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Analysis of the farmers' knowledge on the ecosystem services of trees in the Molawin-Dampalit Watershed, Makiling Forest Reserve, Philippines

ROSELYN F. PAELMO[1*], ROBERTO G. VISCO[1], LEILA D. LANDICHO[1], ROWENA D. CABAHUG[1], ROMNICK S. BALITON[1], MARYA LAYA O. ESPALDON[2] and RODEL D. LASCO[2]

The degree of knowledge on ecosystem services of trees largely depend on the farmers' experiential association including goods and services derived from the trees. This paper sought to determine the farmers' knowledge on the ecosystem services derived from trees found within the Molawin-Dampalit Watershed. Specifically, it aimed to acharacterize the socio-demographic conditions of the farmer respondents and determine farmers' knowledge on the ecosystem services.

Results reveal that 11 major woody perennial (trees) species provide economic, ecological and cultural services. These include acacia (*Samanea saman*), malunggay (*Moringa oleifera*), narra (*Pterocarpus indicus),* coconut (*Cocos nucifera*), banaba (*Lagerstroemia speciosa*), neem (*Azadirachta indica*), pine *(Pinus* sp.) and various species of fruit trees. The ecological services had the highest knowledge score of 13.29, while the cultural services had the lowest score of 0.38. The farmers' knowledge on the economic service of on-farm trees got an average score of 10.23. Furthermore, the correlation of the knowledge scores on the ecosystem services indicates a negative correlation of the cultural services with the ecological services.

These results suggest that the farmers are aware of the positive ecological value of integrating trees in their production system. Furthermore, the level of the farmers' knowledge on the ecosystem services of trees indicates the probable significant influence on the farmers' production system, particularly in integrating woody perennials in their farming system. Therefore, scaling-up the domestication of trees on-farm for better ecosystem services is imperative.

Keywords: keystone species, ecosystem services, farmers' knowledge score, kosmos-corpus-praxis, knowledge-practice-belief, Makiling Forest Reserve, Philippines

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INTRODUCTION

Farmers develop extensive knowledge of the system they are managing. Consequently, developing the farmers' experience-based knowledge can fill in some of the gaps in scientific knowledge (Dore et al. 2011). In view of this, the farmers' knowledge are gaining great recognition for their insights and experiences that provide relevant inputs into the sustainable natural resource management including gauging the "gaps" towards the integration of local and technical knowledge systems (Barrios et al. 2003). Eventually, this would lead to the evolution of cross-cutting development technologies/strategies responsive to enhancing the ecosystem services.

The "knowledge-practice-belief" ("kosmos-corpus-praxis") complex as a way of framing local knowledge (Berkes 1999) played an important role in soliciting the knowledge of the respondents on the ecosystem services of trees.

Ecosystem services (ES) refer to the "benefits people receive from their ecosystems" (Millennium Ecosystem Assessment 2005). De Groot et al. (2002) forwarded four categories of ES, namely: regulation, habitat, production and information. Regulation and habitat functional groups are regarded as important to the maintenance of natural processes and components. Likewise, the authors argue on the importance of "supporting ES" to cover those ES that enable the others to function.

Based on MEA (2005) the general categories of ES and their specific descriptions are as follows: (a) Provisioning services - ecosystem services that combine with built, human, and social capital to produce food, timber, fiber, or other "provisioning" benefits. For example, farm inputs including technology (built capital), farmers (human capital) and farming communities (social capital) are needed to produce fruits as food; (b) Regulating services - services that combine with the other three capitals to produce such as flood control, storm protection, water regulation, human disease regulation, water purification, air quality maintenance, pollination, pest control and climate control; (c) Cultural services - ecosystem services providing recreation, ecotourism, aesthetic, scientific, cultural identity or other "cultural" benefits. Moreover, cultural ecosystems services (CES) are usually the "non-material benefits"which the people gains from ecosystems in the form of spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences', sense of place referring to human attachment and belongingness and cultural heritage (MA 2005 and Costanza et al. 1997 as cited by Morcillao et al. 2013). Urban greenery using trees elicits CES in terms of increased sense of community and personal well-being (Grahn & Stigsdotter 2003, Chiesura 2004), (d) Supporting services - are those maintaining basic ecosystem processes and functions such as soil formation, carbon fixation and habitat for animals. These services affect human well-being indirectly by maintaining processes necessary for provisioning, regulating and cultural services.

Indeed, the ecosystem services are interrelated and could be classified as having direct and indirect benefits. Supporting (indirect) services create a foundation for the provisioning (direct), cultural (direct), regulating (indirect) benefits (Figure 1) (MEA 2005 as cited by Patterson & Coelho 2009).

