RELATIONSHIP BETWEEN DIRECT USE VALUES AND MANAGEMENT STRUCTURES OF MANGROVES IN THE PHILIPPINES

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ABSTRACT

The objectives of this study were: to estimate and compare the direct use values of mangroves between mangrove forests managed solely by a local community and mangrove forests co-managed by a local community and municipal government, to analyze management impact indicators on mangrove forests, and to determine the relationship between direct use values of mangroves and management impact indicators.

Quantitative and qualititative methods were employed in data collection and analysis. Structured questionnaires were used to interview heads of households. The respondents from four barangays in the municipalities of Bani (co-management) and Bolinao (community-management), Province of Pangasinan, Philippines were selected through simple random sampling. Data were analyzed using Microsoft Excel and SPSS 15.0. In-depth interviews were conducted with key persons from two municipal governments and four people's organizations. Field observations focused on the management activities, resource utilization and mangrove forests physical conditions. In-depth interviews and field observations were used to support the analysis of quantitative data.

No significant difference was found in the direct use values of mangroves between the two municipalities having different management structures. However, through one-way ANOVA analysis, significant differences were found across the barangays of each municipality. Analysis of management impact indicators showed more positive impact of co-management over community management. Furthermore, results of the standard multiple regression analysis revealed that five management impact indicators significantly affected direct use values of mangroves. Control, capacity building, financial resource and community compliance had significant positive relationship with direct use values whereas level of threat had significant negative relationship with direct use values. The regression model accounted for a 55% variation in the direct use values.

KEY WORDS: COMMUNITY-BASED MANAGEMENT/CO-MANAGEMENT/DIRECT USE VALUES/ MANGROVE FOREST

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LIST OF ABBREVIATIONS

DUV	direct use values
DENR	Department of Environment and Natural Resources
BFAR	Bureau of Fisheries and Aquatic Resources
CBCRM	community based coastal resource management
CBFMA	community-based forest management agreement
LGU	local government unit
NGO	non-governmenttal organization
PO	people's organization
SAPA	Samahang Pangkabuhayan ng Arnedo
SAMMAKA	Samahan ng Mangingisda at Magsasaka sa Kalikasan, Incorporated
AFAI	Aporao Fisherfolk’s Association, Incorporated
NAGKASAMA	Nagkakaisang Samahan ng Mangingisda ng San Miguel
MPA	marine protected area
UP-MSI	University of the Philippines Marine Science Institute
KAISAKA	Samahang Alay sa Kalikasan
PHP	Philippine peso
USD	United States dollar
ha	hectare
yr	Year

CHAPTER I
INTRODUCTION

1.1 Background and Justification

As mangrove forests are being cleared and converted to other uses, benefits of mangrove forests are assessed and evaluated. Over the years, many researches had elucidated the important goods and services provided by mangroves to local communities and adjoining ecosystems. Alongside with this, management strategies on the sustainable utilization of this natural resource are also evaluated.

Gilbert and Jansenn (1998), for example, conducted a study evaluating the various management alternatives of mangrove ecosystem in Pagbilao, Philippines and determined which management alternative produces the highest economic benefit. Their study assessed the costs and benefits of various management alternatives for mangroves like preservation, subsistence forestry, aquaculture, semi-intensive aquaculture, etc. where semi-intensive aquaculture was found out to have the highest economic returns. In another study conducted by Pomeroy, Pollnac, Katon and Predo (1997), positive evaluation for the socio-economic benefits of mangrove rehabilitation were expressed by the local community members covering six project sites in Central Visayas Region, Philippines. Another study by Maliao and Polohan (2008) revealed almost similar results.

In an economic valuation study by Walton et al. (2006), annual revenues from mangrove fisheries, tourism and timber were estimated to be 315 USD/ha/yr. Consequently, if mangrove-related fisheries will be included, total direct economic benefits can range from 564-2316 USD /ha/yr (Walton et al., 2006). A valuation study in Thailand of direct and indirect use values of mangroves indicated mangroves' values to be 3,207 to 4,116 USD/ha (Sathirathai, 2003). Similar studies around the world revealed varying but high economic values illustrating the economic importance of mangroves to the local communities who are heavily dependent on mangroves and to the whole society as well (Ruitenbeek, 1992; Bann, 1997; Gilbert and Jansenn, 1998).

Aside from socio-economic benefits, mangroves also play important role in the maintenance of biodiversity and environmental quality of adjoining ecosystems. Studies revealed that many fishes of the marine ecosystem are dependent on the nutrients coming from the mangroves. Mangroves can trap sediments before it goes to seas and rivers, thus, preventing pollution. This trapping sediment function of mangroves stabilizes the coast which protects coastal communities from natural disasters like typhoons, coastal erosion and tsunamis (Gilbert and Jansenn, 1998).

Taken together, these studies revealed that mangroves provide many important ecological and socio-economic benefits in contrast to the previous assumption for wetlands in general, as wastelands. This previous assumption has led to the widespread clearance and conversion of mangroves to other land-uses. In the Philippines, out of 500,000 hectares in 1918, only 109,700 hectares remains (FAO, 2003). Conversion to aquaculture was seen as the major cause of decline (White and Trinidad, 1998; Primavera, 2000).

When researches revealed the decline of fishery productivity as correlated with the decline of mangrove area, the importance of mangroves were gradually recognized (Nickerson, 1999). Moreover, most brackishwater ponds were productive only in the first five years (Primavera, 2000). After which, productivity declined leading to abandonment of the area. Thus, rehabilitation of degraded mangroves has become a worldwide effort when the benefits of a well-functioning mangrove become apparent. In the Philippines, many mangrove rehabilitation projects were conducted in the 1980s employing the community-based management approach.

Community-based management approach emerged as a management strategy to change the traditional top-down management approach where there are many cases of poor performance. It aims to empower the local communities giving them vital roles from the preparatory stage up to the monitoring stage.

However, it is important to mention that community-based approaches have many variations in terms of the management structure. It can be managed solely by local communities, collaboration of local communities and non-governmental organization (NGO), collaboration of local communities, NGO, local government unit (LGU) and other stakeholders.

It can be deduced that co-management exists when there are many stakeholders involved. Thus, a community-based co- managed was termed by Israel

(2001) in this type of management scheme. However, he still stresses the differences between community-based management and co-management. He pointed out that in co-management, government has bigger roles than the local communities.

This variation in management structure was evaluated by Salmo, Torio and Esteban (2007) in the mangrove management projects in Lingayen Gulf. The study assessed the performance of the management through the perceptions of different stakeholders involved. Basically, the study covered the survival rates of mangroves and evaluated the participation of local communities under three different management structure – community managed, local government unit (LGU)-managed and co-managed between the LGU and the community. However, no quantitative study was done to evaluate the impact of management to the local communities. Many researches had used impact indicators to evaluate management performance. Maliao and Polohan (2008) for example, employed equity, efficiency and sustainability impact indicators to evaluate mangrove rehabilitation in Cogtong Bay, Bohol. The indicators used were adapted from the previous work of Pomeroy, Pollnac, Katon and Predo (1997), where they assessed the community-based coastal resource management activities at six sites of Central Visayas Regional Project-1 (CVRP-1). The former focused on the disparity between gender and location while the latter focused on the disparity between members and non-members of people's organization.

Although there are many studies implicating the positive impacts of community-based management, Walters (2004), warns that community-based management remains to be examined. Generalizations on the past failures of the government do not necessarily suggest an adoption of community-based management in natural resources. He exemplified the successful management of Talabong Marine and Wildlife sanctuary in Bais Bay, Negros Oriental, Philippines and attributed the conservation strategies to the "heavy hand" of the government.

On the other hand, when local government collaborates with local communities, local communities can just be followers and not active managers due to the dominating character of local government officials. Other reasons of ineffectiveness of co-management can be lack of monitoring which occurred in Magallanes, Agusan del Norte where only 5 hectares of mangroves survived out of 53.8 hectares.

Thus, in this study, the management structure of mangrove rehabilitation project in two of the municipalities bordering Lingayen Gulf will be evaluated using management impact indicators as perceived by the local communities and relate the relationship of these indicators with the outcome of management which is the direct economic benefits. Although direct economic benefits through the estimate of direct use values do not cover the whole benefits that mangrove provides, it is argued that this partial economic benefit can help reveal the disparities in the effects of different management structure in mangrove management.

1.2 Objectives of the study

The objectives of the study were:

1. To estimate and compare the direct use values of mangroves between mangrove forests managed solely by local community and mangrove forests co-managed by local community and municipal government.
2. To analyze management impact indicators on mangrove forests.
3. To determine the relationship between direct use values of mangroves and management impact indicators.

1.3 Conceptual framework

Ecosystem performs important environmental functions providing us many goods and services. The proper functioning of ecosystems depends on their health or well-being which in turn is affected by resource utilization as well as management structure. The way human utilize resources is governed by the existing institutions or by the management. The effectiveness of management can be assessed through management impact indicators which include: participation in mangrove management, influence over mangrove management, control over mangrove resources, access to mangrove resources, collective action, conflict resolution mechanisms, financial resources, capacity building, community compliance, level of threat to mangrove resources, and ecological knowledge. These management impact indicators can be further related to direct use value which is one of the measurable outcomes in natural

resource management. Direct use value is one of the values categorized under the framework of total economic value which is widely used in economic valuation. The relationship of direct use values with the impact of management to local communities will be analysed in order to determine which of these indicators have a significant effect on direct use values.

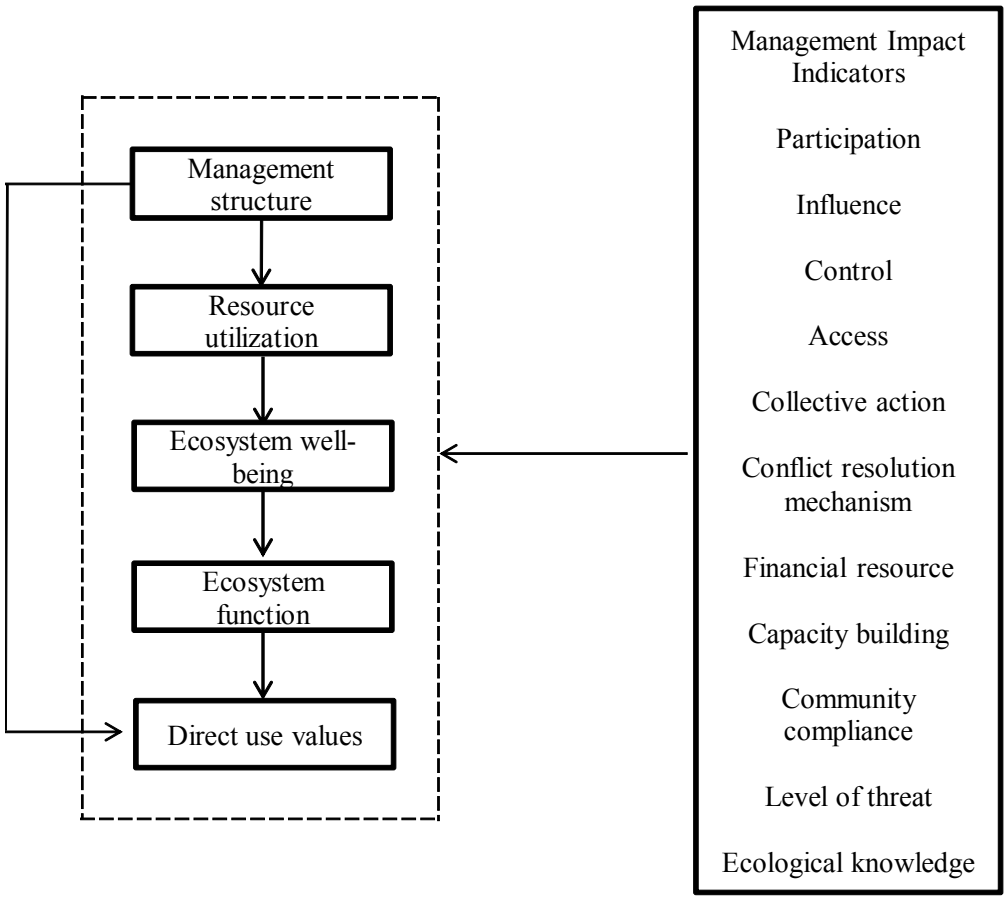


Figure 1.1 Conceptual framework of the study

1.4 Scope of Research

1.4.1 Scope of content

This study assessed and compared the direct use values (DUV) of mangroves and management impact indicators between two municipalities and four barangays by conducting household interviews, in-depth interviews, and field observations. The direct use values of mangroves consisting of fish, mollusks, crabs, shrimps, firewood, charcoal production, and tourism were assessed by applying

market price method approach. The 11 management impact indicators, namely: participation in mangrove management, influence over mangrove management, control over mangrove resources, access to mangrove resources, collective action, conflict resolution mechanisms, financial resources, capacity building, community compliance, level of threat to mangrove resources, and ecological knowledge were rated by household heads through 5-point Likert's scale. Differences in DUV and management impact indicators between mangrove forests in two municipalities were determined with independent t-test. One-way ANOVA analysis and Kruskall-Wallis test were the statistical analysis applied in comparing DUV and management impact indicators among mangrove forests in four barangays. Furthermore, relationship between DUV and management impact indicators was determined through multiple regression analysis.

1.4.2 Scope of study area

The comparison of mangrove forests under different management structure was conducted in the municipalities of Bani and Bolinao, province of Pangasinan, Philippines. These two municipalities – Bani and Bolinao, adjoin each other and located within the same gulf coast. Mangrove forest in Bani municipality is managed jointly by local communities and municipal government while mangrove forest in Bolinao municipality is managed solely by the local communities.

Two barangays in each municipality were selected as study area. These were Barangays Aporao and San Miguel of Bani municipality and Barangays Arnedo and Pilar of Bolinao municipality.

1.4.3 Scope of duration

The study was conducted for one year which included one and a half month for data collection. Table 1.1 shows the approximate period in each activitiy of the study.

Table 1.1 Duration of study

Activities	AY 2011-2012											
	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Conduct of literature review and identification of study area	x											
Thesis proposal preparation	x	x	x									
Thesis proposal defence			x									
MUIRB application & approval				x	x	x	x					
Data Collection							x	x				
Data Analysis							x	x	x	x		
Thesis writing									x	x	x	x
Final thesis defence												x
Presentation in seminar or												x
Submission of Black Book												x

1.5 Research Questions

To accomplish the objectives, the following research questions were formulated:

1. Is there a significant difference in the direct use values that local communities obtain from a community-managed mangrove forest and community/municipal government-managed mangrove forest?

2. Is there a significant difference in the impact indicators of mangrove forests having different management structures?

3. How does the impact of management or effectiveness of management affect the direct use values of mangroves?

1.6 Research Hypotheses

Based on the research questions, hypotheses of this study were:

1. There is a significant difference in the direct use values of community-managed and community/LGU-managed mangrove forest.

2. There is a significant difference in the impact indicators of community-managed and community/LGU-managed mangrove forest.

3. Participation in mangrove management is positively related to direct use values.

4. Influence over mangrove management is positively related to direct use values.

5. Control over mangrove resources is positively related to direct use values.

6. Access to mangrove resources is positively related to direct use values.

7. Collective action is positively related to direct use values.

8. Conflict resolution mechanism is positively related to direct use values.

9. Financial resource is positively related to direct use values.

10. Capacity building is positively related to direct use values.

11. Community compliance with coastal resource-related rules is positively related to direct use values.

12. Level of threat to mangrove resources is negatively related to direct use values.

13. Ecological knowledge is positively related to direct use values.

1.7 Expected Results

Results of this study can show how management performance affects the direct use values. The variations in the estimate of direct use values between two differently managed mangroves can be due to the effectiveness or ineffectiveness of management structure. The indicators having significant relationship with direct use values (DUV) can be a basis for enhancement of these indicators to improve effectiveness of management. Likewise, the estimated direct use values can raise awareness on the importance of mangroves to local communities and government and prevent its further degradation or conversion. It can also be referred by the local government as an additional income in the gross domestic product of the area.

CHAPTER II
LITERATURE REVIEW

This chapter is a review of literatures related to mangrove forest, specifically its importance and management structures. This review focused on the mangrove situation in the Philippines. Concepts about community-based management and co-management were discussed together with indicators used in assessing management effectiveness. This review also covered concepts of economic valuation and total economic value framework. Lastly, related studies about mangrove management in Philippines and economic valuation in Southeast Asia were also reviewed.

2.1 What is mangrove forest?

According to the Ramsar Convention on Wetlands, mangrove forests are assemblage of "taxonomically diverse, salt-tolerant tree and other plant species which thrive in intertidal zones of sheltered tropical shores, "overwash" islands, and estuaries" found between latitudinal gradient 32ºN to 38ºS (Quarto, 1997). They grow along coasts where temperature does not fall below 20 deg C even during winter (Alongi, 2002). Largest area of mangroves can be found between 0 to 10º latitude (Twilley et al., 1992). A total of 70 mangrove species occupies 181,000 km^2 land area globally (Spalding et al., cited in Alongi, 2002). Southeast Asia has the most diverse mangroves because of high humidity, high precipitation, and broad/extensive tidal range in the region (Quarto, 1997; FAO, 2003). According to Food and Agricultural Organization, one third of the world's mangroves is in Southeast Asia. Largest area in this region is found in Indonesia followed by Malaysia and Myanmar while highest diversity is in Indonesia with 45 species, followed by Malaysia (36 species) and Thailand (35 species). Philippines has the sixth largest area and fifth species rich with 30 species (Suratman, 2008).

Although occupying a small part of the world's land area, mangroves are recognized as an important ecosystem because they provide many ecological goods and services and socio-economic benefits. Many people in the tropical and subtropical region depend on mangroves for food, timber, fuel, medicine and non-timber products for their daily subsistence and for livelihood (Alongi, 2002).

Mangroves also known as mangal have unique characteristics because they can adapt to salinity, frequent inundation, and variations in nutrient availability which other plants cannot (Quatro, 1997; Alongi, 2002). They have specialized aerial root system and breathing pores called lenticels which facilitate gas exchange. These roots also serve as nursery ground, breeding sites for birds, fish, crustaceans and other marine organism and protection against strong waves and winds (Quatro, 1997; Suratman, 2008) .

Mangroves are described as viviparous because seeds can germinate while still attached to the parent tree and develop adaptive mechanisms against the saline environment and long-distance dispersal. The seeds are ready to grow once they fall into the mud (Quatro, 1997). Mangrove seeds also have the ability to withstand effects of hurricanes/typhoons. The seeds can still grow despite of the long-distance dispersal and strong forces of hurricanes/typhoons. Nonetheless, Rhizopora spp. are more vulnerable to hurricanes than Avicennae spp (Feller, et al., 2010) .

They tend to grow in zonation patterns along tidal gradient as observed in fringe type (Quatro, 1997; Twilley et al., 1999). Different species grow in the lower part and in the upper part of the fringe due to varying salinity tolerances of the species (Twilley et al., 1999; Alongi, 2002). Other factors that influence zonation are soil type, chemistry, nutrient content, physiological tolerances and predation (Quatro, 1997;Alongi, 2002).

They are classified into six types based on the topographic effects and hydrology namely: overwash, fringe, riverine, basin, scrub and hammock (Twilley, et al., 1999, Kathiresan, n.d.). Figure 2.1 shows the types of mangrove forests according to topographic effects and hydrology.

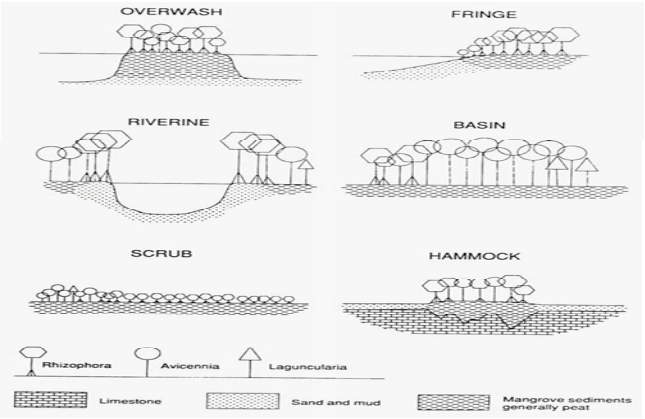


Figure 2.1 Types of mangrove forests
Source: Kathiresan, n.d.

Among the six types, riverine is the most productive because of its topographic feature as a closed system. It is greatly influenced by tidal inputs. Fringe forests occur along the borders of protected shoreline and influenced mainly by tidal range. Overwash forest are small islands formed by tidal washings. Mangroves along the interior side of the swamps and in drainage depression are classified as basin mangrove forest. Hammock forest is almost similar to basin forest except for its elevation being higher. Along flat coastal fringes are dwarf or scrub forests (Kathiresan, n.d.). Riverine and fringe type is commonly found along the coasts of the Philippine islands.

2.2 Productivity of mangrove ecosystems

Primary productivity of mangroves, generally measured through rates of litterfall, is influenced by many factors: solar radiation, temperature, tides, nutrient concentrations, soil type, drainage, oxygen concentration, and pH (Twilley and Day, 1999). It varies across global and local scales (Feller, et al., 2010). In a broader spatial scale (global), differences in primary productivity are attributed mainly to effects of temperature, solar radiation, and amount of rainfall. Twilley, Chen, and Hargis (1992), found out that mangroves in lower latitudes have higher productivity than those in higher latitudes. Highest litterfall (14 ton/ha/yr) was observed in 0-20 degrees latitude while 2 ton/ha/yr was observed in subtropical regions. Lower latitudes are

characterized by high precipitation, high temperature and adequate sunlight boosting photosynthesis, resulting to higher litterfall rates.(Twilley and Day, 1999).

A more complex interaction of physical factors can be observed in a local scale or within same geographic region. Apart from the above mentioned factors, salinity, geomorphology, hydrology and tidal amplitude are the factors that affect the growth and productivity of mangroves (Lugo and Snedaker, 1974; Twilley and Day, 1999).

High productivity can be observed in mangrove forest where there is high river input, high tidal amplitude, and low salinity (Twilley and Day, 1999). High river input provides mangrove ecosystem more nutrients needed by trees. Meanwhile, frequent inundation, both by tides and river, decreases salinity. Although mangroves can tolerate saline conditions, high salinity limits their growth and productivity. This is typically the condition for riverine type. Due to the closed system structure of riverine forest, more sediments are suspended/buried rather than exported. Thus, among mangrove types, riverine type has the highest organic carbon and highest productivity, followed by fringe, basin and dwarf/scrub types respectively (Lugo and Snedaker, 1974; Twilley and Day, 1999). This condition still applies even to poorly developed riverine mangroves in Mexico. High litter fall rates (1,100 g/m2/yr) were observed despite of poor structure caused by frequent hurricanes. Aside from this, they also have low salinity. Scrub mangrove forests were reported to have the lowest productivity because of low tidal amplitude and high salinity (Twilley and Day, 1999).

2.3 The importance of mangroves

Mangroves are less species-rich compared to tropical land forests but highly productive providing many ecological services and socio-economic benefits (Alongi, 2002). In the Philippines, fishery products consisting of fish, mollusks, shrimps, and crabs from mangroves have economic value ranging from US$60-2215/ha/yr (Gilbert and Jansenn, 1998; Walton et al., 2006). Aside from this, non-timber forest products like honey, tannin, fuelwood and medicinal products are also provided by mangroves. Phuviriyakul (2007) estimated the value of timber and non-timber forest products from mangroves to be 55 baht/ha/yr.

Since most of the people living near mangrove forests are the marginalized member of the society, mangroves play a very important role in their daily subsistence and livelihood (Biswas, Mallik, Choudhury and Nishat, 2009). Mangrove resources such as fishery products, firewood, and charcoal are the major sources of income for most of them. Aside from these resources, mangroves also give them alternative livelihood like guiding tours, boat rentals for ecotours, and handicraft making.

Other living things also get substantive ecological benefits from mangroves. They provide home to migratory birds. They are breeding, spawning and nursery sites for small fishes, crustaceans and other marine organisms. The economic value of mangrove's nursery role was estimated to be 243 USD/ha/yr, accounting 50% of fish catches in marine fishery (Samonte-Tan et al., 2007). Nonetheless, Nickerson (1999) accounted 80-90% of demersal fisheries in the tropical areas to be mangrove dependent. He further found that the decline in fish population is correlated with the loss of mangrove forest.

