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Species Composition of Mangrove Forests in Olingan Creek- A Reference for Integrated Coastal Management

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Abstract—

Mangroves shares specialized attributes for growing with excess saltwater, and for promoting sustainability and dispersal. These attributes enabled mangroves to occupy tidal areas around the world and kept from extinction. This study aimed to conduct an identification of mangrove species in Olingan creek and determine the status of the mangroves in terms of their relative abundance. Data collection was done through actual determination of mangrove community structure by using the transect line plot technique. The diversity index was sought using the Shannon's Diversity Index. The results showed that there are 14 mangrove species in 9 families found to grow in the area.Nypa fruticans , Rhizophora stylosa and Rhizophora apiculata species were the most dense and most frequent mangrove species in Olingan creek. Terminalia catappa turned out to be the species having the lowest density.Avicennia(officinalis) lanata ranks first in dominancy and importance value followed by Rhizophora stylosa then Calophylluminophyllum. Moreover, Bruguiera sexangula had the lowest dominancy while Sonneratia ovata had the lowest importance value of all the mangrove species. Major problems observed include conversion of mangrove areas into residential and beach development. The mangrove composition in the area is relatively high and therefore needs proper protection, conservation and management.

Keywords - Nypa fruticans, Olingan creek, relative density, importance value, relative density

I. INTRODUCTION

Mangroves are tropical and subtropical trees and shrubs which share common characteristics. In growth forms, they range from short, prostate forms to timber-size trees 30 m high. All mangroves have shallow, wide spreading roots, many with prop roots coming from trunk and limbs. Many species have root extensions called pneumatophores that take in oxygen for the roots (Smith, R., et al., 2002)

Mangroves thrive in dense, brackish water near the opening of large rivers or along shorelines influenced by the occurrence of tides. The composition, distribution and extent of mangrove communities are influenced by the physical factors such as climate, salt tolerance, nutrient runoff, water level fluctuation and temperature. Typically, mangroves occur in areas where mean annual temperatures do not drop below 19°C (Baskin, et al., 2001). Fluctuation of temperatures even within short periods of time can damage mangroves. Stress induced by low temperatures leads to decreasing structural complexity in black mangroves (Mitsch, W., et al., 2009).

Globally, mangroves are grouped into 16 different families and more than 50 species (Hiremath, K. 2003). All of these trees preferably grow in areas with low-oxygen soil, where slow-moving waters allow terrestrial sources to be deposited into the estuarine waters, and thus act as nutrient "sinks" for these materials. Mangrove forests are among the world's most highly productive ecosystems, with gross primary production estimated at 3-24 g C/m^{-2} day^{-1}, and net productionestimated at 1-12 g C/m^{-2} day^{-1} (Kemp, M. et al., 2012).These materials will be distributed and made available to living organisms through tidal flushing.

Ecologically, mangroves perform a vital role in providing habitat for a wide variety of species. Odum *et al*. (1982) reported 220 fish species, 24 reptile species, 18 mammal species and 181 bird species that all utilize mangroves as habitat during some period of life. Many estuarine invertebrates utilize mangrove prop roots as habitat for at least part of their life cycles (Gillet 1996 *In:* Feller 1996). Mangrove forests stabilize the coastline, reducing erosion from storm surges, currents, waves, and tides. The intricate root system of mangroves also makes these forests attractive to fishes and other organisms seeking food and shelter from predators (NOAA).

The Philippines, being an archipelagic country, is endowed with mangrove forest. Today, mangroves of the Philippines are getting scarce. The estimated 400,000 to 500,000 hectares of mangrove forest (Brown and Fischer 1920) left around 112,400 hectares in 1997. Mangrove resources have been continuously depleted in the middle 70's up to recent years at the annual rate of 5,553 hectares. Coastal developments and agricultural activities had extensively denuded the resources. Illegal logging operations were indiscriminately done over the last few decades even in proclaimed mangroves reserves. Over exploitation of these resources has resulted in lower species diversity as exemplified by the low number of mangrove tree species and associated flora and fauna (Status of Coastal Resources of the Sarangani Bay Learning Site,1997).

Olingan creek is located at Barangay Olingan, Dipolog City about 7 kilometers from the Poblacion.. The banks or edges of the creek are lined with naturally growing mangroves though few were planted. Local residents called these trees as "bakauan", "dungon", "piapi", "pagatpat", "tangal", "popotan", "pedada", "langarai", "lagolo", "tabigi, "saging-

saging", "tiui", and "talisay" since no formal classifications has been made to identify the mangrove species. It is therefore, the aim of this study to determine the species composition, relative density, relative frequency, relative dominance and importance value of mangrove species in Olingan, Dipolog City. Specifically, the study geared towards the identification of the different mangrove species found in the site and determine the status of the mangroves in terms of their relative abundance. It is believed that the results of this study will be an important basis for resource management considering the increasing coastal population. Growing human settlers could pose disturbance on the ecosystem such as the accumulation of solid wastes, river siltation and cutting of these mangrove trees.