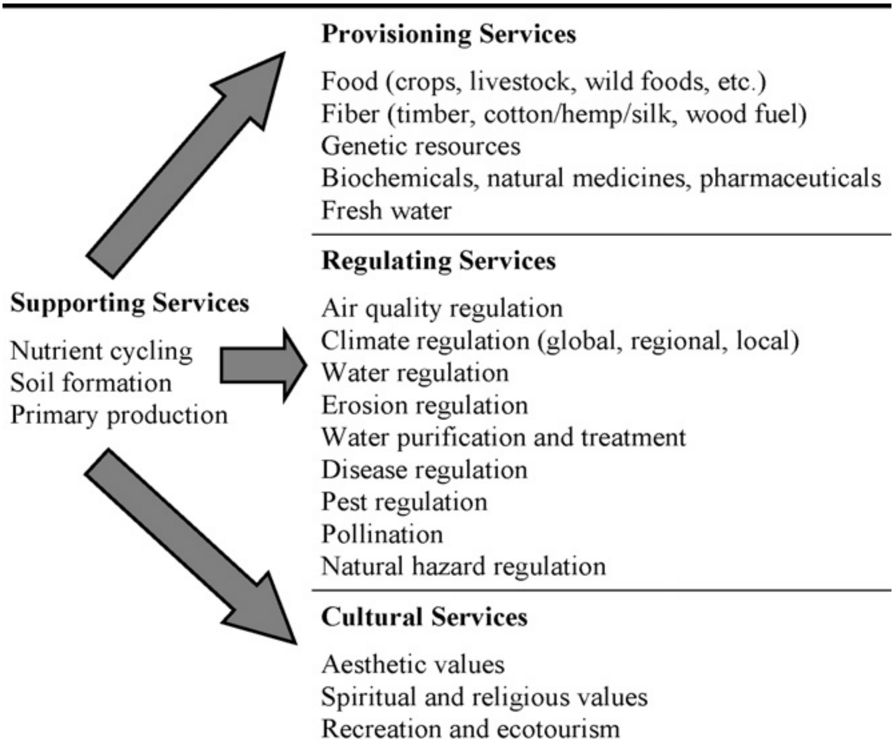

Figure 1. Broad categories of ecosystem services which are interrelated in their function (adapted from MEA 2005 as cited by Patterson & Coelho 2009).

The focus of this paper is on the tree components in agricultural production systems. Trees are recognized to have contribution in the production objectives while simultaneously providing ecosystem services (ES) (Harvey et al. 2006, Pagiola et al. 2007 as cited by Marinidou 2013) especially in an agroforestry-based production scheme.

This paper sought to determine the farmers' knowledge on the ecosystem services derived from trees found within the Molawin-Dampalit Watershed. Specifically, it is aimed to (a) characterize the socio-demographic conditions of the farmer respondents and (b) characterize the ecosystem services' knowledge of the farmers.

MATERIALS AND METHODS

The team organized a workshop/focus group discussion (FGD) to provide an overview/orientation on the concept of ecosystem services and likewise solicit the farmers' understanding/perception on the said subject matter. The FGD *cum* workshop in Molawin-Dampalit Watershed had elicited 39 participants representing the farmers' groups, barangay officials (barangays chairman, barangay council for agriculture and environment, and livelihood), municipal agriculture office, municipal environment and natural resources office, and the research team. This activity had a follow-through interview activity designed to gather their understanding on the role of trees in providing ecosystem services. A semi-structured questionnaire was administered to 104 farmer respondents in six barangays or communities of Los Banos, Laguna, namely: Anos, Putho-Tuntungin and Batong Malake (representing the lowland ecosystem); Lalakay and Timugan (representing the upland ecosystem) and Tadlac as the coastal ecosystem serving as catchment area of the whole watershed.

These barangays represent the watershed continuum and are engaged mainly in rainfed agriculture. Using the the current list of farmers in each of the six barangays, the farmer-respondents were sampled using the Slovin's formula:

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

n = Number of samples
N = Total population
e = Error tolerance

Computation of the Knowledge Score for each of the ecosystems services of the trees is based on Romney et al. (1986 as cited Chi 1999). Where, RQn is the percentage of right answers for questions with n choices.

$$D = \frac{(RQnxn)-1}{(n-1)}$$

For the computation of the knowledge score (D), the focused ES of trees are reclassified as ecological, economic and cultural based on the coded answers of the farmer-respondents. Respondents without answers are given zero (0) default values in the computation. Simple correlation was also done for the knowledge on agroecosystem services of the trees.

Biophysical characterization was also conducted to provide empirical field level evidences of the ecosystem services derived from the tree components of the selected farms. Farm biophysical characterization was conducted using various techniques such as transect mapping, canopy cover measurement using densitometer and observation of soil erosion indices and indications.

RESULTS AND DISCUSSION

Socio-demographic condition of the farmer-respondents in Molawin-Dampalit Watershed. The farmers in the Molawin-Dampalit watershed included in the study are dominantly in their old-age within the range of 51-60 (30%) and >60 (29%) years old. Minority (6%) of the farmers are in their mid-age range of 30-45 years old. This is a positive indication especially that most of the type of land being cultivated by the farmers are technically classified as 75% within the public land. The pressure of extraction on the watershed would be in the declining trajectory in the future. Consequently, less pressure would be providing watershed conservation especially that the farmers are only cultivating small farm size of 1-3 ha and have seasonal planting for agricultural crops being situated in rainfed areas (74%)(Figure 2). A conserved watershed could better provide ecosystem services (Shoyama & Yamagata 2014)

Although majority (58%) of the respondents are male, women (42%) are also involved in farming. Moreover, majority (88%) of the farmer-respondents are married. This implies the presence of more or less gender balance in farming and decision making activities on farm development.

Agroecosystem in the Molawin-Dampalit Watershed. Biophysical characterization was undertaken to validate the farm-related information, particularly the ecological ecosystem services identified by the farmer-respondents. The selection of the farms was based on the dominant farming systems in each barangay, as in the case of Barangays Timugan and Lalakay where agroforestry and Barangays Anos, Tadlac and Tuntungin, with multiple cropping as the dominant farming system, respectively.