Mangrove roots trap sediments which stabilizes their hold on the ground providing coastal residents strong protection against tsunami, coastal erosion, and cyclones. This function of mangroves (trapping sediments) makes them important to adjacent ecosystem like rivers and seas because they filter sediments and organic matter before it goes to them (Quatro, 1997; Gilbert and Janssen, 1998; Lewis, 2005). The value of this ecological service of mangrove is estimated to be US$ 672/ha/yr using replacement cost method where the value of constructing seawalls or dikes are used as proxy for the coastal protection services of mangroves in Bohol, Philippines (Samonte-Tan et al., 2007). Badola & Hussain, (2005), cited in Walton et al., (2006), found out that households protected by mangroves suffered 78% lesser damage cost from typhoons than unprotected households and 24% lower damage cost than those protected by a dyke.

Another important ecological service of mangrove is carbon sequestration. Their role in mitigating global warming is recognized by many scientists and environmentalists because of its capacity to sequester and store large amount of carbon (Alongi, 2002). They are also responsible for > 10% dissolved organic carbon (DOC) flux in oceans which is the largest carbon pool on Earth (Dittmar et al., 2006).

Mangroves can also be a source of recreation. Some mangroves are established as ecotourism sites because of the abundance of migratory birds, monkey and other wildlife that can be observed in its vicinity. Mangroves recreational value is estimated to be 481baht/ha/yr (Phuviriyakul, 2007).

These various ecological, socio-cultural and economic benefits are results of the functions performed by the ecosystems (Gilbert and Janssen, 1998). Functions are the "capacity of natural processes and components to provide goods and services that satisfy human needs, directly or indirectly". They are subset of ecological processes and ecosystem structures (De Groot, Wilson, & Boumans, 2002). Figure 2.2 shows the relationship between structures, functions goods and services, and values. As stated by De Groot, Wilson, & Boumans (2002), the goods and services derived from ecological functions have ecological, socio-cultural, and economic values. These ecological, socio-cultural and economic values are assessed based on the sustainability, equity and efficiency of the whole ecosystem. Further, functions are classified as regulation, habitat, production and information (De Groot, Wilson, & Boumans, 2002). In mangrove ecosystem, regulation function pertains to the local and global climate regulation, run-off and flood prevention, storage and recycling of nutrients, etc. Habitat (carrier) function provides refuge and habitat to fishes or provides space for human settlement. Production function is the provision of food, raw material, medicine, water, and other tangible benefits while the information function is the provision of intangible benefits like cultural, educational, scientific, and historical information (Gilbert and Janssen, 1998).

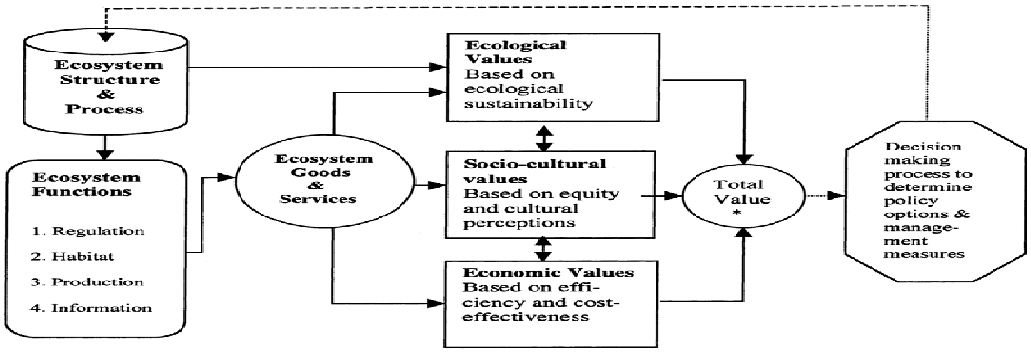


Figure 2.2 Relation of functions, goods and services of mangrove forest

Source: De Groot, Wilson, & Boumans, 2002

Although functions are the results of natural processes occurring in the ecosystems, the proper performance of functions, can be affected by human activities particularly by the way of utilizing resources which in turn are also influenced by the existing institutions (Primavera, 2000; Alongi, 2002; Walters, 2003; Farley, Batker, de la Torre, and Hudspeth, 2009). For example, overlogging of mangrove trees can result to lesser mangrove cover impacting the habitat of fishes, crustaceans and other mangrove dependent animals. The regulation of logging activities is based on the governing rules and regulations of the management. Since functions are interconnected (Gilbert and Janssen, 1998), habitat function may not be the only function affected but also regulating and production functions.

2.4 Mangrove situation in the Philippines

Out of the 70 mangrove species around the world (Spalding et al., cited in Alongi, 2002), forty species belonging to 16 families can be found in the Philippines (Tomlinson, 1986 cited in Primavera, 2000).The earliest estimate of mangrove forest area in Philippines is 500,000 hectares (Brown and Fisher, 1920 cited in Melana, Melana and Mapalo, 2000) and latest estimate from FAO (2003) is 109,700 hectares as shown in Figure 2.3. This 75% (approx.) decline in mangrove forest area is attributed mainly to conversion to brackishwater. Other causes are logging, reclamation for residential and industrial purposes, and conversion to agriculture and salt ponds (White and Trinidad, 1998; Primavera, 2000).

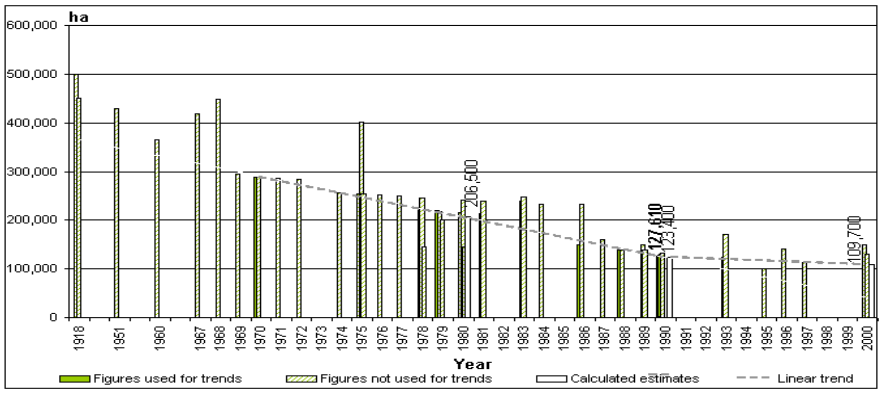


Figure 2.3 Philippine mangrove area estimate

Source: FAO, 2003

The abrupt decline in mangrove forest occurred between 1970-1988 with an annual rate loss of 8,200 hectares (White and Trinidad, 1998). During this period, many mangroves were cleared to pave way for the construction of brackishwater ponds (White and Trinidad, 1998; Primavera, 2000). The high returns of the aquaculture business attracted many investors. Even the government has supported this development with the passage of Fisheries Decree of 1975 (PD704) aiming for an intensified fishpond development to maximize fishery productivity and A.O. 125 extending permits and leases from 10 years to 25 years (Primavera, 2000). Financial assistance was easy to get because of the support of international banks and multilateral agencies like World Bank and ADB (Melana, Melana, and Mapalo, 2000). This was further encouraged by the cheap rentals for brackishwater ponds (50PHP/ha/yr, less than 1 US$) since 1950s. It was only in 2004 when rental fee was increased to 1,000 PHP/ha/yr (Maliao and Polohan, 2008).

Another mechanism facilitating land-use conversions was the government's inefficiency in tax mapping. Permits were issued as long as real estate taxes were paid without due consideration to the land classification. Thus, lands that may belong to forest land were classified as alienable and disposable which also paved way for conversion of mangroves to fishpond (Primavera, 2000).

The constructed ponds were productive only in the first five years and seldom extend up to 10 years (Primavera, 2000). After that, many ponds were abandoned due to its low productivity. This led to searching for another site for pond construction. Thus, forest destruction and degradation eventually occurred.

It was only in 1980s when rehabilitation efforts from government started (Primavera & Esteban, 2008) which was supported by same multilateral agencies who promoted fishpond development (Melana, Melana, and Mapalo, 2000). The first rehabilitation project with the support of multilateral agency (World Bank) was the Central Visayas Regional Project-1 (CVRP-1) with 11 project sites within four provinces of the region (Pomeroy, Pollnac, Katon and Predo, 1997; Primavera and Esteban, 2008). Since then, many rehabilitation projects were established across the country (Primavera and Esteban, 2008). 2.3 shows average carbon levels that sequestered in vegetation and soils for several forest biomes and the weighted average for all biomes.

Aside from rehabilitation activities, some intact mangroves were declared as protected area or reserves to prevent further destruction. In 1981, Presidential Proclamation No. 2151 and 2152 were issued to support mangrove conservation. Presidential Proclamation No. 2151 declared 4,326 has of mangroves as Wilderness Area while Presidential Proclamation No. 2152 declared the entire province of Palawan and some mangrove forest in the country as Mangrove Swamp Forest Reserve with a total area of 74, 267 hectares (Melana, Melana, and Mapalo, 2000).

Currently, remaining mangroves in the Philippines are 5% primary growth and 95% secondary growth (White and Trinidad, 1998).

2.5 Mangrove forest rehabilitation

Field (1998) defined mangrove rehabilitation as the "act of partially, or more rarely, fully replacing structural or functional characteristics of an ecosystem that has been diminished or lost, or the substitution of alternative qualities or characteristics than those originally present with proviso that they have more social, economic or ecological value than existed in the disturbed or degraded state"

Mangrove rehabilitation in Southeast Asia is much more complicated compared to other regions because of lesser research studies done and the highly populated coastal areas in the region. Coastal residents are often the poor and marginalized people in these countries who are heavily dependent on the coastal resources thus, adding too much pressure on it (Biswas, Mallik, Choudhury and Nishat, 2009).

Compared to other Southeast Asian countries, Philippines has a documented mangrove plantation of Rhizopora species and Nipa fruticans in the early 1900s around Manila Bay (Brown and Fisher, 1920 cited in Primavera and Esteban, 2008). The local communities were already active in planting mangroves without government assistance. Beginning 1930s, the local communities in Negros Oriental and Bohol provinces planted mangroves primarily for fuelwood and typhoon protection (Walters, 2004).

Unfortunately, not all planted mangroves remained in the forest for a long period. The boom of the aquaculture industry has led to deforestation of many

mangrove forests. It was only in the 1980s when mangroves vital role to subsistence fisheries in adjacent ecosystems were realized. Thus, rehabilitation activities were conducted throughout the country with financial aid from multilateral agencies like World Bank, Asian Development Bank, USAID, etc (Primavera, 2000).

According to Samson and Rollon (2008), most of the earlier rehabilitation activities experience low survival rate because of inappropriate species planted on the wrong site and barnacle infestation. Successful rehabilitation activities occurred in communities equipped with community organizers and environmental specialists who trained the local communities. Coupled with these is the regular monitoring conducted after the replanting (Primavera and Esteban, 2008).

2.5.1 Purposes of rehabilitation

According to Field (1999), there are four reasons why mangroves are rehabilitated:

1. Conservation

This is almost similar to restoration since it aims to reinstate all the ecological processes and genetic diversity of the pristine condition of the mangrove ecosystem. A protected area, national park or nature reserve is usually established to conserve the area (Field, 1999).

2. Landscaping

The goal is to beautify coastline or estuary especially when a resort complex is located near the mangrove forest.

3. Multiple use system for high and sustainable yield/ Sustainable production

The purpose is to increase productivity of the products derived from the forest like wood, charcoal, fish, and shrimp. Comparison with former state is disregarded. This objective often leads to conflicting goals of preserving the environment, economic efficiency, and equity for the local community (Field, 1999).

When the goal is to increase production of timber, wood or charcoal, monospecific plantations (mostly Rhizopora spp) are done (Erftemeijer and Lewis III, 2000).

4. Protection of coastal areas

Mangroves are planted along coasts which were previously damaged by cyclones or tsunamis.

Most rehabilitation activities include reforestation or afforestation. However, there are some cases when planting is not necessary because mangroves are natural colonizers where they can grow if habitat condition is suitable for their survival. This will require the suitability of hydrology, soil and climatic conditions (Clough, 2000).

However, if site has poor drainage, excessive wave action, frequently flooded or if the propagules present are not suited to the mangrove area, then, manual planting is necessary to rehabilitate the degraded area (Clough, 2000).

2.5.2 How degraded mangroves are rehabilitated

In any case of rehabilitation activity, first and foremost to be considered are the potential stresses preventing natural recovery (Lewis, 2005). Possible causes are man-made structures like dikes which blocks the tidal or freshwater flow.

Together with barrier identification, assessment of the site's hydrology, topography, and soil conditions is also conducted. Hydrology (depth, duration, and frequency of tidal flooding) of a proposed restoration site should be referred to a nearby natural mangrove plantation (Lewis, 2005). After which appropriate species can be identified to conform with the specific objectives of the project (Clough, 2000; Field, 1999).

Many rehabilitation projects have failed because of excluding site assessment before replanting. According to Clough (2000) and Field (1996), rehabilitation can be either through natural or artificial regeneration.

2.5.2.1 Natural regeneration

Natural regeneration is letting propagules grow without direct planting. Mangroves are natural colonizers where they can grow and survive if hydrology and soil are in good conditions (Field, 1996; Lewis, 2005). Thus, hydrology and soil conditions together with topography should be assessed properly before

conducting reforestation. Natural regeneration is also possible if there is sufficient amount of appropriate propagules of natural colonizers on the site.

A successful restoration activity occurred in the Caribbean coast of Panama through natural regeneration. Mangroves in the coast were affected by the oil spill resulting to the death of 69 hectares mangroves. An initial replanting was done on some part of the affected area in an effort to restore it immediately. However, most of the planted seedlings/propagules did not survive. After sometime, natural recruits of mangrove species were observed on other unplanted parts of the degraded area. Six years after the oil spill event, comparative study was conducted on the area and it revealed that there was higher density of seedlings that survived in the unplanted site. Plots with planted seedlings had lower density, shorter height and smaller biomass than the plots with natural recruits (Duke, 1996).

2.5.2.2 Artificial regeneration

Artificial regeneration or manual replanting is conducted when site cannot recover naturally or inhibit secondary succession. Usually, the site has poor drainage, excessive wave action, and frequently flooded. Other cause for inhibition of secondary succession is the insufficient or inappropriate species present on the site (Clough, 2000).

Planting propagules is a cost-effective method compared to nursery grown seedlings. However, nursery grown seedlings have higher percentage of survival than propagules because it was nurtured first in nursery before planted in mangrove sites. Thus, they are stronger and cannot be easily washed by waves (Field, 1996).

Most of the rehabilitation projects employ artificial regeneration. However, there are many failed activities due to the common perception that rehabilitation/restoration involves only planting without careful assessment as to the cause of degradation, appropriate species and site selection, lack of monitoring, etc (Lewis, 2005).

Some of the documented successful restoration showed the application of techniques like silvicultural activities and proper assessment and monitoring. The restoration of Matang Mangrove Forest in Malaysia involves application of such silvicultural activites. It consists of pre-felling inventory, final

felling every 30 years, enrichment planting and stand thinning. Reforestation is done two years after felling. During reforestation, only sound and mature propagules are selected for direct planting and enrichment planting. Direct planting is done immediately after collection of propagules while enrichment planting is done only if the logged areas does not have a 75% natural regeneration. Thus, not all propagules selected are directly planted but some are nurtured in a nursery in case of a need for enrichment planting. It is also observed that natural regeneration occurs after stand thinning every 15 and 20 years which sustains the availability of trees to be logged every 30 years. Some of the wildings from natural regeneration are transplanted to nursery using corer and further used as replacement for dead seedlings on the reforested site (Chan, 1996).

2.6 Community-based coastal resource management (CBCRM) and co-management

Community-based coastal resource management (CBCRM) also known as community-based coastal management (CBCM) is an approach to coastal resource management where local coastal resource users are given active role in the planning and decision-making with regards to the management and utilization of coastal resources like mangroves, coral reefs and seagrass (Hildebrand, 1997). It seeks to address poverty alleviation, natural resource depletion, and environmental degradation by enhancing the capacity of local communities as day-to-day users and managers. It is under the wider umbrella of community based natural resource management where people and environment are regarded as interacting entities.

CBCRM is “people-centered, community-oriented and resource-based”. It gives emphasis to the innate capacity of people to understand and find solution to their own problem and devise strategies appropriate to their own needs and conditions. It aims for a more active people’s participation in the planning, implementation and evaluation of coastal resource management programs. Moreover, it assumes greater responsibility in the assessment and monitoring of environmental conditions and in the enforcement of agreement and laws (Ferrer and Nozawa, 1997). According to Rivera

and Newkirk (1997), CBCRM is a "politically negotiated process of making decisions on the ownership, control, and overall policy directions of coastal natural resources".

The wider application of community-based management approach around the world has gained impetus due to the poor performance of state governance (Israel, 2001). The traditional paternal role of a government is shifted to a "service-provider, facilitator and partner" of local communities. Local communities are not anymore regarded as objects of a "command-and-control" government. Rather, their active involvement and participation is sought after in order for projects/activities to be successful (Hildebrand, 1997).

In state governance, people were regarded as objects and followers whereas in community-based management approach, people have more power in decision-making and implementation.

CBCRM can sometimes be mistaken as co-management as there are CBCRM that involves not only local communities but also LGU, NGO, national government, and other stakeholders. CBCRM does not necessarily denotes exclusion of government from the management. Hildebrand (1997) stated that CBCRM can be initiated either by communities themselves, or by government agencies or NGOs resulting to a partnership between various stakeholders.

When partnership between or among stakeholders is established, this can also be described as co-management approach. However, Pomeroy (1998) stressed that though CBCRM and co-management are almost similar, differences still exist in terms of the power sharing between local communities and other stakeholders. In co-management, government has major and active role but has minor role in CBCRM (Israel, 2001).

CBCRM is now widely applied in the management of mangroves in Philippines. In CBCRM, the local communities are the resource managers. Some of the mangrove forests employing CBCRM and effectively managed by the local communities are the mangrove forests in Pagangan Island and Banacon Island Bohol. Spurred by the importance of causeway in connecting the small island to the mainland, the school principal together with the students initiated the planting of Rhizopora Stylosa along the causeway. This became an annual tradition until the mangrove forest

expanded to 54 hectares in 1999. The mangrove forest is being managed by the local communities themselves (Primavera and Esteban, 2008).

Planting of mangroves in Banacon Island, Bohol was also initiated by one local resident until his neighbors followed him due to the sales income generated from poles coming from mangroves. The management of mangrove forest by local communities was regarded as successful in terms of socio-economic improvements (Walters, 2004).

When local communities and local government have a strong collaboration, mangrove forest management by partnership of local communities and local government can also have a fruitful outcome. This was observed in Bani, Pangasinan when the local communities and local government jointly requested funds for mangrove planting from Department of Environment and Natural Resources (DENR) with an assurance from the requestors of maintaining and managing the mangroves. The site won a Best Community-based Coastal Project Award in 1996 with PHP 1 million as prize which was used to expand the mangrove forest to 42 hectares (Primavera and Esteban, 2008).

However, not all local community/LGU- managed were successful in maintaining the survival of mangroves. In Magallanes, Agusan del Norte, only 5 hectares of mangrove survived out of 53.8 hectare of planted mangroves. This was attributed to lack of monitoring after the planting activities (Primavera and Esteban, 2008).

Albeit, Walters (2004), warns that community management remains to be examined especially on the aspect of resource users' behavior towards conservation. Generalizations on the past failures of the government do not necessarily suggest an adoption of community management in natural resources. He exemplified the successful management of Talabong Marine and Wildlife Sanctuary in Bais Bay, Negros Oriental, Philippines and attributed the conservation strategies to the "heavy hand" of the government.

On the other hand, Hildebrand (1997), puts special consideration on the geography, sociopolitical, and traditions of the country in adopting CBCRM. Based on his meta-analysis/review of several CBCRM projects around the world, CBCRM may

likely to succeed in small rural communities because small size encourages closer relationship with natural resources.

2.7 Impact indicators for coastal resource management

According to Pomeroy, Parks, and Watson (2004), management effectiveness is the "degree to which management actions are achieving the goals and objectives". Community management and co-management both aims to empower the local communities and make them effective resource users and managers. Community empowerment and management can be considered effective if it is equitable, efficient, and sustainable (Maliao and Polohan, 2008). Equitable means that it has fair sharing of benefits and responsibilities. Efficient implies that there is an excellent delivery of service. Sustainable denotes the resilience of management through time.

In order to evaluate the effectiveness of management, criteria and indicators are employed. The criterias for effective management are equity, efficiency and sustainability. Under these three criterias, different indicators are used to measure the effectiveness (Maliao and Polohan, 2008). Impact indicators that will be used in this study reflect the impact of management in the household level. It will measure their perception and behavior towards mangrove resource use and management. Table 2.1 shows these indicators under the three criterias.

Table 2.1 Equity, efficiency, and sustainability impact indicators

Criteria	Impact Indicators	Description
Equity	*, **,***Participation in management	Local users' level of involvement in mangrove management
	*, **,***Influence over mangrove management	Local users' level of bargaining power over decisions made
	*, **,***Control over mangrove resources	Local users' sense of influence to monitor and regulate the internal use pattern of mangrove and associated fisheries

Table 2.1 Equity, efficiency, and sustainability impact indicators **(cont.)**

	*, **Fair access right to mangrove resources	Allocation of user's right to enter and withdraw mangrove resources
Efficiency	**Collective action	Collaboration among stakeholders
	**Conflict resolution mechanisms	Ability to monitor illegal activities and resolve disputes related to mangrove use
	****Financial resource	Sufficiency of budget allocated for mangrove management activities
	***Capacity building	Transfer of knowledge from trainings /seminars
Sustainability	*, **Community compliance with coastal resource-related rules	Local users' conformity of behaviors with prescribed operational rules
	*, **Level of threat to mangrove resources	Overexploitation, inappropriate use, natural and human threats
	*** Ecological knowledge	Level of awareness of members on mangroves importance

Source: Adapted from **Maliao and Polohan, 2008; * Pomeroy et al., 1997; ***Pomeroy, Parks, and Watson, 2004; Maliao, Pomeroy, and Turingan, 2009

2.7.1 Participation in management

Community participation in natural resource management is now gaining international recognition due to their crucial role in the sustainable utilization of natural resources. There is more possibility of achieving management goals when local people participate actively. Active participation means that there is involvement and participation in the inception phase up to monitoring phase (Pollnac and Pomeroy, 2005).

2.7.2 Influence over mangrove management

Influence over mangrove management reflects the local community members sharing of ideas and suggestions in the management of natural resources. Local community members have indigenous knowledge which have been practiced for long time and proved to be effective.

2.7.3 Control over mangrove resources

When people feel a sense of control over the environment where they live, they are more motivated to protect the environment and natural resources. Involvement in monitoring and satisfaction with the involvement increases the community members' sense of ownership resulting to proper resource utilization (Pomeroy, Parks, and Watson, 2004).

2.7.4 Access to mangrove resources

The open-access nature of mangrove forest makes it vulnerable to overexploitation. Thus, the provision of tenurial instruments as an incentive and also as a right to use and access was deemed to ensure protection and conservation of mangrove forest. It is argued that local resource user's behavior and attitude towards conservation will be encouraged when they have defined and secured user rights (Pomeroy, Pollnac, Predo and Katon, 1997). It is noteworthy to mention that the right to use the resources has accompanying responsibility as stated in the tenurial instrument. In the Philippines, Community-based Forest Management Agreement (CBFMA) is an agreement/tenurial instrument between local community through their people's organization and the government to develop, conserve, utilize, and manage a tract of forest land and resources in a period of 25 years and renewable for another 25 years. It aims for the sustainable management of forest resources by granting tenurial rights to the local resource user with a premise that these rights will encourage them to protect the forest resources (DENR, 2003).

The issuance of CBFMA is applicable to all forestlands including mangrove forests and allowable zones of protected areas (Melana, Melana and Mapalo, 2000). In order to obtain CBFMA, communities should organize a people's organization duly registered at Department of Labor and Employment (DOLE), Cooperative Development Authority (CDA), and Securities and Exchange Commission (SEC) (Green et.al., 2002). Upon approval of the registration of the organization, a coastal resources management framework plan for 25 yrs, annual work plan and resource use plan (if there is nypa plantation) should be submitted to DENR (Green et.al., 2002; Melana, 2008). A Provincial Environment and Natural Resources Officer (PENRO) from Department of Environment and Natural Resources (DENR)

approves the CBFMA if area is less than 5,000 has (which is the case for mangrove forest).

As CBFMA holder, members of the approved people's organization can utilize the resources within their designated area. They will also be exempted from paying fees for the land, timber and non-timber resources. Preference will be given to them in giving technical and financial assistance (Green et.al., 2002; Melana, 2008).

