Ecosystems & Development Journal 5(2): 3-11
April 2015 ISSN 2012-3612

Community-Based Management Planning and Payment for Environmental Services: the Case of The Subanen of Misamis Occidental, Philippines

Myranel G. Salvador-Canceran[1*], Rodel D. Lasco[2], Kharmina Paola A. Anit-Evangelista[3], Nathaniel C. Bantayan[4], and Margaret M. Calderon[4]

ABSTRACT

This paper explores the use of community-based management planning (CBMP) in developing a Payment for Environmental Services (PES) scheme for the conservation of Layawan Watershed, particularly the services that the Subanen Tribe provides. The study used the participatory three-dimensional modelling (P3DM) as a tool in community-based management planning. The tool served as guide in identifying land uses and the management strategies to be used for the management planning. Community-based management plans were developed with the vision of uplifting the Subanen's status of living and at the same time conserving and protecting the Layawan watershed. However, the communities do not have sufficient means of livelihood to support their needs, and if this is allowed to continue, it can make them turn to extractive and possibly destructive activities within the watershed. Recognizing Subanen's important role in protecting the watershed and securing watershed services, there is a need to support the Subanen, possibly through a sustainable financing mechanism such as PES.

Through P3DM, the communities were able to visualize their current situation in a holistic way. They were able to appreciate the connection between their livelihood and the surrounding environment, paving the way for their willingness to participate in a PES scheme as environmental services (ES) providers of the Layawan watershed. The communities recognized that the conservation and protection of the Layawan Watershed is also to their best interest because the area is not only a source of natural resources but also serves as their home and ancestral domain. They believed that the agroforestry system is a strategy to address their problem on low household incomes thus, they will be able to conserve and protect the watershed even as they enhance their income-generating capacity.

Keywords: community-based management planning, environmental services, indigenous people, Layawan Watershed, participatory three-dimensional modelling, Payment for Environmental Services, Subanen community

INTRODUCTION

Mt. Malindang Range Natural Park is one of the protected areas of the Philippines located on the island of Mindanao, straddling the provinces of Misamis Occidental, Zamboanga del Norte and Zamboanga del Sur (Figure 1). It has a total area of over 53,000 ha, with its highest peak at 2,402 meters above sea level (masl). Mt. Malindang Range Natural Park was declared an ASEAN Heritage Park (AHP) in 2012. It is an important source of water of 16 major rivers that support domestic, agricultural and industrial uses in the three provinces.

Mt. Malindang is home to the Subanen tribe, indigenous people who got their name because they live along the river, or *suba* in the local dialect. The Subanen practices agriculture and swidden farming, fishing, hunting, and gathering of forest products as their means of livelihood. Their agricultural crops include mountain rice, corn, and root crops like camote, cassava, *gabi* (taro), and *ubi* (yam).

The Subanen hold a Certificate of Ancestral Domain Title (CADT) covering 6,978 ha. They live in the upper portion of Mt. Malindang, placing them in a strategic position to contribute to the provision of environmental services to lowland communities.

There are many landscapes in Asia managed by the upland communities that provide environmental services (ES) to other communities. These communities may benefit from the provision of these services, which include clean and abundant water supply from watersheds, biodiversity protection, stocks of carbon that alleviate global warming, and landscape beauty and amenity. However, the provision of these environmental services is threatened in the face of pressures on the ecosystems that produce them. The alarming rate of environmental degradation requires more direct and innovative solutions for environmental conservation (Leimona and Lee 2008), which also led to the development of a number of natural resource management policies.

In many developing countries, natural resources are increasingly becoming under threat due to overexploitation, population

[1]University Research Associate II, Makiling Center for Mountain Ecosystems, College of Forestry and Natural Resources, University of the Philippines Los Baños
[2]Program Coordinator, World Agroforestry Centre (ICRAF), Philippines
[3]Researcher, World Agroforestry Centre (ICRAF), Philippines
[4]Professor, Institute of Renewable Natural Resources, CFNR, UPLB
*Corresponding author: mgsalvador@uplb.edu.ph

