Original Research Article

Tree Species Diversity in a Semi-Conserved Beach Forest in Southern Philippines

ABSTRACT

Beach forest is a unique type of ecosystem, a mixed group of littoral creepers, shrubs, and trees above the high tide level. In Sarangani Province, beach forest is not well studied even though it experienced various environmental threats due to the increase of coastal development and tourism. This study aimed to determine the composition and diversity of beach forest species in Barangay Kling, Kiamba, Sarangani Province and relate it to the whole coastal area of the municipality by producing a profile. Specifically, the study sought to determine the species composition of beach forest in the sampling areas; assess the beach forest diversity of at least three sampling areas in Barangay Kling. Using transect-quadrat method, species were identified through identification guides. Data analysis includes relative density, relative frequency, relative dominance, species diversity index and species importance value. Results of the assessment of species composition and community structure showed that a total of 39 beach forest species distributed among 23 families are present on the site, and another ten (10) species were observed outside of the transects. *Milletia pinnata* has the highest importance value with a rating of 79.04, followed by *Terminalia catappa* (65.54) and *Barringtonia asiatica* (44.04). The results show that the area has a huge potential for development into a beach forest park considering the diversity and maturity of the stand. In addition, management, protection, and rehabilitation of beach forest are also highly recommended to maximize their potential as climate change mitigators and their role in coastal protection.

Keywords: Coastal ecosystem, mangrove associates, coastal protection, Kiamba Sarangani

1. INTRODUCTION

1.1 Background of the Study

Beach forest is not well recognized in Sarangani Bay or in the whole province, if not the whole country. Mangroves or their associates are what always comes to mind at the mention of it. However, there is a new study concerning beach forest and as it turns out, this forest is totally different from mangroves and an independent group of trees, shrubs, and creepers that serve as natural 'greenbelt' that safeguard communities, towns, and city landward from typhoons and storm surges. Establishment of a hard infrastructure for tsunami protection, for example, is not feasible in many cases because it would adversely affect the ecology and aesthetics of the beachfront. Moreover, developing countries cannot afford such technologically advanced and capital-intensive solutions. Dr. Resurrecion Sadaba of University of the Philippines-Vizayas (UP Vizayas) stated that beach forests have 'bio-shield' function, i.e., preventing coastal erosion, providing medicines and possessing great potential for industrial applications. They can thrive along the coast and extend 200 kilometers from the beach. Immediate examples of these are *talisay* trees (*Terminalia catappa*),coconut *(Cocos nucifera)* and *malibago* (*Talipariti tiliaceum*) which are always seen along the coasts from Glan to Maitum. Mangroves do not thrive in several areas in Sarangani Bay such as in Maitum, Kiamba, and parts of Maasim. Only beach forest is common in all coastal municipalities.

Supporting the essential roles of these forests, the Department of Budget and Management (DBM) has released an initial P400 million to the Department of Environment and Natural Resources (DENR) for their Mangrove and Beach Forest Development under the National Greening Program (NGP) in 2015. Here in Sarangani, NGP is focused much on upland areas. Mangrove rehabilitation is implemented by almost all stakeholders, private and LGUs alike. However, no entity has given beach forest attention and emphasis yet, adding to the factual observation that the destruction went almost unnoticed by the conservationist community since no species are known to be restricted to this ecosystem. This type of forest has been greatly modified since it grows on areas which are most suitable for human settlements. Conspicuous trees of beach forests are also widely planted as ornamentals, in particular, *Terminalia catappa, Calophyllum inophyllum* and *Barringtonia asiatica.* The important and beneficial functions the whole beach forest community can provide, are still greatly neglected in coastal ecosystem management activities. (Goltenboth, 2006)

It is said that due to their early loss since shorelines and riverbanks were among the first sites opened for human settlement, beach forests are not well studied as other flora and therefore not familiar to the average Filipino. The Environmental Conservation and Protection Center (ECPC) recommended that Sarangani Province should have baseline data on this for future rehabilitation activities along coastal areas.

The Sarangani Bay Protected Seascape was declared a protected seascape in 1996 through Presidential Proclamation (PP) 756 in view of its ecological, scientific and economic values. It covers General Santos City and the six (6) coastal municipalities: Alabel, Malapatan, Glan, Maasim, Kiamba, and Maitum.