2.7.5 Collective action

Collective action is the ability to work together as a unified group. This can be reflected in the close collaboration between or among stakeholders involved in the management of natural resources. Collective action is crucial especially in situations where the whole community is affected. For example, whenever there is a proposed project which may bring significant changes in the community, collective action among community members can be seen through their own initiative to bring this matter to higher officials. This was observed in Bolinao when a cement factory was proposed to be built in the community. Through a series of meetings conducted by the community, the construction of cement plant was cancelled due to the persistence of the community members to oppose this project in front of higher officials (McManus, Ferrer, dela Cruz and Cadavos, n.d.).

2.7.6 Conflict resolution mechanism

Despite of regulations prohibiting cutting or poaching, and prohibitions on some fishing gears, incidences of these activities still occur. The ability of the management to resolve conflicts and the imposition of fines and penalties can therefore affect the resource utilization in mangrove forest particularly in marine protected areas where these activities are strictly prohibited (Maliao, Pomeroy and Turingan, 2009).

Capability of deterring violators was seen as a problem in community-managed mangrove in Lingayen Gulf due to lack of patrolling and enforcement mechanisms. This, however, was not a deterrent in the management of mangroves in Central Visayas where there was support from the local government unit (Salmo, Torio, and Esteban, 2007). In Southern Thailand, local communities were regarded as

more effective patrollers than government staffs due to their proximity to the area (Sudtongkong and Webb, 2008).

2.7.7 Community compliance

Rules and regulation are made and implemented in order to protect, conserve, and utilize properly the natural resources. Compliance to these rules and regulation are tantamount to achieve a well-functioning ecosystem providing the society abundant goods and services.

2.7.8 Level of threat

Mangroves are continuously under human and natural threats. Despite of regulations for illegal activities, overexploitation, and inappropriate use still occurs due to man's selfish desire for present benefits. It is man's nature to maximize and enjoy present benefits rather than preserve it for future use. Overpopulation is seen as one factor triggering pressure and overexploitation on natural resources. Aside from human threat, natural threats like typhoon and tsunami can also destroy mangrove forests.

2.7.9 Financial resources

In any management structure, financial resources are vital in carrying out different activities. However, lack of funds or dependence on outside sources (NGO, national government, multilateral agencies) can deter planned activities. This frequently occurs in Philippine government budget disbursement where allocated budgets for annual activities are released late. However, if a local community can generate their own financial resources, then management activities will continuously be implemented (Maliao and Polohan, 2009).

2.7.10 Capacity building

Capacity building of the local community is achieved through community organizing and trainings which are usually conducted by NGOs or academic institutions (Ferrer and Nozawa, 1997). Through trainings, skills and management capability can be enhanced which are important in sustainable management of natural

resources. Trainings also develop the capacity of local communities to work together as one team or one organized community (Pomeroy, Parks, and Watson, 2004).

2.7.11 Ecological knowledge

Ecological knowledge in this study refers to the level of understanding of local community members on the importance of mangroves and activities that have an impact on mangroves (Pomeroy, Parks, and Watson, 2004). When people are aware of these, they will be more concern on proper utilization of mangroves.

2.8 Economic valuation

Economic valuation is defined as the "attempt to assign quantitative values to the goods and services provided by environmental resources, whether or not market prices are available" (Barbier, Acreman, & Knowler, 1997). In general, the economic value of goods and services is measured through people's willingness to pay for the benefits they derived from the resource less the cost of supplying it. However, when market prices are not available, economic value is estimated through people's willingness to pay alone whether or not payment is actually done (Lambert, 2003).

Many goods and services are public goods in nature which are often undervalued because of market failure. Public goods are characterized by non-excludability and non-rivalry. The former pertains to goods and services that a consumer may still consume even if other consumer already used it since the quantity of good was not affected by the last consumer's usage. Non-excludability does not prevent or exclude a consumer from using a resource even if another consumer chose to pay for it.

These characteristics of public goods give them lesser economic value because of the absence of market price/value attached in it which often results to resource overexploitation or environmental degradation. Since public goods are non-rival and non-excludable, people have tendency to favor maximization of present benefits rather than sustaining future benefits.

Through economic valuation, these goods and services are assigned with monetary value by using different valuation techniques which will be discussed later in

Section 2.8.2. It is believed that when goods and services have attached price even though it is not traded in the market, people will be more aware of its true economic value and support for wise use and management of resources can be easily gained (Lambert, 2003).

Thus, economic valuation is conducted to help reveal market failure. In general, three main reasons govern its conduct: to assess the over-all contribution of ecosystems to social and economic well-being, to understand resource user's way of ecosystem utilisation and the reason behind it, and/or to assess the relative impact of alternative uses of ecosystems (MEA, 2003).

It is apparent that ecosystems have a wide array of social and economic benefits through the goods and services it provides. It is a source of consumption and livelihood as well and contributes to the gross income of a nation. However, accounting of national wealth does not include its over-all contribution due to some goods and services not traded in the market.

Assessment of the over-all contribution of ecosystems to social and economic well-being can be achieved in economic valuation by assigning monetary values to the environmental services which are not usually included in the accounting for national wealth. Changes in the flow of services bring significant impact to economy and society. However, when loss of an environmental service is not taken into account, the more apparent benefits of exploitation are easily observed.

Through economic valuation, resource user's way of utilization and reason behind it is better understood. Why people cut trees and why they pollute water bodies is guided by the market. The costs and benefits of resource utilization is based on individual's preference and influenced by the market. But for public goods where market fails, lost of services are unaccounted which often leads to unsustainable use of resources. Economic valuation can help reveal these failures by reporting the existence and magnitude of differences between the costs and benefits. The information can guide in choosing options (market-based instruments, incentives, taxes) for correcting these failures (MEA, 2003).

The most common application of economic valuation is in assessing the impacts of alternative uses of ecosystems. When development projects are proposed, economic valuation is conducted to estimate the benefits of the project and the

opportunity cost which is the foregone benefits lost due to the alteration in the ecosystem.

Economic valuation therefore can be a powerful tool in decision and policy-making involving the wise use and management of different ecosystems. It is based on the utilitarian paradigm of value where people derive valuable utility from the direct, indirect and future use that ecosystem goods and services provide (MEA, 2003). Nonetheless, ecosystem goods and services have non-utilitarian values like ecological, socio-cultural and intrinsic values that economic valuation does not capture entirely. Thus, De Groot, Stuip, Finlayson, and Davidson (2006) suggested that economic, ecological, and socio-cultural assessment have its different criteria and value units in assessing its total value or benefits to the society. Economic valuation in this regard, is capturing the utilitarian value expressed in monetary units and is only one part of the total value of goods and services (MEA, 2003). Ecological and socio-cultural valuation has its separate yet complementary role in making decisions towards the wise utilization of natural resources (De Groot, Stuip, Finlayson, and Davidson, 2006).

2.8.1 Total economic value

Total economic value is the framework widely used in economic valuation (Figure 2.4).

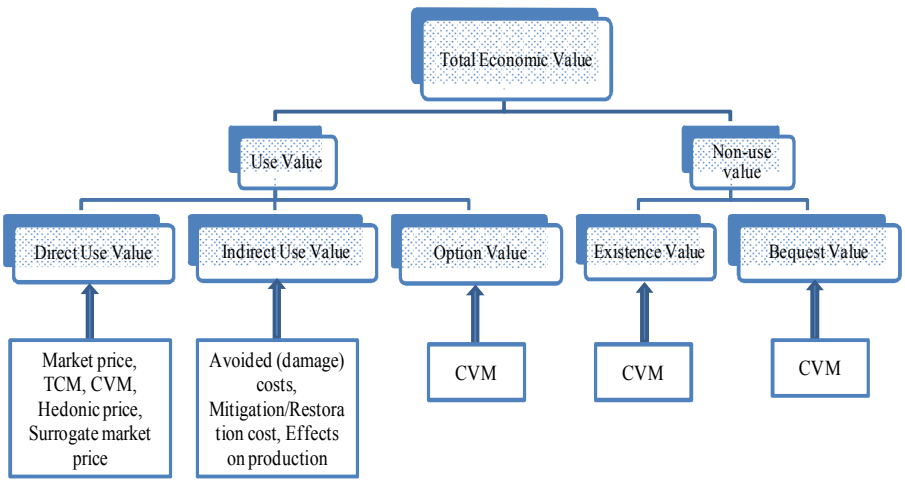


Figure 2.4. A framework of total economic value

Source: Adapted from Barbier, Acreman, & Knowler, 1997

It is categorized into use value and non-use value. Use value is further classified into direct use and indirect use. Direct use values are "values derived from the direct use or interaction with natural resources" (Bann, 1997). It can be consumptive or non-consumptive. Consumptive direct use values (fish, timber, fuelwood, medicine, tannin) are those goods which society can directly benefit by extracting the good from the environment whereas, non-consumptive use are those goods which society can directly benefit without extracting the good such as recreation and tourism (MEA, 2003; Bann 1998). Consumptive use is the easiest to value because quantities and price can be easily measured and observed in the market. Unlike consumptive use, non-consumptive use may not have observable quantities making valuation difficult (Dixon and Pagiola, 1998).

Indirect use value is the value derived from the services the environment provides. They are unmarketed and connected indirectly to the economic activities that their ecological functions support (Ramachandra, Rajinikanth, and Ranjini, 2005). For example, the storm protection and shoreline stabilization function of mangroves protect coastal communities from strong typhoons by reducing or avoiding costs on property damages (Barbier, Acreman, and Knowler, 1997).

The value attached to maintaining the option to take advantage of something's use value at a later date is called as the option value (De Groot, Stuip, Finlayson, and Davidson, 2006). Production, regulating, habitat, and information functions may all provide option value in the future even if not utilized at present. Table 2.2 shows the many use values of a mangrove ecosystem.

Table 2.2 Goods and services from mangrove ecosystem under TEV framework

Total Economic Value			
Use Values			Non-use Value
Direct Use (1)	Indirect Use (2)	Option Value (3)	
-Timber, firewood woodchips, charcoal -Fisheries(fish,shrimp, crabs, molluscs) -fruit/propagules, medicine, construction material, dyes, tannins sap, honey, nipa shingles, worms -fish culture, crab culture -Water transport -Tourism and recreation	-Shoreline/riverbank stabilisation -Groundwater recharge and discharge -Carbon sequestration -Flood and flow control -Sediment, contaminant, nutrient removal and storage -Migration habitat -Nursery and breeding grounds for fish -Nutrient retention -Coral reef maintenance and protection -Saline water intrusion prevention	-Future use as per (1) and (2)	-Cultural heritage -Spiritual and religious -Biodiversity

Source: Ruitenbeek, 1992; Barbier, Acreman, and Knowler 1997; Bann, 1998; Gilbert and Jansenn, 1998; UNEP 2007a

Non-use value is classified into existence and bequest value. Existence value is the value people derived from the knowledge that something exists even if they never plan to use it. An example is the value put on endangered species by protecting it to ensure its existence. Bequest value is the value derived from the desire to pass on values to future generations (Dixon and Pagiola, 1998). It is like an inheritance that present generations would like to preserve in order that future generations can see it. Local communities will usually put high bequest values on their local habitats (wetlands) because they wanted to pass on to the future generations the wetland and their associated way of life with it (Ramachandra, Rajinikanth, and Ranjini, 2005).

Option value and non-use value are more difficult to valuate than direct use value and indirect use value. Direct use values have measurable value available in the market and indirect use values have economic value that can be derived from measurable economic activities they support or protect. Whereas, many valuation techniques can be applied to direct and indirect use value, only contingent valuation

method can be applied to option and non-use value. Aside from this, option and non-use values depend on the subjective valuation of individuals and require many data. (Bann, 1997).

2.8.2 Valuation techniques

Economic valuation has different methods/techniques to quantify the goods and services in terms of its monetary value.

2.8.2.1 Market price

Market price is the associated price of goods in the commercial market making it the simplest, most straightforward and commonly used method because of the available price in the commercial market (IUCN, 2003). It reflects the people's willingness to pay for goods that are traded in the market (Barbier, Acreman, and Knowler, 1997). This is applicable only to consumptive use as the value of non-consumptive uses and environmental services are not traded in the market.

2.8.2.2 Surrogate market price

When goods and services does not have market price but have equivalent/substitute goods that are traded in the market, the market price of this substitute good or the value of the resources (time) used in producing the untraded good or the substitute good is used as proxy to estimate for the price of untraded goods (IUCN, 2003). This is usually applied to goods consumed by local resource users and are not therefore sold to the market. Three approaches can be used under this method. The widely used substitute price method values the unmarketed good by using the market price of a substitute good. The indirect substitute price method approach uses the opportunity costs of producing the substitute good instead of using it for its original purpose while the indirect opportunity cost uses the opportunity cost (time spent) of producing the unmarketed good (Barbier, Acreman, and Knowler, 1997; Spaninks and van Beukering, 1997). Surrogate market price method is also referred to as substitute/proxy method (Lal, 2003) and replacement cost (IUCN, 2003)

2.8.2.3 Effects on production

Changes in the environmental quality of ecosystems can have a significant impact on the production of marketed goods. This can be observed on the productivity of marine and coastal fisheries where productivity is affected by the

supply of nutrients coming from the mangroves. Any disturbance on the mangroves can affect the population of off-site fisheries (Spaninks and van Beukering, 1997). For example, the value of mangroves' contribution to fishery production can be estimated by calculating first the harvested product and then create a production function model based from the impacts of mangrove nutrient production to the fishery product (IUCN, 2003).

2.8.2.4 Avoided (damage) cost

Ecosystem provides services that allow society to avoid costs that would have been incurred in the absence of those services (De Groot, Stuip, Finlayson, and Davidson, 2006). When ecosystem services are lost as consequence of environmental decline or degradation, the beneficiary of those services incur significant economic loss (IUCN, 2003). For example, mangroves protect communities from strong typhoons and flooding. When mangroves are cleared and typhoons occur, damages will be inflicted to properties due to the absence of coastal protection services of mangroves. The value of this service will be quantified based on the foregone economic loss of the properties.

2.8.2.5 Mitigation or restoration cost

This method which is also called mitigative or avertive expenditure (IUCN, 2003) and preventative expenditure method (Lal, 2003), estimates the value of environmental service by determining the cost of replacing the service once it is lost. Mangroves prevent coastal erosion and stabilize shoreline structure. The economic value of this service can be estimated by calculating the cost of constructing flood barriers (seawall) to mitigate coastal erosion (IUCN, 2003).

2.8.2.6 Travel cost

The recreational value of an ecosystem can be estimated through people's willingness to pay to visit the site. The travel cost and other expenditures can be an indicator of this willingness to pay and equivalent to the recreational value. Other way of capturing the environmental value is through the amount of fees that visitors pay (Lal, 2003; IUCN 2003).

2.8.2.7 Hedonic pricing

Properties and wages have varying prices in different locations. This can be attributed to the convenience, cleanliness or scenic view which

is associated with environmental attributes. Houses having similar size and amenities but located in different locations will have different selling price which may be due to effects of pollution. Properties located in the less polluted area will have higher selling price than those more exposed to pollution. In hotel rooms, those which have better scenic view are more expensive than other rooms (Dixon and Pagiola, 1998). The differences in cost due to varying attributes is separated and assessed as the environmental value (Barbier, Acreman, and Knowler, 1997).

2.8.2.8 Contingent valuation

This is conducted by asking people's willingness to pay for a specific environmental service or willingness to accept compensation for its loss under a hypothetical scenario that they would be available for purchase through structured questionnaires or interviews (De Groot, Stuip, Finlayson, and Davidson, 2006; IUCN, 2003). It is otherwise known as stated preference method and usually the only way for estimating non-use values (Lambert, 2003). In estimating the value of ecotourism sites, CVM and travel cost method can be both employed to produce a more valid/reliable/robust results by comparing or cross-checking the results from the two methods. A robust result can be expected because of different basis for measurement, one involves observable behavior while the other is based on hypothetical settings (Dixon and Pagiola, 1998).

2.8.2.9 Group valuation

This is also conducted by asking people's willingness to pay for a specific environmental service but through conducting the questionnaire or interview in a group.

2.8.2.10 Benefit transfer

When all described methods above cannot be conducted due to lack of data, human or financial resources, benefit transfer can be applied provided the two sites have similar characteristics. The value of the valuated site can then be transfer/adopted to the site being valued (Lal, 2003; De Groot, Stuip, Finlayson, and Davidson, 2006).

2.8.3 Application of market price method

Market price, TCM, CVM, hedonic price, and surrogate market price are the valuation methods that can be used to estimate direct use values Barbier, Acreman,

and Knowler, 1997. Among all of these methods, market price method is the simplest, straightforward and commonly used method; hence, this study will adopt this method. Moreover, comparison will be easier between calculated DUV in this study and previous studies that used market price method.

2.9 Related researches

Mangroves used to be regarded as wastelands and have minimal value. This was observed in the clearance and land-use conversion of mangroves around the world in the past decades. However, due to many researches conducted to assess the value of mangroves to communities and adjacent ecosystems, there is now a change in perception. Mangroves' importance is now recognized and part of the change can be attributed to the economic valuation researches conducted for mangroves. Although, there are varying values which is due mainly to site differences, it can at least illustrate the value of mangroves in economic terms. Table 2.3 is a synthesis of some of the economic valuation studies for mangroves in Asia.

Table 2.3 Synthesis of economic valuation studies on mangroves

Economic value of mangroves	Surat Thani, Thailand Sathirathai (2003)	Chonburi, Thailand Phuviriyakul (2007)	Panama, Sri Lanka IUCN (2007)	Sarawak, Malaysia Bennett & Reynolds (1993)	Bohol, Philippines Samonte-Tan (2007)	Aklan, Philippines Walton et al. (2006)	Asia UNEP (2007)
Direct use values							
USD/HH/YR	1,479	1,690	1,171		55	209	
USD/HA/YR	3,513	3,852	9,201	2,856	49	564-2316	1,585
Indirect use values (USD/HA/YR)							
Coastal protection	2,994	134,769	474		672		444
Carbon sequestration	88		393				89
Nursery function							573
Sediment retention							66
Ecotourism							43
Biodiversity					19		

Most of the economic valuation studies involved cost-benefit analysis of mangrove conservation and mangrove conversion to other land-use. Sathirathai (2003) compared the net benefits of mangrove conservation and mangrove conversion to shrimp farm at Surat Thani, Thailand and found out that mangrove conversion to

shrimp farm has higher net financial returns if only direct costs (labor and dredging) will be included in the analysis. However, if economic cost of environmental impact is included, costs will outweigh the gross income from aquaculture. Moreover, shrimp ponds were only productive during the first five years. After this period, productivity decline due to some diseases infecting the shrimps. Based on their economic valuation using market price method, the direct use value of mangroves from fish, shrimp, crab, mollusks, honey and wood for fishing gear is 3,513USD/ha/yr whereas indirect use value from coastline protection and carbon sequestration are 2,994 USD/ha/yr and 88 USD/ha/yr respectively.

Another study conducted by Phuviriyakul (2007) in Chonburi, Thailand compared the net benefits of mangrove conservation to conversion to either shrimp farm or salt pan. The results revealed that net benefits of both land-use conversion do not outweigh the benefits of mangrove conservation. The direct use value of mangrove was estimated using market price method to be 3,852 USD/ha/yr or a mean annual direct economic benefit to households of 1,690 USD/hh/yr. Mangroves coastal protection services was valued at 134,769 USD/ha/yr using replacement cost method approach.

In Sarawak, Malaysia, the benefits of an intact mangrove was compared to mangroves converted to aquaculture ponds, oil palm plantation, and industry and housing. Results revealed higher economic values of an intact mangrove over converted mangroves. For intact mangrove, floating cage aquaculture was recommended in order to augment the income of local communities who are heavily dependent on the mangrove resources for their daily subsistence and livelihood. Unlike pond aquaculture, this method does not involve clearing of mangroves. Instead, fishes are cultivated on the river connected to the mangrove ecosystem (Bennett and Reynolds, 1993).

Most researches do not estimate the total economic value. According to Bann (1998), the valuation of all goods and services is not necessary in order to come up with a viable management strategy. Partial valuation is enough to show disparities on the impacts of resource utilization. As observed in the previous researches (Table 2.3), most valuation studies only cover direct use value and parts of indirect use value.

This is due to the time, data, and resource constraints that can be encountered if the total economic value will be assessed.

Other economic valuation studies evaluated the economic benefits of mangroves under different management levels or alternatives. Schatz (1991), cited in De Leon and White (1999) assessed the economic value of mangroves' wood and fishery products to be US$156 and US$538 under mangrove plantation option, US$90 and US$538 if mangroves are naturally regenerated, and US$42 and US$538 if mangroves are unmanaged under-stocked stands.

Gilbert and Janssen (1998) evaluated the economic values of mangroves in Pagbilao Bay, Quezon, Philippines under eight management alternatives namely: preservation, subsistence forestry, commercial forestry, aquasilviculture, semi-intensive aquaculture, intensive aquaculture, commercial forestry/intensive aquaculture and subsitence forestry/intensive aquaculture. Among the eight management alternatives, semi-intensive aquaculture generated the highest economic benefit.

A comparative study of the net benefits of mangrove conservation and mangrove conversion to aquaculture in the whole Lingayen Gulf, Pangasinan, Philippines revealed contrasting results when two different approaches in valuation were used. Using a direct cost and revenue approach favored the conversion of mangroves to aquaculture. This approach estimates the net revenue by subtracting cost of conversion which includes dredging, labor and operational cost from the benefits accrued from conversion in this case, the value of the shrimps. However, when the TEV approach was employed, the opposite came out. Incorporating indirect use values in terms of the foregone benefits into the direct use values resulted to a net benefit of PHP 26,962/ha or US$ 627/ha indicating the non-conversion or conservation as the optimal land-use (Cruz-Trinidad, Alojado, and Cargamento, 1996).

As commonly practiced, economic valuation assesses the costs and benefits of any projects or management plans. The assessment covers therefore the economic benefits under different ways of managing or utilizing the resources within the project without due regard as to who manage the resources. Thus, this study will use economic valuation to compare the direct economic benefits (partial key benefits) generated by rehabilitated mangroves under two different management structures.

Moreover, relationship between direct use values and management effectiveness will be analyzed.

In a study conducted by Maliao and Polohan (2008), there was a significant improvement in the participation and involvement of communities in mangrove-related activities and in control over resource management but negative impact on household income and fish abundance 15 years after the mangrove rehabilitation under CBCRM. Pomeroy Pollnac, Katon, and Predo (1997), also assessed the performance of CBCRM in Central Visayas Region and resulted to a positive impact of mangrove rehabilitation in terms of participation, involvement, compliance, income and well-being of the resource. Both studies used the equity, efficiency and sustainability criteria to evaluate the management.

CHAPTER III
METHODOLOGY

This study used combination of qualitative and quantitative research methods for data collection and analysis. Quantitative method consisted of household interviews through structured questionnaires and statistical analysis using SPSS Version 15.0. The qualitative method consisted of in-depth interviews and field observation.

3.1 Study Area

Figure 3.1 shows the map of the study area. The municipalities of Bani and Bolinao were chosen as the study site because these two municipalities have different management structures employed in managing the mangrove forest. They are among the eighteen municipalities/cities of the provinces of Pangasinan and La Union lying along the 160 km. coastline of Lingayen Gulf. They are adjacent to each other, thus, differences in environmental settings will have less impact on the comparison of direct use values. Bolinao is on the northwestern tip of the province of Pangasinan while Bani is on the southern part of Bolinao.

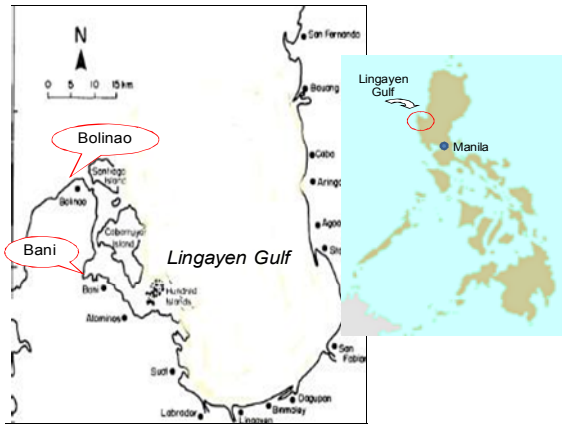


Figure 3.1 Map of Lingayen Gulf (inset: map of the Philippines)
Source: McManus and Chua, 1990

3.2 Research process

The research process consisted of the following steps and procedures as outlined in Table 3.1.