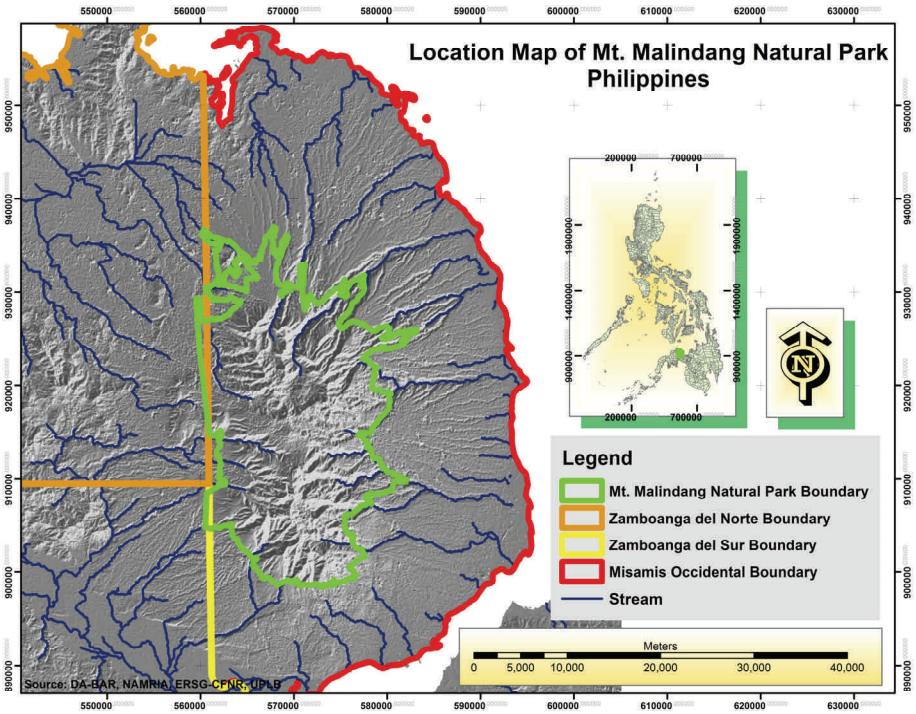

Figure 1. Location map of Mt. Malindang Natural Park where Layawan watershed can be found.

growth and land conversion. Thus, developing and applying sustainable financing mechanisms to support natural resource management is needed (Kallesoe and de Alvis 2004). Natural resource degradation in the Philippines has adversely affected the environmental services that they provide. Therefore, various incentive schemes have been devised and implemented to encourage people to plant trees on private and public land, but these have been ineffective and inefficient (Lasco *et al*. 2008). Moreover, the present institutional arrangements in the Philippines neither efficiently nor equitably function to make upland communities share in the benefits, rewards, incentives and the like from the environmental services they provide (Boquiren 2004).

The two main participants in a PES program are the environmental service providers who are paid for the provision of environmental services, and the environmental service owners who pay for the services they receive (Arcenas 2005). Likewise, PES is an innovation to increase the effectiveness of conservation efforts and the flow of more benefits to the communities, characterized by a shift from rigid, top-down decision-making towards more flexible and voluntary approaches (Leimona and Lee 2008). If the PES is designed properly, it can be used as a sustainable financing mechanism and can achieve conservation while reducing poverty (Kallesoe and de Alvis 2004).

In a watershed setting, PES normally includes the implementation of market mechanisms to compensate upstream landholders to maintain or modify a particular land use that affects the availability and/or quality of the water resource downstream. Usually, the compensation comes from downstream water users to make up for providers for increasing the quality and quantity of environmental services (FAO 2004). PES creates a market, bringing together sellers and buyers of environmental services.

Calderon *et al.* (2013) conducted a study to estimate the willingness to pay for improved watershed services from the Layawan Watershed with the end view of developing a PES program. On the other hand, Llanza (2014) evaluated the willingness of upland communities to participate of in adopting watershed conservation measures to secure water supply from the Layawan Watershed. The results of these studies show that there is willingness to pay among the residents of Oroquieta City for improved watershed services of the Layawan Watershed, and willingness to participate in a PES program among the Subanen in the same watershed. However, the activities that the Subanen can undertake under a PES program need to be identified in the context of the biophysical and social characteristics of the watershed. This study addresses this gap, and makes use of participatory three-dimensional modelling (P3DM) to draw up a plan that will enhance the services that the Layawan Watershed can provide.

Participatory mapping is a map-making process that attempts to make visible the association between land and local communities by using the commonly understood and recognized language of cartography. On the other hand, participatory three-dimensional modelling (P3DM) is a community-based method that makes use of stand-alone scale relief models created from the template of a topographic map (Corbett 2009). P3DM integrates people's knowledge and spatial information to produce stand-alone relief models that have been proven to be user-friendly. This method also aims to provide relatively accurate data storage and analysis devices, and excellent communication media (Rambaldi and Callosa-Tarr 2002).

P3DM is a communicative facilitation method used in innovation processes related mainly to resource use and tenure (Rambaldi and Callosa-Tarr 2002). Its methods have been conceived to support collaborative initiatives to increase public participation in problem analysis and decision-making. It also guides the participants through a collective learning process to visualize their economic and cultural domains in the form of scaled and geo-referenced relief model, which can be used subsequently for different purposes.