Kiamba is one of the six coastal municipalities of Sarangani Province. It is geographically located 97 kilometers South-West of the Capital Town of Alabel. It is positioned at Latitude 05 degrees 59 minutes North, and Longitude 124 degrees 37 minutes East. It has 39 kilometers stretch of regular coastline. Bounded to the North by the Municipality of T'boli, South Cotabato whose mountain ranges are thick and heavy with vegetations; to the South by the Celebes Sea; to the East by the Municipality of Maasim with the Taluk River marked as its natural boundary; to the West by the Municipality of Maitum bounded by the Pangi River. It has nineteen (19) barangays, thirteen (13) of which are coastal, including Barangay Kling which is immediately selected for this study since the beach forest in the area is very notable for its thickness and semi-preserved state. The forest is also very open to the public since it is located very close to the national highway.
For years there has been a growing concern in the province about various threats to coastal and marine biodiversity. The primary threat to the bay's biodiversity has been coastal habitat destruction caused by the cutting or clearing of mangroves and by destructive fishing practices that rely on the use of explosive or toxic chemicals, which damages seagrass beds and coral reefs.

The bay is also affected by a seriously deteriorated terrestrial environment in the province's upland and lowland areas. The threat from this is coastal siltation caused by erosion from degraded lands. Another threat comes from chemical and biological pollutions from agricultural and urban runoff. Wastes that enter the bay include industrial effluents and discharges of sewage and solid waste from households. The coastal zone of the province and the city is subject to continuous change because of industrial, urban and infrastructure growth. Increased urbanization (influx of people to the central towns and cities) and industrialization put further pressure on the coastal environment. As a result, the (natural) quality of the coastal environment and the adjacent coastal waters can be expected to continue to decline.

As far as natural hazards are concerned the inhabitants of the coastal zones of Maitum, Kiamba, Maasim, Alabel, Malapatan, and Glan, Sarangani are affected by infrequent storm surges. They are also exposed to the unpredictable risk of tsunamis that may be generated by ocean bottom earthquakes that can occur at relatively near or very far away locations. Tsunamis especially, pose a tremendous risk to people's lives and properties. Exposure to the Celebes Sea makes the municipalities of Maitum, Kiamba, Maasim the most vulnerable. (Sarangani Provincial Development and Physical Framework Plan, 2010-2030*)*

1.2 Objectives of the Study

The study aimed to determine the diversity of beach forest species in Kling, Kiamba Sarangani and relate it to the whole coastal area of the municipality by producing a profile. Specifically, the study seeks to:

1. Determine the species composition of beach forest in the sampling areas;
2. Describe beach forest community structure qualitatively and quantitatively in a given area;

1.3 Significance of the Study

This study is a first in Sarangani since most studies done in Sarangani Bay Protected Seascape deal on mangroves and seagrasses for coastal flora diversity. Beach forest species are different from mangroves and have a significant role in coastal stability. Thus, the data gathered may help the government unit in coming up with a management plan for the protection of this ecosystem.

1.4 Scope and Limitations

The study area is only limited to one barangay along Sarangani Bay as a pilot area to be used as a baseline for future studies of this type. This study focused on the assessment of diversity, spatial distribution, and species composition.
The assessment was limited to beach forest species only along the beach of Kling Kiamba Sarangani. Mangroves were not included in the study. The identification of species relied directly on observable and basic morphological features of individual species with the aid of taxonomic key by Primavera and Sadaba (2012).

2. MATERIAL AND METHODS

Figure 1. Map of the study area showing beach forest area size and transect locations. Note: The fourth transect was established outside of the main beach forest area which is on the other side of the national highway, to consider also some species that thrive several meters away from the shoreline.

The study was conducted during July 3-4, 2016 in the whole coastline of Barangay Kling, Municipality of Kiamba Sarangani Province, which geographically lies between 124^{o}43'13.50"E, 5^{o}56'16.20"N and 124^{o}44'32.55"E, 5^{o}55'43.05"N. The area was monitored the following year (2017) for updating and for the planned formulation of beach forest eco-park management plan in the Barangay. The actual location of sites was determined through the use of Global Positioning System (GPS).