Table 3.1 Research procedure

Procedure	Methodology	Outcome
1. Background and justification	Reviewed literature on secondary data	Understood concept of community-based coastal resource management/co-management
2. Research focus	Reviewed literature on mangrove importance, economic valuation, mangrove rehabilitation and management structures	Understood concept of direct use values, valuation techniques, and mangrove management structures
3. Research study site selection	Reviewed literature on community-based management and co-management of mangrove forest	Selection of municipalities of Bolinao and Bani as the study area
4. Research design	Formulated the conceptual framework of the research, identified research process and procedures	Conceptual framework, research questions, objectives, hypothesis, and methodology
5. Data collection	Household survey	- Socio-demographic and economic conditions - Direct use values of mangrove forest - Management impact indicators

Table 3.1 Research procedure **(cont.)**

	In-depth interview	History of mangrove management and perception on economic benefits
	Field Observation	Mangrove management activities and status of mangrove forest
6. Data analysis	Descriptive statistics	Socio-demographic status of the respondents; management impact indicators
	Independent t-test	Comparison of DUV between the mangrove forests of two municipalites
	One-way ANOVA	Comparison of DUV of mangrove forests among four barangays
	One-way ANOVA; Kruskall-Wallis test	Comparison of impact indicators among four mangrove forests
	Multiple regression analysis	Analysis of the relationship between management impact indicators and DUV
7. Data interpretation	Mixing quantitative and qualitative data	Conclusions and recommendations

3.3 Target population and sample size

Population for this study was household head/wives who are members of the people's organization managing the mangrove forests. Yamane's formula was used in calculating for the sample size in this study. The formula was as follows (Yamane, 1967):

$$n = \frac{N}{1 + N(e)_2}$$

….....eq. 3.1

Where:

n = sample size

N = population size

e = level of precision (±5 percent margin of error)

The number of sample size in each barangay using Yamane's formula is shown in Table 3.2. The sampled households were selected through simple random sampling method.

Table 3.2 Number of respondents per barangay

Name of municipality	Name of barangay	Total number of PO member	Sample size (households)
Bani	1. Aporao	52	46
Bani	2. San Miguel	56	49
Bolinao	3. Pilar	60	52
Bolinao	4. Pilar	30	28
	Total	**198**	**175**

3.4 Research methods and data collection

Quantitative method was employed by conducting household interview using structured questionnaires. In order to obtain more relevant information on the status of mangrove forest and the community, qualitative method was employed by interviewing key informants from the barangays and municipal government. Likewise,

field observation was conducted throughout the data collection period by observing the management activities, resource utilization and status of mangrove forest.

3.4.1 Primary data

The primary data were collected through key informant interviews, household interviews and field observations.

3.4.1.1 Household interview

Structured questionnaire was used in obtaining socio-demographic information of the respondents, economic activities, types, amount, and price of goods derived from the mangrove forest, and perception and behavior towards mangrove management. The structured questionnaire was divided into four parts. Questions on part 1 inquired on the socio-demographic status of the respondent. The second part asked about the household's economic activities. This part covered the quantity and price of direct use values obtained as well as the costs incurred in collecting the resources. The third part tackled the perception on mangrove management. For the last part, the community members' behavior towards mangrove management was ascertained. The questionnaire in Appendix A was translated to Filipino/Tagalog - the Philippine national language, before interview was conducted. Translation to local dialect was unnecessary since all respondents can speak and understand Filipino/Tagalog.

3.4.1.2 In-depth interview

In order to obtain more information on the history and status of mangrove management, in-depth interviews were conducted to (6) key informants. Key informants included two (2) officers from Municipal Planning and Development Office of the Municipality of Bolinao, and Municipal Planning and Development Office of the Municipality of Bani; and four (4) people's organization head/president.

3.4.1.3 Field observation

Field observation was carried out by the researcher continuously throughout the data collection in the field which was approximately for one and a half month. The observation focused on the status of mangrove forests, availability of mangrove resources, resource utilization, and management activities.

3.4.2 Secondary data

The secondary data were collected from journal articles, reports and publications from various government agencies like Bureau of Fisheries and Aquatic Resources, Department of Environment and Natural Resources, and municipal offices.

3.5 Selection of key informants and household interviewees

Respondents for household interview were selected by simple random sampling. Before conducting household interview, the list of members of people's organization was checked first from the records of the people's organization (PO) in order to know the present and updated number of members of the PO.

The list of key informants for in-depth interview is presented in Table 3.3.

Table 3.3 Key informants for in-depth interview

Number	Position	Name of Office/Organization	Location
1	Division Chief	Municipal Planning and Development Office, LGU-Bani	Bani, Pangasinan
1	Division Chief	Municipal Planning and Development Office, LGU-Bolinao	Bolinao, Pangasinan
1	Head of People's Organization	Nagkakaisang Samahan ng Mangingisda ng San Miguel	Barangay San Miguel, Bani, Pangasinan
1	Head of People's Organization	Aporao Fishermen's Association, Inc.	Barangay Aporao, Bani, Pangasinan
1	Head of People's Organization	SAMMAKA (Samahan ng mga Mangingisda at Magsasaka sa Kalikasan, Inc.)	Barangay Pilar, Bolinao, Pangasinan

Table 3.3 Key informants for in-depth interview **(cont.)**

1	Head of People's Organization	SAPA (Samahang Pangkalikasan ng Arnedo)	Barangay Arnedo, Bolinao, Pangasinan

3.6 Valuation of direct use values

To estimate the direct use values from fishery products (i.e. fish, mollusks, crabs, and shrimps), fuelwood, and charcoal, the market price method was applied using the following equation:

$$NB = \sum (P_i Q_i - C_i) \quad \text{eq.3.2}$$

Where:

NB = net benefit = direct use value

P = price of products

Q = quantity of products

C = cost of collecting products

i = product

3.7 Data analysis

A combination of qualitative and quantitative methods approach was used in order to accomplish the objectives of this research. Qualitative analysis was conducted based on the researcher's own observation and interviews from key informants while quantitative analysis used Microsoft Excel and Statistical Package for Social Survey (SPSS) Version 15.0. Preliminary analysis using descriptive statistics such as frequency, percentage, mean, maximum, minimum and standard deviation were conducted prior to other statistical analysis involving comparison of means and determination of relationship between dependent and independent variables. Table 3.4 shows how the objectives and research questions were answered and analysed with statistical analyses.

Table 3.4 Method of data collection and analysis corresponding to objectives

Objectives	Research Questions	Data Collection Method	Method of Analysis
1. To estimate and compare the direct use values of mangroves between mangrove forests managed solely by local community and mangrove forests co-managed by local community and municipal government.	- Is there a significant difference in the direct economic benefits that local communities obtain from a community-managed mangrove and community/municipal government-managed mangrove forest?	Household interview, In-depth interview	Market price method, Descriptive statistics, Independent t-test, one way ANOVA
2. To analyze management impact indicators on mangrove forests	- Is there a significant difference in the impact indicators of mangrove forests having different management structures?	Household interview, In-depth interview, & Field Observation	Descriptive statistics, one way ANOVA & Kruskall-Wallis test
3. To determine the relationship between impact indicators and direct use values.	How does the impact of management or effectiveness of management affect the direct use values of mangroves?	Household interview, In-depth interview, & Field Observation	Multiple regression analysis

3.7.1 Analysis of direct use values of mangroves

To determine if there is significant difference in the direct use values of mangroves between two municipalities, independent t-test was used in the analysis. Independent t-test is being used to determine whether the means between two groups have significant differences (Coakes, Steed and Ong, 2010, p.178).

On the other hand, one-way ANOVA analysis and Kruskall-Wallis test were used to determine significant differences in the direct use values of mangroves across the four barangays,. One-way ANOVA was used if assumption for equality of variances was satisfied. Otherwise, Kruskall-Wallis test was applied.

3.7.2 Analysis of management impact indicators on mangrove forests

The management impact indicators characterize the respondent's perception and behavior towards mangrove management. Each management impact indicator has sets of questions and was rated using Likert's scale ranging from 1 (strongly disagree) to 5 (strongly agree). The answers in each question/item were coded accordingly to the assigned Likert's scale. Questions that were negatively coded were transformed first before they were weighted and summed up with other questions under the same indicator. After summing up all the items/questions in the indicator, mean was computed to represent the over-all management impact indicator as perceived by the respondents. The whole barangay's management impact indicator is the mean of all the measured indicator from its respondents.

After getting the mean representing the barangay's management impact indicator, they were categorized into low, moderate and high level using holistic scoring rubric technique (eq. 3.3) in order to describe the level of impact of management in each barangay.

$$\text{Range} = \frac{\text{Max-Min}}{\text{Number of level}} \qquad \text{eq. 3.3}$$

Since all management impact indicator have similar maximum (=5) and minimum (=1) scores, the score range and corresponding level of each management impact indicator will also be the same. The score range and its corresponding level is presented in Table 3.5.

Table 3.5 Holistic scoring rubric for management impact indicator adapted from Novak and Gowin (1984)

Level	Score Range
Low	<2.33
Moderate	2.33–3.36
High	>3.36

3.7.3 Analysis of relationship between direct use values and management impact indicators

Standard multiple regression analysis was used to determine the relationship between management impact indicators and direct use values, Table 3.6 shows the unit and scale of measurement of the variables tested. Dependent variable was the direct use values and management impact indicators were the independent variables.

Table 3.6 Management impact indicators and scale of measurement

Variables	Unit of Measurement	Scale of Measurement
Dependent variable		
Direct use value	Philippine Peso (PHP)	interval
Independent variable		
1. Participation in mangrove management	Score range*	interval
2. Influence over mangrove management	Score range*	interval
3. Control over mangrove resource use	Score range*	interval
4. Access to mangrove resources	Score range*	interval
5. Collective action	Score range*	Interval

Table 3.6 Management impact indicators and scale of measurement **(cont.)**

6. Conflict resolution mechanism	Score range*	interval
7. Financial resources	Score range*	interval
8. Capacity building	Score range*	interval
9. Community compliance	Score range*	interval
10. Level of threat	Score range*	interval
11. Ecological knowledge	Score range*	interval

Note: *Score range (Min=1, Max=5)

Sources: Pomeroy, Pollnac, Katon and Predo (1997); Maliao and Polohan 2008

The predicted regression equation based from the hypothesis formulated is:

$$Y = a + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + b6X6 + b7X7 + b8X8 + b9X9 - b10X10 + b11X11$$

Where:

Y = direct use values

a = constant value

b1 = regression coefficient of participation

b2 = regression coefficient of influence

b3 = regression coefficient of control

b4 = regression coefficient of access

b5 = regression coefficient of collective action

b6 = regression coefficient of conflict resolution mechanism

b7 = regression coefficient of financial resources

b8 = regression coefficient of capacity building

b9 = regression coefficient of community compliance

b10 = regression coefficient of level of threat

b11 = regression coefficient of ecological knowledge

X1 = participation

X2 = influence

X3 = control

X4 = access

X5 = collective action

X6 = conflict resolution mechanism

X7 = financial resources

X8 = capacity building

X9 = community compliance

X10 = level of threat

X11 = ecological knowledge

Management impact indicators were inquired by asking for respondent's perception and/or behavior as shown in Table 3.7. Questions eliciting respondent's opinion on mangrove management were grouped accordingly in the questionnaire (Section III, Appendix A) and were measured through Likert's scale of 1 to 5 with 1= strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree. Questions describing behavior also used Likert's scale ranging from 1 to 5 with 1=never, 2=seldom, 3=occasionally, 4=frequently, 5=always and were grouped accordingly in the questionnaire (Section IV, Appendix A).

However, not all questions had same scoring system where strongly disagree or never will always have a score of 1. A reverse scoring system was applied in order to avoid response bias or the tendency of people to answer questions in the same way or pattern due to laziness or psychological predisposition (Neuman, 2003, p.197). To distinguish the questions under reverse scoring system, these questions were italicized as shown below. These italicized questions have reverse scores where 1=strongly agree, 2=agree, 3=neutral, 4=disagree, 5=strongly disagree. Same reverse scoring were applied to italicized questions under the section of respondents' behavior towards mangrove resource use and management where 1=always, 2=frequently, 3=occasionally, 4=seldom, 5=never.

Table 3.7 Questions for management impact indicators

Management impact Indicators	Question Number	Section Number in Appendix A
1. Participation in mangrove management	1,3,4,6	IV
2. Influence over mangrove management	1,6,7 2,7	III IV
3. Control over mangrove management	27 8, 9	III IV
4. Access to mangrove resources	2,3 12,13	III IV
5. Collective action	4,5,8,9	III
6. Conflict resolution mechanism	11,12,13,14	III
7. Financial resources	18,19,20	III
8. Capacity building	21,22,23 5	III IV
9. Community compliance	10,11,14,15	IV
10. Level of threat	10,15,16,17	III
11. Ecological knowledge	24,25,26,28,29,30	III

The following were the sets of questions for each management impact indicator:

1. Participation in mangrove management
   a. Respondent's attendance in meetings of the community.
   b. Respondent's share ideas and suggestions during meeting.
   c. Respondent's participation in coastal clean-up.

d. Respondent's participation in mangrove planting activities.

2. Influence over mangrove management
   a. Respondent's involvement in planning activities related to mangroves
   b. Respondent's ideas and suggestions are taken into consideration in decision-making.
   c. Whenever there is proposed project involving mangrove conversion, community members are consulted first before project is implemented.
   d. Rules are made by the management and are presented to the barangay residents during meetings.
   e. Activities are planned by the management and are presented to the barangay residents during meetings.
3. Control over mangrove resources
   a. Respondent's involvement in monitoring the harvest/collection of mangrove resources
   b. Respondent notify the barangay head when he see illegal activities done in mangrove forest.
   c. Respondent's think that community compliance improved because of his involvement in monitoring.
4. Access to mangrove resources
   a. *We can do fishing anywhere in the mangrove forest.*
   b. Only members of the people's organization do fishing activities.
   c. Anyone from the barangay can collect firewood and construction post.
   d. Only members of the people's organization collect firewood and construction post.
5. Collective action
   a. There are many residents in the barangay who join mangrove-related activities.
   b. Barangay residents help one another to protect the mangrove forest.
   c. The barangay and local government can work together to protect the mangrove forest.
   d. The management is able to implement what has been agreed in the meeting.

6. Conflict resolution mechanism
   a. The management can resolve conflict immediately.
   b. There are incidences when conflicts cannot be resolved in the barangay level and has to be brought to the municipal level.
   c. The judgment made in resolving conflict is fair to all parties concerned.
   d. The penalty or fine imposed to violators is not enough to prevent further offences.
7. Financial resource
   a. The management has sufficient fund to manage the mangrove forest.
   b. The management can generate its own financial resource for mangrove planting activities.
   c. There is a fixed budget allocated for mangrove-related activities.
8. Capacity building
   a. Respondent join trainings related to sustainable mangrove resource use and management.
   b. The trainings conducted are useful.
   c. Respondent able to participate more to any activities after attending trainings.
   d. Trainings are necessary in order to improve mangrove management.
9. Community compliance
   a. Respondent throw garbage on mangrove forest.
   b. Respondent use prescribed fishing gears.
   c. Respondent see other people perform illegal fishing.
   d. Respondent see other people overharvest mangrove trees.
10. Level of threat
   a. Mangrove fishery products are decreasing.
   b. The mangrove trees are overharvested.
   c. Typhoons are frequent to occur in the area.
   d. There are enough patrollers to monitor illegal activities.
11. Ecological knowledge
   a. Mangroves protect us from strong typhoons.
   b. Mangroves provide shelter to migratory birds.

c. *Marine fishes will not be affected if mangroves are cleared.*
d. *It is better to convert mangroves to fishpond.*
e. *It is better to plant only Rhizophora species (bakawan) in the mangrove forest.*
f. *Mangrove seedlings can grow on its own (without planting it manually).*

CHAPTER IV
RESULTS AND DISCUSSION

This chapter presents the results of the quantitative and qualitative analysis of the effect of management structures with the direct use values of mangroves. Direct use values and management impact indicators were compared between two municipalities and among four barangays to determine disparities in management structures. The relationship between direct use values and management impact indicators were determined through standard multiple regression analysis. The results are presented into subchapters as follows: historical profile of mangrove management, socio- demographic characteristics of the survey respondents, direct use values of mangroves, comparison of direct use values of mangroves between co-managed and community-based mangrove forest, one-way ANOVA analysis of management impact indicators in the four barangays, and multiple regression analysis of the relationship between direct use values and management impact indicators.

4.1 Historical profile of mangrove management

Before the enactment of RA 7160 also known as Local Government Code of 1990, management of mangrove forest is under the jurisdiction of Department of Environment and Natural Resources (DENR). When RA 7160 was implemented, management of communal forest was turned-over to local government units (*i.e.* municipal and barangay). Thus, people's organization (PO) within the barangays can managed mangroves through Community-based Forest Management Agreement (CBFMA) - a binding agreement of People's Organization (PO) with DENR. In order to be a CBFMA holder, a PO should be organized and well-established. Upon complying the requirements for CBFMA application, a PO can start managing mangrove forest in their barangay and enjoy the incentives of being a CBFMA holder. Some of these are: exemption from paying rent and forest charges, financial grants from DENR, and establishment of income-

generating activities such as mangrove tours, handicraft making and oyster culture (DENR, 2004).

4.1.1 Municipality of Bani

The 42.5 hectares of mangrove forest in Bani Municipality were rehabilitated in 1988. It is located along Tambac Bay within barangays San Miguel and Aporao. In 11 July 2007, the two people's organization namely Nagkakaisang Samahan ng Mangingisda ng San Miguel (NAGKASAMA) and Aporao Fisherfolk's Association, Incorporated (AFAI) together with the municipal government of the two barangays, formed the Bangrin Federation to specifically manage the mangrove forest that was established as a marine protected area (MPA). They work in collaboration with the municipal government in patrolling, mangrove planting, maintenance and assessment.

Before the establishment of Bangrin Federation, the two POs worked separately in their respective barangays catering mostly to the needs and issues in fishing activities. The two POs were organized in 1990s with the assistance of Sagip Lingayen Gulf Project (SLGP).

Currently, Bangrin Federation is composed of 108 members. The association had been active in collaborating with the municipal government since its establishment. Several municipal ordinances were enacted with the proposal from the said association.

On the other hand, the municipal government assists the association in monitoring, assessment and financing. Five patrollers known as "Bantay-Dagat" coming from both barangays are employed by the municipal government to patrol the MPA regularly. Aside from this, fish catch is being monitored, reported and analysed by the municipal government. Records for 2008 showed that fishers in the municipality had an average net income of PHP 18,689.00 annually from fishing. The on-going fish catch monitoring is conducted not only in the MPA but on the whole coastal area of the municipality.

In addition, a mangrove planting scheme was adopted by the management. The municipal government of Bani paid Bangrin Federation 20 PHP for every seedling planted. The Federation shouldered the cost for planting which include seedling, labor, and sticks for markers. Fourteen pesos (14 PHP) was initially paid by the municipal government. The remaining amount will be paid if 60% survival is observed after six months upon planting.

Out of the total income for mangrove planting, three pesos (3 PHP) went to the planter and the rest to the Bangrin Federation.

4.1.2 Municipality of Bolinao

Mangroves in Bolinao are primarily managed by the people's organization in each of the 13 coastal barangays. In 1990s, a community-based coastal resource management (CBCRM) project was jointly implemented by University of the Philippines Marine Science Institute (UP-MSI), University of the Philippines College of Social Work and Development, and Haribon Foundation, Inc, a non-governmental organization (NGO). The aim of the project was to enhance the capabilities of local communities in managing the coastal resources, to identify and develop sustainable sources of income, and to devise networking mechanisms between barangay/municipal and provincial, regional and national levels. Some of the outcomes of the project were the establishment of people's organization in each barangay and the identification of a need for mangrove rehabilitation activity due to the decreasing fishery catches. In 1995, 32 hectares of mangroves in Bolinao municipality were rehabilitated.

Samahan ng Mangingisda at Magsasaka sa Kalikasan, Inc. (SAMMAKA) of Barangay Pilar and Samahang Pangkabuhayan ng Arnedo (SAPA) of Barangay Arnedo were among the four POs first established by the said institutions. The other two are from barangays Balingasay and Binabalian. In 1997, these four pioneer POs formed a federation called Samahang Alay sa Kalikasan (KAISAKA) where they formulated the Coastal Development Plan of the municipality together with the Municipal Council. They also helped other barangays of the municipality established its own people's organization. At present, each of the 13 coastal barangays have their own PO. KAISAKA works in collaboration with the municipal government in monitoring and assessing mangrove planting activities. The municipal government provides funding for these activities. However, it is still the individual PO in barangays who managed the mangrove forest.

Mangrove forest in Arnedo has an area of 8.65 hectares and Pilar has12 hectares. Barangay Pilar was the first CBFMA recipient (granted in 2001) in the whole Lingayen Gulf. During the data collection, it was observed in Barangay Pilar that one woman, a member of SAMMAKA, is persistently taking care of the mangroves. An

interview with her revealed that her action is due to her love of nature and environmental concern since she is not being paid either by the barangay or municipal government in patrolling the mangrove forest. She goes to the mangrove forest everyday to monitor illegal activities, remove barnacle and oyster infecting the mangroves, and replace dead mangroves with new seedlings/propagules.

In the past, SAPA was an active member of KAISAKA. However, when its previous president left his post, management of mangroves in the barangay has also dwindled. This was expressed by the members of SAPA during the data collection. Even the current acting president is hesitant to continue her post because of time constraints brought by her job as primary teacher. Aside from this, she did not undergo trainings conducted by other institutions involving mangrove management because it was the previous president who frequently attended. One issue she raised was there should have been a re-echo whenever there were trainings held and participated by selected members. Other members mentioned that there was improvement in the fish catch when the mangroves were rehabilitated but now they are worried that fishery products will decline again if mangroves will be left unattended and poorly managed.

4.2 Socio-demographic characteristics of the survey respondents

There were 120 respondents who participated in household interview. The study decided to include only residents who are members of the people's organization in each barangay as they were the major users/beneficiaries of mangrove resource. This was witnessed by the researcher during the data collection where most of the resident gathering/collecting mangrove resources were indeed members of the people's organization. However, some members refused to participate in the household interview because according to them, they do not collect mangrove resources. It was later known that these members were also inactive members in their PO. Thus, only 120 respondents or 69% response rate was achieved in this study.

4.2.1 Gender

Figure 4.1 shows the percentage of male and female respondents in household interview. There were more female (59.17%) than male (40.83%) who

participated in the household interview except in Barangay Arnedo. However, this does not indicate that there were more female household heads than male household heads. This percentage distribution is due to the availability of female/wives during the data collection.

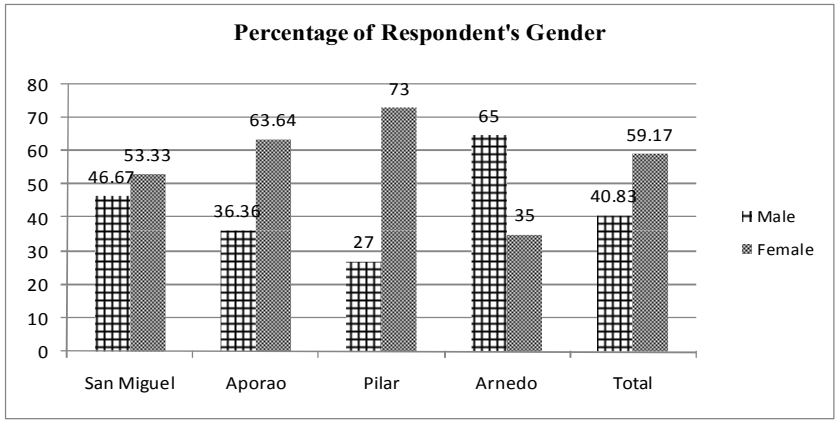


Figure 4.1 Gender of the survey respondents

4.2.2 Age

The percentage distribution of respondent's age is shown in Figure 4.2. More than half of the respondents (54.17%) were 50 years old and above. The average age of the respondents is 50.48 with 23 as the minimum age and 71 as the maximum age.

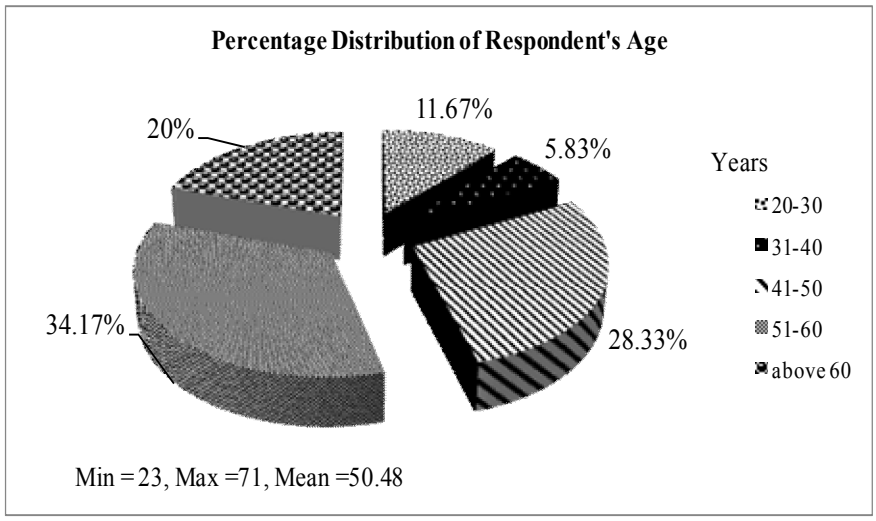


Figure 4.2 Age of the survey respondents

4.2.3 Educational attainment

Figure 4.3 shows that almost half of the respondents (49%) have finished secondary school while 43% finished primary school. Only 8% have college degree. Majority of the college degree holders came from Barangay Aporao. Barangay Pilar has the highest percentage of respondents (59%) having primary education as their highest educational attainment. Barangay Arnedo does not have a college graduate but seventy five (75%) of its respondents finished secondary school.

