Will Mangrove Reforestation Provide Net Benefits: A Case in Sibunag, Guimaras[1]

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ABSTRACT

In response to the threats in mangrove resources such as massive fishpond conversion, industrialization, and increased human settlements in coastal areas, the province of Guimaras answered these threats by widespread mangrove reforestation projects in its coastal communities. These projects were found out to be beneficial, as depicted on large gap on the mangroves overall benefits and the costs of implementation of the mangrove reforestation project. Results of the study show that the present total benefit of mangrove per hectare with sustainable harvesting in the first year is lesser than the costs. However after the first year, the net benefits are positive. However, in compliance with Republic Act 7161 (R.A. 7161) that banned the cutting/using of all mangrove species, cost-benefit analysis of mangrove reforestation without harvesting was also computed. The net benefits exceed the costs from the start of the year up to the 20th year. Both the scenarios include the Mean WTP equivalent to PhP 142.75, which is the amount people are willing to give for the conservation of mangroves. The net present values (net benefits) of mangrove reforestation were found positive for both scenarios: with sustainable harvesting and without harvesting.

Key words: mangroves, mangrove reforestation, total economic value, contingent valuation method, willingness to pay, cost-benefit analysis

INTRODUCTION

Mangroves is a community of intertidal plants including all species of trees, shrubs, vines and herbs found on coast, swamps, or border of swamps (Melana, et al., 1998). In the past, mangrove areas were regarded as wastelands that should be reclaimed for better economic purposes. Through the years, however, science has revealed that mangrove ecosystem is not a wasteland but rather an area with high natural productivity in terms of plant growth and all associated organisms. The diversity of the mangrove ecosystem can be seen through the abundance of species of flora and fauna. About a quarter of the 18 million hectares of mangroves are found in Southeast Asia. The Philippines with its 18,000 kilometer-shoreline, has a mangrove area of about 500,000 hectares in at the early 1990s but has shrunk to 117,700 in 1993. In Guimaras Island, the total number of mangrove cover has declined to 395.6 hectares in year 1990s. There is no record of the province's previous number of hectares but a map of the Bureau of Coast and Geodetic Survey (BCGS) in 1956 noted extensive mangrove areas in the southern region of the province (Babaran and Ingles, 1997).

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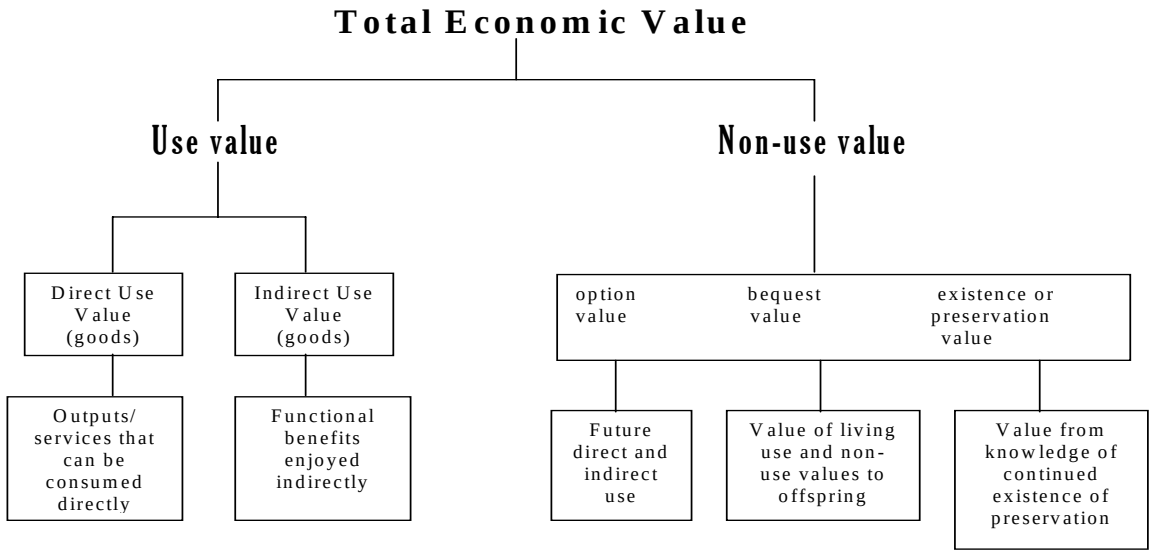

Figure 1. Total Economic Value of Natural Resources Source: White and Trinidad (1998)

There has been a continuing decline of mangrove areas not only in the world but also in the Philippines. Even in the province of Guimaras, substantial decrease of mangrove cover is noted. Main reasons for this decline are the following: clearing of mangrove areas for fishpond and other aquaculture purposes, industrialization, and increase of population. People go for their short-term benefits by exploiting mangroves i.e. cutting for timber use, and not for the trees' long term benefits. In response to the threat to mangroves, conservation must be considered.

One way to conserve and preserve the mangrove ecosystem is through reforestation. In planting mangrove seedlings/propagules, it could restore the ecosystem, gaining benefits from an increase in fish catch to coastal protection. The main problem was people do not realize or are not aware that mangroves can provide huge net benefits. Considering the efforts and costs involved, sustaining mangrove reforestation is not an easy task. The coastal community as project implementers can just weaken their commitment considering that benefits from mangrove reforestation will be reaped after several years yet.

This paper examined the costs and benefits of mangrove reforestation projects in three coastal barangays in Sibunag, Guimaras, namely, Bubog, Sabang, and Sebaste. Cost-Benefit Analysis (CBA) of mangroves resources was computed in two scenarios: with sustainable harvesting and without harvesting.

COSTS AND BENEFITS OF MANGROVE REFORESTATION

The mangrove ecosystem is an open-access resource. According to Field (1996), open access resource is a resource or facility that is open to uncontrolled access by individuals who wish to use the resource. It is important, therefore to know the values of these resources. The total economic value (TEV) of the natural resource composes of the use and non-use values (Figure 1).

White and Trinidad (1998) defined use values as one that measures the consumptive value (direct use values) of tangible natural resources as well as non-consumptive (indirect use values) ecological and recreational uses of natural resources. Use value can be classified as direct use value ("goods") and indirect use value ("services"). The former can be outputs or services that can be consumed directly while the latter can be functional benefits enjoyed directly. On the non-use value side, there are three classifications: (i) option, (ii) bequest and (iii) existence or preservation values. The first one refers to the future direct and indirect use of the natural resource. The second one pertains to how much the present generation values the use and non-

use values of the resource for their offspring. Lastly, the third classification is the value from knowledge of continued existence of preservation.