Four (4) sampling stations/transects were assessed in the beach area with sufficient beach forest vegetation. The fourth transect was established outside of the main beach forest area which is on the other side of the national highway, to consider also some species that thrive several meters away from the shoreline. That area is partially dominated by the terrestrial species so only the coordinates of the plotted transect are recorded and not the entire vegetation, as seen on the map.

A quadrat of 10 meters by 10 meters was employed at 10 meters interval, depending on the density of the vegetation. A GPS was used to record the position of each transect. The coordinates were plotted on Google Earth and estimated its area cover to its extent.

2.1 Estimating Beach Forest Species Distribution

A GPS was used to approximate beach forest vegetation cover and extent. The position of the transects was recorded. Samples such as soil and certain species were collected from each sampling station and surrounding parameters were recorded. When plotted on Google Earth, the area cover and extent were estimated. The data on diversity was utilized to point out the distribution of the beach plant species along the gradient.

Data collection went as follows:

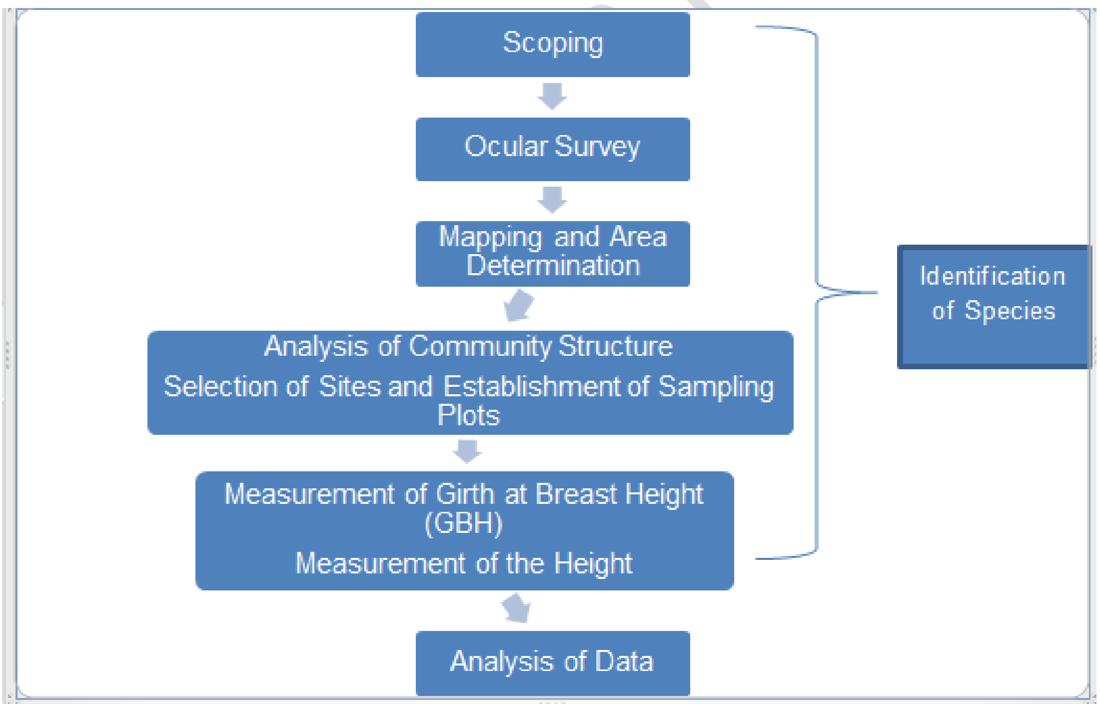

Figure 2. The flow of the collection of data. The identification of species was done even during the scoping activity and then verified further in the actual assessment.

