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RESEARCH ARTICLE

MANAGEMENT STRATEGIES EMPLOYED UNDER PNAP MANGROVE REHABILITATION PROJECT IN DAVAO DEL SUR, PHILIPPINES

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ABSTRACT

This study was conducted in the 5 selected coastal barangays of Davao del Sur namely Brgy. Tagabuli, Sta. Cruz, Brgy. Punta Biao, Digos City, Brgy. Bucana, Hagonoy, Brgy. Balasinon, Sulop and Brgy. Bagumbayan, Malalag. These barangays were the Program Partners during the implementation of the Philippine National Aquasilviculture Program (PNAP) – Mangrove Rehabilitation Project due to suitability requirements. These were also declared by the Philippine Government as the identified Key Biodiversity Areas (KBAs) in the region. The purpose of this study was to assess the current status of the mangroves planted under PNAP, and determined its contributing factors behind its survival and mortality rates. Research questionnaire was also used in data gathering for socio-profiles of the project beneficiaries and management interventions employed. Results of the study revealed that Brgy. Punt Biao, Digos City (98.7%) and 95.85% in Brgy.Bucana, Hagonoy exhibited high survival rates. In terms of area orientation, these Barangays is a midland zone, and hence, expected minimum to high survival rates since planted mangroves in these areas were not directly exposed over strong winds and waves actions. However, lowest survived mangroves were recorded in Brgy. Balasinon, Sulop with 10.22% due to wave fluctuations and other climatic conditions in general. Results further revealed that Mangrove mortalities may result from different factors: change in nutrient availability, grazing animals, deforestation, feral pigs, sea level rises, storms and strong winds, shoreline erosion, altered tidal flows, and climate change which is mainly caused by human pollution and disorderness. Different management strategies includes direct planting method, and regular visitation, cleaning and overall monitoring in the different mangroves areas at least once a month or twice a month. Replanting mechanisms of mangroves were also realized and being practiced in some study areas. Hence, this could be the reason why Brgy. Punta Biao and Brgy. Bucana recorded excellent number of mangroves survived.

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INTRODUCTION

Mangrove systems are threatened by both natural and anthropogenic processes that pose a risk to their long-term survival. This has received considerable attention in the literature with various estimates of mangrove loss worldwide in the order of 1–2 % annually (Duke *et al*., 2007). However, mitigation actions through restoration or rehabilitation can stem the losses and protect the services and values mangroves provide. For the past decades, the Philippine fisher folks have been experiencing declining fish catch. Many coastal communities are also experiencing displacement due to storm surges in their areas.

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A major contributor to these problems is the disappearance of our mangrove forests. With this, breeding grounds of fishes were destroyed and the disappearance of natural wave barriers left communities vulnerable to storm surges. In 1995, it was recorded that there were only 117,000 hectares of mangrove forests left from a high of 500,000 hectares a century ago. Mangrove forests have been converted to fishponds, used indiscriminately as firewood and as a resource for housing construction as well as for other uses (Yparraguire, 2008). Mangroves protect shorelines from damaging storm and hurricane winds, waves, and floods. Mangroves also help prevent erosion by stabilizing sediments with their tangled root systems. They maintain water quality and clarity, filtering pollutants and trapping sediments originating from land. Interest in mangrove rehabilitation has increased rapidly since 2003, as has awareness of the damaging effects of natural and anthropogenic pressures that contribute to mangrove loss, which is estimated at 1–2 % per annum.