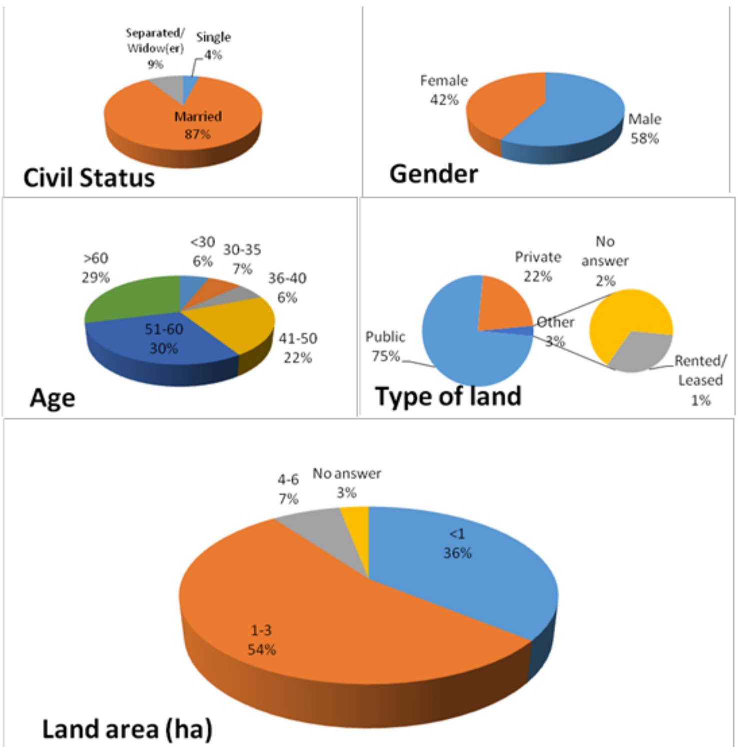

Figure 2.Socio-demographic profile of the 104 farmer-respondents in the Molawin-Dampalit Watershed, Los Banos, Laguna, Philippines

Among the indices of soil erosion are observable presence of gullies, exposed roots (Figure 3), turbid surface runoff and erosion pedestal, rills and bare area.

Fortunately, these were negligibly sighted field documentation in Barangays Anos, Tadlac and Putho categorically described as “no apparent significant erosion” (Table 1). These results are expected particularly that the said communities are in the lowland and the overstorey percentage of 89.99, 78.15 and 93.37, respectively are adequate to prevent the drip fall influence on the soil. Moreover, this indicates that the overstorey is sufficient to provide soil and water conservation measures for the inventoried sample farms.

With a numerical rating of 10.85 and 11 for Barangays Timugan and Lalakay, respectively, these are categorically noted to be slightly eroded being located in vulnerable upland area. The overstorey of 96 both for Timugan and Lalakay communities implies the need for structural modification targeting the enhancement of soil surface cover to ensure that the level of soil erosion is controlled. The sloping areas in the sampled farms in the said two barangays are exposed to the environmental elements of erosion like rain, extreme temperature causing physical weathering. The very dense canopy of the multi-storey-based agroforestry system limited the growth of understorey species which could have contributed to the observance of bare soil condition (Figure 4). The overstory cover of 96.3% is mostly provided by the canopy of the fruit trees as shown in Figure 5. This implies the necessity of silvicultural treatments like pruning if growth of other species in the understorey is desired. However, the woody perennial-based system already exists which serves as vegetative soil and water conservation measure to arrest soil erosion thereby, eliciting the farm to consider their farm/area as only slightly eroded.

Several studies have proven that among the benefits of agroforestry practices are deterring or reversing land degradation, sequestering carbon from the atmosphere and securing rural livelihoods through provision of ecological and economic benefits. The latter benefits are also accounted by the farmer-respondents in this study. Besides increasing soil fertility, trees managed by farmers also provide ecosystem services and functions in addition to the products and services that motivated farmers to plant or preserve them (Torquebiau 2000).

Table 2. Degree of soil erosion and overstorey cover in selected study sites in the Molawin-Dampalit Watershed, Makiling Forest Reserve, Philippines.

Barangay	Numerical Rating	Category of Erosion	Overstorey Cover (%)
Anos	2.1	No apparent significant erosion	89.99
Putho	7.03	No apparent significant erosion	93.37
Tadlac	3.03	No apparent significant erosion	78.15
Timugan	10.85	Slightly eroded	96.30
Lalakay	11.0	Slightly eroded	96.37

Figure 3. Exposed roots as an indicator of the prevalence of soil erosion in one of the farms in Barangay Timugan, Los Banos, Laguna, Philippines.

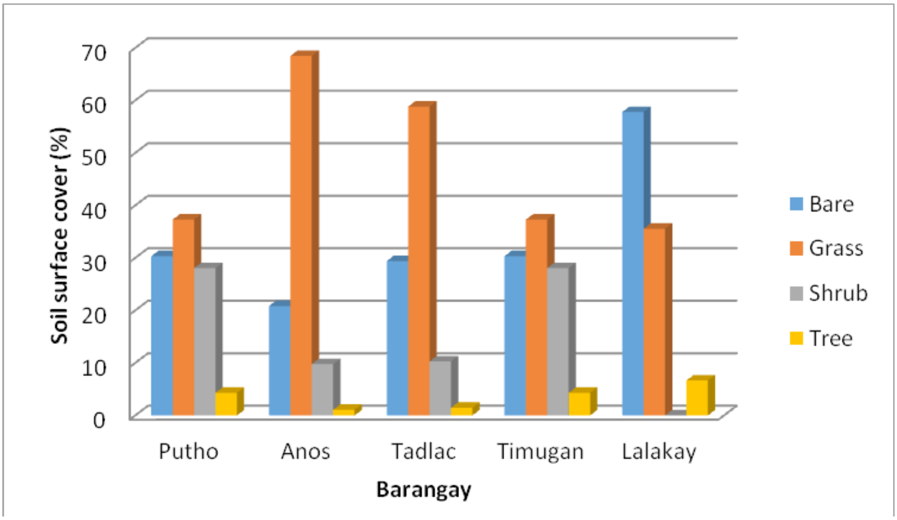

Figure 4.Soil surface cover in the selected study sites in the Molawin-Dampalit Watershed, Makiling Forest Reserve, Philippines.

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Based on the current farming practices, the farmers cultivating in the lowland areas are usually engaged in annual agricultural crop production. Meanwhile, farmers in the upland areas are domesticating woody perennials with a few annual crops. This indicates the inherent awareness of the farmers to plant species that would provide permanent canopy cover to ensure sustainable production even in vulnerable areas. The "bare" soil surface cover that was observed in some farms, particularly in the multistorey agroforestry-based systems, is accounted to the light attenuation, which prevents the germination of probable understorey species. However, sufficient litterfall is able to cushion the impact of erosive rainfall.