Since non-use values are intangible, this posits difficulties to measure the true (or total economic) value of a natural resource. Thus, some valuation techniques have evolved to measure and capture non-use values of natural resources. In this study, contingent valuation method (CVM) was used to assess the willingness to pay (WTP) for conservation of mangroves. Alternatively, WTP provides a measure of the conservation value or benefit for the natural resource concerned, mangroves in the case of this study. A contingent evaluation study, according to Boyle (2001), requires very careful design and data analysis.

On the cost side of the analysis, social costs can be measured by the opportunity costs of using resources in certain ways, and the costs of price changes. The opportunity cost of using resources in a particular way is the highest-valued alternative use to which they might otherwise have been put. Costs are incurred by all sorts of individuals, firms, agencies, industries, and groups. Such costs are the capital costs of initial construction (initial implementation of the reforestation project), and the annual operating and maintenance costs that will extend over the life of the project. The source of data on costs of this type is normally from engineering or scientific authorities that can specify in detail the inputs needed for various phases of the projects.

According to White and Trinidad (1998), Cost-Benefit analysis compares the present value of all benefits (environmental, financial and social) with all costs associated with achieving a proposed outcome. It can give valuable insights into the economic efficiency of management and regulatory actions. The more benefits exceed the costs; the better off the society in economic terms as a result of the activity.

The study focused on the costs and benefits of mangrove reforestation in two scenarios: with sustainable harvesting and without harvesting. Two values were determined, the costs (C) and benefits (B). All the costs incurred for the implementation of the mangrove reforestation were broken down for each of the *barangay* studied. The total cost in general form is, $TC = TFC + TVC - OC$, where

TC = Total cost
TFC = Total Fixed Cost
TVC = Total Variable Cost
OC = Total Opportunity Cost

TABLE 1: Items of Costs of Mangrove Reforestation in Sibunag, Guimaras

Costs	Variable Representation	Definition
Labor for planting	X_1	- physical strength exerted in the planting of mangrove propagules
Labor for maintenance	X_2	- physical strength exerted in putting up bamboos poles; cleaning mangroves trees from “lumot”; putting up nets and other works under maintenance
Tree planting snacks	X_3	- snacks during the plantingperiod
Seedling/Propagules	X_4	- mangrove seedling
Nylon	X_5	- a synthetic material used in the nets
Rope to be used as *latid*	X_6	- a string used to tie up the nets
Nets for fencing	X_7	- a piece of fabric used in confining mangrove areas
Bamboo pole	X_8	- pole made of bamboo used as a support for young mangrove trees
Bamboo post	X_9	- post made of bamboo used in supporting the net
Straw seedling	X_{10}	- a piece made of plastic used to tie up mangrove to the pole
Land	X_{11}	- solid part of the earth surface, pertaining to mangrove areas

TABLE 2: Benefits of Mangrove Reforestation in Barangay Bubog, Sabang and Sebaste with Their Corresponding Representation

Benefits	Variable Representation	Definition
Fuel	Y_1	- something that is burned to provide power or heat i.e. branches of mangroves
Medicine · cough · stomachache · body pains	Y_2	- any part of mangroves trees as treatments for cough, stomachache and body pains (usually the leaves and the bark)
Household Items · Christmas Tree	Y_3	- upper portion of the mangrove tree cut usually during ber months
Mangrove roots for aquarium trade	Y_4	- the roots of the mangrove tree use as a decoration in aquarium
Control of shoreline and riverbank erosion	Y_5	- the capacity of the mangrove tree to hold soil
Carbon Sequestration	Y_6	- a chemical process of binding oin i.e carbon
Baluk	Y_7	- usually in the form of the roots, used as a cork
Dye	Y_8	- red coloring from the bark of the mangrove tree
Agriculture · fodder for pigs	Y_9	- use as a medicine and food for animals
Construction (furniture) · sala set · cabinet · dining table · single bed · table	Y_{10}	- mangrove trees as an input in building something
Fishing Poles	Y_{11}	- refers to the braches used in catching fishes
WTP	Y_{12}	- willingness to pay for conservation of mangroves

The Total Cost (TC) in the equation is the total cost of the mangrove reforestation projects in Sibunag, Guimaras. The Total Fixed Cost (TFC) on the other hand is part of the budget that stays the same regardless of whether the output (mangrove trees) increases or not. Total Variable Cost (TVC) is part that varies as one produce more or less. Total Opportunity Cost (OC) includes the foregone benefits one incurred in participating in the mangrove reforestation. It was assumed that OC is zero, to simplify our analysis. But must be pointed out that Opportunity cost Method i.e. foregone benefits, is used in quantifying TFC and TVC.

Specifically the model is,

$$C = \sum_{i=1}^{11} X_i \text{ ; i = integer}$$

Table 1 shows the costs incurred in reforesting mangroves with their representation:

On the benefit side of analysis, specifically the model is,

$$B = \sum_{i=1}^{12} Y_i \quad \text{, where i=integer}$$

Table 2 shows the benefits incurred in reforesting mangroves with their corresponding representation.

Net present value (NPV) will be used to determine the viability of the project. The general formula for NPV is:

$$NPV = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t} \text{ , wherein}$$

B=benefits of mangrove reforestation

C=costs of mangrove reforestation
t= number of years
r= rate of interest
n= duration of the reforestation project

On the other hand, benefit-cost ratio will also be used, assuming the formula:

$$BCR = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+r)^t}}$$, wherein

B=benefits of mangrove reforestation
C=costs of mangrove reforestation
t= number of years
r= rate of interest
n= duration of the reforestation project

The willingness to pay (WTP), denoted as Y16 in the benefit table is dependent o other variables, assuming a formula of

$WTP = f(Z_1, Z_2, ...Z_9)$, wherein;

Z1= age
Z2= sex
Z3= civil status
Z4= scale of knowledge on mangroves
Z5= occupation
Z6= wtp amount
Z7= mode of payment
Z8= educational attainment
Z9= household income

The Z variables above show the factors that could affect the willingness to pay of respondents. The age is length of time (expressed in years) that the respondent has lived. Sex refers to the male and female duality of biology and reproduction of the respondent. Civil status is presented as whether the respondent was "single" or "married", a variable illustrating respondent's marital status. The scale for knowledge is a variable which measure the level of awareness and information of respondents regarding mangrove ecosystem. Occupation pertains to the job, profession, work, career, livelihood, living, employmentof the respondent. The WTP amount in the equation would be the bid prices cited on the questionnaires. The bid prices are PhP 10, 50, 100, 200, 500. These prices were based on the Pre-test in Barangay Baguingin, Tigbauan, Iloilo. The test for the prices was an open-ended question. The top five prices assumed the bid prices in the actual survey. In the questionnaire, there are two modes of payment or payment vehicles. One is through surcharges in electric bill and the other one is through an addition charge on cedula. These are the ways to collect the charges for mangrove reforestation.