Experience gained in the Philippines over a decade has shown that 3-D modelling exercises conducted entirely at the community level and as a response to local needs versus

external threats have yielded positive effects in terms of community cohesion and identity building (PAFID 2001 as cited by Rambaldi and Callosa-Tarr 2002). Moreover, P3DM led the way towards legal recognition of ancestral rights claimed by indigenous peoples (IPs). Relief modeling stimulates community cohesion because it gathers people to share information and concerns and frequently reinforces community self-actualization through the revival of local knowledge. Hence, P3DM can be used to secure access and facilitate management to natural resources. It is also an exercise through which tacit knowledge, as embedded in people's spatial memory, is converted into explicit and externally-usable knowledge. It can thus play a role in the empowerment of people and communities (Gesca 2008).

Community-based management means that all community members, including women, elders and the youth, have the opportunity to decide how plans are made and how they will be carried out. Community-based involvement and planning can keep the resources within the control of individual communities and let each community decide which approach is best for them. According to McNeil *et al.* (2006), the programs developed through the traditional top-down form of governance by various levels of government, organized along sectoral lines with minimal citizen input to the design and delivery has not been effective in addressing complex ecological, social and economic issues. On the other hand, the community-based approach provides a framework of governance that allows the public to have more meaningful involvement in decision-making. It involves all sectors (governments, industry, communities) working together towards a common vision of sustainability. This approach allows the community to address issues in a holistic manner, involving interested stakeholders from the very beginning of the process to identify priority issues and agree on common solutions.

The paper explores the use of community-based management planning to enhance the provision of environmental services that the Subanen tribe provides in the Layawan Watershed, Misamis Occidental, Philippines. Specifically, it examines the use of participatory three-dimensional modelling (P3DM) as a tool for community-based planning, identifies areas that have a potential to be engaged in the PES scheme, and draw lessons from the community-based management planning that the communities can use as a basis in supplying ecosystem services.

The area of the study is the Layawan Watershed, which is one of the catchment basins of Mt. Malindang Range and is drained by the Layawan River. The Layawan River, adjudged the Philippines' cleanest river in 2001, has three major headwater streams namely Layawan, Panobigon, and Manimatay, all of which converge to form the single Layawan River. The total area of the Layawan Watershed is 10,706 ha.

METHODOLOGY

Community-Based Management Planning Participants

The communities involved in the community-based management planning came from the barangays of Sebucal, Mialen, Toliyok, Dullan Norte, Bunga and Victoria of Oroquieta City (Figure 2).

These upland barangays were chosen based on the following criteria: (a) they are the primary provider of the watershed services, specifically water resources; (b) they are located near the headwaters of the Layawan River; (c) their activities greatly affect the quality and quantity of water being supplied in the lowlands; and (d) the residents and the local government officials participation in the conservation and protection of the Layawan Watershed is needed.

The participants have already been introduced to the PES concept, having attended an orientation-workshop in connection with the assessment of the potential of developing a PES for the Layawan Watershed (Calderon *et al.* 2013).

Participatory Three-dimensional Modeling (P3DM)

The barangays that participated in the 3-dimensional modelling were divided into two groups based on the barangays' location in

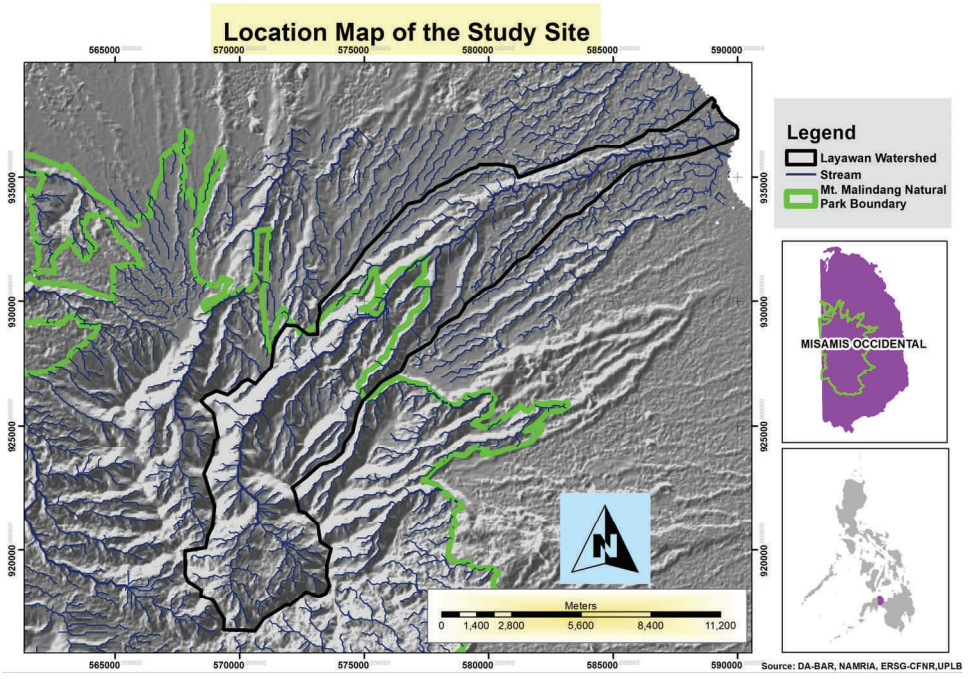

Figure 2. Study site showing the headwaters of the Layawan Watershed.