Forty three percent of the farmer-respondents, who are mostly cultivating in the lowland barangays (e.g. Tuntungin, Anos and Tadlac) grow annual agricultural crops, particularly cereals (rice, corn), root crops and vegetables (Figure 5). The flat and open areas in these barangays are very much favourable to the cultivation of the agricultural crops. While agricultural crops are considered as their major crops, the farmer-respondents from these barangays also plant fruit trees along the boundaries. It is also interesting to note that while Barangay Tadlac is a coastal community, there were also respondents who are engaged in crop production such as rice and root crops.

Meanwhile, 51% of the farmer-respondents, particularly those in the upland barangays of Timugan and Lalakay were engaged in cultivating perennial crops such as fruit trees and forest trees, with some root crops as understorey. Likewise, the cultivation of ornamentals, particularly the tropical plants (e.g. Heliconiaspp) is unique in Barangay Timugan.

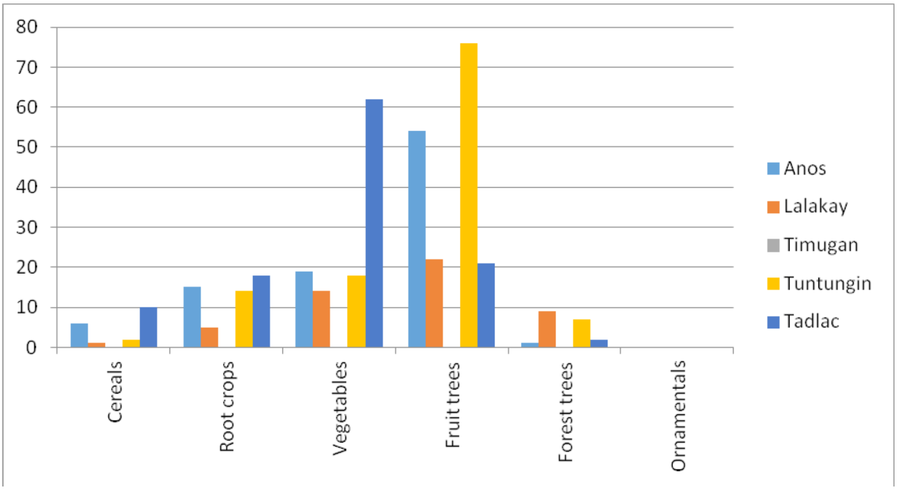

Figure 5.Crop components of the agricultural production systems being practiced by the farmer-respondents within the Molawin-Dampalit Watershed, Makiling Forest Reserve, Philippines.

Farmers' knowledge on the ecosystem services of trees

Knowledge/understanding of the farmers on ecosystem servicesof trees. On-farm and off-farm trees represent semi-natural habitats within the farmland mosaic which form part of a 'high-quality agricultural matrix' (Grashof-Bokdam et al. 2009, Vandermeer & Perfecto 2007) are likewise noted in this study. The noted dominant tree species in the study sites are listed in Table 3.

There are 11 tree species that were reportedly providing ecosystem services. The most common are the fruit trees found domesticated in Barangays Batong Malake, Lalakay, Tadlac, Timugan and Tuntungin. Narra and coconut are found among the three barangays, namely: Batong Malake, Lalakay and Timugan. Meanwhile, Barangay Batong Malake is noted to have the most tree species (8) providing ecosystem services. It is also notable that neem and pine trees in Barangay Tadlac are found thriving outside the farm. These ecosystem services provided by these trees are being recognized by the farmers. .

Table 3. Trees on and off-farm recorded within the study sites as reported by the farmer-respondents (FGD 2012) providing ecosystem services.

Tree Species/Taxon	Anos	Batong Malake	Lalakay	Tadlac	TImugan	Tuntungin
Acacia (*Samanea saman*)	✓	✓				
Malunggay/Horseradish (*Moringa oleifera*)	✓	✓				
Narra (*Pterocarpus indicus*)		✓	✓		✓	
Coconut (*Cocos nucifera*)		✓	✓		✓	
Banaba (*Lagerstroenia speciosa*)		✓			✓	
Fruit trees		✓	✓	✓	✓	✓
Neem (*Azadirachta indica*)				✓		
Pine (*Pinus* sp.)				✓		
Lapnis (*Broussonetia papyrifera*)						✓
Bamboo (*Bambusa* sp.)		✓				
Kapok (*Ceiba pentandra*)		✓				

Farm trees have been conceptualized as 'keystone structures' in recognition of their influence on ecosystem functioning which is presumed to be disproportionately high relative to the small area occupied by any individual tree (Gibbons et al. 2008). Their ecological importance is particularly high in intensively farmed landscapes (Jackson 2012). Farm trees create high structural diversity in agricultural landscapes; thereby, providing a great number of microhabitats and permitting multi-directional movements of biota across landscapes and ecological networks (Manning et al. 2009). Basically, this could perhaps be the attributes that the identified tree species (Table 3) were given recognition among the farmer-respondents.

The specific ecosystem services derived from the trees have varying perception which could probably be attributed to the "knowledge-practice-belief" ("kosmos-corpus-praxis") (Berkes 1999) resulting to the experiential exposure to the tree species. A single tree species either had more or less ecosystem functions depending on the actual engagement of the farmers on the said tree species (Tables 4a-h). In addition to the four major categories of the ecosystem services earlier discussed as provided by MEA (2005), the survival function of the tree species was positively identified by the farmer-respondents, specifically in terms of herbal used as medicine for urinary tract infection (UTI).

Table 4a. Ecosystem services from Acacia (*Samanea saman*) and Malunggay/ Horse radish (*Moringa oleifera*) (FGD 2012).