2.2 Sampling Method

The survey used the transect-quadrat method modified after English et al., 1997. The length of the transect was dependent on the extent of the vegetation encountered. The distance between transects was about 50 to 100 meters parallel to each other. The transects were laid perpendicular to the shore. In each one, sampling quadrats/plots of 5-meter by 5-meter were placed along the line in 5-10 meters interval. In the case of trees and shrubs, the quadrat or plot size was 10-meter by 10-meter, which is similar to mangrove assessment. Only two (2) plots were established in transects 1 and 2, whereas in transects 3 and 4, three (3) plots were done. Thus, a total of 10 plots were established for assessment in the area (Figure 3). Photographs were taken periodically of representative quadrats.

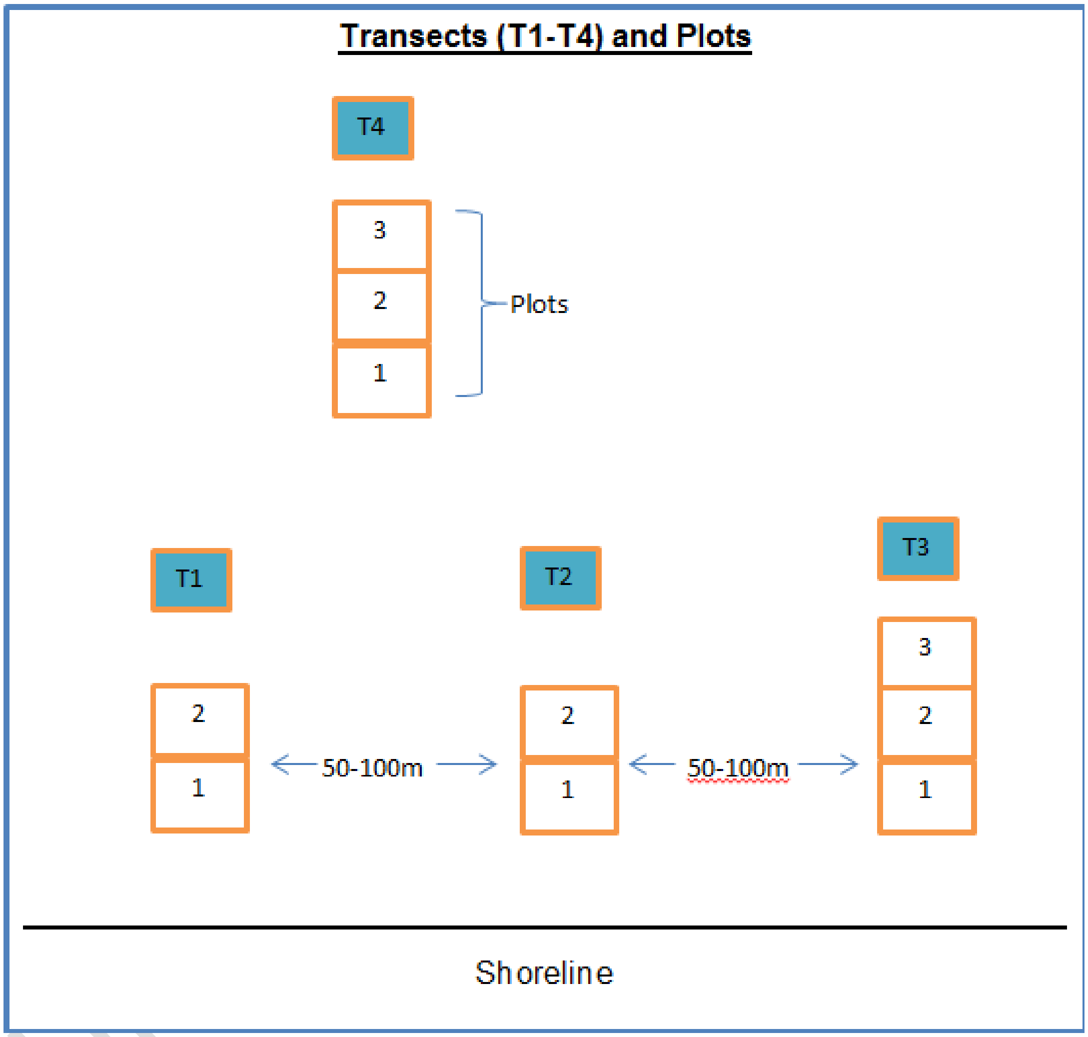

Figure 3. Sampling layout design that was followed during the survey. Trees > 5cm diameter at breast height (DBH) (16cm GBH) measured inside each plot; Seedlings identified and counted inside a 5 x 5 m subplot within the 10 x 10 m plot; Other vegetation < 5cm DBH measured inside each sub-plot; Area of plot =10 x 10 m.