the watershed. These are the upland group (Barangays Sebucal, Mialen and Toliyok) and the midland group (Barangays Dullan Norte, Bunga, and Victoria). Constructing the three-dimensional (3D) model involved (1) preparatory work, (2) assembling the model, (3) depicting information, (4) extracting and digitizing data, (5) data elaboration and manipulation, and (6) field verification.

For the preparatory work, the geographical scope of the model was considered, which includes the physical (topography, watershed, sub-watershed, stream network, location of infrastructures, roads), administrative (protected area, buffer zones, land use classification), cultural (ethnicity, ancestral rights, values, customary tenure, *etc*.), socio-economic (settlements, harvesting or grazing areas, livelihoods, *etc*.) aspects and other points of interest.

The participants were first oriented on the mechanics of constructing the model and map reading before assembling the model. For an organized flow of work, they were divided into four distinct groups, each group with a facilitator. The groups were the base map group, tracer group, cutting group, and pasting/ assembling group (Figure 3).

Figure 3. Community members assembling the 3D model of the Layawan Watershed.

After the model was assembled, local representatives were asked to depict information on the model. This allowed the establishment of a common ground and understanding like the use of local definitions for land use and land cover and vernacular translations. The community located and named in sequential order the mountain peaks, islets, water courses, roads, trails, social infrastructures and other features needed to orient themselves within their areas. The selected features were delineated on the model with the use of color -coded paints, yarns, and pins. The yarns and dressmaker's pins were used for initial contouring before painting, which allowed informants to negotiate distribution, location and extent of any particular feature (Figure 4).

Figure 4. Community members depicting information activity based on their personal observations.

The next activity consisted of transforming the data into a Geographic Information System (GIS) to minimize data loss or erroneous geo-referencing. A picture was taken perpendicular to the model, after which the image was stored in a computer. The image, now in a raster format ready for digital extraction, correction and geo-referencing was then converted to vector format. This was done through onscreen digitizing, which allowed the creation of map layers by adding labels during tracing and also for editing features when enough information is available from the image.

In the data elaboration and manipulation phase, information obtained from official and other sources, such as administrative and political boundaries, was integrated. The last phase was the field verification, wherein GIS translation of the model data was compared with other existing spatial information like maps produced from satellite-interpreted imagery.

Land use was one of the important features identified in the activity, especially the forest area present in the midland and upland areas. They identified the condition of the forest area, i.e. whether good or not. The activities inside the forest were also reflected in the model. The digitized map of identified land uses in the Layawan Watershed is shown in Figure 5.

Community-based Management Planning (CBMP)

The community-based management planning was undertaken to identify the conservation activities that may be funded under the PES program mentioned earlier. There were two groups involved in the activity consisting of 15 participants per group. The first group consisted of representatives from Barangay Sebucal, while the members of the second group represented the Mialen, Toliyok, Bunga, Sebucal and Victoria (MITOBUSVIC) Association. Barangay Sebucal was placed in a group separate from MITOBUSVIC because its area is situated in the headwaters of the Layawan River.

Figure 5. Land use map output of the Subanen community for the Layawan Watershed.

For the CBMP activity, the groups were first introduced to the formulation of management plans and resource characterization. The study generated a map of the model generated through GIS, which was presented to the community for visual planning. The community members generated a problem tree where they identified the causes of the main problem (root), and then identified the effects (branches). The problem tree analysis served as a guide for management planning especially in identifying the vision, objectives, strategies and activities.

RESULTS AND DISCUSSION

Participatory Three-dimensional Modeling (P3DM)

During the participatory 3-dimensional modeling (P3DM), the groups identified different land uses within their areas (Table 1).

Forests were found to have the largest area with 3,750 ha, followed by the agricultural area (2,970 ha for coconut plantation and corn/ rice fields), and naturally growing trees of 660 ha. Both midland and upland areas had built-up areas, coconut plantation, corn/ rice field, forest, and slash-and-burn farming areas (*kaingin*). Grassland area was only identified in the upland while naturally growing trees, poultry/livestock, and tree plantation areas were in the midland. Based on the identified land uses, the major source of income of the communities inside the watershed was found to be agriculture. However, the communities revealed that their source of income was insufficient to address their daily living requirements, thus other members of the community engaged in activities like *kaingin*.