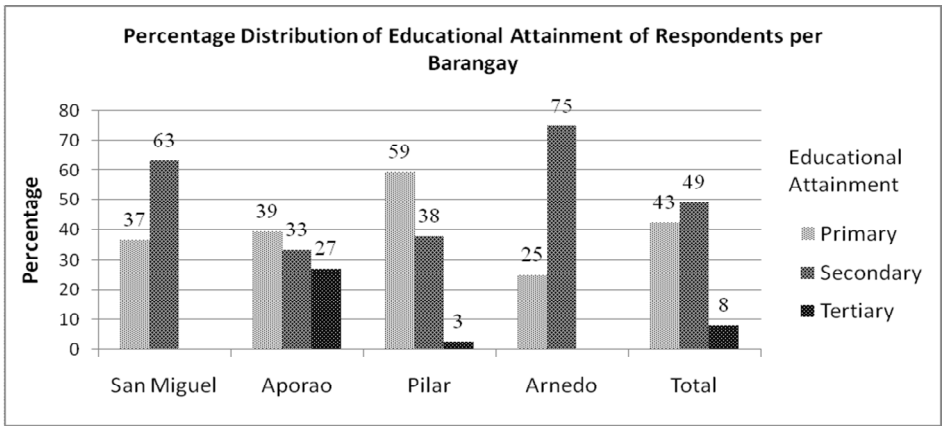
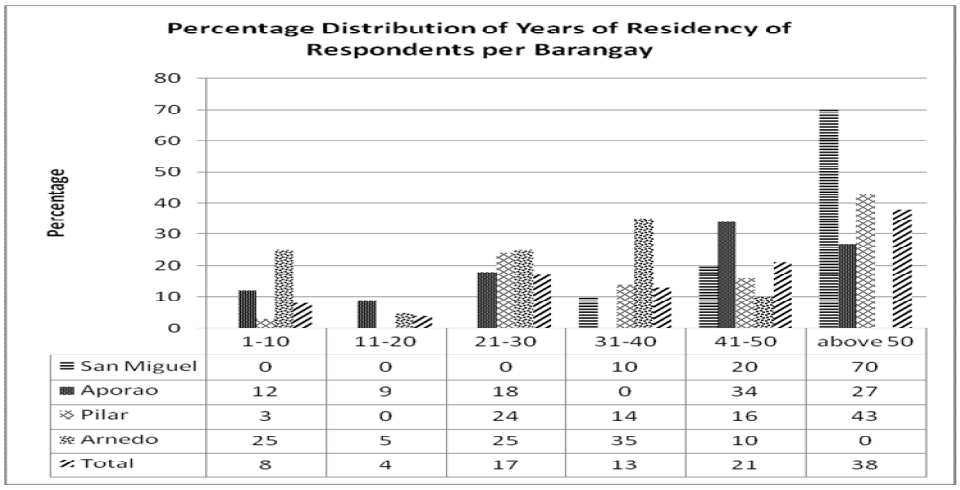


Figure 4.3 Educational attainment of survey respondents per barangay

4.2.4 Years of residency

The number of years spent by respondents in their barangay was grouped into 6 subgroups and is shown in Figure 4.4 through percentage distribution. Fifty nine (59%) percent of the entire respondents had been living on their barangays for more than 40 years (Figure 4.4). This result corresponds to the age of the respondents where more than half are 50 years old and above. This suggests that most of them were residing on their barangay since birth particularly Barangay San Miguel and Barangay Pilar where majority of the respondents lived in their respective barangays for more than 50 years.



	1-10	11-20	21-30	31-40	41-50	above 50
San Miguel	0	0	0	10	20	70
Aporao	12	9	18	0	34	27
Pilar	3	0	24	14	16	43
Arnedo	25	5	25	35	10	0
Total	8	4	17	13	21	38

Figure 4.4 Years of residency of respondents per barangay

4.2.5 Ethnicity

As illustrated in Figure 4.5, Majority of the respondents in each barangay except for Barangay Aporao have Pangasinan as their origin. It is also apparent that Barangay Aporao was also the most diverse with its respondents composed of Ilocano, Bisaya, Bicolano, and Pangasinan origin. All of the respondents in Barangay San Miguel originated from Pangasinan.

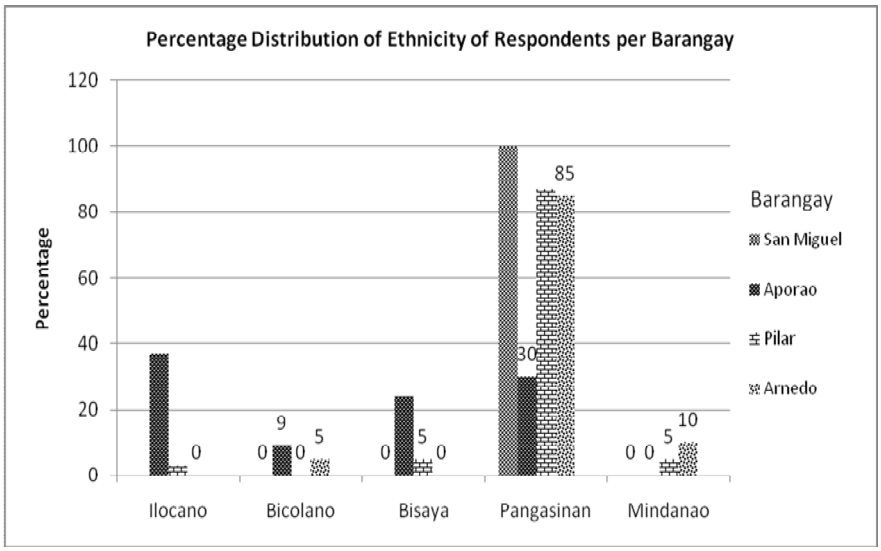
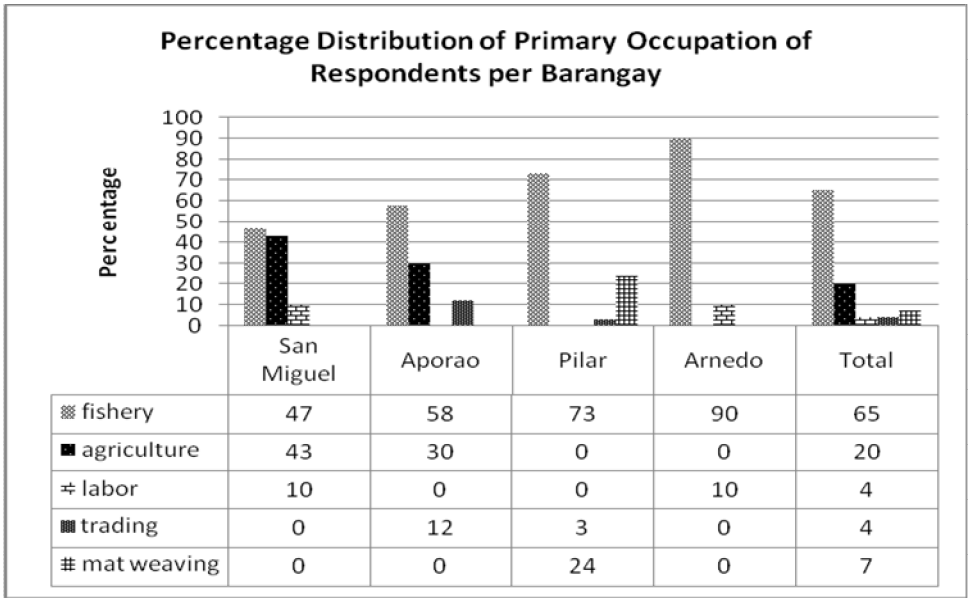


Figure 4.5 Ethnicity of respondents per barangay

4.2.6 Primary occupation

Figure 4.6 shows the percentage distribution of respondents per barangay in 5 major occupations: fishery, agriculture, labor, trading and mat weaving. Based from Figure 4.6, 65% of total respondents have fishing, gathering shells, selling fishery products, fish drying and fishpond business as their major occupation. One fifth (20%) of them were engaged in either farming or selling vegetables. There was same number of respondents who were in labor category (carpenters, plumbers, welder, or construction worker) and who were traders/merchants of various goods. Only seven (7%) percent of the respondents were mat weavers who mainly came from Barangay Pilar.



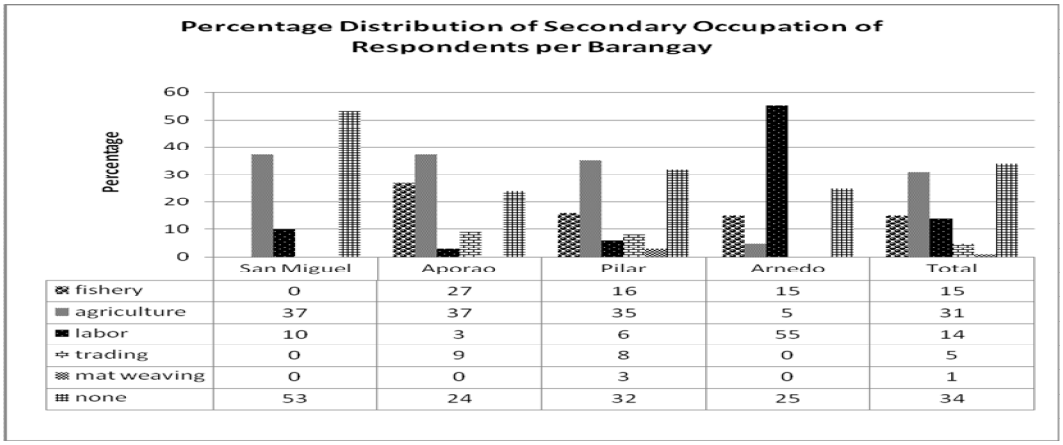
	San Miguel	Aporao	Pilar	Arnedo	Total
fishery	47	58	73	90	65
agriculture	43	30	0	0	20
labor	10	0	0	10	4
trading	0	12	3	0	4
mat weaving	0	0	24	0	7

Figure 4.6 Primary occupation of respondents per barangay

4.2.7 Secondary Occupation

Figure 4.7 shows the percentage distribution of respendents per barangay who have secondary occupation. Sixty six (66%) percent of the entire respondents have other jobs aside from their primary occupation. Agriculture has the highest percentage of secondary occupation as shown in Figure 4.7. Further details of the secondary occupation in Figure 4.7 shows that 53% of barangay San Miguel respondents do not have other job aside from their primary occupation while 55% of barangay Arnedo respondents resort to blue collar jobs (Labor) for other source of

income. Furthermore, only respondents from Barangay Pilar were engaged in mat weaving job.



	San Miguel	Aporao	Pilar	Arnedo	Total
fishery	0	27	16	15	15
agriculture	37	37	35	5	31
labor	10	3	6	55	14
trading	0	9	8	0	5
mat weaving	0	0	3	0	1
none	53	24	32	25	34

Figure 4.7 Secondary occupation of respondents per barangay

4.3 Analysis of the direct use values of mangroves

The direct use values of mangroves in the study area were calculated using eq. 3.2 outlined in Chapter III. Ninety eight (98%) percent of total direct use values (DUV) came from extractive goods consisting of fish, shell, oysters, mussels, crabs, and shrimp. Non-extractive use which is tourism was just one (1%) percent of the total DUV. Since cutting of mangroves is strictly prohibited in the whole study area, firewood and charcoal accounted 1% of the total DUV. These timber products were those which fell down from the mangroves. Fishing within the mangroves is also prohibited in four barangays. Fishermen can only fish near the mangroves. Respondents spent an average amount of 1,470 PHP/yr to 16,459 PHP/yr in collecting mangrove products. Most of them used hook and line and nets in fishing.

Table 4.1 shows the income generated from tourism activity. An average of 70 tourists per year visited the mangrove forest generating a net income of 8,600 PHP/yr. The amount collected from entrance fee and boat fee went to Bangrin Federation. Expenses incurred (4,800 PHP) for crude oil is shouldered by the Federation. The municipal government provided the boat used in touring to the Federation. The income from entrance fee and boat fee and the expenses incurred were

distributed equally to Barangays San Miguel and Aporao in the calculation of total and mean direct use values of mangroves since they constitute the Federation. The tour guide fee went to the tour guides who are mainly from Barangay Aporao.

Table 4.1 Income from tourism activity

Tourist fee	Quantity (Q)	Units	Price per unit (P)	Total (P*Q)
tour guide fee	12	tour guide	200	2,400
entrance fee	70	person	20	1,400
boat fee	12	boat	800	9,600
			Total income (P*Q)	**13,400 PHP/yr**
			Total expenses (C)	**4,800 PHP/yr**
			Net income/benefit [(P*Q)-C]	**8,600 PHP/yr**

At present, the mangroves in Barangay Pilar and Arnedo of Bolinao Municipality can be visited by tourists free of charge. However, respondents said that most of the visitors were either researchers or students. So far, few tourists came to the mangrove forest even though there are many tourists in Bolinao municipality visiting beaches. This was probably because of the difficulty in travelling to the mangrove forest especially in Barangay Pilar which is reachable through a small boat. Upon hopping out from the small boat, a tricycle ride costing 84 PHP/ride (one-way) should be taken in order to reach Barangay Pilar. Travel via boat and tricycle takes 20 minutes each. For ordinary tourists, these can be tiresome and time-consuming.

Meanwhile, the mangrove forest in Barangay Arnedo can be easily reached and seen because it is closer to the commercial center of the Municipality of Bolinao, thus, charging entrance fee is not viable.

4.3.1 Barangay San Miguel (co-management)

Table 4.2 Direct use values of mangroves in Barangay San Miguel

Extractive goods	Quantity collected per year (Q)	Units	Price per unit (P)	Market Value (P*Q)
barangan (*rabbitfish*)	336	kilogram	45	15120
Alukan	1005	kilogram	60	60300

Table 4.2 Direct use values of mangroves in Barangay San Miguel **(cont.)**

lapu-lapu (*grouper*)	240	kilogram	250	60000
talaba (*oyster*)	11,572	glass	20	231440
Firewood	678	bundle	100	67800
Charcoal	48	bag	140	6720
Total market value of extractive goods(P*Q)				**441,380 PHP/yr**
Total cost in collecting extractive goods (C)				**44,110 PHP/yr**
DUV from extractive goods (P*Q)-C				**397,270 PHP/yr**
DUV from tourism [(P*Q)- C]				**3,100 PHP/yr**
Aggregate DUV [(P*Q)-C]				**400,370 PHP/yr**
Mean DUV [(P*Q)-C]/# of HH				**13,346 PHP/HH/yr**

Table 4.2 shows the direct use values of mangroves: extractive (fishery products) and non-extractive (tourism) goods in Barangay San Miguel. The total direct economic benefit from extractive goods is 397,270 PHP/yr while from non-extractive goods is 3,100 PHP/yr. A separate table (Table 4.1) shows the calculation for tourism activities since this income is shared by the two barangays under co-management structure. Distribution of income from tourism is discussed in Subchapter 4.3.

Annually, the respondents from this barangay obtained an average direct economic benefit worth 13,346 PHP.

4.3.2 Barangay Aporao (co-management)

Calculation for direct use values of mangroves in Barangay Aporao is presented in Table 4.3. Respondents in this barangay obtained average direct economic benefits from mangrove worth 29,597 PHP/yr. The total direct use value from extractive goods was 971,200 PHP/yr whereas from non-extractive good (tourism) was 5,500 PHP/yr. Although Barangay Aporao and Barangay San Miguel shared the income from tourism (boat and entrance fee), Barangay Aporao received higher income because of the extra income from tour guide fee. Only residents of Barangay Aporao had worked as tour guide fee because of their proximity to the Bangrin mangrove forest.

Table 4.3 Direct use values of mangroves in Barangay Aporao

Extractive goods	Quantity collected per year (Q)	Units	Price per unit (P)	Market Value (P*Q)
bangus (*milkfish*)	2,609	kilogram	70	182,630
tilapia (*tilapia*)	275	kilogram	25	6,875
barangan (*rabbitfish*)	4,946	kilogram	45	222,570
alimasag (*crablets*)	318	kilogram	90	28,620
hipon (shrimp)				
Small	84	kilogram	150	12,600
Medium	210	kilogram	180	37,800
Large	450	kilogram	200	90,000
alimango (*mudcrabs*)				
Small	204	kilogram	200	40,800
Medium	398	kilogram	220	87,560
Large	48	kilogram	250	12,000
talaba (*oyster*)	7,584	glass	20	151,680
tahong (*mussel*)	9,390	bucket	20	187,800
purong (*sea mullet*)	193	kilogram	50	9,650
lumalanang (*silverbiddy*)	18	kilogram	50	900
Shell	920	sack	100	92,000
malaga (*spinefoot*)	2,339	kilogram	150	350,850
Total market value of extractive goods(P*Q)				**1,514,335 PHP/yr**
Total cost in collecting extractive goods (C)				**543,135 PHP/yr**
DUV from extractive goods (P*Q)-C				**971,200 PHP/yr**
DUV from tourism [(P*Q)- C]				**5,500 PHP/yr**
Aggregate DUV [(P*Q)-C]				**976,700 PHP/yr**
Mean DUV [(P*Q)-C]/# of HH				**29,597 PHP/hh/yr**

4.3.3 Barangay Pilar (community-based management)

Table 4.4 presents the calculation for direct use values of mangroves in Barangay Pilar which is managed by Samahan ng Mangingisda at Magsasaka sa Kalikasan, Inc. ng Pilar (SAMMAKA). The respondents of this barangay obtained only extractive goods consisting of fish (spinefoot, rabbitfish, ponyfish, largehead hairtail), clams, mudcrabs, mussels, and shells. The total direct use values of mangroves in this barangay was 915,660 PHP/yr in which an average cost worth 99,730 PHP/yr was incurred in collecting these extractive goods. Average yearly direct economic benefit obtained by Barangay Pilar resident was 24,748 PHP/yr.

Table 4.4 Direct use values of mangroves in Barangay Pilar

Extractive goods	Quantity collected per year (Q)	Units	Price per unit (P)	Market Value (P*Q)
malaga (spinefoot)	748	kilogram	100	74,800
barangan (*rabbitfish*)	6952	kilogram	45	312,840
sapsap (*ponyfish*)	1788	kilogram	35	62,580
espada (*largehead hairtail*)	780	kilogram	50	39,000
halaan (clams)	4176	Dipper	15	62,640
alimango (*mudcrabs*)	135	Kilogram	250	33,750
tahong (*mussel*)	4024	Bucket	20	80,480
Shell	4990	Gallon	70	349,300
Total market value of extractive goods(P*Q)				**1,015,390 PHP/yr**
Total cost in collecting extractive goods (C)				**99,730 PHP/yr**
Aggregate DUV (P*Q)-C				**915,660 PHP/yr**
Mean DUV [(P*Q)-C]/# of HH				**24,748 PHP/HH/yr**

4.3.4 Barangay Arnedo (community-based management)

Direct use value of mangroves in Barangay Arnedo is estimated to be 266,120 PHP/yr (Table 4.5). This amount came from extractive goods: fish (rabbitfish, grey mullet, trevally), shells, and mudcrabs. Respondents in this barangay directly benefitted from mangrove forest an average annual income of 13,306 PHP.

Table 4.5 Direct use values of mangroves in Barangay Arnedo

Extractive goods	Quantity collected per year (Q)	Units	Price per unit (P)	Market Value (P*Q)
barangan (*rabbitfish*)	4370	kilogram	45	196,650
burasi (*grey mullet*)	780	kilogram	60	46,800
talakitok (*trevally*)	336	kilogram	70	23,520
Shell	941	gallon	70	65,870
alimango (*mudcrabs*)	24	kilogram	250	6,000
Total market value of extractive goods(P*Q)				**339,190 PHP/yr**
Total cost in collecting extractive goods (C)				**73,070 PHP/yr**
Aggregate DUV (P*Q)-C				**266,120 PHP/yr**
Mean DUV [(P*Q)-C]/# of HH				**13,306 PHP/HH/yr**

4.3.5 Comparison of direct use values of mangroves between co-managed and community-managed mangrove forests

Table 4.6 presents the results of independent t-test conducted comparing direct use values of mangroves between Municipality of Bani (co-management) and Municipality of Bolinao (community-managed). Results revealed no significant difference in the DUV of mangroves between Municipality of Bani (*M=21858, s.d.=12264*) and Municipality of Bolinao (*M=20733, s.d.=8878*); $t(118)=0.57$, $p=0.57$.

Table 4.6 Independent t-test of DUV between two municipalities

Municipality	n	Mean (PHP/hh/yr)	Std. Deviation	t	Significance (*p*-value)
Bani	63	21,858	12,264	0.57	0.57
Bolinao	57	20,733	8,878		

This result suggests that accounting the direct economic benefits obtained by respondents per municipality as a whole does not have an effect on the differences between the municipalities where mangroves are located. The calculated mean direct use values of mangroves in Bani (21,858 PHP/hh/yr) was just slightly higher than the mean direct use values of mangroves in Bolinao (20,733 PHP/hh/yr). The two municipalities are adjacent to each other and the mangroves in the study area are within the same body of water - the Lingayen Gulf.

However, results from one-way ANOVA analysis revealed significant differences across the barangays having different management structures, $F(3,116) = 28.86$, $p = 0.000$. A Tukey multiple comparison was performed at 0.05 significance level to determine where significant differences lie across the four barangays. The result is presented in Table 4.7 which indicates that DUV of mangroves in Barangay Aporao ($M = 29597$, *s.d.* = 11092) is significantly higher than barangays San Miguel ($M = 13345.67$, *s.d.* = 6533) and Arnedo ($M = 13306$, *s.d.* = 56901) but not significantly higher than barangay Pilar ($M = 24747.57$, *s.d* = 7636). It can also be asserted that Barangay Pilar's DUV is significantly higher than barangay San Miguel and Arnedo. Moreover, the DUV between barangays San Miguel and Arnedo and

between barangay Pilar and Aporao were found not to be significantly different from each other.

Table 4.7 Means of direct use values per barangay

Mean Direct Use Values (PHP)			
		Subset for alpha=.05	
Barangay	n	1	2
Arnedo	20	13306	
San Miguel	30	13346	
Pilar	37		24748
Aporao	33		29597

Note: Means that do not appear in the same column differ at $p < .05$ in the Tukey Multiple Comparison

The results from one-way ANOVA analysis indicated that comparison within smaller political units can reveal significant differences in DUV of mangroves with different management structures. Surprisingly, there are disparities not only in DUV of mangroves having different management structures (i.e. Aporao vs. Arnedo) but also in DUV of mangroves with similar management structures (i.e. Aporao vs. San Miguel). Mangroves in Barangay Aporao and San Miguel are both under co-management structure. However, respondents in Barangay Aporao obtained significantly higher direct economic benefits than respondents in Barangay San Miguel. Also, Barangay Pilar has significantly higher DUV than Barangay Arnedo, both barangays under community-based management.

These differences between Barangay San Miguel and Aporao can be attributed to proximity to mangrove forest. Houses of respondents in Barangay Aporao are closer to mangrove forest than Barangay San Miguel giving them easy access in collecting mangrove goods. This is also the reason why Barangay Aporao respondents got extra income from guiding tours.

Other cause can be attributed to dependency to mangrove goods. It can be inferred from Figure 4.6 that Barangay Aporao respondents depend more on mangrove foods for their livelihood than respondents in Barangay San Miguel. Figure 4.6 shows

that more respondents in Barangay Aporao (58%) are engaged in fishery activities than Barangay San Miguel (47%).

Dependency on mangrove goods, however, cannot be the reason for difference of DUV of mangroves between Barangay Pilar and Arnedo since Figure 4.6 shows higher respondents of Barangay Arendo engaged in fishery activities than Barangay Pilar respondents. Rather, proximity to mangrove forest probably affected their frequency in collecting mangrove goods, thus, increasing/decreasing their direct economic benefits from mangroves. During field observation, it was observed that houses of Barangay Pilar respondents are closer to mangrove forest than Barangay Arnedo. This gave easy access for Barangay Pilar respondents in gathering mangrove goods.