Table 1. Location of the selected study sites

Barangay	Municipality	Province	Coordinates	Total Area Planted (PNAP)
Bagumbayan	Malalag	Davao del Sur	6° 35' 45" N, 125° 23' 57"E	3 has
Balasinon	Sulop	Davao del Sur	6° 36' 46"N, 125°21' 59" E	10.5 has
Paligue	Hagonoy	Davao del Sur	06°41′ 56" N, 125°18′ 23" E	3 has
Punta Biao	Digos City	Davao del Sur	6°44'59"N, 125°21'26"E	3 has
Tagabuli	Sta. Cruz	Davao del Sur	6° 50' 13" N, 125° 24' 47"E	8 has

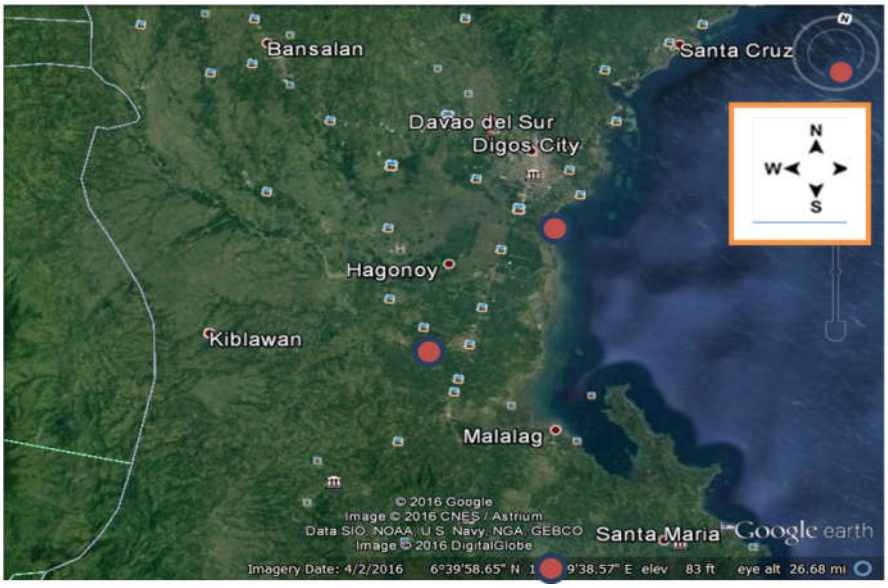

Fig. 2. Map showing the PNAP study sites in Davao del Sur, Philippines

Mangroves are the characteristic intertidal plant formations of sheltered tropical and subtropical coastlines. They have been variously described as 'coastal woodlands', 'mangals', 'tidal forests' or 'mangrove forests'. They grow luxuriantly in the places where freshwater mixes with seawater and where sediment is composed of accumulated deposits of mud. Where conditions are optimal, mangroves do indeed form extensive and productive forests. The major pressures are from urbanization and other development in all areas and forestry and fisheries, especially where communities depend on mangroves for their livelihood. However, rehabilitation success has been uncertain, reflecting gaps in integration between human and ecological components of the rehabilitation system. In Davao del Sur, Balasinon is one of the areas identified having a low survival rate for mangrove rehabilitation projects. Balasinon has a total of 4,387 mangroves survive or there are only 13.71% over the planted mangroves of 32,000. The Southern Philippines Agri-Business and Marine and Aquatic School of Technology (SPAMAST) in close coordination with the Department of Agriculture – Bureau of Fisheries and Aquatic Resources (BFAR) XI has implemented the mangrove rehabilitation projects in the different coastal areas in the two (2) provinces in Davao del Sur and Davao Occidental. The purpose of this project is to rehabilitate the denuded and disturbed mangrove areas and preserve its remains (Pacyao and Llameg, 2018). The objective of this study was to assess the mangrove area covered by the Philippine National Aquasilviculture Program (PNAP) in Davao del Sur. Strategies employed by key players of the project in the management of mangrove areas in the province was the main course of this study.

MATERIALS AND METHODS

Research Locale: The study was conducted in the five (5) coastal barangays of Davao del Sur where mangroves planted under the rehabilitation project of the Philippine National Aquasilviculture Program (PNAP) established. Area orientation of the different study site was determined. These were into: tidal/mud flats and midland. Tidal/mud flats are shoreline area which was directly exposed to changing tidal levels and wave actions; whereas midland areas are areas exposed only during high tides and protected by heavy to moderate and sometimes no vegetation. The mangrove species planted in the five (5) barangays in Davao del Sur are the *Rhizophoramucronata, Avicennia marina, Avicenniaofficinales, Rhizophorastylossa, Sonneratiacaseolaris,* and *Sonneratiaalba.*

Research design and instrument: The data on current mangrove management practices of People Organizations of the projects and the data on survival rate of mangroves were gathered through survey and actual sampling, while the best practices and socio-demographic profile were gathered using questionnaire. The questionnaire was presented in English dialect and translated into Visayan version so that the respondents can easily understand.