Table 1. Land use identified by the groups during the participatory 3D mapping

Land Use	Midland (ha)	Upland (ha)
Built up area	240	315
Coconut plantation	510	2,180
Corn/Rice field	160	120
Forest	860	2,890
Grassland	0	630
Kaingin	20	20
Naturally grown trees	660	0
Poultry/Livestock	150	0
Tree plantation	190	0

Community-based Management Planning (CBMP)

The results of the problem tree analysis of the MITOBUSVIC and Sebucal groups are shown in Figures 6 and 7, respectively. Both groups identified insufficient income relative to their needs as the main problem that their communities were facing. However, the identified root causes of this problem were different for the two groups.

MITOBUSVIC Group

For the MITOBUSVIC group, the main problem identified was the insufficient income due to the lack of alternative sources of livelihood, low farm production, and problems in farm to market roads (Figure 6).

The lack of livelihood sources was tied to the absence of a legal basis for land ownership or security, and the communities were restricted to work only in their Certificate of Ancestral Domain Title (CADT) areas located within the core zone for other livelihood sources. On the other hand, the illegal cutting of trees and illegal quarrying were identified to be the root causes of low farm production, which resulted in denuded areas and heavy soil erosion

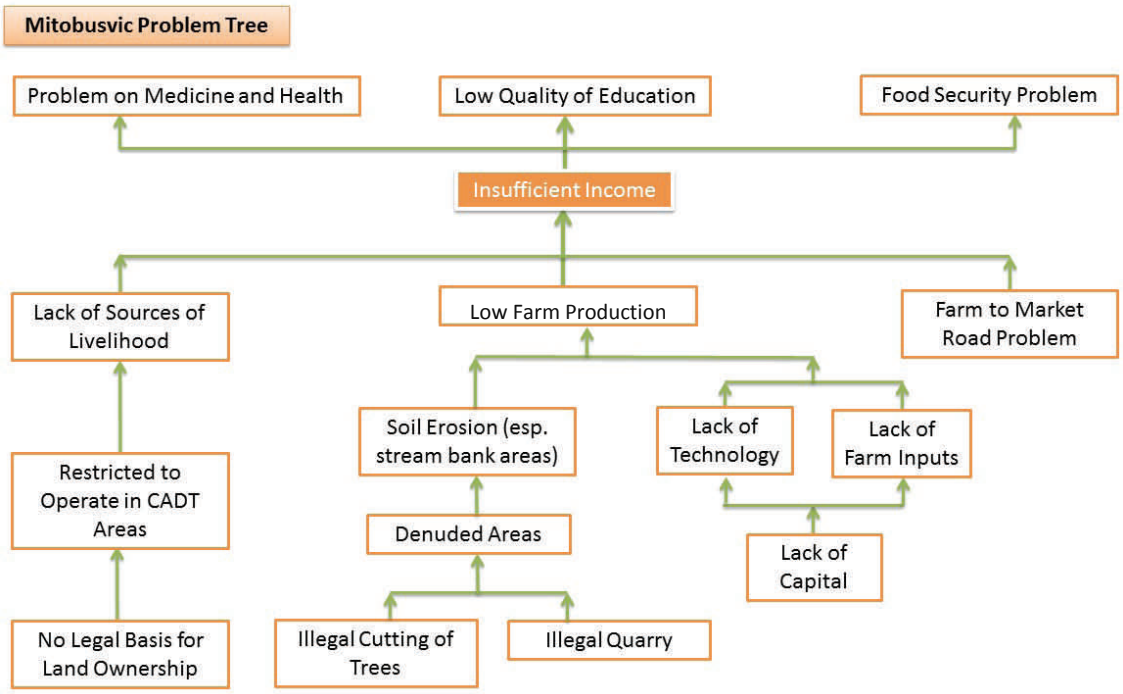

Figure 6. Diagram of a problem tree of MITOBUSVIC group used in the study.

especially on stream bank areas. Furthermore, the lack of capital was also the main cause of the problem on low farm production, mainly because it limited the farmers' access to technology and farm of inputs.

The effects identified by the group for the lack of income were problems relating to health, education; and food security. Poor access to health facilities and insufficient food have resulted in a large number of malnourished children in the communities. The group mentioned that it was rare for them to eat nutritious foods, which increased the chance of having health problems.