4.3.6 Comparison with other economic valuation studies in Asia

Figure 4.8 shows varying direct use values of mangroves in Asia. The estimated direct use values of mangroves in this study (476 USD/ha/yr) and by United Nations Environmental Programme (479 USD/ha/yr) for Philippines are almost the same (UNEP, 2007). Compared to other mangrove forests in Asia, mangrove forests in Pangasinan have relatively low direct use values. Direct use values of mangroves in this study were estimated to be 476 USD/ha/yr while other mangrove forests in Asia has direct use values ranging from 1,346 USD/ha/yr to 4,496 USD/ha/yr. It is also lower than the estimated weighted mean regional value for Asia (1,585 USD/ha/yr).

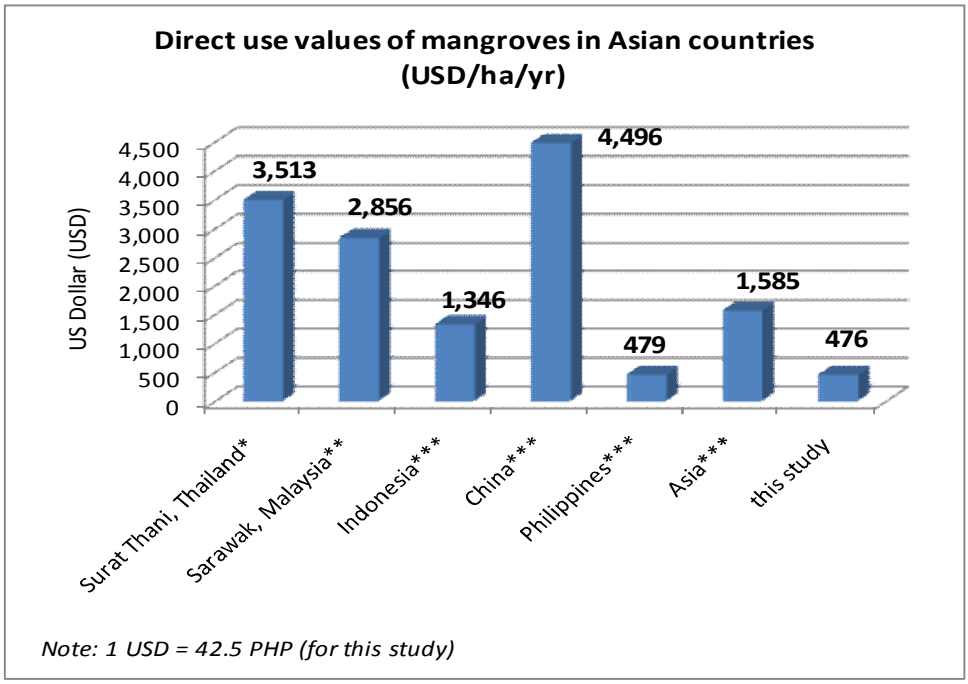


Figure 4.8 Direct use values of mangroves in Asian countries

Sources: *Sathirathai, 2003; **Bennett & Reynolds, 1993; ***UNEP, 2007

These differences could be due to several factors: different environmental settings, area of mangrove forest, relative importance of mangrove goods in each country and intensity of use. Environmental settings accounts mainly to the differences in direct use values of mangroves located in different countries. Climate, tidal inundation, hydrology, topography, etc. which varies according to location have crucial roles in ecosystem functions (Lewis, 2005). As pointed out by De Groot, Wilson and Boumans (2002), ecosystem functions are responsible to the provision of environmental goods and services. And environmental settings have vital role in the proper functioning of ecosystem such as mangroves, seagrass, etc.

The mangrove forest in Surat Thani has an area of 400 ha. which is a huge difference compared to the area of mangrove forest in Pangasinan (8.65 to 42.5ha). Obviously, bigger area can accommodate many and varied species of mangrove goods resulting to higher DUV.

Mangrove goods like fish, shrimp, crabs, shells, etc. do not have similar prices across Asia. Market prices of these goods depend on its prevailing importance to the market consumers. For example, shrimps in China (3.66 USD/kg) are more

expensive than shrimps in Thailand (3.23 USD/kg) which may be due to more demand for shrimps in Chinese markets (UNEP, 2007).

Intensity of use of mangrove goods can also be a probable cause for the differences of DUV among Asian countries. When mangroves are more intensively used, the quantity and quality of mangrove goods are affected resulting mostly to resource depletion and environmental degradation. This factor, however, has many other root causes such as (population, management scheme, and level of dependency of resource users to mangrove goods), which is beyond the scope of this study.

4.4 Analysis of management impact indicators

Forty five (45) items/questions using Likert's scale was employed to inquire for respondents' perception on management impact indicators. Each impact indicator has sets of questions which is outlined in Subchapter 3.7.3. The score for each management impact indicator is the mean of the weighted scores of all items/questions describing the indicator. After getting the score for each indicator, it was categorized into low, moderate and high level using the rubric scoring method.

Differences in the mean of indicators between two municipalities were tested using independent t-test. Further statistical analysis (one-way ANOVA and Kruskall-Wallis test) were performed to determine significant differences across the four barangays. One-way ANOVA was used when test of homogeneity of variance was not significant which means the variances of the indicators were equal across the four barangays and satisfied the assumption for one-way ANOVA. When test of homogeneity of variance was found to be significant indicating unequal variances in the four barangays and violating the assumptions for one-way ANOVA, a Kruskall-Wallis test was then performed.

4.4.1 Descriptive statistics

4.4.1.1 Barangay San Miguel (co-management)

Table 4.8 presents the percentage, weighted score, mean, and standard deviation of management impact indicators in Barangay San Miguel. The calculated mean was further categorized into 3 levels: low, moderate, and high. The perceived level of indicators by respondents of this barangay is presented in Table 4.9.

Table 4.8 Descriptive statistics of management impact indicators in Barangay San Miguel

Management Impact Indicator	Percentage (%) of Respondents' Perception (n=30)					Weighted Score
	Strongly Disagree (1)	Disagree (2)	No Opinion (3)	Agree (4)	Strongly Agree (5)	
1. Participation (Mean = 3.48±0.84)						
a. Respondent's attendance in meetings of the community.	0	63.33	0	16.67	20	2.93
b. Respondent's share ideas and suggestions during meeting.	0	0	30	16.67	53.33	4.23
c. Respondent's participation in coastal clean-up.	10	26.67	0	37	27	3.43
d. Respondent's participation in mangrove planting activities.	0	20	0	50	30	3.9
2. Influence (Mean = 2.95±0.47)						
a. Respondent's involvement in planning activities related to mangroves.	0	36.67	0	10	53.33	3.80
b. Respondent's ideas and suggestions are taken into consideration in decision-making.	0	0	0	100	0	4
c. Residents are consulted first before project is implemented.	0	0	0	100	0	4
d. *Rules are made by the management and are presented to the barangay residents during meetings.*	0	0	0	20	80	1
e. *Activities are planned by the management and are presented to the barangay residents during meetings.*	0	0	0	0	100	1
3. Control (Mean = 4.09±0.77)						
a. Respondent's involvement in monitoring collection of mangrove goods.	0	20	0	53.33	27.67	3.87
b. Respondent notify the barangay head when he see illegal activities.	0	20	0	53.33	27.67	3.87
c. Respondent's think that community compliance improved because of his involvement in monitoring.	0	0	0	47	53	4.53
4. Access (Mean = 3.56±0.66)						
a. *We can do fishing anywhere in the mangrove forest.*	46.67	53.33	0	0	0	4.47
b. Only members of the people's organization do fishing activities.	53.33	16.67	0	30	0	2.07
c. *Anyone from the barangay can collect firewood and construction post.*	56.66	26.67	16.67	0	0	4.40
d. Only members of the people's organization collect firewood.	33.33	0	10	16.67	40	3.30
5. Collective Action(Mean = 4.04±0.86)						
a. There are many brgy. residents who join mangrove-related activities.	10	46.67	0	0	43.33	3.20
b. Barangay residents help one another to protect the mangrove forest.	16.67	0	0	20	63.33	4.13

Table 4.8 Descriptive statistics of management impact indicators in Barangay San Miguel **(cont.)**

c. The brgy. and local government can work together to protect mangrove forest.	0	0	0	23	77	4.77
d. The management is able to implement what has been agreed in the meeting.	0	0	36.67	20	43.33	4.07
6. Conflict Resolution Mechanism (Mean = 3.58±0.17)						
a. The management can resolve conflict immediately.	0	0	10	0	90	4.80
b. *There are incidences when conflicts cannot be resolved in the barangay level and has to be brought to the municipal level.*	0	0	10	46.67	43.33	1.67
c. The judgment made in resolving conflict is fair to all parties concerned.	0	0	0	100	0	4.00
d. *The penalty or fine imposed to violators is not enough to prevent further offences.*	0	0	46.67	20	33	2.13
7. Financial Resources (Mean = 4.07±0.54)						
a. The management has sufficient fund to manage the mangrove forest.	0	0	46.66	26.67	26.67	3.80
b. The management can generate its own financial resource for mangrove planting activities.	0	10	10	70	10	3.80
c. There is a fixed budget allocated for mangrove-related activities.	0	0	10	20	70	4.60
8. Capacity Building (Mean = 4.31±0.39)						
a. Do you join trainings related to sustainable mangrove resource use and management?	20	20	7	43.33	10	3.03
b. The trainings conducted are useful.	0	0	0	0	100	5
c. Respondent able to participate more to any activities after attending trainings.	0	0	0	80	20	4.20
d. Trainings are necessary in order to improve mangrove management.	0	0	0	0	100	5
9. Community Compliance (Mean = 4.83±0.30)						
a. *Respondent throw garbage on mangrove forest.*	100	0	0	0	0	5
b. Respondent use prescribed fishing gears.	0	0	0	0	100	5
c. *Respondent see other people perform illegal fishing.*	63.33	26.67	0	0	10	4.33
d. *Respondent see other people overharvest mangrove trees.*	100	0	0	0	0	5
10. Level of threat (Mean = 3.7±0.37)						
a. Mangrove fishery products are declining.	3	10	36.67	50	0	3.33
b. The mangrove trees are overharvested.	10	10	50	30	0	3
c. Typhoons frequently occur here.	0	16.67	0	50	33.33	4

Table 4.8 Descriptive statistics of management impact indicators in Barangay San Miguel **(cont.)**

d. *There are enough patrollers to monitor illegal activities.*	66.67	23.33	0	10	0	4.47
11. Ecological Knowledge (Mean = 3.69±0.66)						
a. Mangroves protect us from strong typhoons.	0	0	0	36.67	63.33	4.63
b. Mangroves provide shelter to migratory birds.	0	20	0	50	30	3.90
c. *Marine fishes will not be affected if mangroves are cleared.*	30	50	0	20	0	3.90
d. *It is better to convert mangroves to fishpond.*	73.33	0	16.67	0	10	4.27
e. *It is better to plant only Rhizophora species (bakawan) in the mangrove forest.*	33.33	20	46.67	0	0	3.87
f. Mangrove seedlings can grow on its own (without planting it manually).	70	20	0	0	10	1.60

Table 4.9 Level of management impact indicators in Barangay San Miguel (n=30)

Management Impact Indicators	Percentage of Respondents (%)		
	Low	Moderate	High
Participation	16.66	46.67	36.67
Influence	0	90	10
Control	0	20	80
Access	0	60	40
Collective action	0	26.67	73.33
Conflict resolution mechanism	0	56.67	43.33
Financial resources	0	20	80
Capacity building	0	0	100
Compliance	0	0	100
Threat	0	36.67	63.33
Ecological knowledge	6.67	23.33	70

Among the 11 management impact indicators, compliance and capacity building indicators have the highest level (Table 4.9). Table 4.8 indicates that all respondents in Barangay San Miguel do not throw garbage on mangrove forest nor use any illegal fishing gears. They also do not see other people overharvest mangrove trees. All of them believed that trainings conducted are useful and necessary in the

improvement of mangrove management. However, only 53% have joined trainings related to sustainable mangrove resource use and management.

Interestingly, this barangay perceived high level of threat. Ninety (90%) of the respondents believed that existing number of patrollers are not enough to monitor illegal activities. Eighty three (83%) agreed/strongly agreed that typhoons frequently occur in their place.

Other indicators that have high level were: control (80%), collective action (73.33%), financial resources (80%), and ecological knowledge (70%). Closer examination of respondents' ecological knowledge revealed that most of them know the importance of mangroves as barrier from strong typhoon and as habitat to migratory birds. However, a large percentage (73%) preferred conversion of mangroves to fishpond.

The high level of financial resources stemmed from the strong belief of respondents in the ability of management to generate its own funding for mangrove planting activities. Aside from this, 90% of respondents believed that there is a fixed budget allocated for mangrove-related activities.

4.4.1.2 Barangay Aporao (co-management)

The descriptive statistics of management impact indicators for Barangay Aporao is tabulated in Table 4.10. The level of each indicator as perceived by the respondents is presented in Table 4.11

Table 4.10 Descriptive statistics of management impact indicators in Barangay Aporao

Management Impact Indicator	Percentage (%) of Respondents' Perception (n=33)					Weighted Score
	Strongly Disagree (1)	Disagree (2)	No Opinion (3)	Agree (4)	Strongly Agree (5)	
1. Participation (Mean = 4.02±0.75)						
a. Respondent's attendance in meetings of the community.	9.09	0.00	9.09	60.61	21.21	3.85
b. Respondent's share ideas and suggestions during meeting.	0	18.18	21.21	30.30	30.30	3.73
c. Respondent's participation in coastal clean-up.	0	21.21	0	48.49	30.30	3.88

Table 4.10 Descriptive statistics of management impact indicators in Barangay Aporao **(cont.)**

d. Respondent's participation in mangrove planting activities.	0	0	0	39.39	60.61	4.61
2. Influence (Mean = 3.2±0.37)						
a. Respondent's involvement in planning activities related to mangroves.	0	57.58	33.33	9.09	0.00	2.52
b. Respondent's ideas and suggestions are taken into consideration in decision-making.	0	9.09	0	42.42	18.18	4.30
c. Respondents are consulted first before project is implemented.	0	9.09	0	42.42	18.18	4
d. *Rules are made by the management and are presented to the barangay residents during meetings.*	0	18.18	42.42	39.39	0	1.20
e. *Activities are planned by the management and are presented to the barangay residents during meetings.*	0	0	51.52	18.18	30.30	1
3. Control (4.02±0.86)						
a. Respondent's involvement in monitoring the harvest/collection of mangrove resources.	3.03	9.09	0	33.33	54.54	4.27
b. Respondent notify the barangay head when he see illegal activities done in mangrove forest.	3.03	9.09	0	33.33	54.54	3.87
c. Respondent's think that community compliance improved because of his involvement in monitoring.	0	9.09	51.52	18.18	21.21	4.53
4. Access (Mean = 3.83±0.74)						
a. *We can do fishing anywhere in the mangrove forest.*	18.18	81.82	0	0	0	4.18
b. Only members of the people's organization do fishing activities.	48.48	0.00	0	0	51.52	3.06
c. *Anyone from the barangay can collect firewood.*	30.30	69.70	0	0	0	4.30
d. Only members of the people's organization collect firewood.	18.18	9.09	0	21.21	51.52	3.79
5. Collective Action (Mean = 4.27±0.48)						
a. There are many residents in the barangay who join mangrove-related activities.	9.09	0	0	60.61	30.30	4.03
b. Barangay residents help one another to protect the mangrove forest.	9.09	0	0	51.52	39.39	4.12
c. The brngy and local government can work together to protect the mangroves	0	0	0	15.15	84.85	4.85
d. The management is able to implement what has been agreed in	0	0	0	90.91	9.09	4.09

Table 4.10 Descriptive statistics of management impact indicators in Barangay Aporao **(cont.)**

6. Conflict Resolution Mechanism (Mean = 3.64±0.71)						
a. The management can resolve conflict immediately.	0	9.09	51.52	21.21	18.18	3.48
b. *There are conflicts that cannot be resolved in the barangay level and has to be brought to the municipal level.*	9.09	0	0	81.82	9.09	2.18
c. The judgment made in resolving conflict is fair to all parties concerned.	0	0	0	48.48	51.52	4.52
d. *The penalty or fine imposed to violators is not enough to prevent further offences.*	9.09	18.18	24.24	24.24	24.24	2.64
7. Financial Resources (Mean = 4.38±1.05)						
a. The management has sufficient fund to manage the mangrove forest.	9.09	9.09	0	0	81.82	4.36
b. The management can generate its own financial resource for mangrove planting activities.	0	6.06	0	21.21	72.73	4.61
c. There is a fixed budget allocated for mangrove-related activities.	9.09	9.09	0	18.18	63.64	4.18
8. Capacity Building (Mean = 4.61±0.31)						
a. Do you join trainings on sustainable mangrove use and management?	9.09	12.12	15.15	33.33	30.30	3.64
b. The trainings conducted are useful.	0	0	0	0	100	5
c. Respondent able to participate more to any activities after attending trainings.	0	0	0	18.18	81.82	4.82
d. Trainings are necessary in order to improve mangrove management.	0	0	0	0	100	5
9. Community Compliance (Mean = 4.84±0.17)						
a. *Respondent throw garbage on mangrove forest.*	100	0	0	0	0	5
b. Respondent use prescribed fishing gears.	0	0	0	0	100	5
c. *Respondent see other people perform illegal fishing.*	69.70	30.30	0	0	0	4.70
d. *Respondent see other people overharvest mangrove trees.*	66.67	33.33	0	0	0	4.67
10. Level of threat (Mean = 2.55±0.61)						
a. Mangrove fishery products are declining.	63.64	18.18	0	15.15	3.03	1.76
b. The mangrove trees are overharvested.	36.36	27.27	0	15.15	21.21	2.58
c. Typhoons frequently occur in the area.	0	9.09	9.09	0	81.82	4.55
d. *There are enough patrollers to monitor illegal activities.*	0	0	0	33.33	66.67	1.33

Table 4.10 Descriptive statistics of management impact indicators in Barangay Aporao **(cont.)**

11. Ecological Knowledge (Mean = 3.69±0.52)						
a. Mangroves protect us from strong typhoons.	42.42	0	0	9.09	48.48	3.21
b. Mangroves provide shelter to migratory birds.	0	0	0	39.39	60.61	4.61
c. *Marine fishes will not be affected if mangroves are cleared.*	60.61	39.39	0	0	0	4.61
d. *It is better to convert mangroves to fishpond.*	30.30	9.09	18.18	9.09	33.33	2.94
e. *It is better to plant only Rhizophora species (bakawan) in the mangrove forest.*	30.30	18.18	33.33	0	18.18	3.42
f. Mangrove seedlings can grow on its own (without planting it manually).	39.39	0	0	9.09	51.52	3.33

Table 4.11 Level of management impact indicators in Barangay Aporao (n=33)

Management Impact Indicators	Percentage of Respondents (%)		
	Low	Moderate	High
participation	0	33.33	66.67
influence	0	96.96	3.04
control	6.06	12.12	81.81
access	0	48.48	51.52
collective action	0	9.09	91.91
conflict resolution mechanism	9.09	39.39	51.52
financial resources	9.09	9.09	81.81
capacity building	0	0	100
compliance	0	0	100
threat	45.45	51.52	3.03
ecological knowledge	0	48.48	51.52

Similar with Barangay San Miguel, which is also under co-management structure, Barangay Aporao entire respondents perceived high level of capacity building and compliance (Table 4.11). This 100% capacity building stemmed from their belief on the usefulness of trainings conducted. Eighty (80%) percent agreed and 20% strongly agreed that they participated more to activities after attending

seminars. Respondents in this barangay used prescribed fishing gears. They did not see any people breaking the rules for fishing and cutting mangrove trees.

Control had also high level. Eighty (88%) eight percent of the respondents were involved in monitoring collection of mangrove goods. Same percentage of respondents notified the management when they saw illegal activities done on mangrove forest. Half of the respondents, however, were not sure if their involvement had an effect on community's compliance.

Meanwhile, high level of collective action (91.91%) is based on their belief that many residents join mangrove-related activities and help one another to protect mangrove forest. They also believed that the barangay and municipal government can work together in protecting mangrove forest. Also, the management implemented what had been agreed in meetings.

Financial resource was perceived as high level by 81.81% of the Barangay Aporao respondents. Majority of the respondents believed that management has sufficient fund to manage the mangrove forest and can generate its own fund for mangrove planting activities.

Also, more than half of the respondents perceived high level on participation (66.67%), access (51.52%), conflict resolution mechanism (51.52%), and ecological knowledge (51.52%).

Influence was of moderate level. According to majority of the respondents, planning activities and rules were made by the management. Nonetheless, they are consulted first before project is implemented.

Only 3.03% perceived high level of threat. This suggests that mangrove forest is not exposed to many threats. They (64%) perceived that mangrove fishery products are not decreasing. Moreover, 33% agreed and 67% strongly agreed that patrollers are enough to monitor illegal activities.

4.4.1.3 Barangay Pilar (community-based management)

The percentage, weighted score, mean, and standard deviation of management impact indicators in Barangay Pilar are presented in Table 4.12. Samahan ng mga Mangingisda at Magsasaka ng Pilar (SAMMAKA) manages the mangrove forest in this barangay. The calculated mean of each indicator is presented in Table 4.13.