Acacia (*Samanea saman*)
Cultural (Fertility/Love tree - landmark of UPLB)
Regulating (provides oxygen)
Provisioning (source of wood for construction)
Regulating (regulates microclimate)
Malunggay/Horseradish (*Moringa oleifera*)
Survival (as herbal medicine)
Provisioning (source of vitamins and minerals for health)
Provisioning (source of vitamins for health; source of food)
Survival (as herbal medicine for UTI)

Table 4b. Ecosystem services from Narra and Coconut (FGD 2012).

Narra (*Pterocarpus indicus*)
Provisioning (source of wood for furniture; source of seeds for seed propagation & seedling production)
Cultural (provides good landscape and shade during Lenten Season)
Regulating (provides shade; improves landscape and prevents soil erosion)
Supporting (controls soil erosion)
Coconut (*Cocos nucifera*)
Provisioning (source of materials for domestic use and construction e.g. food - oil, vinegar; broom, firewood, coco lumber)
Supporting (controls soil erosion)
Survival (with medicinal value, e.g. herbal medicine for UTI))

Table 4c. Ecosystem services from Banaba (*Lagerstroemia speciosa*) (FGD 2012).

Banaba (*Lagerstroemia speciosa*)
Regulating (provides oxygen & shade)
Survival (as herbal medicine, e.g. for ulcer)

Table 4d. Ecosystem services from fruit trees Barangays Lalakay, Tuntungin and Timugan, Los Banos, Laguna, Philippines (FGD 2012).

Barangay	Ecosystem services
Batong Malake	
	Provisioning (as source of food and additional income)
	Regulating (provides oxygen)
Lalakay	
	Survival (herbal medicine for diarrhea)
	Provisioning (source of food)
Tuntungin	
	Provisioning (source of fruits; additional source of income)
	Regulating (controls soil erosion, regulates microclimate)
	Provisioning (source of fruits and additional source of income)
Timugan	
	Provisioning (source of food and additional source of income)

Table 4e. Ecosystem services from neem (*Azadirachta indica*) and pine trees (*Pinus* sp.) Barangay Tadlac, Los Banos, Laguna, Philippines (FGD 2012).

Species	Tadlac		
Neem	Survival (insect repellent)	Regulating (provides shade)	Provisioning (source of firewood)
Pine	Survival (herbal medicine for high blood pressure)	Provisioning (source of firewood)	-

Table 4g. Ecosystem services from lapnis (*Broussonetia papyrifera*) in Barangay Tuntungin, Los Banos, Laguna, Philippines (FGD 2012).

Species	Tuntungin	
Lapnis	Provisioning (source of seeds and seedlings); source of firewood and rope)	Regulating (regulates microclimate)

Table 4h. Ecosystem services from neem (*Azadirachta indica*) and pine trees (*Pinus* sp.) in Barangay Batong Malake, Los Banos, Laguna, Philippines (FGD 2012).

Species	Batong Malake	
Bamboo	Supporting (Flood control, soil erosion prevention)	Regulating (provides oxygen)
Kapok	Provisioning (source of materials for upholstery)	Regulating (provides oxygen)
Kakawate	Provisioning (provides ornamentals)	Regulating (provides oxygen)

From the literature review and results of farmers' interview, regulating and supporting are classified as the ecological roles of trees. Provisioning services directly provide the economic role of trees. The cultural services of trees were gauged by the farmer-respondents in terms of its cultural, aesthetic, cosmetic values, among others (Table 5).

The farmers' knowledge on the potential ecological benefits of trees on and off-farm coincide with the findings of several researchers. Among the ecological services are the provision of habitat and refuge for biodiversity (Bhagwat et al. 2008), carbon sequestration (Albrecht & Kandji 2003) including many parallel ecosystem services, such as maintaining water supply (Ryszkowski & Kedziora 2007), controlling surface runoff and soil erosion (Pattanayak& Mercer 1997). Cultural ecosystem services such as aesthetics (McCollin 2000) were also recognized by the farmer-respondents. Similarly, the contribution of farm trees as carbon sink (mainly through enhanced carbon sequestration in vegetation and soils, (Nair et al. 2009; Plieninger 2011 as cited by Scheleyer et al 2011)and maintenance of soil fertility (Verchot et al. 2007, Manning et al. 2009) have been acknowledged by the farmer-respondents. This validates the conformity of the research results with other previous scientific investigations.

For the agroforestry-based production system observed in Barangays Lalakay and TImugan, the farmers have recognized the multifunctionality of agroforestry, particularly its significance in simultaneously providing ecological and economic agroecosystem services. This findings is in line with the research of Perfecto and Vandermeer (2006). Agroforestry system has the potential to enhance soil fertility, reduce erosion, improve water quality, enhance biodiversity, increase aesthetics and sequester carbon (Oelbermann et al. 2004, Thangata et al. 2012).

In the analysis of the agroecosystem services, it is bounded by the concepts of supply delivery and value. ES supply refers to the potential beneficial contribution of ecological or biophysical functions in an ecosystem to humans regardless whether these are actually used or value by humans for the intended function (Bathurst et al. 2011). On one hand, ES delivery represents the actual contact of the potential supply of the service with human populations, and takes into account the spatial distribution of people and infrastructure (Ghillardi et al. 2007). On the otherhand, ES value reflects the way in which peoples' references for different services measured which can be expressed in economic terms (Costanza et al. 1998) and the intangible or non-material dimensions (Wallen 2013, Satterfield et al. 2013).

The ES delivery and value could have shaped the farmer-respondents' knowledge and understanding about the ecosystem services of tree s.In terms of the corresponding knowledge score among the farmer-respondents, the highest was on ecological (13.29), economic (10.23) and the least is on the cultural ecosystem services (0.38). These values are categoricallywithinn the low knowledge level. Chi et al. (1999) argues that the level of knowledge with <35, 35-65 and >65% as low, medium and high, respectively. Therefore, the results suggest the need for capability-building programs that would enhance/strengthen the farmers' awareness about the ecosystem services of trees. . To better realize the acquisition of said knowledge, farmers should be encouraged to integrate more trees in their production system. Gamfeldtet al. (2013) stated that there are increasing ecosystem services with increasing number of trees. Moreover, the level of knowledge of the farmers on the trees' ecosystem services could influence their production system vis-à-vis integrating the woody perennials in their sustainable farming system (Cerdán et al. 2012). It is also verified by Liu et al. (2007) that human decisions and actions affect the ecosystem processes that consequently feed back into the quality and quantity of ES that influence human well-being and vice versa. The relationship between human and natural systems arises from an understanding of the ecological importance of environmental services as well as to the values and experiences ascribed to those services.

