farmers for the opportunity costs of shifting gradually to tree-based farming systems.

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