Table 4.12 Descriptive statistics of management impact indicators in Barangay Pilar

Management Impact Indicator	Percentage (%) of Respondents' Perception (n=37)					
	Strongly Disagree (1)	Disagree (2)	No Opinion (3)	Agree (4)	Strongly Agree (5)	Weighted Score
1. Participation (Mean =3.37±0.82)						
a. Respondent's attendance in meetings of the community.	16.21	10.81	43.24	18.92	10.81	2.97
b. Respondent's share ideas and suggestions during meeting.	16	32.43	37.84	5.41	8.11	2.57
c. Respondent's participation in coastal clean-up.	11	13.51	0	24.32	51.35	3.92
d. Respondent's participation in mangrove planting activities.	0	14	3	51.35	32.43	4.03
2. Influence (Mean = 3.11±0.57)						
a. Respondent's involvement in planning activities related to mangroves.	18.92	27.02	13.51	13.51	27.02	3.03
b. Respondent's ideas and suggestions are taken into consideration in decision-making.	0	0	10.81	59.46	29.73	4.19
c. Respondents are consulted first before project is implemented.	0	0	10.81	59.46	29.73	4.19
d. *Rules are made by the management and are presented to the barangay residents during meetings.*	0	0	10.81	35.14	54.05	1.57
e. *Activities are planned by the management and are presented to the barangay residents during meetings.*	2.70	8.11	0	29.73	59.46	1.65
3. Control (Mean = 4.13±0.43)						
a. Respondent's involvement in monitoring the harvest/collection of mangrove resources.	0	0	8.11	64.86	27.03	4.19
b. Respondent notify the barangay head when he see illegal activities done in mangrove forest.	0	0	8.11	64.86	27.03	4.19
c. Respondent's think that community compliance improved because of his involvement in monitoring.	0	0	5.41	29.73	64.86	4.00
4. Access (Mean = 2.86±0.53)						
a. *We can do fishing anywhere in the mangrove forest.*	35.14	56.76	2.70	5.41	0	4.22
b. Only members of the people's organization do fishing activities.	83.78	13.51	0	0	2.70	1.24
c. *Anyone from the barangay can collect firewood.*	43.24	56.76	0	0	0	4.43
d. Only members of the people's organization collect firewood.	78.38	5.41	0	13.51	2.70	1.57

Table 4.12 Descriptive statistics of management impact indicators in Barangay Pilar **(cont.)**

5. Collective Action (Mean = 3.68±0.62)						
a. There are many residents in the barangay who join mangrove-related activities.	18.92	16.22	0	62.12	2.70	3.14
b. Barangay residents help one another to protect the mangrove forest.	37.84	0	0	54.05	8.11	2.95
c. The brngy and local government can work together to protect the mangroves	2.70	0	0	54.05	43.24	4.35
d. The management is able to implement what has been agreed in the meeting.	0	0	8.11	56.76	35.13	4.27
6. Conflict Resolution Mechanism (Mean =3.22±0.47)						
a. The management can resolve conflict immediately.	0	43.24	24.32	16.22	16.22	3.05
b. *There are conflicts that cannot be resolved in the barangay level and has to be brought to the municipal level.*	0	0	29.73	64.86	5.41	2.24
c. The judgment made in resolving conflict is fair to all parties concerned.	5.41	2.70	13.51	45.95	32.43	3.97
d. *The penalty or fine imposed to violators is not enough to prevent further offences.*	0	24.32	32.43	0	43.24	2.38
7. Financial Resources (Mean = 3.42±0.74)						
a. The management has sufficient fund to manage the mangrove forest.	5.41	13.51	19	43	18.92	3.57
b. The management can generate its own financial resource for mangrove planting activities.	0	32.43	24.32	40.54	2.70	3.14
c. There is a fixed budget allocated for mangrove-related activities.	0	24.32	16.22	37.84	21.62	3.57
8. Capacity Building (Mean = 4.43±0.34)						
a. Do you join trainings on sustainable mangrove use and management?	0	43.24	35.13	8.11	13.51	3.22
b. The trainings conducted are useful.	0	0	0	0	100	5.00
c. Respondent able to participate more to any activities after attending trainings.	0	0	0	27.02	72.98	4.73
d. Trainings are necessary in order to improve mangrove management.	0	0	0	21.62	78.38	4.78
9. Community Compliance (Mean = 4.91±0.18)						
a. *Respondent throw garbage on mangrove forest.*	100	0	0	0	0	5.00
b. Respondent use prescribed fishing gears.	0	0	0	0	100	5.00

Table 4.12 Descriptive statistics of management impact indicators in Barangay Pilar **(cont.)**

c. *Respondent see other people perform illegal fishing.*	78.38	8.11	14	0	0	4.65
d. *Respondent see other people overharvest mangrove trees.*	100	0	0	0	0	5.00
10. Level of threat (Mean =3.57±0.42)						
a. Mangrove fishery products are declining.	5.41	2.70	10.81	27.02	54.05	4.22
b. The mangrove trees are overharvested.	29.73	62.16	10.81	2.70	0	1.81
c. Typhoons frequently occur in the area.	0	0	0	62.16	37.84	4.38
d. *There are enough patrollers to monitor illegal activities.*	32.43	45.94	5.41	10.81	5.41	3.89
11. Ecological Knowledge (Mean = 3.91±0.54)						
a. Mangroves protect us from strong typhoons.	0	0	2.70	29.73	67.57	4.65
b. Mangroves provide shelter to migratory birds.	0	13.52	2.70	51.35	32.43	4.03
c. *Marine fishes will not be affected if mangroves are cleared.*	32.43	51.35	2.70	13.52	0	4.03
d. *It is better to convert mangroves to fishpond.*	35.13	51.35	5.41	8.11	0	4.14
e. *It is better to plant only Rhizophora species (bakawan) in the mangrove forest.*	51.35	35.13	8.11	0	5.41	4.27
f. Mangrove seedlings can grow on its own (without planting it manually).	18.92	56.76	0	21.62	2.70	2.32

Table 4.13 Level of management impact indicators in Barangay Pilar (n=37)

Management Impact Indicators	Percentage of Respondents (%)		
	Low	Moderate	High
participation	10.81	40.54	48.65
influence	8.11	75.67	16.22
control	0	8.11	91.89
access	5.4	86.49	8.11
collective action	2.7	51.35	45.95
conflict resolution mechanism	5.4	78.38	16.22
financial resources	0	51.35	48.65
capacity building	0	0	100
compliance	0	0	100
threat	0	59.46	40.54
ecological knowledge	0	27.03	72.97

Table 4.13 indicates that similar to Barangays Aporao and San Miguel, Barangay Pilar also had high level of capacity building and compliance. Respondents in Barangay Pilar believed in the usefulness of trainings held. They had participated more to barangay activities after joining trainings although only 44% agreed/strongly agreed that they had joined trainings related to sustainable mangrove resource use and management (table 4.12). Forty (43%) percent did not attend such trainings. Most of the respondents (except for 14%) did not see illegal fishing activities but all agreed for non-occurrence of overharvesting mangrove trees.

Control (91.89%) and ecological knowledge (72.97%) also had high level in Barangay Pilar. Respondents in this barangay believed that there should be other mangrove species aside from Rhizophora spp. They (86%) do not prefer conversion of mangroves to fishpond and believed that marine fishes will be affected if mangroves are cleared. Majority of them knew that mangroves provide shelter to migratory birds.

Influence, access and conflict resolution mechanism were of moderate level. The rules and plans for activities are made by the management according to 89% of the respondents. When it comes to access over mangrove resources, 92% stated that fishing is not allowed anywhere in the mangrove forest. The management does not have capacity to resolve conflict immediately according to 43% Barangay Pilar respondents. Moreover, 70% of them stated that there are incidences when conflicts are brought to the municipal level because it cannot be resolved in their barangay.

4.4.1.4 Barangay Arnedo (community-based management)

Table 4.14 presents the descriptive statistics - percentage, weighted score, mean, and standard deviation of management impact indicators in Barangay Arnedo. Mangrove forest in this barangay is managed by Samahang Alay sa Kalikasan ng Arnedo (SAPA). The level of each indicator was categorized into low, moderate, and high (Table 4.15).

Table 4.14 Descriptive statistics of management impact indicators in Barangay Arnedo

Management Impact Indicator	Percentage (%) of Respondents' Perception (n=20)					
	Strongly Disagree (1)	Disagree (2)	No Opinion (3)	Agree (4)	Strongly Agree (5)	Weighted Score
1. Participation (Mean = 3.38±0.68)						
a. Respondent's attendance in meetings of the community.	0	30	35	35	0	3.05
b. Respondent's share ideas and suggestions during meeting.	15	5	60	20	0	2.85
c. Respondent's participation in coastal clean-up.	5	15	0	60	20	3.75
d. Respondent's participation in mangrove planting activities.	0	20	0	55	25	3.85
2. Influence (Mean = 3.24±0.48)						
a. Respondent's involvement in planning activities related to mangroves.	15	5	30	50	0	3.15
b. Respondent's ideas and suggestions are taken into consideration in decision-making.	0	0	15	65	20	4.05
c. Respondents are consulted first before project is implemented.	0	0	15	65	20	4.05
d. *Rules are made by the management and are presented to the barangay residents during meetings.*	0	20	10	70	0	2.50
e. *Activities are planned by the management and are presented to the barangay residents during meetings.*	0	0	0	100	0	2.00
3. Control (Mean = 3.93±0.77)						
a. Respondent's involvement in monitoring the harvest/collection of mangrove resources.	0	30	5	40	25	3.60
b. Respondent notify the barangay head when he see illegal activities done in mangrove forest.	0	30	5	40	25	3.60
c. Respondent's think that community compliance improved because of his involvement in monitoring.	0	0	5	30	65	4.60
4. Access (Mean = 2.59±0.39)						
a. *We can do fishing anywhere in the mangrove forest.*	40	15	0	45	0	3.50
b. Only members of the people's organization do fishing activities.	95	0	5	0	0	1.10
c. *Anyone from the barangay can collect firewood.*	80	15	5	0	0	4.75

Table 4.14 Descriptive statistics of management impact indicators in Barangay Arnedo **(cont.)**

d. Only members of the people's organization collect firewood.	0	25	5	40	30	3.75
5. Collective Action (Mean = 3.9±0.89)						
a. There are many residents in the barangay who join mangrove-related activities.	0	30	10	25	35	3.65
b. Barangay residents help one another to protect the mangrove forest.	0	25	0	40	35	3.85
c. The brngy and local government can work together to protect the mangroves	0	0	0	65	35	4.35
d. The management is able to implement what has been agreed in the meeting.	0	25	5	40	30	3.75
6. Conflict Resolution Mechanism (Mean = 3.26±0.35						
a. The management can resolve conflict immediately.	0	20	5	65	10	3.65
b. *There are conflicts that cannot be resolved in the barangay level and has to be brought to the municipal level.*	0	10	0	70	20	2.00
c. The judgment made in resolving conflict is fair to all parties concerned.	0	0	35	45	20	3.85
d. *The penalty or fine imposed to violators is not enough to prevent further offences.*	0	15	15	50	20	2.25
7. Financial Resources (Mean = 2.23±0.56)						
a. The management has sufficient fund to manage the mangrove forest.	15	55	30	0	0	2.15
b. The management can generate its own financial resource for mangrove planting activities.	10	65	25	0	0	2.15
c. There is a fixed budget allocated for mangrove-related activities.	10	60	10	20	0	2.40
8. Capacity Building (Mean = 4.14±0.40)						
a. Do you join trainings on sustainable mangrove use and management?	35	15	0	30	20	2.85
b. The trainings conducted are useful.	0	0	0	0	100	5.00
c. Respondent able to participate more to any activities after attending trainings.	0	10	15	50	25	3.90
d. Trainings are necessary in order to improve mangrove management.	0	0	0	20	80	4.80
9. Community Compliance (Mean = 4.65±0.52)						
a. *Respondent throw garbage on mangrove forest.*	100	0	0	0	0	5.00

Table 4.14 Descriptive statistics of management impact indicators in Barangay Arnedo **(cont.)**

b. Respondent use prescribed fishing gears.	0	0	0	0	100	5.00
c. *Respondent see other people perform illegal fishing.*	60	20	10	10	0	4.30
d. *Respondent see other people overharvest mangrove trees.*	60	20	10	10	0	4.30
10. Level of threat (Mean = 3.09±0.45)						
a. Mangrove fishery products are declining.	0	35	0	40	25	3.55
b. The mangrove trees are overharvested.	10	65	10	15	0	2.30
c. Typhoons frequently occur in the area.	0	15	10	55	20	3.80
d. *There are enough patrollers to monitor illegal activities.*	10	15	10	65	0	2.70
11. Ecological Knowledge (Mean = 3.75±0.53						
a. Mangroves protect us from strong typhoons.	0	0	0	35	65	4.65
b. Mangroves provide shelter to migratory birds.	0	20	0	55	25	3.85
c. *Marine fishes will not be affected if mangroves are cleared.*	20	0	55	0	0	2.65
d. *It is better to convert mangroves to fishpond.*	20	10	20	40	10	2.90
e. *It is better to plant only Rhizophora species (bakawan) in the mangrove forest.*	70	10	0	20	0	4.30
f. Mangrove seedlings can grow on its own (without planting it manually).	5	45	0	50	0	2.95

Table 4.15 Level of management impact indicators in Barangay Arnedo (n=20)

Management Impact Indicators	Percentage of Respondents (%)		
	Low	Moderate	High
participation	10	50	40
influence	5	80	15
control	0	30	70
access	40	60	0
collective action	0	30	70
conflict resolution mechanism	0	80	20
financial resources	50	50	0
capacity building	0	5	95

Table 4.15 Level of management impact indicators in Barangay Arnedo (n=20) **(cont.)**

compliance	0	10	90
level of threat	0	80	20
ecological knowledge	0	35	65

Table 4.15 shows that control, collective action, capacity building, compliance, and ecological knowledge had high level in Barangay Arnedo. The responses of Barangay Arnedo respondents to questions under capacity building and compliance were almost similar to other three barangays. With regards to collective action, 38% of the respondents in this barangay had strong negative perception on their co-residents's action regarding protection of mangrove forest. However, 99% believed that their barangay and municipal government can work together to protect it. Their level of ecological knowledge was also high. Majority of them knew the importance of mangroves to migratory birds and marine fishes. They all knew that mangroves can protect them from strong typhoons and more than one mangrove species should be planted.

Influence, access, and threat were of moderate level. The entire respondents perceived that activities are planned by the management and presented to them during meetings. Half of the respondents, however, stated that they are involved in planning mangrove-related activities. Seventy (70%) stated that rules are also made by the management. Nonetheless, they (85%) are consulted first whenever there is a proposed project involving mangrove conversion. Also, all of them believed that only members of the organization collected firewood although 95% believed that anyone from the barangay can do so. They perceived typhoons and declining fishery products as threat. Sixty (65%) of the respondents believed that fishery products are declining and 75% of them stated that typhoons frequently occur in their area.

This barangay is the only barangay in this study where half of its respondents perceived low level of financial resource. Seventy five (75%) percent of the respondents believed that their organization cannot generate its own fund for mangrove planting activities. Their organization has no sufficient fund for management according to 70% of them.

4.4.2 Comparison of management impact indicators between co-managed mangrove forests and community-managed mangrove forests

Management impact indicators were used to assess the impact of management to the local communities. Significant differences in management impact indicators between co-management and community-management structures were determined through independent t-test. The result of independent t-test is presented in Table 4.16.

Table 4.16 Independent t-test of management impact indicators

Management Impact Indicators	Mean score±Standard deviation		t	Significance (*p*-value)
	Bani	Bolinao		
participation	3.76±0.83	3.37±0.0.77	2.655	0.009
influence	3.08±0.43	3.15±0.53	-0.844	0.400
control	4.05±0.81	4.06±0.57	-0.043	0.966
access	3.70±0.71	2.77±0.50	8.261	0.000
collective action	4.16±0.69	3.75±0.73	3.153	0.002
conflict resolution mechanism	3.61±0.52	3.24±0.43	4.278	0.000
financial resources	4.23±0.76	3.01±0.88	7.713	0.000
capacity building	4.47±0.38	4.33±0.38	1.996	0.048
compliance	4.84±0.24	4.82±0.16	0.311	0.757
level of threat	3.10±0.77	3.40±0.49	-2.556	0.012
ecological knowledge	3.69±0.58	3.85±0.54	-1.559	0.122

Among the 11 indicators, 7 indicators, namely: participation (p=0.009), access (p=0.000), collective action (p=0.002), conflict resolution mechanism (p=0.000), financial resources (p=0.000), capacity building (p=0.048), and level of threat (p=0.012) were significantly different from each other. Municipality of Bani had significantly higher mean in all the seven indicators than Municipality of Bolinao (Table).

Further examination of differences in management impact indicators among barangays was determined through one-way ANOVA analysis and Kruskall-Wallis test. The Levene's F test for Equality of Variances revealed three management impact indicators satisfying assumption for homogeneity of variances: participation (F=1.056, p=0.371), capacity building (F=1.141, p=0.336), and ecological knowledge

(F=0.352, p=0.787). Thus, differences in the means of these three indicators were tested using one-way ANOVA analysis.

The result for one-way ANOVA analysis is presented in Table 4.17. Participation (p=0.006) and capacity building (p=0.000) were found to be significantly different across the barangays while ecological knowledge (p=0.339) was found not to be significantly different.

Table 4.17 One-way ANOVA for management impact indicators

Impact Indicators	Mean score				Significance (p)
	San Miguel	Aporao	Pilar	Arnedo	
participation	3.48±0.84^{ab}	4.02±0.75^{b}	3.37±0.82^{a}	3.38±0.68^{a}	0.006
capacity building	4.31±0.39^{ab}	4.61±0.31^{c}	4.43±0.34^{bc}	4.14±0.40^{a}	0.000
ecological knowledge	3.69±0.66	3.69±0.52	3.91±0.54	3.75±0.53	0.339

Note: Mean score that do not have same letter are significantly different from each other.

Participation was highest in Barangay Aporao and significantly different to Barangays Pilar and Arnedo. High level of participation can be attributed to their participation in meetings, coastal clean-up, and mangrove palanting activities.

Capacity building was highest also in Barangay Aporao but was significantly different to Barangay San Miguel and Arnedo. Capacity building was described in this study as the transfer of knowledge from trainings and seminars. This significant differences between Barangay San Miguel and Aporao (both co-management), was due to more respondents in Barangay Aporao had attended seminars than respondents in San Miguel. Barangay Arnedo has the lowest capacity building due to their lesser involvement in trainings. Excerpts of interview in Barangay Arnedo had these statements:

Interviewee # 6: "Only few residents joined seminars because of limited budget. Most of the time, it is same people who always attend seminars. Our organization is not active now. Most of us do not know how to run the organization since our ex-president had left already".

Kruskall-Wallis test was performed to other management impact indicators that did not meet the assumption for homogeneity of variance. Results of which are presented in Table 4.18. Differences in access (p=0.000), collective action (p=0.000), conflict resolution mechanism (p=0.000), financial resources (p=0.000), and level of threat (p=0.000), across the barangays were found to be statistically significant.

Table 4.18 Kruskall-Wallis test of management impact indicators

Management impact indicators	Mean Ranks				χ^2	Significance (p-value)
	San Miguel	Aporao	Pilar	Arnedo		
Influence	47.53	66.30	59.81	71.65	7.34	0.06
Control	64.37	61.21	58.77	56.73	0.74	0.86
Access	77.13	84.71	41.91	30.00	49.82	**0.00**
Collective action	64.47	74.88	45.19	59.15	13.40	**0.00**
Conflict resolution mechanism	72.80	76.58	44.74	44.68	23.49	**0.00**
Financial resources	71.88	87.59	50.31	17.58	57.95	**0.00**
Community compliance	61.42	54.50	69.19	52.95	5.77	0.12
Threat	84.65	27.24	77.42	47.85	56.93	**0.00**

Barangay Aporao and Barangay San Miguel have higher mean ranks than Barangays Pilar and Arnedo in all significant indicators except level of threat. Barangay Aporao perceived the lowest level of threat among the barangays while Barangay San Miguel perceived the highest level of threat. This contrasting/opposing perceptions between the two barangays having same mangrove forest and management structures can be attributed to the perceived amount of mangrove goods that respondents actually collected. Respondents in Barangay San Miguel believed that fishery catch is decreasing while only few Barangay Aporao respondents perceived this scenario.

Barangay Pilar had higher access, conflict resolution mechanism, financial resources and community compliance than barangay Arnedo. This low mean rank of Barangay Arnedo compared to Pilar was supported by excerpts from in-depth interview. Some of the statements were:

Interviewee #6: " We do not have enough funds for activities like coastal clean-up, mangrove replanting, monitoring, etc. Since the former president left his post, meetings are seldom held. Most of us do not know financial statements of our organization".

Surprisingly, Barangay Pilar had the lowest mean rank for collective action. This was contrary to the belief that those located in islands can generate more collective action because of the spatial limitations as compared to mainland barangays/communities (White & Vogt, 2000). Most of the time, people were eager to participate only at the start of project implementation according to one of the respondents. Excerpts from in-depth interview have similar statement:

Interviewee #5: "There were many residents who joined mangrove planting because sometimes they gave us money but when it comes to monitoring the planted mangroves, only few helped in removing barnacles because it is for free".

These results from one-way independent t-test, one-way ANOVA analysis and Kruskall-Wallis test indicated more positive impact of co-management over community-based management. In independent t-test, Municipality of Bani which is under co-management had significantly higher mean in seven indicators than Municipality of Bolinao which is under community-management, $p<0.05$. One-way ANOVA analysis revealed similar results: higher mean/mean ranks of 7 indicators were found for the barangays under co-management.

Contrary to the negative outcome of co-management in Magallanes, Agusan del Norte (Primavera and Esteban, 2008), positive outcome emerged from the partnership between Municipality of Bani and Bangrin Federation, Inc. in managing Bangrin mangroves. Lack of monitoring was the reason for failure of co-management in Agusan del Norte (Primavera and Esteban, 2008). In this study, regular monitoring was conducted by municipal government of Bani and people's organization which gave positive perceptions to respondents of co-management.

The respondents of co-management appreciated the financial and technical help of municipal agriculture office of Bani. Excerpts from in-depth interview revealed their appreciation:

Interviewee #3: "We can easily ask help from the municipal office when we have problem related to mangrove management".

Interviewee #4: "The mayor is fair in treating offenders. He does not give favorable treatment on his allies or friends of his friends".

Presence of other stakeholders in managing natural resources had been an issue in effective management since local communities tend to be mere followers of other stakeholders who are more dominant in managing (Agrawal and Gibson, 1999). In this study, the municipal government's intrusion into the management of mangroves brought positive light to the local communities. They were grateful for technical and financial support. Even for community managed mangrove forest, respondents believed that local communities and municipal government can work together.

Community-based management is not in itself an ineffective management structure as demonstrated in other studies (Maliao and Polohan, 2008; Pomeroy, Pollnac, Katon, and Predo, 1997). However, strong leadership capability of local community or people's organization is much needed in this management structure. It requires more collective action and participation from the members of local community in order to be more self-reliant. Albeit, the community leader should have strong authority over his members in order to demand such participation and collective action.

Other studies that employed management indicators had almost similar results. In Pomeroy, Pollnac, Katon, and Predo (1997), successful and less successful communities were evaluated using same management indicators. Community conflict resolution meachanism, compliance, influence and control were significantly different between the communities. Their study identified "early and continuous participation in project planning and implementation" as the cause for positive impacts perceived by the local communities on the project. Another study by Maliao and Polohan, compared

pre-project and post-project effects of mangrove rehabilitation project and found out that there were improvements in all indicators except access.

4.5 Multiple regression analysis of the relationship between direct use values and management impact indicators

Multiple regression analysis was performed to determine which of the impact indicators are significant in predicting direct use values of mangroves. A standard/simultaneous multiple regression method was selected since we are interested in examining the relationship between the whole set of impact indicators and the direct use values. The first regression performed identified one extreme outlier using the casewise diagnostics test. This outlier was found to be a case with high direct use values. Thus, a second regression analysis was run excluding this case. No more outlier was identified. Scatterplot showed scattered dots indicating that errors were normally distributed and variances of the residuals are constant. However, a problem with multicollinearity was detected with the variable "participation" having a low tolerance value of 0.33 (R^2=0.55). Examining its correlation with other independent variables revealed a high correlation with influence (r=0.581), control (r=0.551), and capacity building (0.511).

A third regression analysis was performed excluding the variable participation. Table 4.19 presents the results of the third and final multiple regression analysis.

Table 4.19 Regression of direct use values with management impact indicators

Independent variables	Direct Use Values of Mangroves				
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
influence	-1738	2318	-0.06	-0.75	0.45
control	4531	1585	0.24	2.86	0.01
access	-106	1525	-0.01	-0.07	0.94
collective action	-209	1250	-0.01	-0.17	0.87
conflict resolution mechanism	500	1760	0.02	0.28	0.78

Table 4.19 Regression of direct use values with management impact indicators **(cont.)**

financial resources	2959	1084	0.23	2.73	0.01
capacity building	9550	2954	0.28	3.23	0.00
community compliance	9168	3253	0.21	2.82	0.01
level of threat	-9761	1356	-0.48	-7.20	0.00
ecological knowledge	1914	2168	0.08	0.88	0.38
(Constant)	-62380	21730			
Number of observations (N)		119			
R^2		0.55			

The regression model accounted for a 55% variation in the direct use values. The predicted equation based on the results of the multiple regression analysis is:

Y = -62380 – 9761level of threat + 9550capacity building + 9168communtiy compliance + 4531control + 2959financial resources.

Five of the predictors confirmed the hypothesis in chapter 1. Level of threat was the highest predictor and was negatively related to direct use values.. Respondents who perceived low level of threat obtained high direct use values. This result can be seen in the pattern of level of perception of the respondents for threat (Table 4.21). Barangay Aporao, which has the highest mean direct economic benefits perceived low level of threat while eighty (80%) percent of Barangay Arnedo, (lowest mean direct economic benefits) perceived moderate level of threat and sixty (62%) percent of Barangay San Miguel (2^{nd} lowest mean direct economic benefits) respondents perceived high level of threat. This result suggests that as threat over mangrove resources increases, direct benefits will decrease

Capacity building has a significant positive relationship with direct use values. Referring to Table 4.17, most of the respondents perceived a high level of capacity building in their respective barangay and this maybe the cause for the high coefficient of capacity building (β=0.28). This positive relationship between capacity building and direct use values indicate that those respondents who believed that there is a high level of capacity building in their barangay were also the respondents who obtain high direct use values from mangroves. Respondents expressed that through

trainings, they were able to know more about mangroves. It encouraged them to participate more in mangrove-related activities. It also raised concern and awareness among them to further protect mangroves from destruction.

Community compliance is also a significant predictor and has positive relationship with DUV. This suggests that compliance to existing rules like not throwing garbage, using prescribed fishing gears and fishing methods can result to higher DUV

Financial resource also has a significant positive relationship with DUV. When respondent believed that they have sufficient funds and ability to generate own financial resources for mangrove planting activities, a high direct use values can be expected. This outcome is apparent only in Barangay Aporao and Arnedo but not in Barangay San Miguel as indicated in Table 4.15. Respondents in Barangay San Miguel may have perceived high level of financial resources similarly with their co-partner Barangay Aporao but did not obtained similar amount of direct economic benefits which may be due to far distance from the mangrove forest hindering the respondents from frequent collecting of mangrove resources.

All of the independent variables are important indicators that should be assessed in management. Surprisingly, participation was not included in the final model due to multicollinearity problem. This indicator was frequently one of the factors identified in successful implementation of projects and management of natural resources (Janiola, 1996; Pomeroy, Pollnac, Katon, and Predo, 1997; Ferrer and Nozawa, 1997; Pollnac and Pomeroy, 2005).

Based from the results of multiple regression analysis, threat, capacity building, control, compliance, and financial resources can significantly affect direct use values of mangroves. Although other indicators are important for effective management of mangroves, these 5 indicators should be given more attention as implied by the findings in this study.