Hanemann's formula was also used to get the mean WTP, assuming the formula:

$$meanWTP = \left[\left(\frac{1}{\beta_1}\right)\ln\left(1+e^{a_0+\Sigma\beta_i\delta_i}\right)\right]$$ Where:

β_1 = coefficient of WTP amount

a_0 = coefficient of the constant

e = natural logarithm

β_i = coefficient of the independent variables

δ_i = mean of the independent variables

However, there are situations when Hanemann's mean WTP can be overestimated. This can happen when the percentages of no responses are not consistently increasing as bid price increases (Hanemann, 1984). To deal with this Haab and McConnel (2002) devised the Turnbull Mean WTP as a conservative lower bound mean WTP estimate. In this situation given the present data set, Turnbull WTP offers a better estimate.

To get the Turbull Mean WTP, the formula that was used was:

$MeanWTP = \Sigma t_j f^*_{j+1}$; where

$F_j = \frac{N_j}{T_j}$, or the ratio of number of no responses and the number offered in the specific bid

N_j = number of no responses

T_j = number offered in the specific bid

t_j = bid prices

f^*_j = Turbull estimate of $\frac{N_j}{T_j}$

To get the Social Mean WTP, the formula that was used was:

Table 3: Respondent Distribution of the Study

Barangay	Total Number of Households	Male	Female	Total
1. Hoskyn	423	16* *(40%)	24 (60%)	40 ** (20%)
2. Sinapsapan	293	16 57.14%	12 (42.86%)	28 (14%)
3. Lawi	280	15 (55.56%)	12 (44.44%)	27 (13.5%)
4. Buluangan	149	6 (42.86%)	8 (57.14%)	14 (7%)
5. Santo Rosario	502	28 (58.33%)	20 (41.67%)	48 (24%)
6. Rizal	206	7 (35%)	13 (65%)	20 (10%)
7. Umilig	121	8 (66.67%)	4 (33.33%)	12 (6%)
8. San Miguel	102	7 (63.64%)	4 (36.36%)	11 (5.5%)
TOTAL	2076	103 (51.5%)	97 (48.5%)	200.00

Note : The figures in columns three, four and five with parenthesis are percentage of raw total.
Legend:
* means that 40% are males in barangay (percentages by rows)
** means that percentage of the total number of respondents (N=200)

Social Mean WTP= (percentage of the respondent who are willing to pay) x (total households of the barangay) x (mean WTP)

METHODOLOGY

The duration of the study was from June 2004 to February 2005. Actual gathering of data was conducted from October 2004 to January 2005. Purposive sampling was used in choosing the sites. These were three barangays in Sibunag, Guimaras, namely; Brgy. Bubog, Sabang, and Sebaste, where mangrove reforestation projects were being conducted .

Eight barangays were selected from two different municipalities in Guimaras (Jordan and Buenavista) to determine people's willingness to pay. The selection of these barangay to determine the variable WTP was due to logistics, e.g. time and money. Benefit-transfer method was then used to transfer the WTP of Jordan and Buenavista to that of Sibunag's.

Table 3 shows the distribution of respondents in the eight barangays where the WTP survey was conducted. The first four barangays in the table were from the municipality of Jordan and the last four were from the municipality of Buenavista. Sibunag is a two and a half -hour PUJ ride to Buenavista and an hour PUJ ride to Jordan.It should be noted however, that due to logistics reason, the WTP survey was done in Buenavista and Jordan, not from Sibunag. The authors then used Benefit transfer Analysis to transfer the benefits to the municipality of Sibunag.

The contingent valuation method survey instrument was divided into six sections. The first section was background framing and information. This contains an overview of what the survey is all about. The second section was nine questions on knowledge of marine environment. It contains specific areas such as politics, economics, and environment, which the respondents gets to choose the one they are most familiar and

concern with. The third section was a 10-point Likert scale knowledge on study site information. This section contains the rating that the respondent would rate to themselves as to the level of knowledge that he/she has regarding mangrove conservation. The fourth section was an information box on background information about mangrove reforestation. The conservation efforts of the province as well as the reasons for the continuing decline of mangrove areas were highlighted on this section. The fifth section comprised the background information on trust fund and WTP questions. This section illustrates the hypothetical scenario. It is n this section where the conservation plan for mangrove reforestation was presented. It includes the willingness to conserve question of whether to contribute for the mangrove conservation or not. The last section was on socio-economic background of the respondent. It contains information about income, age, civil status and other socio-economic variables.

Regression analysis in the CVM logit model was used to derive mean WTP. Other tools such as correlation, frequency and percent distribution, and average cost were also used in the interpretation of data. Basically, the study monetized the costs and benefits of the mangrove reforestation by averaging cost data across three barangays for the two scenarios: with sustainable harvesting and without harvesting. The costs of mangrove reforestation were quantified using key informants. Two mangrove experts were interviewed to determine the sustainability use of mangroves species. This information was important in the CBA analysis.

In quantifying the benefits through opportunity costs, prices in the prevailing market were used. In the pricing of the shoreline protection benefit, data were gathered through interviews with the respondents who experienced the effect of coastal erosion thereby incurring costs which were quantified through the costs of repairing the damage. Carbon sequestration value was adopted from the study of Guanzon and Lagera (Unpublished, 2006). The value was revised for the only species present in the area which were Rhizophora and Avicennia. This is a non-use value of mangroves.

RESULTS AND DISCUSSION

Contingent Valuation Method (CVM)

The Contingent Valuation Method (CVM) was used to elicit the non-use value of conservation of mangroves depicted on their willingness to pay (WTP). The WTP is expresses in monetary terms.

Table 4 shows the frequency of the willingness to pay reply of the people in the eight barangays. The highest number of people willing to pay was Php 10 while the lowest was Php 200 and Php 500. The Law of Demand tells that as the WTP amount increases the people will less likely pay for the conservation of it, holding other factors constant. However on the table, as the price of the bid goes higher, the willingness to pay declines but, at PhP100, it goes up and decline again. This trend was corrected by using the Turnbull Formula in solving for the Mean WTP as shown in the succeeding paragraphs.

TABLE 4: Frequency of the WTP Reply

WTP AMOUNT	WTP REPLY		TOTAL
	Yes	No	
10	33	7	40
50	29	11	40
100	30	10	40
200	28	12	40
500	28	12	40

TABLE 5: Coefficient and Mean of the Different Independent Variables

Variables	Coefficient	T statistics	Mean
1. constant	-0.99264800	-0.989	
2. age	-0.00433351	-0.318	45.64
3. sex	-0.09752380	-0.290	0.4850
4. knowledge scale	0.14250700	2.252	7.1750
5. mode	0.18794500	0.553	0.51
6. educational years	0.03705550	0.529	7.9450
7. total household income	0.31388100	1.724	2.3650
8. civil status	0.431706	0.780	0.87
9 WTP amount	-0.00116414	-1.240	172.0

Mean WTP

The Mean WTP is value or price for conservation of mangroves. Table 5 shows the coefficient and mean of the different independent variables used to get the mean WTP. Using the Hanemann's (1984) formula the mean WTP of the study was PhP 1605.