2.2.1 Species Composition and Percent Cover

The beach forest communities were assessed along each transect run perpendicular to the shore in terms of their composition, abundance and percent cover in relation to prevailing habitat conditions. The species composition and percentage cover were measured within the quadrats placed at regular intervals along the length of each transect. The individual species was counted and identified. Trees inside were identified to species level, and diameter at breast height was measured using a tape measure.

Beach forest community structure was calculated using the formulae adopted from English *et al*, (1994) and Odum and Barret (2005). Microsoft Excel program was used to facilitate computations using the following formulae:

a. Basal Area (BA): $\frac{\pi \text{DBH}^2 (cm)^2}{4}$

(DBH=Diameter at Breast Height)

b. Stand Basal Area: $\frac{\sum BA\ (m^2 ha^2)}{Area\ of\ the\ plot}$

c. Stems per Hectare: $\frac{Number\ of\ stems\ per\ plot \times 10{,}000}{area\ of\ the\ plot}$

d. Relative Density: $\frac{Number\ of\ individuals\ of\ species}{Total\ number\ of\ individuals\ of\ species} \times 100$

e. Relative Frequency: $\frac{Number\ of\ plots\ where\ species\ occur}{Total\ number\ of\ plots} \times 100$

f. Relative Dominance: $\frac{Total\ BA\ of\ species}{BA\ of\ all\ species} \times 100$

g. Importance value: (Rel. Density) + (Rel. Frequency) + (Rel. Dominance)

h. Shannon Index of Diversity (H'):

$$\underset{i=1}{H'} = -\frac{\sum(Ni)}{N}\log\frac{(Ni)}{N}$$

where:

Ni = importance value of species I

N = sum of importance values for all species

Or

$$N = \overset{s}{\underset{i=1}{Ni}}$$

where:

s = total # of species in the sample

i. Species Richness Index:

$$\boldsymbol{e} = \boldsymbol{h} / \mathbf{log}\ \boldsymbol{s}$$

$$H' = \frac{s\,n\ \log n - \sum fi\ \log fi}{n}$$

where:

n = total number of species

f = total number of species

H' max = log 8

Evenness Index (j'):

$$j' = \frac{H'}{H'max}$$

Index of Dominance = I – j'

The Shannon diversity index (H') measures the degree of uncertainty in a community and has two (2) main parameters: richness and species abundances. In order to understand the meaning of a given value of H', you should also calculate the evenness E (or equitability): E= H' / H'max, where H'max is the log of the number of species in the community. This will give us a better understanding of the obtained value of H'. If E is close to 1.0, this means that equitability is higher (all species in the community are represented by a similar number of individuals) and therefore H' can be considered higher.

The diversity index tells the level of diversity in that particular area, i.e., it is possible to say the diversity is low or high (since H' generally ranges between 0 and 5). H' also aids to compare and contrast diversity between communities within an area or ecosystem and diversity between different study areas. Species richness is the most commonly used measure of diversity, but H' is a strong indicator of diversity (Fedor & Spellerberg, 2013).

2.2.2 Identification of Beach Forest Species

Each species of beach forest was identified and listed as part of the inventory. The main references used for species identification were the book of Primavera and Sadaba (2012), *Beach Forest Species and Mangrove Associates in the Philippines* and some of Calumpong H.P. and E.G. Meñez (1997) *Field Guide to the common mangroves, seagrasses and algae of the Philippines.* Other reliable identification manuals were also utilized.

Some samples were collected for herbarium specimen. Photographs were taken as part of the documentation.

3. RESULTS AND DISCUSSION

Results of the assessment of species composition and community structure of beach forest in Barangay Kling, Kiamba showed that a total of 39 beach forest species distributed among 23 families are present in the site (Table 1) and another ten (10) species were observed outside of the transects (Table 2). The results show that the area has a huge potential for developing into a beach forest park considering the diversity and maturity of the stand. The forest covers 18.9 hectares as part of the coastal area of the Barangay (Figure 1).