Threat is the strongest predictor. Lack of patrollers, typhoons, and declining fishery products were the threats perceived by respondents. The need for additional patrollers in Municipality of Bani is not urgent compared to the need in Municipality of Bolinao. Municipality of Bolinao, particularly Barangay Pilar does not have regular patrollers and this was perceived by its respondents as threat to mangrove

resources. Apparently, solving the declining fishery products entails an effective management which encompasses the enhancement of all management impact indicators except threat. This involves integrated approach for ecological, social and economic aspect of management or the ecosystem approach. According to Convention on Biologigal Diversity (CBD), ecosystem approach aims for a healthy and sustainable environment balancing the prospects for environmental well-being and economic prosperity (Macintosh, Epps, and Abrenilla, 2010).

Previous studies had indicated the importance of capacity building in sustainable management of natural resources. Capacity building had high level in all barangays. However, data from in-depth interview revealed that trainings conducted to the community had focused on strengthening the people's organization. Respondents appreciated the importance of these trainings. It had encouraged them to participate more to mangrove-related activities. Nonetheless, survival of replanted mangroves was still a problem to the management. This can be addressed by conducting trainings that focuses on techniques of mangrove replanting and maintenance. Basic ecological concepts should also be included specially information on suitability of species with different kinds of substrate. Inappropriate species and site selection had been one of the causes for failure of mangrove rehabilitation (Primavera and Esteban, 2008).

Control over mangrove resources can be more enhanced through involvement of local community members in patrolling and monitoring. According to Pomeroy, Parks, and Watsons (2004), involvement in such activity increases sense of ownsership which in turn, can result to proper utilization of natural resources.

Community compliance can also positively affect direct use values. The four barangays had exhibited high level of community compliance through, using prescribed fishing gears and not throwing garbage. They also did not see other people committing illegal fishing or cutting mangrove trees. This manifested high level of compliance was despite of occasional occurrences of illegal fishers caught by the Bantay Dagat Patrollers. However, according to patrollers, they are residents of other barangays. In this case, a wider network of of management is needed to address this issue. As suggested in the study by Maliao and Polohan (2008), baywide management council is needed to address illegal fishing and other transboundary issues. This council is an integrated council between or among municipal governments sharing

same body of water that aims “to catalyze collective action and cohesive plan of action for the whole bay. The municipalities bordering the Lingayen Gulf can also adopt this management strategy.

Other option to address illegal activities in mangrove forest is by increasing the penalties in such a way that people will think twice before committing any illegal activities. Penalties for such offenses are applicable to all, irrespective of the barangay or municipality of their residence.

Many studies had also indicated lack of fund as deterrent in effective management. It is widely understood that any activity needs sufficient fund. When organization lacks financial resources, many activities will be impaired. In mangrove management, it is mangrove planting that often have budget. However, regular maintenance activities are often left unbudgeted. According to Lewis (2005), newly planted mangroves are prone to barnacle infestations and they need regular caretaker to handle this problem. Regular caretakers should of course be given incentive since their full time is required in doing the job. Only few community members will volunteer to this kind of activity as in the case of Barangay Pilar.

CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

This research aimed to assess and compare direct use values and management impact indicators of co-managed and community-based managed mangrove forests. The relationship between direct use values of mangroves and management impact indicators were also determined. Conclusions on the hypotheses, answers on research questions, limitations of the study, and recommendations for management and future studies are presented in this chapter.

5.1 Assessment and comparison of direct use values of mangroves

Mangrove forests provide high direct economic benefits to local communities. The study estimated direct use value of mangroves to be 266,120 to 976,700 PHP/year. This also indicates that mean annual direct economic benefits that respondents obtained from mangroves were: 13346 PHP/hh/yr (Barangay San Miguel), 29,597 PHP/hh/yr (Barangay Aporao), 24,748 PHP/hh/yr (Barangay Pilar), and 13,306 PHP/hh/yr (Barangay Arnedo). The mangrove goods assessed, comprised mainly of fishery products, are vital sources of income for most of the households.

Results of the independent t-test revealed no significant difference in the direct use values of mangroves between the municipalities of Bani (co-management) and Bolinao (community-based management). On the other hand, a one-way ANOVA analysis for the means of direct use values of mangroves across the four barangays (of the two municipalities) revealed significant differences. This implied that the differences in the management structures among smaller political units affected the direct use values of mangroves. However, there is no clear conclusion on the effectiveness of co-management and community-based management based on direct use values alone. Apparently, ranking of direct use values of mangroves in the four barangays were not consistently related to type of management structures. This can be

observed on the ranking of direct use values among the four barangays where Barangay Aporao, is the highest; Barangay Pilar, the second; Barangay San Miguel, the third; and Barangay Arnedo, is the lowest. Mangroves in Barangay Aporao and San Miguel are both under co-management while mangroves in Barangay Pilar and Arnedo are both under community-based management.

These differences can be attributed to proximity to mangrove forest and dependency on mangrove goods for livelihood. Data from field observation shows that Barangay Aporao is nearer to the mangroves than Barangay San Miguel. This gave them easy access in gathering mangrove goods. The socioeconomic data revealed that respondents of Barangay Aporao were more engaged to fishery activities than respondents of Barangay San Miguel. Obviously, lesser time and frequency in gathering mangrove goods can result to lower direct economic benefits.

Barangay Pilar's mangroves has the second highest direct use values and is managed by the local communities through the people's organization SAMMAKA. Unlike Bani municipality who employed Bantay Dagat to monitor the mangrove forest, Bolinao municipality does not have. In Barangay Pilar (Bolinao Municipality), one person persistently monitors the area without being mindful of financial remunerations from this action. This could have an effect on the good health of the mangroves and thus, on the direct use values. On the other hand, mangroves in Barangay Arnedo (Bolinao Municipality) which is managed by people's organization SAPA, does not have a regular volunteer patroller like Barangay Pilar and it has the lowest direct use values of mangroves among four barangays.

5.2 Analysis of management impact indicators

There were significant differences in the seven management impact indicators, namely: participation, access, collective action, conflict resolution mechanism, financial resources, capacity building and threat, between co-managed and community-managed mangrove forests. Results of statistical analyses revealed higher mean/mean ranks of the 7 indicators in co-management than community-based management structure. This indicates that co-management has more positive impact to the local communities than community-management.

Several factors had been identified on the disparities between co-management and community-based management. First and foremost, community management requires strong leadership. The community leader has crucial role in invoking participation and collective action among his members. It is the leader who represents the community and whom members regard as someone who has higher authority to lead them. Transparency is another important aspect in management. Trust in the organization and in its leaders can be attained when members see transparency in the administration. Especially in a small community and organization, slight dishonesty perceived by members onto the management/administration can spread like fire throughout the whole community which poses havoc and disentanglement of the organization.

Second, local communities who were granted CBFMA to manage natural resources on their own should be self-reliant and self-sufficient. This means not having too much dependence on other stakeholders for financial and technical support. However, what usually happen is there's always lack of financial and technical capabilities in the management. It takes time to ask for this kind of assistance from other stakeholders such as NGO, local government, and national government. In co-management, it is much easier because other stakeholders are already part of the management and are aware of the problem/needs.

Third, co-management can only be effective if there is closer coordination and equitable sharing of benefits and responsibilities between/among stakeholders. Regular meetings and monitoring ensure awareness of the local situation and contributes to closer relationship between/among stakeholders. Whenever there is national recognition/award, all stakeholders have their own representative to receive such award. In this study, co-management has advantages in terms of financial resources since it is the municipal government who holds the budget for the entire municipality. It is up to their discretion how much budget should be allotted to each sector (health, mangroves, upland forest, etc.)

5.3 Relationship between direct use values and management impact indicators

Results of multiple regression analysis revealed that control, capacity building, financial resource and community compliance had significant positive relationship with direct use values whereas threat had significant negative relationship with direct use values. The results suggest more focus should be given on activities influencing control, capacity building, financial resource, community compliance and threat.

5.4 Limitations of the study

The study focused only on the members of people's organization where most of them benefitted from mangrove goods. The calculated direct use values may be positively skewed since only members were included for sampling. In-depth interview stressed that non-members can also gather mangrove goods. However, difficulty in soliciting the participation of non-members was encountered during the data collection due to negative perception of non-members towards the topic of the interview. They immediately said that they do not obtain income from mangroves. This limitation can be dealt by going back to the houses of non-members with a Barangay Official and a non-member who can properly explain the purpose of the study.

Mangrove goods inquired were only the average catch for the last two years. The number of barangays studied and evaluated was limited to four due to financial and time constraints.

5.5 Recommendations for mangrove management

While community-based management had been adopted worldwide in order to give local communities bigger roles in managing natural resources, co-management has also similar objective but with the inclusion of other stakeholders in management.

There is no clear conclusion on the effectiveness of co-management over community-based management on the basis of direct use values of mangroves alone because of other factors affecting direct use values. However, when perceptions of respondents on management impact indicators are taken into consideration, these manifested the advantages of co-management over community-based management. The respondents of Barangay San Miguel and Aporao have more positive perceptions on the management impact indicators than the other two barangays which adopted community-based management. In the seven (out of 11) management impact indicators having significant differences across the four barangays, Barangay Aporao and San Miguel consistently had higher level of management impact indicators than the other two barangays except for participation and threat indicators.

These results suggest that co-management has positive feedback on the respondents. Even though Barangay San Miguel respondents did not benefit much from the mangrove forest, still, they had high regard on the management. This can be attributed to the support felt and observed by respondents from the municipal government.

Based on in-depth interviews with key persons from four barangays, they all agreed that it is better if other stakeholders will support them in managing the mangroves particularly through financial assistance. They were grateful of the trainings conducted in the past because it had raised their awareness on the importance of mangroves in their lives and environment. However, they admitted that it is difficult to manage on their own because of financial constraints and other factors like loss of interest when there are no activities that can give them money. In the case of Barangay Pilar, one respondent said that residents were only active in participating when they get revenues from participation. Residents will join mangrove planting, however, only few will volunteer to monitor the planted mangroves.

Based from these results, it is recommended that in both management structures, regular activities in mangroves should be maintained in order to sustain the interest of people in taking care of the mangroves. Coastal clean-up, mangrove planting, meetings, and other programs are activities that can be a venue for residents to raise more awareness and concern, and encourage more participation for the improvement of management towards healthy mangrove forests. In addition, the

management especially the people's organization should have a strong leadership capabilities. It is up to the people to choose the right leader for their organization.

Municipal government should always have an active collaboration with the people's organization. In this way, some of the constraints experienced by the people's organization can be filled up by the municipal government. Financial support will always be of great help to them. Since municipal governments hold the budget for the entire municipality, they are also responsible for allocating these funds to various activities within the municipality. Thus, the municipal government can employ people to regularly monitor mangrove forests, provide financial support in activities, impart information, etc.

Capacity building is also important for the local communities. Trainings had been useful as expressed by the respondents. However, they were not able to attend all trainings due to limitations on the number of participants. In this case, those who were able to join trainings should have a re-echo once they get back to their community in order that other people can also learn new ideas and skills. Since number of participants in most training were limited, it would also be helpful if there is a rotation among residents in attending such trainings and seminars. In this way, knowledge and skills in mangrove management will not be limited to only few residents. Other ways to disseminate new knowledge is by posting training documents to the barangay hall, a place for barangay meetings and where residents come to request documents, assistance, etc.

It is also suggested that future trainings should focused on techniques and ecological concepts of mangrove replanting and rehabilitation. Based on in-depth interview and field observation, many newly planted mangroves did not survive. They blamed it on typhoon. However, it was observed that there were also many algae on the replanted area. In an assessment study by Primavera and Esteban (2008), of mangrove rehabilitation in Philippines, inappropriate species in selected sites was the major reason for low survival of newly planted mangroves. Other causes were algae, barnacle, and pest infestation due to lack of monitoring.

To ensure high survival rates, the local community can work together with stakeholders assisting them in mangrove planting activities. The local community knows previous species that thrives in the area whereas environmentalists, NGOs,

academe, and local government can impart new techniques, identify the substrate of selected site, assess suitability of species to the substrate and provide logistical support. According to Melana, Melana, and Mapalo (2000), and Primavera and Esteban (2008), Avicennia and Sonneratia Alba are natural colonizers that should be planted on the seaward side. Rhizophora spp., which is preferred species in most mangrove planting projects, thrives on the middle to high intertidal areas or on the sheltered part of fringe mangroves.

Moreover, capacity building entails not only knowledge and awareness, but also behavioral changes. Behavioral changes will depend more on the priorities of the people. Some people are already aware of the negative consequences of illegal fishing and illegal logging, but still, they continue doing it for financial reasons. It is suggested that alternative livelihoods be provided to the local communities. There were alternative livelihoods established before such as goat raising, sardine making, and oyster culture but all had failed to flourish. The reasons for these failures had not been studied or investigated. The stakeholder who provided these alternative livelihoods can conduct in-depth study to investigate problems encountered and provide solution and cautionary measures for future projects.

Low compliance to rules like illegal fishing and logging can also be addressed by implementing higher fines for violations, and employing more patrollers. When violators caught are residents of other barangays/municipalities, it is difficult for the aggrieved barangay to punish the violators even though ban for illegal fishing applies to entire country. Creation of baywide management council can better tackle this issue. It will not only minimize illegal activities but will also serve as platform to address other transboundary issues.

The established “Bolinao Provincial Mangrove Information Center and Nursery” is near the mangrove forest of Barangay Arnedo. Since there is a current problem on the management of the people’s organization in Barangay Arnedo, the Center can help the organization in maintaining and monitoring the mangrove forests. Similar to Bani municipality where Bani residents were employed as “Bantay Dagat” to guard the premises of the forest, the Center can also do this to Barangay Arnedo.

5.6 Recommendations for further studies

1. Direct use values constitute a small percentage of the total economic value of mangroves. Future studies should aim to assess the total economic value of mangroves in order that strong justification can be garnered for its conservation and sustainable development policies.

2. The study assessed and compared direct use values between two different management structures. But no clear conclusion can be obtained on the effectiveness of one management structure over the other based on the direct use values alone. It is recommended for future studies to include more municipalities in order to depict the effects of differences in management structures.

3. The management impact indicators revealed significant differences among the four barangays and significant relationship with direct use values. However, there are still other factors to be considered in the comparison. Thus, it is recommended for future studies that research should be conducted in different mangrove forests having similar management structures and identify the factors (i.e. socioeconomic, geographic and management) affecting direct use values. Aside from management impact indicators, this study identified dependence to mangrove resources and proximity to mangrove forest as factors affecting the direct economic benefits obtained by respondents. Likewise, inclusion of total monthly income of household in questionnaire will help determine the percentage constituted by mangroves' direct use values in the household's total income.

4. The 5 indicators (threat, control, capacity building, compliance and financial resources) having significant relationship with direct use values needs in-depth study.

5. The carrying capacity of mangroves needs to be studied to ensure sustainable resource utilization. Also, the economic needs of the local communities should be integrated in the management strategy. Applicability of semi-intensive aquaculture, intensive aquaculture, conservation, and other management strategies depend on the local ecological and socio-economic settings which needs further investigation.

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APPENDICES

APPENDIX A
SURVEY QUESTIONNAIRE FOR HOUSEHOLD INTERVIEW

This survey questionnaire is used to interview the household heads who are members of the barangays within the municipalities of Bani and Bolinao, Pangasinan in order to estimate the direct economic benefits obtained from mangrove forests in the two municipalities. The respondent's identity and valuable information will be kept confidential. The questionnaire is set into four parts. This survey is conducted by Ms. Margie Gianan, in partial fulfillment of M.Sc. Natural Resource Management, Faculty of Environment and Resource Studies, Mahidol University, Thailand.

I. DEMOGRAPHIC INFORMATION

1. Respondent Number …….
2. Barangay : …….3. Municipality…….
4. Yrs. of residence: ……5. Marital Status: ☐ Single ☐ Married ☐ Separated
6. Age …… 7. Gender ☐ M ☐ F
8. Education Level: ☐ Elementary ☐ High School ☐ College ☐ others……..
9. Ethnicity: ……..
10. Major Occupation of HH head : ……
    How many years have you done this occupation? ……...
11. Secondary Occupation : ……
12. Other occupation : ……
13. Member of people's organization : Yes No
    If yes, name of organization ……
14. Household members involved in collecting mangrove resources:

Position	Occupation	Time spent (hrs/day)		
		(hrs/day)	(day/week)	(week/month)

II. ECONOMIC ACTIVITIES

1. Fishery products collected from mangroves during dry season (Dec-May):

Fishery Products	Species	Quantity (kg/day)	Price (PHP/kg)	Frequency of catch	
				(days/week)	(week/month)
1. Fish	a.				
	b.				
	c.				
	d.				
	e.				
	f.				
2. Mollusks	a.				
	b.				
	c.				
3. Crabs	a.				
	b.				
	c.				
4. Shrimps	a.				
	b.				
	c.				

2. Fishery products collected from mangroves during wet/rainy season (Jun-Nov):

Fishery Products	Species	Quantity (kg/day)	Price (PHP/kg)	Frequency of catch	
				(days/week)	(week/month)
1. Fish	a.				
	b.				
	c.				
	d.				
	e.				
	f.				
2. Mollusks	a.				
	b.				
	c.				
3. Crabs	a.				
	b.				
	c.				
4. Shrimps	a.				
	b.				
	c.				

3. Cost of fishing gear used in collecting mangrove products:

Fishing gear	Cost	Material life
Gill net		
Hook and line		
Dip net		
Square dip		
Motor boat		
Others (specify)		

4. Do you use motorized boat when fishing in mangroves?

☐ Yes ☐ No

How much do you pay for fuel per fishing day? _____ (PHP/day)

5. Other mangrove products collected:

Other products	Firewood	Charcoal production	Construction wood	Nipa shingles	Nipa fruit	Handicrafts	Others
Unit	bundle	bag	post	per 100pc	per piece	per piece	
Quantity (unit/day)							
Price (PHP/unit)							
Frequency of collection/ production:							
hrs/day							
days/week							
week/month							
month/year							
Tools used in collecting							
Price of tool (PHP)							
No. of workers involved							

6. Are you involved in guiding tourists within mangrove forest?

☐ Yes ☐ No

On what month do you have many guiding tours activity (peak season)?

_____

7. Earnings in guiding tourists:

Peak season:			
Earnings per day	Time spent		Fuel used per day (Liters/day)
	(days/week)	(weeks/month)	

Off-peak season:			
Earnings per day	Time spent		Fuel used per day (Liters/day)
	(days/week)	(weeks/month)	

8. Aside from the boat you used in guiding tours, do you have other boat for rent which is used in guiding tours?

Number of boat	Rent per boat	Frequency of rental (days/week)	Fuel used per boat (Liters)

9. Do you have other sources of income from mangrove forest aside from the livelihood (fishing, wood gathering, tour guide, boat rental) you mentioned earlier? _____. If yes, what is it? _____. How much do you earn from this per month? On what month/s do you do this?

_____

III. Perception Towards Mangrove Management

Impact Indicator	Items	Opinion				
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Influence	**1. Whenever there is proposed project involving mangrove conversion, community members are consulted first before project is implemented.**					
Access	**2. We can do fishing anywhere in the mangrove forest.**					
Access	**3. Anyone from the barangay can collect firewood and construction post.**					
Collective action	**4. There are many residents of the barangay who join mangrove-related activities.**					
Collective action	**5. Barangay residents help one another to protect the mangrove forest.**					
Influence	**6. Rules are made by the management and are presented to the barangay residents during meetings.**					
Influence	**7. Activities are planned by the management and are presented to the barangay residents during meetings.**					
Collective action	**8. The barangay and municipal government can work together to protect the mangrove forest.**					
Collective action	**9. The management is able to implement what has been agreed in the meeting.**					
Level of threat	**10. There are enough patrollers to monitor illegal activities.**					
Conflict resolution	**11. The management can resolve conflict immediately.**					
Conflict resolution	**12. There are incidences when conflicts cannot be resolved in the barangay level and has to be brought to the municipal level.**					
Conflict resolution	**13. The judgment made in resolving conflict is fair to all parties concerned.**					
Conflict resolution	**14. The penalty or fine imposed to violators is not enough to prevent further offences.**					
Threat	**15. Mangrove fishery products are declining.**					

III. Perception Towards Mangrove Management (cont.)

Impact Indicator	Items	Opinion				
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Threat	**16. The mangrove trees are overharvested.**					
Threat	**17. Typhoons are frequent to occur in the area.**					
Financial resources	**18. The management has sufficient fund to manage the mangrove forest.**					
Financial resources	**19. The management can generate its own financial resource for mangrove planting activities.**					
Financial resources	**20. There is a fixed budget allocated for mangrove-related activities.**					
Capacity building	**21. Trainings are useful in sustainable mangrove resource use and management.**					
Capacity building	**22. Trainings enable me to participate more to any activities after attending trainings.**					
Capacity building	**23. Trainings are necessary in order to improve mangrove management.**					
Ecological knowledge	**24. Mangroves provide shelter to migratory birds.**					
Ecological knowledge	**25. Marine fishes will not be affected if mangroves are cleared.**					
Ecological knowledge	**26. It is better to convert mangroves to fishpond.**					
Control	**27. Do you think that community compliance improved because of your involvement in monitoring?**					
Ecological knowledge	**28. Mangroves protect us from strong typhoons.**					
Ecological knowledge	**29. It is better to plant only Rhizopora species in the mangrove forest.**					
Ecological knowledge	**30. Mangrove seedlings can grow on its own (without planting it manually).**					

IV. Behavior Towards Mangrove Management

Impact Indicators	Items	Action				
		Never	Seldom	Occasionally	Frequently	Always
Participation	**1. Do you attend meetings of the community?**					
Participation	**2. Are you involved in planning mangrove-related activities?**					
Participation	**3. Do you join coastal clean-up?**					
Participation	**4. Do you join mangrove planting activities?**					
Capacity building	**5. Do you join trainings/workshops related to mangrove resource use and management?**					
Influence	**6. Do you share ideas and suggestions during meeting?**					
Influence	**7. Does your ideas and suggestions taken into consideration during decision-making?**					
Control	**8. Are you involve in monitoring the harvest/collection of mangrove resources?**					
Control	**9. Do you notify the barangay head when he see illegal activities done in mangrove forest?**					
Compliance	**10. Do you throw garbage on mangrove forest?**					
Compliance	**11. Do you use prescribed fishing gears?**					
Access	**12. Only members of the people's organization do fishing activities**					
Access	**13. Only members of the people's organization collect firewood and construction post.**					
Compliance	**14. Do you see other people perform illegal fishing?**					
Compliance	**15. Do you see other people overharvest mangrove trees?**					

APPENDIX B
KEY QUESTIONS FOR IN-DEPTH INTERVIEW FOR HEAD OF PEOPLE'S ORGANIZATION

Respondent Code:……...
Designation:……..
Mandates/responsibilities:…….

1. Are there regular meetings held with the barangay residents? What is the percentage of attendance? What do you think is the reason for less/high attendance?
2. How many members do you have in your organization?
3. How was the people's organization formed?
4. Are residents active in sharing their ideas and suggestions?
5. Do many barangay residents join whenever there are mangrove-related activities?
6. Is it better if only officers are involved in planning activities? Why or why not?
7. Are rules and regulations strictly followed? Why or why not?
8. Is there an area where collecting mangrove resources is strictly prohibited?
9. What are the threats to mangrove encountered by the community? How did the community respond to this?
10. Do you think that your barangay needs outside help to protect the mangroves? What is the kind of assistance needed?
11. When you ask for assistance, how does the agency respond to your request?
12. What do you think of the trend of the mangrove fishery products for the past ten years? Is it decreasing/increasing/same? Why decreasing/increasing/same?
13. Where does the barangay get the funds to support the management activities of mangrove forests?

14. Is there a need to train the residents which is related to mangrove use and management? Why or why not? What is the specific topic you can suggest for training?

APPENDIX C
KEY QUESTIONS FOR IN-DEPTH INTERVIEW FOR DIVISION CHIEFS OF MUNICIPAL PLANNING AND DEVELOPMENT OFFICE

Respondent Code:……...
Designation:……..
Mandates/responsibilities:…….

1. What is the agency's role in protecting the mangroves?
2. What had been the agency's past projects related to mangrove management? Did it involve local community's participation? How would you rate their participation?
3. Is there a fixed budget allocated for mangrove-related activities? How much?
4. What do you think of the management? Do you think the local communities can manage by themselves? Why or why not?
5. What are the terms and conditions between the municipal government and the local community in terms of mangrove management?
6. Are there instances when conflicts on mangrove resource use are brought into the municipal level? How often?
7. Are there trainings conducted to the local communities regarding mangroves? How would you rate the level of participation? Why?

BIOGRAPHY

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