II. METHODS

Data collection was done through actual determination of mangrove community structure by using the transect line plot technique (English *et al.*, 1994).Transect line was perpendicular to the shoreline. Plots (10 m x 10 m) were randomly established in each forest type or zone. Mature mangroves (DBH > 4 cm) found in each plot were counted and measured for diameter at breast height. If the density of saplings (<4 cm DBH and height >1m) is very high and uniform, a 5 x 5 m plot was established inside the 10m x 10m plot and the saplings actually counted. If the density of seedlings (height < 1 m) is very high and uniform, a 1 m x 1 m subplot was established for actual counts. Only dominant mangrove species were quantified.

Based on the definitions on the books by Odum and Barett, 2005, Cox 1996, the following formula or equations were used:

$$\text{Population Density} = \frac{\text{Number of individuals}}{\text{Total area sampled}}$$

$$\text{Relative Population Density} = \frac{\text{Density for a species}}{\text{Total density for all species}} \times 100$$

$$\text{Frequency} = \frac{\text{Number of plots in which a species occur}}{\text{Total number of plots sampled}}$$

$$\text{Relative Frequency} = \frac{\text{Frequency value for species}}{\text{Total of frequency value for all species}} \times 100$$

$$\text{Dominance} = \frac{\text{Total of basal area of each tree of a species from all plots}}{\text{Total area of all the measured plots}}$$

$$\text{Relative Dominance} = \frac{\text{Dominance for a species}}{\text{Total dominance for all Species}} \times 100$$

Importance Value = Relative Density + Relative Frequency + Relative Dominance

Basal area is measured species wise and total in each plot as follows:

Basal area (m^2) of each species = 0.005 x DBH

$$\text{Total basal area of all species (m2/ha)} = \frac{\text{sum of all species basal area}}{\text{area of plot in } m^2 \times 10{,}000\ m^2}$$

The diversity index was sought using the Shannon's Diversity Index:

$$H = \sum_{i=1}^{s} - (P_i * \ln P_i)$$

III. RESULTS AND DISCUSSION

Fourteen mangrove species in nine (9) families were identified to occur in both sides of the Olingan creek, which is regularly inundated by the saline water during high tide. The species identified belongs to the Families of: Acanthaceae (*Acanthus ebracteatus*), Avicenniaceae (*Avicennia alba* blume, *Avicennia (officinalis) l.*), Clusiaceae (*Calophyllum inophyllum)*, Combretaceae (*Terminalia catappa*), Myrsinaceae (*Aegiceras floridum*), Palmae(*Nypa fruticans*), Pteridaceae (*Acrostichum speciosum*), Rhizophoraceae (*Bruguiera sexangula*, *Rhizophora apiculata*, *Rhizophora mucronata*, *Rhizophora stylosa*) Sonneratiaceae (*Sonneratia alba*, *Sonneratia ovata)*.

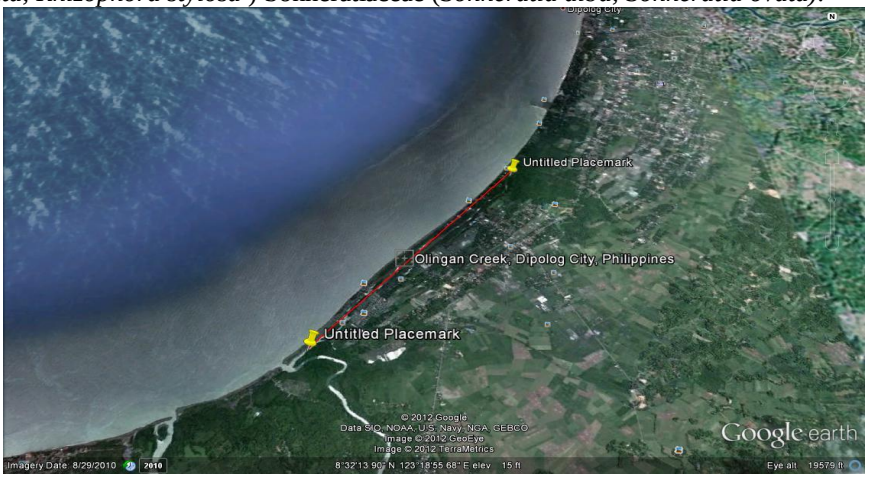

Figure 1. Satellite Image of Olingan Creek, Olingan, Dipolog City.

The figure below is a satellite image showing Olingan Creek. The creek runs more than 3 kilometers lying near the coastline of Olingan that flows out into the Sulu Sea. Participatory Coastal Resource Assessment results conducted by PENRO-ZDN and CENRO-Dipolog (2008) estimated about 8 hectares of mangroves in barangay Olingan. Debris of dried leaves, branches and other sediments are quite thick on the mouth of the creek.