Table 5. Ecosystem services of trees defined by the farmer-respondents and their computed knowledge score (Interview 2012).

Ecosystem Services of trees	Description	Knowledge Score
Ecological	provide shade to understorey crops	13.29
	maintains soil fertility	
	increase water input	
	maintains soil moisture	
	improves microclimate	
	improves soil drainage	
	stabilizes soil	
	windbreaks	
	maintain water supply	
	serve as carbon sink	
	habitat or shelter of wildlife	

Ecosystem Services of trees	Description	Knowledge Score
Economic	provides firewood source of charcoal used as herbal medicine provides construction materials source of feeds for animals source of food source of income others (air quality)	10.23
Cultural	cultural value aesthetic value cosmetic value spice and condiments others	0.38

Relationship among the ecosystem services of trees. Table 6 shows that the knowledge on ecological services is negatively correlated with knowledge on cultural services. The knowledge on the other ecosystem services is not significantly related to each other. These results, therefore, imply that the knowledge of the farmers on the different ecosystem services of trees are mutually exclusive.

Table 6. Relationship of the knowledge on ecosystem services of trees.

	KSCULT	KSECOL	KSECON
KSCULT	1		
KSECOL	-0.08218	1	
KSECON	0.203564	0.173939	1

CONCLUSION

The research results confirmthatthe visible ecosystem functions (i.e. ecological, economic and cultural) of on- and off-farm trees have been recognized by the smallholder farmers in Molawin-Dampalit Watershed within the Makiling Forest Reserve (MFR). However, the level of knowledge is still considerably low. This is the challenge to the concerned stakeholders around the MFR to enhance the derived ecosystem services from the trees including the watershed as a whole through appropriate research, extension and development programs that are all geared towards strengthening the capabilities of the farmers.

Moreover, integration of trees through the agroforestry systems would require the intricate consideration of their silvical characteristics including the silvicultural and overall management requirements to optimize their ecosystem services. Trees have their own peculiarities to which the farmers are often exposed to; hence, the need for them to further deepen their knowledge and understanding of such unique characteristics, particularly in their continuing practice of agroforestry as among the sustainable farming practices in the Molawin-Dampalit Watershed.

LITERATURE CITED

Albrecht, A. and S.T. Kandji. 2003. Carbon sequestration in tropical agroforestry systems. Agriculture, Ecosystems and Environment 99: 15-27. Accessed at doi:10.1016/S0167-8809(03)00138-5 on December 4, 2013.

Bathurst, J.C., S.J. Birkinshaw, F. Cisneros, J. Fallas, A. Iroume, R. Iturraspe, M.G. Novillo, A. Urciuolo, A. Alvarado, C. Coello, A. Huber, M. Miranda, M. Ramirez and R. Sarandon. 2011. Forest impact on floods due to extreme rainfall and snow melt in four Latin American environments 2: Model analysis. Journal of Hydrology 40: 292-304.

Balvanera, P., M. Uriarte, L. Almeida-Leñero, A. Altesor, F. De Clerck, T. Gardner, J. Hall, A. Lara, P. Laterra, M. Peña-Claros I, D.M. Silva Matosm, A.L. Vogl, L.P. Romero-Duque, L.F. Arreola, A.P. Caro-Borrero, F. Gallego, M. Jain, C. Little, R. de Oliveira Xavier, M.J. Paruelo, J.E. Peinado, L. Poorter, N. Ascarrunz, F. Correa, M.B. Cunha-Santinom, A.P. Hernandez-Sanchez and M. Vallejos. 2012. Ecosystem services research in Latin America: The State of the Art. Ecosystem Services 2: 56-70. Accessed at http://dx.doi.org/10.1016/j.ecoser.2012.09.006 on November 26, 2013.

Barrios, E. and M. Trejo. 2003. Implications of local soil knowledge for integrated soil management in Latin America**.** Geoderma 111: 217-231. Accessed at doi:10.1016/j.geoderma.2005.12.007 on November 21, 2013.

Berkes, F. 1999. *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*. Taylor and Francis, Philadelphia and London, 219 p.

Bhagwat, S.A., K.J. Willis, H.J.B. Birks and R.J. Whittaker. 2008. Agroforestry: A refuge for tropical biodiversity? Trends in Ecology and Evolution 23: 261-267. Accessed at doi:10.1016/j.tree.2008.01.005 on December 04, 2013.

Cerdán, C.R., M.C. Rebolledo, G. Soto, B. Rapidel and F.L. Sinclair. 2012. Local knowledge of impacts of tree cover on ecosystem services in smallholder coffee production systems. Agricultural Systems 110: 119-130. Accessed at http://dx.doi.org/10.1016/j.agsy.2012.03.014 on November 18, 2013.

Chiesura, A. 2004. The role of urban parks for the sustainable city. Landscape and Urban Planning 68: 129-138.