To address the problem of low income, the farmers need feasible livelihood programs, increased farm production and road rehabilitation. They believe that land title security and agroforestry approach can address the problem on the lack of livelihood sources. For the increase in farm production, one of the group members discussed the potential of the agroforestry approach to address this problem, and reforestation projects for denuded areas to reduce soil erosion. The members appreciated that agroforestry could provide farming techniques that will increase production due to enhanced soil fertility, which will in turn contribute to the protection and conservation of the Layawan Watershed. They also identified the need for training and seminars about new farming technologies and nursery establishment.

If their income will increase, the community will have better chances of having good health, their children will have better access to good education because they have the capacity to provide their needs in school until college, and will have better means to buy adequate food supply. They see that the PES scheme has the potential to help them augment their income.

Barangay Sebucal Group

The members of the Barangay Sebucal group, likewise identified insufficient income as the main problem of the community (Figure 7). They noted that they experienced low production of agricultural crops such as rice and corn due to damage in the production areas caused by exposure to extreme weather conditions (rain and wind). This results in damage to the production areas, making them susceptible to landslides and soil erosion. The low production or harvest is attributed to the limited area available for farming, soil infertility and poor irrigation system. The area is accessible only by foot, and it usually takes six hours to reach the area from the nearest barangay of Toliyok. There are no roads to the area, only foot trails, which limits the accessibility of the area is limited and makes it difficult to transport their products.

In turn the insufficient income in turn adversely affected the household budgets for basic needs (*e.g.* food), farm inputs (*e.g.* horse, plow), access to hospital facilities and medicines, and access to education. The group cited a case when a sick family member died because they could not bring the sick to the hospital, and they did not have money to buy medicines. To improve their livelihood sources, the group saw the need to lessen the damage on production areas to increase production/harvest, and the need to rehabilitate the road. To lessen damage on production areas, they now realize the importance of planting native trees to control landslides and reduce soil erosion. To

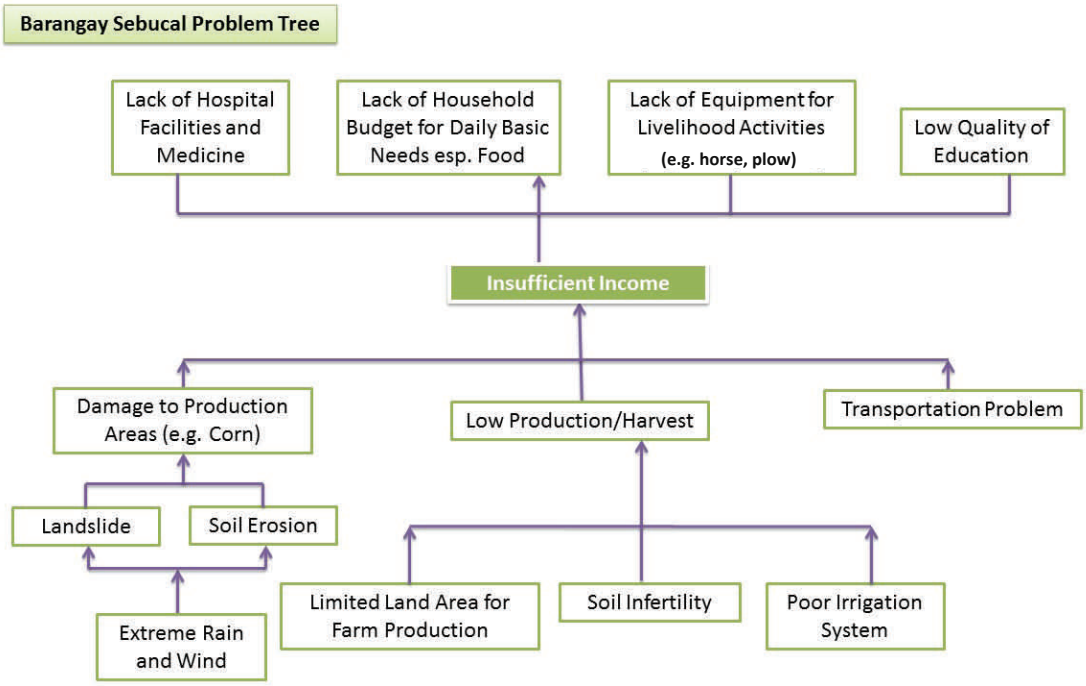

Figure 7. Diagram of a problem tree of Sebucal group used in the study.

increase production or harvest, they identified the need for technical assistance from farming experts, particularly in agroforestry, the possibility of using fertilizers, and the need to rehabilitate the irrigation system. However, they will require the assistance of the local government units (LGUs) for the rehabilitation of the irrigation system and road network.

An improvement in livelihood will result to increased income and better access to medical care, which in turn will improve the health conditions of the community. Furthermore, they will be able to sustain their daily basic needs, buy or rent farming inputs, and gain access to education.