The results of the vegetation analysis based on actual observation and data gathered showed that out of the 14 species identified, the *Nypa fruticans* turned out to have the highest relative population density of 49.21% and highest relative frequency of occurrence of 10.92%. The abundance of *Nypa fruticans* has an economic valueto the people in the community. Theleaves are important raw material for thatch production (for cottage siding and roofing) thus it gives livelihood to the community. This was followed by the species *Rhizophora stylosa* having a relative density of 17.46% and a relative frequency of 11.24%. *Rhizophora stylosa's* relative frequency was a little higher than *Nypa fruticans* since the counting includes the saplings. The species of *Rhizopora apiculata* rank the third with a relative density of 9.52% and relative frequency of 5.46%.

On the other hand, the three mangroves species having the lowest ranks in terms of its relative density were *Avicennia (officinalis) lanata*, *Calophylluminophyllum* and *Terminaliacatappa* all with relative density of 0.32%. Four mangrove species had the same relative frequency of 3.60%, *Avicennia (officinalis*) *lanata*, *Acrostichum speciosum*, *Sonneratia alba* and *Sonneratia ovata*.

Table 1. Relative Density and Relative Frequency of Mangrove Species

No.	Species	Local Names	PD(m2)	RPD	F	RF
1	*Acanthus ebracteatus*	tigbau	2.83	5.40	0.67	7.31
2	*Avicennia alba* blume	piapi	1.00	1.90	0.50	5.46
3	*Avicennia (officinalis)lanata*	piapi	0.17	0.32	0.33	3.60
4	*Calophyllum inophyllum*	bitaog	0.17	0.32	0.70	7.64
5	*Terminalia catappa*	talisay	0.17	0.32	0.70	7.64
6	*Aegiceras floridum*	saging-saging	0.83	1.59	0.70	7.64
7	*Nypa fruticans*	nipa	25.83	49.21	1.00	10.92
8	*Acrostichum speciosum*	lagolo	1.17	2.22	0.33	3.60
9	*Bruguiera sexangula*	pototan	0.67	1.27	0.67	7.31
10	*Rhizophora apiculata*	bakauan laki	5.00	9.52	0.50	5.46
11	*Rhizophora mucronata*	bakauan baye	1.00	1.90	0.67	7.31
		sapling	1.00	1.90	0.70	7.64
12	*Rhizophora stylosa*	bakhaw	9.17	17.46	0.33	3.60
		sapling	0.67	1.27	0.70	7.64
13	*Sonneratia alba*	pagatpat	1.83	3.49	0.33	3.60
14	*Sonneratia ovata*	pedada	1.00	1.90	0.33	3.60
Total			**52.5**	**100**	**9.16**	**100**

***PD= Pop. Density; RPD=Relative Pop. Density; F=Frequency; RF= Relative Frequency**

There were only 10 mangrove species who diameter at breast height were recorded. Out of the ten, *Avicennia (officinalis) lanata* had the highest relative dominance of 24.89% and as to the importance value it ranks first with a value of 28.82%. It is a medium to large tree that grows on firm mud on the upper intertidal in estuarine areas. *Rhizophora stylosa* ranks second having the importance value of 28.52% and relative dominance of 7.46%. This species is widely distributed that prefers sandy and rocky intertidal shores. The third mangrove species having the highest importance value of 23.31% was *Calophyllum inophyllum*. Locally this is known as bitaog. This tree is a good source of shade and has a lot of medicinal uses.

On the other hand, three mangrove species had the lowest importance value, *Rhizophoramucronata* 12.73%; *Bruguiera sexangula* 11.77% and *Sonneratia ovata* 9.13%. *R. mucronata* was one of the three species having the lowest relative dominance value of 3.52% along with *Sonneratia ovata 3*.62% and *Bruguiera sexangula* 3.19%.

Rhizophora species was cultivated in fuel wood plantations. It is favored for fuel wood and charcoal because of its high heating value (Primavera, et al. 2004).

A Sonneratiaceae species (*Sonneratia alba*) hosts colonies of fireflies thus this was locally called as pagatpat (Primavera, et al. 2004).

Table 2. Relative Dominance and Importance Value of Mangrove Species

No.	Species	D	RD	IV
1	*A. alba* blume	0.01	7.48	14.84
2	*A. (officinalis) l.*	0.05	24.89	28.81
3	*C. inophyllum*	0.03	15.17	23.13

4	*T. catappa*	0.03	13.19	21.15
5	*B. sexangula*	0.01	3.19	11.77
6	*R. apiculata*	0.01	6.48	21.47
7	*R. mucronata*	0.01	3.52	12.73
8	*R. stylosa*	0.01	7.46	28.52
9	*S. alba*	0.03	15.01	22.10
10	*S. ovata*	0.01	3.62	9.13

*** D = Dominance; RD = Relative Dominance; IV = Importance Value**

The computed Shannon's Diversity index has a value of 1.77. This means that the mangrove forest of Olingan creek is a diverse community. The abundance of mangrove species is evenly distributed among all the species in the community.

IV. CONCLUSIONS

The mangrove composition in the area is relatively high and therefore needs proper protection, conservation and management. The mangrove having the lowest density, frequency, dominancy and importance values would mean that these species might have the lowest ability for adaptation, less suitability and survival for any mangrove management activities.

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