This estimate is an overestimation since it is even greater than the maximum bid of 500. A more conservative estimate as formulated by Haab and McConnel (2002) provides a lower bound WTP which they called Turnbull WTP. The details are presented in their work. For this study Table 6 presents how the Turnbull WTP is completed.

$$\text{Turnbull WTP} = \Sigma t_j f^*_{j+1} = 0\ (0.175) + 10\ (0.0875) + 50\ (0.0375) + 100\ (0) + 200\ (0.7)$$

TABLE 6: Computation of Turnbull WTP for Conservation of Mangroves

Bid Price (t_j)	Number of No's		Unestimated $F_j = \frac{N_j}{T_j}$	Turnbull	
	N_j	T_j		F^*_j	f^*_j
10	7	40	0.175	0.175	0.75
50	11	40	0.275	0.2625	0.0875
100	10	40	0.25	Pooled Back	Pooled Back
200	12	40	0.3	0.3	0.0375
500	12	40	0.3	0.3	0
500+				1	0.7

$$= 0 + 0.875 + 1.875 + 0 + 140$$
$$= 142.75 \quad \text{PhP } 143$$

The mean, therefore is equal to 143.

Social Mean WTP

Social mean willingness to pay method was used to determine the willingness to pay of the sampled barangay. Since there are surveyed barangay eight barangays, there are also eight social mean WTPs. In order to get the overall social mean WTP for all the barangays, the same formula was used, thus the value PhP 219682. This social mean WTP represents the conservation value for mangroves, or the benefit which society acquires if conservation or reforestation is done. Since this conservation is non-market value, CVM provides the estimate for this non-use value of mangroves.

Benefits

The study also conducted interview to the residents on benefits they acquire from mangroves. Table 7 shows the benefits of mangroves as cited by the respondents. The flora and the fauna that can be obtained from mangroves as cited by the respondents are the following: tuway (shells), alimango (crabs), shrimps, babuy-baboy, palu-palo (fingerlings), iras, pala, dawat (small crabs), suso, tipsay, lusaw, bangi-bangi, sisi and samaral or gusaw. The birds like kalansiyang and kalaksahan can also be seen in mangroves area. Other important benefits were discussed in the succeeding paragraphs namely, as Christmas trees; as dye; as a shade; as an aid to vinegar production; as a protector of big waves; as medicine; and as a source of income.

One of the benefits from mangroves is that a part of it can be made into a Christmas tree. Moreover the sap of the bark can also be used as a dye which is mahogany brown or red in color is from the bark of the tree. Mangroves can also serve as a shade. It also acts as a protection from big waves and can prevent soil erosion and flood in the coastal communities. The "balok", which when fermented becomes vinegar, can also be

TABLE 7: Benefits of Mangroves as Cited by the Respondents

Benefits (Goods and Services) of Mangroves as Cited Respondents	
· Flora and fauna	- (shells), alimango (crabs), shrimps, babuy-baboy, palu-palo (fingerlings), iras, pala, dawat (small crabs), suso, tipsay, lusaw, bangi-bangi, sisi and samaral or gusaw
· Households uses	- Christmas trees, tables, chairs, dye, firewood, corks, decoration and walls for houses, driftwood for orchids, boats as souvenir, and *landay* (small boats) etc.
· Medicine	- stomachache, cough, body pains
· Bird sanctuary	- kalansiyang and kalaksahan
· Others	- increase fish catch of the fishermen, coastal protection

TABLE 8: Benefits of Mangroves per hectare per year (in PhP)

Benefit	Price (Brand)	Quantity consumed (households)/ year	Total Benefit
Fuel	P15/bundle‘	1 bundle per tree	34440
Medicine			
· Stomachache	P12/capsule (Imodium)	Twice a month	288
· Cough		8.50 PhP(Tuseran forte)	Twice a month
204			
· Body pains	13.70 PhP (25 ml of efficascent oil)	Everyday	5000.5
Household Items			
· Christmas Trees	P200/tree	Once a year	229600
Mangroves roots for aquarium trade	P75/qty	Once a year	172200
Control of shoreline and riverbank erosion	P2475/year	Throughout the year	2475
Carbon Sequestration	P4664.93/ha/year	Throughout the year	4275.18
Baluk	P10/liter	1 liter per tree	22960
Dye	P3.50/pack	1 pack per tree	8036
Agriculture			
· Fodder for pig	P25/kilo	1 kilo per tree	57400
Construction (furniture)			
· Sala set	P20000 (5 trees)	Once in 10 years	20000
· Cabinet	P6000 (3 trees)	Once in 10 years	6000
· Dining-table	P8000 (2 trees)	Once in 10 years	8000
· Single Bed	P2500 (2 trees)	Once in 10 years	2500
· Table	P2500 (2 trees)	Once in 10 years	2500
Fishing Poles	P50/piece	1 piece per tree	114800
WTP	P142.75/hh	Once a year	296349
· Total benefits will vary each year, refer to Tables 16-17			
· 2296 mangrove trees per hectare out of 4445 tress in a hectare			
· Note: 51.67% survival rate which is the average of 55% (Bubog), 40% (Sabang), and 60% (Sebaste)			

extracted from mangrove trees. Firewood, corks, decoration and walls for houses, driftwood for orchids, boats as souvenir, and landay (small boats) are some of the benefits mangroves can offer.

Another benefit that a mangrove can provide is medicine. It can be use as a remedy for cough, stomach ache, and body pains. The roots and leaves of mangroves were used to alleviate cough and stomach ache of an individual as cited by the respondents. On the other hand, remedy for body pains can be obtain from the barks of a mangrove. Moreover, mangrove area also acts as a bird sanctuary.

Furthermore, mangrove can also increase the income of fishermen through their fish catch. Mangrove areas can attract many fishes especially fingerlings since they serve as nursery ground for a variety of marine organisms. Mangroves also act as providers of coastal protection, especially from big waves and soil erosion. During the last December 2004 tsunami tragedy over Indian Ocean and Andaman Sea, Sumatra suffered fewer casualty and destruction due to protection provided by mangroves.

Since monetary values of mangroves are in question here, Table 8 shows the benefits of mangroves. It provides different benefits from mangroves as well as the corresponding value in Philippine peso (PhP). It must noted however, that the estimation is based on sustainability. This means that the third column (quantity consumed per year) assumed that this amount will not kill the mangrove trees. Hence, there is no total benefit derived from this listing. The following paragraphs will explain the value estimation.