Selection of respondents: The respondents of the study were the PNAP mangrove rehabilitation project beneficiaries. They were randomly selected from the members of the organization beneficiaries of the five (5) barangays. The beneficiaries were composed of fisherfolks and there were at least five representatives from each identified people's organization

Table 2. Summary of survival rates of mangroves planted under PNAP in selected sites in Davao del Sur

Project Sites	Total Planted	Total Survival (as of October 2014)	Percent Survival (%)	Total Survival (as of February 2015)	Percent Survival (%)	Total Survival (as of January 2018)	Percent Survival (%)
Bagumbayan, Malalag	9,000	7,881	87.5%	7,617	84.63%	8,150	90.56%
Balasinon, Sulop	32,000	14, 184	44.33%	4,387	13.71%	3,270	10.22%
Bucana, Hagonoy	6,500	6,500	100%	6,475	99.62%	6,230	95.85%
Punta Biao, Digos City	10,000	10,000	100%	9,987	99.87%	9,870	98.7%
Tagabuli, Sta. Cruz	25,000	22,000	88%	21, 873	87.49%	20,690	82.76%
TOTAL	82,500	60,565	73%	50,339	61%	48,210	58%

Table 3. Best Practices of the beneficiaries in the project sites of PNAP in Davao del Sur, Philippines

Ideal Protocols or Common practices	Malalag		Sulop		Hagonoy		Digos City		Sta. Cruz		Total	
No. of Respondents'	5	%	5	%	5	%	5	%	5	%	25	%
How many times you visited the mangrove area after planting?												
Once a week	2	40	3	60	2	40	3	60	3	60	13	52
Twice a week	-	-	-	-	-	-	-	-	-	-	-	-
No visitation done	3	60	2	40	3	60	2	40	2	40	12	48
How often do you cleaned the mangroves area?												
Once a week	5	100	-	-	5	100	5	100	5	100	20	80
Twice a week	-	-	5	100	-	-	-	-	-	-	5	20
Method used in planting mangrove propagules?												
Natural method/Direct planting	5	100	5	100	5	100	5	100	5	100	25	100
Bagging/Nursery	-	-	-	-	-	-	-	-	-	-	-	-

were considered as respondents. Active member were given priority.

Statistical Analysis: Percentage and mean were used in analyzing the collected data using excel program.

RESULTS AND DISCUSSION

Socio-demographic profile of the respondents: A total of 25 respondents interviewed under the Philippine National Aquasilviculture Program (PNAP) in the province of Davao del Sur using the survey questionnaire. Majority of the respondents their age range form 31-60 years old. Most are elderly with 76%, and the remaining 24% were in the age of 20-30 years old. In terms of gender, 80% are males and 20% of them were females. As of civil status, majority are married with 80% and 20% of them are singles. These married beneficiaries during present implementations used PNAP as an alternative source of income. Results showed that out of 25 respondents, one respondent attained elementary level (4%), four respondents graduated in elementary (16%) and 20 respondents attained high school level (80%).