Costanza, R., R. d' Arge, R. de Groot, S. Farber, M. Grass, B. Hannon, K. Limburg, S. Naeem, R.V. O'Neill and J. Paruelo. 1998. The value of ecosystem services: Putting the issues in perspective. Ecological Economics 25: 67-72. *In:* Balvanera, P. M. Uriarte, L. Almeida-Leñero, A. Altesor, F. De Clerck, T. Gardner, J. Hall, A. Lara, P. Laterra, M. Peña-Claros I, D.M. Silva Matosm, A.L.Vogl, L.P. Romero-Duque, L.F.Arreola, A.P. Caro-Borrero, F. Gallego, M. Jain, C. Little, R.de Oliveira Xavier, M.J. Paruelo, J.E. Peinado, L. Poorter, N. Ascarrunz, F. Correa, M.B. Cunha-Santinom, A.P. Hernandez-Sanchez and M. Vallejos. Ecosystem services research in Latin America: The State of the Art. 2012. Ecosystem Services 2: 56-70. Accessed at http://dx.doi.org/10.1016/j.ecoser.2012.09.006 on November 26, 2013.

Costanza, R., R. d'Arge,R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R.V.O.O'neill, J. Paruelo, R.G. Raskin, P. Sutton and M. van den Belt.1997. The value of the world's ecosystem services and natural capital. Nature 387 (6630): 253-260. *In:* Morcilloa,H.N., T.Plieningera and C.Bieling. 2013. An empirical review of cultural ecosystem service indicators. Ecological Indicators 29: 434-444. Accessed at http://dx.doi.org/10.1016/j.ecolind.2013.01.013 on November 22, 2013.

de Groot, R.S., M.A. Wilson, R.M.J. Boumans. 2002. A Typology for the classification, description and valuation of ecosystem functions, goods and services. Ecology and Economics 41: 393-408. *In:* Costanza, R., I. Kubiszewski, D. Ervin, R. Bluffstone, J. Boyd, D. Brown, H. Chang, V. Dujon, E. Granek, S. Polasky, V. Shandas and A. Yeakley.2011. Valuing ecological systems and services. F1000 Biology Reports 3: 14. Accessed at doi:10.3410/B3-14 on November 22, 2013.

Dore, T., D. Maowski, E. Malezieux, N. Munier-Jolain, M. Tchamitchian and P. Tittlnell. 2011. Facing up to the paradigm of ecological intensification in Agronomy: Revisiting methods, concepts and knowledge. European Journal of Agronomy 34: 197-210. Accessed at doi:10.1016/j.eja.2011.02.006 on November 21, 2013.

Gamfeldt, L., T. Snall, R. Bagchi, M. Jonsson, L. Gustafsson, P. Kjellander, M.C. Ruiz-Jaen, M. Froerg, J. Stendahl, C.D. Philipson, G. Mikusin´ski, E. Andersson, B. Westerlund, H. Andre´n, F. Moberg, J. Moen and J. Bengtsson. Higher Levels of multiple ecosystem services are found in forests with more tree species. Nature Communications 4: 1340. doi: 10.1038/ncomms2328 |www.nature.com/naturecommunications.

Grashof-Bokdam, C.J., J.P. Chardon, C.C. Vos, R.P.B. Foppen, M. Wallis De Vries, M. van der Veen and H.A.M. Meeuwsen. 2009. The synergistic effect of combining woodlands and green veining for biodiversity. Landscape Ecology 24: 1105-1121. *In:* Tobias, P., C. Schleyera, M. Mantelb and P. Hostertb (Eds.). 2012. Is there a forest transition outside forests? Trajectories of farm trees and effects on ecosystem services in an agricultural landscape in Eastern Germany. Land Use Policy 29: 233-243. Accessed at doi:10.1016/j.landusepol.2011.06.011 on November 20, 2013.

Grahn, P. and U.A. Stigsdotter. 2003. Landscape planning and stress. Urban Forestry and Urban Greening 2: 1-18.

Ghillardi, A., G. Gabriela and O. Masera. 2007. Spatial analysis of residential fuelwood supply and demand patterns in Mexico using the WISDOM Approach. Biomass and Bioenergy 31: 475-491.*In:* Balvanera, P. M. Uriarte, L. Almeida-Leñero, A. Altesor, F. De Clerck, T. Gardner, J. Hall, A. Lara, P. Laterra, M. Peña-Claros I, D.M. Silva Matosm, A.L.Vogl, L.P. Romero-Duque, L.F. Arreola, A.P. Caro-Borrero, F. Gallego, M. Jain, C. Little, R. de Oliveira Xavier, M,J. Paruelo, J,E. Peinado, L. Poorter, N. Ascarrunz, F. Correa, M.B. Cunha-Santinom, A.P. Hernandez-Sanchez and M. Vallejos. 2012. Ecosystem services research in Latin America: The State of the Art. Ecosystem Services 2: 56-70. Accessed at http://dx.doi.org/10.1016/j.ecoser.2012.09.006 on November 26, 2013.

Gibbons, P., D.B. Lindenmayer, J. Fischer, A.D. Manning, A. Weinberg, J. Seddon, P. Ryan and G. Barrett. 2008. The future of scattered trees in agricultural landscapes. Conservation Biology 22: 1309-1319. *In:* Tobias P., C. Schleyera, M. Mantelb, and P. Hostertb (Eds.). 2012. Is there a forest transition outside forests? Trajectories of farm trees and effects on ecosystem services in an agricultural landscape in Eastern Germany.Land Use Policy 29: 233-243.Accessed at doi:10.1016/j.landusepol.2011.06.011 on November 20, 2013.

Harvey, C.A., A. Medina, S.D. Merlo, S. Vílchez, B. Hernández, J.C. Saenz, J.M. Maes, F. Casanoves and F.L. Sinclair. 2006. Patterns of animal diversity in different forms of tree cover in agricultural landscapes. Ecological Applications 16: 1986-1999. *In:* Marinidou, E., B. Finegan, G. Jiménez-Ferrer, D. Delgado and F. Casanoves. 2013. Concepts and methodology for evaluating environmental services from trees of small farms in Chiapas, México. Journal of Environmental Management 114: 115-124. Accessed at http://dx.doi.org/10.1016/j.jenvman.2012.10.046 on November 22, 2013.