Through the documents provided by PENRO (2004), it was found out that the average survival rate of mangroves in the three barangays was 51.67%. It was

found out that an average of 4445 trees of mangroves was planted in one hectare. It was estimated that about 2296 of mangrove trees survive in a year. This is one of the major assumptions of the estimation.

As shown on table, mangroves could be a source of fuel or firewood. It was monetized by an indirect opportunity cost approach. The PhP 15 is the regular cost of a bundle of firewood in the market in the year 2005. This could also be the value of the firewood benefit of mangroves. Its total benefit in a year per hectare was PhP 34440, which was obtained by multiplying PhP 15 by 2296 trees.

Another benefit from mangroves is medicine. Mangroves can provide remedy for cough, stomach ache, and body pains. These services were also monetized by an indirect opportunity cost approach. The PhP 12, PhP 9, PhP 14 value of medicine for stomachache, cough, and body pain were obtained by assuming that these values are equal to the costs of one capsule of Imodium for stomach ache, one capsule of Tuseran Forte for cough and 25 ml of efficascent oil for body pains in the market. The prices were taken from a convenient store. The respondents also cited that at least twice a month an individual can experienced stomachache and cough. However, they are prone to body pains everyday since most of the respondents were drivers. Using indirect opportunity cost approach, total price for medicine from mangroves is PhP 5493. The value of medicine for stomachache was computed by multiplying PhP 12 with 2 (assuming that individuals can get a stomachache at least twice a month) and 12 (months in a year). The value of medicine for cough has the same computation while that for stomachache is only PhP 9. The value of medicine for body pains was computed by multiplying 365, which is the number of days in a year, and PhP 14 which is the price of medicine for body pain.

The table also shows that mangroves can control the shoreline and river banks erosion. The value for this benefit from mangrove was quantified using opportunity cost method. It was assumed that the opportunity cost of a person for one hour's work is equal to PhP 23. This was derived from the minimum 10-hour wage of PhP 180. Two respondents cited their restoration costs from erosion. One respondent spent a total of PhP 2590 per hectare of mangroves. This cost includes total labor cost of 900, for ten hectares of land and equipment cost of 2500. This equipment cost includes 5 shovels that cost 500 each. Another respondent cited a cost of PhP 2360 per hectare of mangrove. This cost includes total labor cost of 360, for 2 persons who worked 10 hours. Materials used were bamboo that cost 50 per bamboo, garnering 2000 for the materials used. Getting their average, the total value for mangrove control of shoreline and restoration was equal to, PhP 2475 per hectare.

Carbon sequestration value at Php 4275 was adopted from the study of Guanzon and Lagera (Unpublished, 2006). The value was revised for the only species present in the area which were Rhizophora and Avicennia. This is a non-use value of mangroves.

Another benefit from mangroves is that its barks can be made into Christmas tree and its roots can be made as an aquarium decoration. Indirect opportunity cost approach was used to determine the monetary value of these two benefits. The price of one quantity of Christmas tree and aquarium decoration is PhP 200 and PhP 75, respectively. The table also shows that half of the 2296 trees in a hectare were utilized for Christmas trees and other half for mangrove roots for aquarium trade. To compute for the total benefits of the household use of mangroves, particularly in making a Christmas tree, the value of one Christmas tree which is PhP 200 was multiplied to half of the number of mangrove trees in a hectare which is 1148. Its total benefit is PhP 459200. On the other hand, the benefit for mangrove roots for aquarium trade was PhP 344400 which was from the product of PhP 75 which is the value of one mangrove root for aquarium trade, 2 from an assumption that this item will be derived twice in a year and 1148 which is half of the number of mangrove trees in a hectare.

The "baluk", which when fermented can turn into vinegar, is another benefit from mangroves. Again, using indirect opportunity cost approach, the monetary value of "baluk" was computed. The market price for "tuba" which is extracted from coconut trees is PhP 10 per liter. Assuming that the value of tuba is equal to baluk, then 1 liter of baluk is also equal to PhP 10 per liter. To compute for its total benefit which was PhP

22960, price per liter of baluk was multiplied to the number of mangrove trees in a hectare.

The table also shows that dye can also be derived from mangrove trees. The monetary value attach to it is from the price of 1 pack of dye in a market that costs PhP 4. The indirect opportunity cost approach was again used in order to attach an equal value for dye from mangroves and dye in the market. The total benefit derived from dye was PhP 80 which was from the product of 4 and 2296 mangrove trees in a hectare.

Mangroves can also be used for fodder for pigs. In the market, the price of one kilogram of "lintok" which is used as feeds for pigs costs PhP 25. Indirect opportunity cost approach was used to attach monetary value on the fodder for pigs. Therefore the value attach on fodder for pigs was PhP 25. To compute for the total benefit of agricultural benefit of mangroves which was PhP 57400, monetary value of fodder for pigs was multiplied to the total number of trees in a hectare.

Mangroves can also provide fishing poles. The monetary value attach on the fishing poles was obtained

TABLE 9: The Preliminary Planting Cost of Mangrove Reforestation in Barangay Sabang, Sibunag (7 ha.)

ITEM	Agency Involved	UNIT	UNIT COST	ECON LIFE	DEP COST	TOTAL COST
Bamboo Poles	PENRO	50 pcs.	40	¼ year	500	2500
	Barangay Counterpart	100 pcs.	20	¼ year	5000	7000
	SAVE	187.5	40	¼ year	1875	9375
Bamboo Posts	SAVE	562.5 pcs.	15	¼ year	2109.38	10546.88
	PENRO	150 pcs.	15	¼ year	562.5	2812.5
Seedlings/ Propagules	PENRO	4445	1	-	-	4445
	PESCO-Dev	10000	1	-	-	10000
	SAVE	16000	1	-	-	16000
	Barangay Counterpart	20 rolls	35	1/12 year	58.33	758.33
Nylon	PENRO	2 legs	200	¼ year	100	500
	PESCO-Dev	6 rolls	90	¼ year	135	675
	SAVE	8 legs	200	¼ year	400	2000
Fish Net	PENRO	3 bundles	2300	½ year	3450	10350
	SAVE	9 bundles	2300	½ year	10350	31050
Labor for Planting	Barangay Counterpart	40 pax	180	-	-	7200
Nets for Fencing	Municipal 400 m Counterpart	30	½ year	6000	18000	
Billboards	Barangay Counterpart	1	300	5	60	360
Tree Planting Snacks	Barangay Counterpart	-	-	-	-	700
Straws	Barangay Counterpart	20 rolls	35	1/12 year	58.33	758.33
	SAVE	19	35	1/12 year	55	720.39
	PENRO	5 rolls	35	1/12 year	14.58	189.58
TOTAL						135941.01

with the use of indirect opportunity cost approach. The price of a piece of bamboo is PhP 50 per piece. This was used to attach the monetary value of fishing poles from mangrove trees. To compute for the total benefit of mangrove trees used as fishing poles, the value attach to the fishing pole from mangroves was multiplied from the number of mangrove trees in a hectare. The total benefit from mangrove trees as fishing poles was PhP 114800.