Survival rate of mangroves: The results showed that Punta Biao in Digos City, and Bucana in Hagonoy were the areas having high percentage of survival rate because it was planted in the midland area/zone. Brgy. Punta Biao in Digos City exhibited 98.7 % survive mangroves and 95.85% were recorded and in Bucana in Hagonoy, Davao del Sur. Increasing number of mangroves were also recorded in the two areas: Bagumbayan, Malalag and Tagabuli, Sta. Cruz due to replacement mechanisms done by the project beneficiaries during project implementations. The lowest survival was recorded in Balasinon, Sulop with 10.22%. The results supported with the findings that area is located in a seaward zone where plants are exposed directly to winds and waves (Pacyao and Llameg, 2018). Based on the latest data collected, Balasinon, Sulop still got the lowest survival rate due to the location of project site that are very closed to the coastal settlers which probably have problems on human pollution such as fish nets, plastics, etc., and with grazing of animals (livestocks in particular). Other contributing factors to its lowest survival include deforestation, and the effect caused by climate change.

Interventions employed: Majority of the planters used *Rhizophora* species during the program implementation, even without considering site and species selection. Results of the study revealed that Balasinon, Sulop exhibited low survival 3 years back up to the present with 10.22%. This area employed seafront planting mechanisms, and it has supposedly be successfully implemented if the program implementators used seafront species like *Sonneratia* and *Avicennia*. It is also noticeable that not all mangrove species are able to withstand the extreme weather conditions and wave action. Among 5 study sites, Bagumbayan, Malalag exhibited high survival rate of mangroves from 7,617 of the year 2015, raised to 8,150 for this year 2018. This is due to intensive replacement mechanisms employed in this area, regular monitoring and patrolling who became a factors in the increasing number of mangroves.

Reasons of the high mortality rate of mangroves: Results revealed in the interview that mangroves mortality may result from different factors such as but not limited to the change in nutrient availability, grazing animals, deforestation, feral pigs, sea level rises, storms and strong winds, shoreline erosion, altered tidal flows, and climate change which are mainly caused by human pollution and activity. Brgy.Balasinon, Sulop exhibited high mortality rates due to the occurences of astray animals, deforestation and climate change with 49%. Further, program beneficiaries also confirmed that during the first 1-3 years of program implementation, mangroves are very vulnerable to various manmade and natural phenomenon.

Management strategies: Out of 25 respondents, 52% of them answered that they visited the mangroves area at least once a week, while 48% no visitation done. In terms of cleanliness, 80% of the respondents confirmed that they cleaned the area once a week and the remaining 20% said that they clean the rehabilitated areas twice a week. Replanting of mangroves were also done, and died and uprooted mangroves was replaced with a nursery-source seedlings like in the case of Brgy. Bagumbayan. Other best practices includes regular

monitoring, maintenance and general supervision of their respective sites.

Planting methods

All of the project beneficiaries prefered natural method or direct way of planting mangrove propagules because it entails less labor and cost. Melana *et al.,* 2000 confirmed that the species of *Rhizophora* should be planted directly on the ground. Futher, direct planting method in economical with a high percentage of survival.

Conclusion

The following conclusions were derived based on the findings of the study:

1. Majority of the PNAP beneficiaries of the province of Davao del Sur with age range 31-60 years old with the percentage of 76% and the remaining 24% are 20-30 years old.
2. Most of them have an educational background of high school level (68%) and most of them were vendors, drivers, and fisherman. All of them came from the province of Davao del Sur.
3. Most of the respondents visited the mangrove area once a month with the percentage of 52% and the remaining 48% no visitation done.
4. In terms of cleaning the mangrove area, 80% of them cleaned twice a month and 20% of them clean the mangrove once a month.
5. Punta Biao, Digos City and Bucana, Hagonoy have the highest survival rate among the five study sites in the province of Davao del Sur. While Balasinon in Sulop have the lowest survival rate of mangroves with the percentage of 10.22% as of 2018.

Recommendations

Based on the result of the study, the following recommendations are suggested:

1. Planting and restoration of mangroves in the area with low number of mangroves could be considered in locations where conditions are appropriate;
2. Plant new mangroves forests in sites where they have potential to provide protection;
3. Efforts should be made to raise awareness on the importance of mangrove forests;
4. Mangroves should be preserved, provide some policies to keep mangroves as one of the wasteland of the community and destruction of mangroves to be minimized;
5. Waste disposal on mangrove areas should be discouraged

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