Jackson, LE., M.M. Pulleman, L. Brussaard, K.S. Bawa, G.G. Brown, I.M. Cardoso, P.C. de Ruiter, L. Garcı´a-Barrios, A.D. Hollander, P. Lavelle, E. Oue´draogo, U. Pascual I,

S. Setty, S.M. Smukler, T. Tscharntke and M. van Noordwijk. 2012. Social-ecological and regional adaptation of agrobiodiversity management across a global set of research regions. Global Environmental Change 22: 623-639. Acessed at http://dx.doi.org/10.1016/j.gloenvcha.2012.05.002 on November 28, 2013.

Liu, J., T. Dietz, S.R. Carpenter, M. Alberti, C. Folke, E. Moran, A.N. Pell, P. Deadman, T. Kratz, J. Lubchenco, E. Ostrom, Z. Ouyang, W. Provencher, C.L. Redman, S.H. Schneider and W.W. Taylor. 2007. Complexity of coupled human and natural systems. Science 317(5844): 1513-1516.

MEA (Millennium Ecosystem Assessment). 2005. *Ecosystems and Human Well-being: Synthesis,* Island Press, Washington DC, USA. *In:* Morcilloa, H.N., T. Plieningera and C. Bieling (Eds.). 2013. An empirical review of cultural ecosystem service indicators. Ecological Indicators 29: 434-444. Accessed at http://dx.doi.org/10.1016/j.ecolind.2013.01.013 on November 22, 2013.

MEA (Millennium Ecosystem Assessment). 2005. *Ecosystems and Human Well-being: Current State and Trends,* Island Press, Washington DC, USA. *In:* Patterson, T.M. and D.L. Coelho (Eds). 2009. Ecosystem services: Foundations, opportunities and challenges for the forest products sector. Forest Ecology and Management 257: 1637-1646. Accessed at doi:10.1016/j.foreco.2008.11.010 on November 22, 2013.

Manning, A., J. Fischer and D. Lindenmayer. 2006. Scattered trees are keystone structures - Implications for conservation. Biological Conservation 132: 311-321. Accessed at doi:10.1016/j.biocon.2006.04.023 on December 02, 2013

Manning, A.D., P. Gibbons and D.B.Lindenmayer. 2009. Scattered trees: A complementary strategy for facilitating adaptive responses to climate change in modified landscapes? Journal of Applied Ecology 46: 915-919. Accessed at doi: 10.1111/j.1365-2664.2009.01657.x on November 29, 2013.

Oelbermann, M., R.P. Voroney and AM. Gordon. 2004. Carbon sequestration in tropical and temperate agroforestry systems: A review with examples from Costa Rica and Southern Canada. Agriculture, Ecosystems and Environment 104: 359-377. Accessed at doi:10.1016/j.agee.2004.04.001 on December 06, 2013.

Pattanayak, S. and E. Mercer. 1997. Valuing soil conservation benefits of agroforestry. American Journal of Agricultural Economics 79: 1714-1714. *In:* Schleyer, C. and T. Plieninger (Eds.). 2011. Identifying obstacles and options for the design and implementation of payment schemes for ecosystem services (PES schemes) provided through farm trees. 9th International Conference of the European Society for Ecological Economics (ESEE 2011).'Advancing Ecological Economics: Theory and Practice', June 14-17, 2011, Boğaziçi University, Istanbul, Turkey.

Perfecto, I., J. Vandermeerb, A. Masa and L.S. Pintoc. 2005. Biodiversity, yield and shade coffee certification. Ecological Economics 54: 435-446. Accessed at doi:10.1016/j.ecolecon.2004.10.009 on December 06, 2013.

Romney, A.K., C.W. Susan and H.B. William. 1986. Culture as consensus: A theory of culture and informant accuracy. American Anthropologist 88: 313-333. *In:* Chi, T.N., T.Q. Tuyen and L.L. Price. 1999. Effect of IPM_Farmer Field School on farmers' insect knowledege and control practices: A case study. OMONRICE 7 (1999).

Ryszkowsi, L. and A. Kedziora. 2007. Modification of water flows and nitrogen fluxes by shelterbelts. Ecology and Engineering 29: 388-400. *In:* Tobias, P., C. Schleyera, M. Mantelb, and P. Hostertb. 2012. Is there a forest transition outside forests? Trajectories of farm trees and effects on ecosystem services in an agricultural landscape in Eastern Germany.Land Use Policy 29: 233-243.Accessed at doi:10.1016/j.landusepol.2011.06.011 on November 20, 2013.

Shoyama, K. and Y. Yamagata. 2014. Predicting land-use change for biodiversity conservation and climate-change mitigation and its effecton ecosystem. Ecosystem Services (2014). Accessed at http://dx.doi.org/10.1016/j.ecoser.2014.02.004i on June 3, 2014.

Terre, S., R. Gregory, S. Klain, M. Roberts and K.M. Chan. 2013. Culture, intangibles and metrics in environmental management. Journal of Environmental Management 117: 103-114. Accessed on http://dx.doi.org/10.1016/j.jenvman.2012.11.033 on December 04, 2013.

Thangata, P.H. and P.E. Hildebrand. 2012. Carbon stock and sequestration potential of agroforestry systems in smallholder agroecosystems of Sub-Saharan Africa: Mechanisms for 'Reducing Emissions from Deforestation and Forest Degradation' (REDD+). Agriculture, Ecosystems and Environment 158: 172-183. Accessed at http://dx.doi.org/10.1016/j.agee.2012.06.007 on December 06, 2013.

Torquebiau, E.F. 2000. A renewed perspective on agroforestry concepts and classification. Comptes Remdus Academie des Sciences Paris, Sciences de la Vie/Life Sciences 323: 1009-1017

Vandermeer, J. and I. Perfecto. 2007. The agricultural matrix and a future paradigm for conservation. Conservation Biology 21: 274-277. Accessed at DOI: 10.1111/j.1523-1739.2006.00582.x on November 26, 2013.

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