The problem tree analysis paved the way for the community to clearly identify the roots or causes of their problems and the corresponding effects, which in turn allowed them to identify how they could address these problems to benefit not only them but also future generations.

Strategies for Layawan Watershed Conservation and Protection

The management plans developed by the two groups have the same vision of uplifting their status of living while conserving and protecting the Layawan Watershed. They have almost similar objectives and strategies but differed in the implementation of strategies, costs, and scheduling.

In the management planning activity, the groups identified watershed protection (*e.g.* forest protection and stream bank stabilization) and forest restoration as the environmental services they provide. For their problem in household income, they decided that the agroforestry system would be adopted within the areas that they were allowed to farm. In the process, they will also conserve and protect the watershed.

Table 2 shows the strategies identified by the two communities for the conservation and protection of the Layawan Watershed. The MITOBUSVIC group proposes to use the agroforestry system as its main strategy to augment income and at the same time conserve and protect the area. They allotted PhP 8,000 for training and seminar on agroforestry system. The agroforestry system will also be adopted in their reforestation projects covering 126 ha and streambank stabilization with an area of 126 ha. The group members agreed that the maintenance activities will be the group's counterpart. The total cost for all the activities amounted to PhP 5,144,560. The agroforestry system training and seminar, nursery construction, reforestation project, and streambank rehabilitation will be undertaken in one year, while the maintenance activities will be for five years.

The Barangay Sebucal group believed that practicing agroforestry would not only enhance their income sources but would conserve and protect the watershed. For this they will need a fund amounting to PhP 128,000. The group will provide planting materials as its counterpart, with a value of PhP 120,000. The other activities will be reforestation for four ha, streambank stabilization for 220 ha, and forest protection for 2,542 ha. The cost of reforestation activities will be PhP 2,400,800 for a 5-year period. The counterpart of the group will be the seedlings (PhP 40,000) and care and maintenance (PhP 2,160,000 for three

Table 2. Strategies of the communities for the conservation and protection of Layawan Watershed

MITOBUSVIC Group		Sebucal Group	
Activity/ Strategy	**Cost (PhP)**	**Activity/ Strategy**	**Cost (PhP)**
Agroforestry System Training and Seminar	8,000	Agroforestry System	128,000
Nursery Construction	300,000	Reforestation	2,400,800
Reforestation Project	1,011,560	Streambank stabilization	3,670,000
Streambank Stabilization	945,000	Forest Protection	1,806,000
Maintenance Activities	2,880,000		
Total	**5,144,560**	**Total**	**8,004,800**

years). For streambank stabilization they will need an amount of PhP 3,670,000 in which the PhP 3,600,000 for care and maintenance for the period of five years will be their counterpart. For the forest protection activity they would need funds of PhP 1,806,000 for the period of one year. However, the group decided to counterpart the labor cost for the tower construction amounting to PhP 180,000. For all the activities the group would need a total cost of PhP 8,004,800.

In estimating the cost of management activities, the MITOBUSVIC group at first wanted to cover the whole CADT area of 6,978 ha, which resulted in very high estimates. Focusing on a more realistic area reduced the cost estimates, although not as detailed as expected. The group also wanted to apply the agroforestry system especially in reforestation areas and even for streambank stabilization. They also prefer to use rubber and cacao as planting materials for their activities. The group also plans to apply an agroforestry system in the areas where they are allowed to farm.

In the case of Barangay Sebucal, the farmers considered only the area where they would probably be allowed to work in estimating the cost of the activities. Their strategies are attainable and provided good details. Although they are a small group, they are very willing to provide counterpart for every activity like labor for maintenance activities.

CONCLUSION

Community-based management planning is a simple tool in getting a community to participate in decision-making, and in generating information needed for effective planning and in developing a PES scheme. The P3DM as a tool in management planning enabled the communities to jointly visualize their economic and cultural territories, and identify land uses and important features. As evidenced in the P3DM activity, the participants were very familiar with their place/location. They were very interested in constructing the model and even planning to make a bigger one next time. In fact, they enjoyed the activity especially in marking the landmarks and showing the land uses in the model. The tool served as the image of what their area looks like. Through the model they visualized the different land uses present in the area and had an idea on what ES they will provide. For instance, they will conduct reforestation project on areas classified as *kaingin* area to protect and conserve the Layawan watershed.

The CBMP served as guide for the member of the community on management planning. They now realized what their situation is and what they can do. It is a community-based approach so every member of the community participated in the planning that make the situation of the area realistic. As far as costing of strategies is concerned, expert guidance will be needed to ensure realistic estimates.