The benefits in question here are not complete. It does not include other mangrove benefits such as increase in fish catch; bequest value; and other benefits because of time constraints.

Costs

The costs of mangrove reforestation in three barangays were divided into two: preliminary and maintenance cost. The preliminary cost is the cost incurred at the start of the mangrove reforestation project. This usually includes the planting costs. On the other hand the maintenance cost includes all the cost incurred in maintaining the reforested area.

Table 9 showed the total preliminary cost of mangrove reforestation in Barangay Sabang. The agencies involved in the reforestation in this barangay were the following: Fisherfolk Association, PENRO, SAVE, Barangay Council and Local Government Unit (LGU-Municipal). It was assumed that the labor for planting was PhP 22.5 per hour of work. Since, cost of labor for planting was not shouldered by any agency, the labor cost was quantified using opportunity cost method. This assumption was also used in the two remaining barangays.

TABLE 10: The Maintenance Cost of Mangrove Reforestation in Barangay Sabang, Sibunag (7 ha.)

ITEM	Agency Involved	UNIT	UNIT COST	TOTAL COST
Seedlings for replanting	PENRO	445	1	445
Labor for Monitoring	Barangay Counterpart	24	22.5/day	197100
TOTAL				197545

Table 10 shows the maintenance cost of mangrove reforestation in the barangay. Again, the same assumption was considered for labor cost. This cost was used throughout the years of implementation of the project. The total cost here was the yearly cost of mangrove refo in Barangay Sabang. The total

TABLE 11: The Preliminary Planting Cost of Mangrove Reforestation in Barangay Bubog, Sibunag (2.5 ha.)

ITEM	Agency Involved	UNIT	UNIT COST	ECON LIFE	DEP COST	TOTAL COST
Bamboo Poles	PENRO	125 pcs.	40	¼ year	1250	6250
Bamboo Posts	PENRO	375 pcs.	15	¼ year	1406.25	7031.25
Seedlings/Propagules	PENRO	11113	1	-	-	11113
Straw	PENRO	12.5 rolls	35	1/12 year	36.44	473.94
Nylon	PENRO	5 legs	200	¼ year	250	1250
Fish Net	PENRO	7.5 bundles	2300	½ year	8625	25875
Billboard	Municipal Counterpart	1	300	5	60	360
Stick	Barangay Counterpart	4	30	¼ year	30	150
Labor for Planting	Barangay Counterpart	28	180	-	-	5040
Total						57543.19

reforested mangrove area was 7 hectares. In the computation of the depreciation cost, it was assumed that the salvage value or the replace cost was equal to zero. This would break down the equation of the depreciation to total cost over the economic life of the equipment/material. This assumption was also used in the entire cost tables presented on this research.

Table 11 shows the preliminary costs of putting up mangrove reforestation project in Brgy. Bubog. Similar to Brgy. Sabang, the same labor cost was used. Opportunity cost method was also used, as well as the zero-salvage cost. The agencies involved in the reforestation project in the area were almost the same with that of Sabang except for the fisherfolk association, which was replaced by local fisherfolk association. The SAVE, an NGO, which actively participated in the mangrove reforestation in Sabang and Sebaste, did not participate on this project.

Table 12 shows the maintenance costs of mangrove reforestation in Barangay Bubog, Sibunag, Guimaras. It includes labor costs for monitoring and seedlings for replanting. The total maintenance cost was 230395 PhP.

TABLE 12: The Maintenance Cost of Mangrove Reforestation in Barangay Bubog, Sibunag (2.5 ha.)

ITEM	Agency Involved	UNIT	UNIT COST	TOTAL COST
Labor for Monitoring	Barangay Counterpart	28	22.5/day	229950
Seedlings for replanting	PENRO	445	1	445
TOTAL				230395

TABLE 14: The Maintenance Cost of Mangrove Reforestation in Barangay Sebaste, Sibunag (5 ha.)

ITEM	Agency Involved	UNIT	UNIT COST	TOTAL COST
Labor for Monitoring	Barangay Counterpart	18	22.5/day	147825
Seedlings for replanting	PENRO	668	1	668
TOTAL				148493

TABLE 13: The Preliminary Planting Cost of Mangrove Reforestation in Barangay Sebaste, Sibunag (5 ha.)

ITEM	Agency Involved	UNIT	UNIT COST	ECON LIFE	DEP COST	TOTAL COST
Seedlings/Propagules	SAVE	16000	1	-	-	16000
	PENRO	6668	1	-	-	6668
Bamboo Poles	Barangay Counterpart	75 pcs.	20	¼ year	5000	7000
	SAVE	187.5	40	¼ year	1875	9375
	PENRO	75 pcs.	40	¼ year	750	3750
Straws	Barangay Counterpart	20 rolls	35	1/12 year	58.33	758.33
	SAVE	19	35	1/12 year	55	720.39
	PENRO	7.5 rolls	35	1/12 year	21.87	284.37
Billboards	Barangay Counterpart	1	300	5	60	360
Bamboo Posts	Barangay Counterpart	150 pcs.	15	¼ year	562.5	2812.5
	SAVE	562.5 pcs.	15	¼ year	2109.38	10546.88
	PENRO	225 pcs.	15	¼ year	843.75	4218.75
Nylon	SAVE	8 legs	200	¼ year	400	2000
	PENRO	3 legs	200	¼ year	150	750
Fish Net	SAVE	9 bundles	2300	½ year	10350	31050
	PENRO	4.5 bundles	2300	½ year	5175	15525
Labor for Planting	Barangay Counterpart	18	-	-	-	3240
TOTAL						99534.22

TABLE 15: Summary of Cost Incurred in Mangrove Reforestation in Sibunag, Guimaras (in PhP)

Cost	Barangay Sabang (7 ha.)	Barangay Bubog (2.5 ha.)	Barangay Sebaste (5ha.)	Average
Preliminary Cost	PhP 135941.01	57542.69	115059.20	69514.47
Maintenance Cost	197545.00	230395.00	148493.00	192144.3
Total Cost	233486.01	287937.69	263552.20	261658.8

Table 13 and 14 showed the details of preliminary and maintenance cost of mangrove reforestation in Sebaste. The total reforested area of this barangay is 5 hectares. The computation was also done with the use of similar assumptions mentioned earlier.