Through CBMP, the Subanen community identified the environmental services they can provide, such as watershed protection that includes forest protection and streambank stabilization and forest restoration. The indigenous communities of the Layawan Watershed can play an important role in securing the environmental services of the watershed. However, it was found that the communities do not have sufficient means of livelihood that, if allowed to continue, can make them turn to extractive and possibly destructive activities within the watershed. Thus, there is a need to provide support or assistance to the farmers, possibly through a sustainable financing mechanism such as PES. The communities revealed their willingness to participate in a PES scheme as ES providers of the Layawan watershed, particularly by protecting it and undertaking economic activities like agroforestry that are consistent with watershed conservation. The communities recognize that the conservation and protection of the Layawan Watershed is also to their best interest because the area is not only a source of natural resources, but also serves as their home and ancestral domain. In the conservation of the Layawan Watershed, PES is a promising tool because it will not only ensure sustainable financing mechanism for environmental conservation, it will also provide sources of livelihood to the poor communities in the uplands.

REFERENCES CITED

Arcenas, A. 2005a. Environment and Poverty: PES in the Spotlight. In: *Bayad Kalikasan Policy & Research Notes*, No. 10, November 2005: 1-3.

Boquiren, R.R. 2004. Rewards for Environmental Services in the Philippines Uplands: Constraints and Opportunities for Institutional Reform. World Agroforestry Centre (ICRAF), Indonesia. 51 pp.

Calderon, M.M., Anit, KP.A., Palao, LK.M., and R.D. Lasco. 2013. Household's Willingness to Pay for Improved Watershed Services of the Layawan Watershed in Oroquieta City, Philippines. *Journal of Sustainable Development*. Canadian Center for Science and Education, 6 (1): 1-18.

Corbett, J. 2009. Good Practices in Participatory Mapping: A Review Prepared for the International Fund Agricultural Development (IFAD). International Fund Agricultural Development (IFAD). India. 55 pp. http://www.ifad.org/pub/map/pm_web.pdf [date accessed: January 13, 2014].

Food and Agriculture Organization of the United Nations (FAO). 2004. Electronic Forum on Payment Schemes for Environmental Services in Watersheds. Final Report. August 2004. 27 pp. http://www2.gsu.edu/~wwwcec/special/ci/docs/waetershed%20pes.pdf [date accessed: August 20, 2014].

Gesca, S.D. 2008. Participatory Mapping as a Tool for Empowerment-Experiences and Lessons Learned from the ILC Network. *Knowledge for Change*. International Land Coalition. Rome, Italy. 45 pp.

http://www.landcoalition.org/sites/default/files/legacy legacypdf/08_ILC_Participatory_Mapping_Low.pdf?q=pdf/08_ILC_Participatory_Mapping_Low.pdf[date accessed: August 25, 2014].

Kallesoe, M., de Alvis, D. 2004. Review of Developments of Environmental Services Markets in Sri Lanka. World Agroforestry Centre (ICRAF), Indonesia. 27 pp.

Lasco, R.D.,Villamor, G., Pulhin, F., Catacutan, D., Bertomeu, M. 2008. "From Principles to Numbers: Approaches in Implementing Payments for Environmental Services (PES) in the Philippines." In Smallholder Tree Growing for Rural Development and Environmental Services: Lessons from Asia, edited by D.J. Snelder and R.D. Lasco, USA: Springer Science. 193-206.

Leimona B., Lee, E. 2008. Pro-Poor Payment for Environmental Services, Some Considerations. RUPES-RECOFTC Brief January 2008. RECOFTC and World Agroforestry Centre (ICRAF), Bogor, Indonesia. 8 pp. http://www.researchgate.net/publication/242546399_Pro-Poor_Payment_for_Environmental_Services_Some_Considerations [date accessed: November 12, 2012].

Llanza, MB.C. 2014. Potential of Payment for Environmental Services (PES) for the Conservation of the Layawan Watershed in Upland Communities in Misamis Occidental, Philippines. Unpublished M.S.Thesis. Graduate School, University of the Philippines Los Baños, College, Laguna. 194 pp.

Mcneil, T.C., Rousseau, F.R., Hildebrand, L.P. 2006. Community-Based Environmental Management in Atlantic Canada: The Impacts and Spheres of Influence of the Atlantic Coastal Action Program. Environmental Monitoring and Assessment. Springer, 113: 367-383 http://www.environmental-expert.com/Files%5C6063%5Carticles%5C8594%5C1.pdf [date accessed: January 13, 2014].

Profile of Layawan Watershed. 2003. DENR-CENRO Oroquieta City.

Rambaldi, G., Callosa-Tarr, J. 2002. Participatory 3-Dimensional Modelling: Guiding Principles and Applications. Asean Regional Center for Biodiversity Conservation (ARCBC), Los Baños, Laguna, Philippines. 72 pp.

3D Model of the Layawan Watershed developed by the community.