Table 15, summarizes the costs of mangrove reforestation projects in the three barangays. On the average the preliminary cost would approximately at PhP 69514 and the maintenance cost at PhP 192144. It noted that most of the cost incurred is on labor. This means that initiating and maintaining a mangrove reforestation project is labor-intensive. The labor costs were calculated using opportunity cost method. This implies that the 'payment'' for laborers in the area are actually their foregone benefits and not the actual payment they received. These laborers were members of organization of fisher folks who believe that participating in the project would give them more fishes to catch.

Cost-Benefit Analysis

The Cost-Benefit Analysis is tool to weigh down the benefits and the foregone benefits of a particular project, i.e. mangrove reforestation. The authors wanted to know if the net benefits will be positive in two different situations. One situation is the With Sustainable Use of mangrove trees. In here, people are using the resource but without damaging the ecological balance or depriving others from consuming it in the future.

Scenario 1: With Sustainable Harvesting

Table 16 shows the comparison of the costs and the benefits of mangroves on the span of 20 years. It was compounded at different interest levels: 5, 8, 10, 12, 15 and 20 %. Using the Turbull estimate the benefit through the social mean WTP was PhP 219298. This is the willingness to pay of all the households for the mangrove conservation.

On this scenario, aside from the non-use value (WTP) there are also used values in the benefit equation. All the benefits listed in Table 7 are depicted on this scenario. But it must be noted however that they are add added up in every year. That's why the benefits in Table 16 vary from year to year. The variation is due to that fact that one cannot acquire the same benefits to the same trees all year round. The fuel benefit of mangrove can be ripped in 10 years time and onward. Remember that the value for the tree is equivalent one bundle of firewood and the wood will be harvested once a year. The medicinal value of mangrove trees is further expressed into three uses. The first cure is for stomachache, since leaves are used, the values can be acquired in 10 years time and onwards. This is also true in the case of the treatment for cough. The last cure would be for body pain, which will be valued after 10 years, for the bark uses. The Christmas tree benefit can be ripped after 10 years, and it will is assumed that only half of all the mangrove trees will be used. The Christmas tree is actually the top part of the tree, thus, not killing it at all. In the case for aquarium trade, it is

Table 16: Cost and Benefit Analysis of Mangrove Reforestation in Sibunag, Guimaras (With Sustainable Harvesting)

Year	Total Benefit	Total Cost	Net Benefit	Discounted Net Benefit					
				5%	8%	10%	12%	15%	20%
0	219298	268909	-49611	-41674	-41674	-41674	-41674	17771	17308
1	219298	199394	19904	-18956	18430	18095	17771	14711	13954
2	219298	200844	18454	16738	15821	15251	14711	23134	21370
3	234796	202294	32502	28076	25801	24419	23134	19734	17754
4	234796	203744	31052	25546	22824	21209	19734	15974	13996
5	234796	206644	28152	24330	21133	17480	15974	445282	379976
6	1085551	206644	878907	655854	553861	496120	445282	397573	330414
7	1085551	206644	878907	624623	512834	451018	397573	354976	287316
8	1085551	206644	878907	594879	474846	410017	354976	322531	254246
9	1101049	206644	894405	576541	447425	379315	322531	2293928	1761090
10	7331236	206644	7124592	4373881	3300065	2746839	2293928	2164780	1618586
11	7736941	206644	7530297	4402809	3229615	2639323	2164780	1932840	1407466
12	7736941	206644	7530297	4193151	2990384	2399385	1932840	1725750	1223884
13	7736941	206644	7530297	3993477	2768875	2181259	1725750	1540848	1064247
14	7736941	206644	7530297	3803312	2563773	1982963	1540848	1375757	925432
15	7736941	206644	7530297	3622202	2373864	1802693	1375757	1228355	804723
16	7736941	206644	7530297	3449716	2198022	1638812	1228355	1096745	699760
17	7736941	206644	7530297	3285444	2035205	1489829	1096745	979237	608487
18	7736941	206644	7530297	3128994	1884449	1354390	979237	874318	529119
19	7736941	206644	7530297	2979994	1744861	1231264	874318	784866	462593
20	7777691	206644	7571047	2853448	1624355	1125388	784866	462593	197484

also assumed that half of the trees will be used and the value can be ripped off after 9 years. According to mangrove experts, in order for a mangrove tree to fully participate in control of a riverbanks or coast, it should be a grown tree. That is why the value for shoreline control is used after 9 years. Since after 10 years, a mangrove tree has grown, balok and dye benefits can be added up. The fodder for pigs (actually associated its acapacity to treat pig's parasites) will be ripped after 5 years. In the case of carbon sequestration, from year 0 to 2, there are no values for it. In the 3rd to 5th year, only 25% of the value is assumed to be present; 50% in the 6th to 8 years and 75% in the 9th to 20th years.

On the cost side of analysis, it was assumed that the cost for the land was at PhP 500. This is based on the Fishpond Lease Agreement (FLA) Fee set by the Philippine government. There is a 100 PhP increment for the next three years, and became fixed at 500 PhP in the fifth year onwards. On the first year of the project, the cost is higher, than the second year onwards. This was for the reason that the cost in the first year includes cost for the first planting of project. This is also the cost of putting a reforestation project per hectare of mangrove. It can be seen that the NPVs in zero year is negative in 5%, 8%, 10% and 12%. But after the 1st year, the NPVs are all positive in all levels of interest rates.

Scenario 2: Without Harvesting

In the analysis of CBA, it was assumed that the person will use mangrove resources (bark, leaves, etc.) at sustainable level for their consumption. This would reflect mangroves direct use/benefit to the society. In compliance with R.A. 7161 of 1990, which banned all cutting of all mangrove species, CBA analysis for without mangrove harvesting was computed. This implies that utilization is no longer permitted. However, it was found out that this RA does not explicitly specify that reforested mangrove species could not be harvested. If this is the case, there is an unclear policy/ regulation for this utilization. If planted mangrove species can be cut down, then the previous CBA will hold true.

Moreover, there are other policies that allow the cutting of mangrove species. Memorandum Circular No. 5, Series of 1990, prescribed guidelines on the cutting of mangrove species within approved FLA areas. There

Table 17: Cost and Benefit Analysis of Mangrove Reforestation in Sibunag, Guimaras (Without Harvesting)

Year	Total Benefit	Total Cost	Net Benefit	Discounted Net Benefit 5%	8%	10%	12%	15%	20%
0	219298	76764	142534	-41674	-41674	-41674	-41674	-41674	-41674
1	219298	199394	19904	-18956	18430	18095	17771	17308	16587
2	219298	200844	18454	16738	15821	15251	14711	13954	12815
3	234796	202294	32502	28076	25801	24419	23134	21370	18809
4	234796	203744	31052	25546	22824	21209	19734	17754	14975
5	234796	206644	28152	24330	21133	17480	15974	13996	11313
6	250293	206644	43649	32572	27506	24639	22114	18871	14618
7	250293	206644	43649	31021	25469	22399	19745	16409	12182
8	250293	206644	43649	29543	23582	20363	17629	14269	10151
9	265791	206644	59147	38126	29588	25084	21329	16813	11463
10	265791	206644	59147	36311	27396	22804	19044	14620	9553
11	265791	206644	59147	34582	25367	20731	17003	12713	7960
12	265791	206644	59147	32935	23488	18846	15181	11055	6634
13	265791	206644	59147	31367	21748	17133	13555	9613	5528
14	265791	206644	59147	29873	20137	15575	12103	8359	4607
15	265791	206644	59147	28451	18645	14159	10806	7269	3839
16	265791	206644	59147	27096	17264	12872	9648	6321	3199
17	265791	206644	59147	25805	15985	11702	8614	5496	2666
18	265791	206644	59147	24577	14801	10638	7691	4779	2222
19	265791	206644	59147	23406	13705	9671	6867	4156	1851
20	265791	206644	59147	22292	12690	8792	6132	3614	1543

is also this DAO No. 2000-29, Series of 2000 which prescribed guidelines regulating the harvesting and utilization of forest products within CBFM (Community-Based Forest Management) areas. However, according to the Philippine National Committee, following the hierarchy of policy, Republic Act is above other laws and therefore, cannot be amended by a mere Administrative Order.

Table 18: Summary of Net Present Values (NPV) at Different Rates of Interests for the Two Scenarios

Interest Rates	NPV (With Harvesting)	NPV (W/o Harvesting)	Benefit Cost Ratio (With Harvesting)	Benefit Cost Ratio (Without (Harvesting)
5%	42614057	523690	16	1.27
8%	28806441	421382	13	1.27
10%	22425067	351859	12	1.27
12%	17609110	298785	11	1.28
15%	12441720	238739	9	1.28
20%	7242423	172514	7	1.29

Nevertheless, for the sake of comparison, CBA for mangrove without harvesting is presented in Table 17. This is in accordance to the policies that banned the cutting and using of all mangrove species. Only the non-use values comprised the benefits under the CBA without harvesting. These were the following: shoreline protection, carbon sequestration, and social willingness to pay. This implies that there would be no benefits on mangrove direct uses i.e. for medicine, construction, aquarium, etc. Similar to the first scenario (with harvesting), benefits derived from carbon sequestration and shoreline protection will only be reaped starting ten years onwards when mangrove trees have already grown. The benefits for the first nine years will largely depend on the social mean WTP of the community.

Based on these tables, it was found out that over 20-years time, the benefit will also outweigh the cost, at different interest rates. However, the net benefit from without harvesting is lower than the values obtained from allowing harvesting. This is may be due to the fact that the benefits calculated were only non-use

values of mangrove. This is the case if R.A 7161 is strictly implemented.

However, there were other policies such as DAO No. 15 and M. C. No 5, where cutting/using these mangrove resources are allowed --- with corresponding guidelines. On the other hand, DAO 15 do not allow cutting of mangrove trees within existing Fishpond Lease Agreement (FLA) unless permit were obtained from the Department of Environment and Natural Resources. The trees cut in FLA areas through a permit shall be turned over to the DENR for disposition through public bidding. FLA holders are given the right to compete the highest bidder, in which case the bid is automatically awarded to him. In the case of commercial plantations, mangrove plantation developers shall be allowed to cut the planted trees found within their respective plantations through clear cutting by strips system, whether such action is intended for personal or commercial purposes. Provided they secure a permit from the immediate office of the DENR. If sustainable harvesting can be allowed, higher net benefits can be reaped from mangroves (Table 18). The Benefit-Cost Ratios is also greater than one in all levels of interest rates, whether on the first or second scenarios. This implies that the benefits really exceed the costs.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

SUMMARY

This study examined the benefits and costs of mangrove reforestation in three selected barangay of Sibunag, Guimaras. Key informants were interviewed to determine the different costs and benefits involved in mangrove reforestation. Before the proper survey was conducted a Pretest Survey was done, this is to determine the bid prices to be used in the survey proper. Survey of 200 respondents were undertaken to determine the conservation value of mangroves. The survey of 200 respondents involved personal interviews using contingent valuation method to determine people's WTP reply. These 200 respondents are the usual size personal interview CVM survey. CVM respondents were comprised of 51.5% males and 48.5% female. It was noted that as the WTP amount increases the people will less likely pay for the conservation fee. The mean WTP of the study was at PhP 142.75, while the social WTP was PhP 219298. In the cost side of analysis, the costs were divided into the cost of preliminary planting and the maintenance cost, for the entire 14.5 hectares of mangrove reforested area. The average cost of preliminary work in mangrove reforestation was at PhP 69514. On the other hand, the aveage maintenance cost approximately at PhP 261259. This means with this amount, any agency or community can start up a mangrove reforestation project. Comparing the costs and the benefits, it was found out that at different interest rate levels, the NPV was still positive until the next 20-years for the two scenarios: with sustainable harvesting and without harvesting. This means that the benefits outweigh the cost. Whether the mangrove trees were utilized or not, still, the NPVs were positive at all interest rates. Therefore, the mangrove reforestation is beneficial, either in accordance to RA 7161 or not.

CONCLUSION

In conclusion, the mangrove reforestation projects in Sibunag, Guimaras were successful. The benefits of the project outweigh its costs. This implies that the project should be continued and expanded. There were indeed, many benefits that could be reaped in the mangrove ecosystem; however that these benefits would entail time i.e. twenty years or so. Some people do not realize this. Oftentimes, they want immediate benefits from any natural resources like mangroves. As shown in the CVM survey, some people are also aware of the non-use benefits of mangroves. The Social Mean WTP equal to PhP 219298.

CBA was also conducted for mangrove reforestation without harvesting. This is in accordance to the Republic Act 7161 that banned the cutting/using all mangrove species. The net present value was also positive indicating that the mangrove reforestation is also beneficial in this scenario.

RECOMMENDATIONS

A wider scope of CVM survey involving more respondents can update and maybe enlarge the non-use values of mangroves during reforestation. Benefit

transfer of non-use values could only be used if mangrove species were similar in the area where CVM was conducted thus; more studies are needed to determine the economic value of non-use benefits of mangroves. Other benefits of mangroves such a bequest value, increase fish catch and other ecosystem uses should also be included in further studies such as this. This can make the values of mangroves even higher than what is concluded here.

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