The area is also highly diverse with 0.86 species diversity index and species richness index of 0.59 (Table 3). Species richness index ranges within 0 to 1, with 1 being the highest. The closer to 1, the higher the species richness is.

Table 1. List of Beach Forest Tree Species in Brgy Kling, Kiamba, Sarangani

Families	**Species**	**Local Names**	**Conservation Status (IUCN Red List)**
Amaryllidaceae	*1. Crinum asiaticum L.*	bakong	Not listed
Apocynaceae	*2. Cerbera odollam Gaertn.*	baraibai, buta-buta, panabulon	Not listed
	3. Tabernaemontana pandacaqui Poir.	pandakaki, kampupot	Not listed
Arecaceae	*4. Cocos nucifera L.*	lubi, niyog	Not listed
Bignoniaceae	*5. Dolichandrone spathacea (L. f.) K.Schum.*	tiwi, tanghas	Least Concern/Population decreasing
Boraginaceae	*6. Carmona retusa (Vahl) Masam.*	tsaang-gubat, alangit	Not listed
Combretaceae	*7. Terminalia catappa L.*	talisay	Not listed
Convolvulaceae	*8. Ipomoea pes-caprae (L.) R.Br.*	palang-palang, katang-katang	Not listed
Euphorbiaceae	*9. Antidesma ghaesembilla Gaertn.*	binayuyu, inyam	Not listed
	10. Breynia vitis-idaea (Burm. f.) C.E.C. Fisch.	matang-ulang, sungut-olang	Not listed
	11. Macaranga tanarius (L.) Müell.-Arg.	binunga	Not listed
	12. Mallotus tiliifolius (Blanco) Müell.-Arg.	alay, palu-baliskad	Not listed
	13. Melanolepis multiglandulosa (Reinw. ex Blume)	alim	Not listed

	Reichb. f. & Zoll.		
Fabaceae	14. *Caesalpinia bonduc (L.) Roxb.*	dalogdog, balogbog	Not listed
	15. *Canavalia maritima (Aubl.) Thouars*	lagailai, katang-katang	Not listed
	16. *Dendrolobium umbellatum (L.) Benth.*	miyagos, malapigas	Not listed
	17. *Derris trifoliata Lour.*	butong, hingasinan, asim-asiman	Not listed
	18. *Erythrina variegata L.var. orientalis (L.) Merr.*	dapdap	Least Concern/Population stable
	19. *Millettia pinnata (L.) Panigrahi*	bani, balukbaluk	Least Concern/Population stable
	20. *Vigna marina (Burm.) Merr.*	antak-antak	Not listed
Flagellariaceae	21. *Flagellaria indica L.*	huak, baling-uai, taua	Not listed
Guttiferae	22. *Calophyllum inophyllum L.*	dangkalan, bitaog, palo maria	Lower Risk/least concern/needs updating
Hernandiaceae	23. *Hernandia nymphaeifolia (C. Presl.) Kubitz.*	pantog-lubo, koron-koron	Not listed
Lauraceae	24. *Cassytha filiformis L.*	malabuhok	Not listed
Lecythidaceae	25. *Barringtonia asiatica (L.) Kurz*	botong, bulubitoon, bitoon	Lower Risk/least concern/needs updating
	26. *Barringtonia acutangula*	himbabalod, putat	
Malvaceae	27. *Talipariti tiliaceum (L.) Fryxell*	malabago, balibago, lambago	Not listed
	28. *Thespesia populnea (L.) Soland ex Correa*	banago	Least Concern/Population stable
Moraceae	29. *Ficus septica Burm. f.*	lubnog, hawili	Not listed
Pandanaceae	30. *Pandanus tectorius Parkinson ex Du Roi*	pandan	Not listed
Pteridaceae	31. *Acrostichum aureum L.*	lagolo	Least Concern/Population stable
	32. *Acrostichum speciosum Willd.*	lagolo	Least Concern/Population stable

Rhamnaceae	*33. Colubrina asiatica (L.) Brongn.*	dabatti, watitik	Not listed
Rubiaceae	*34. Morinda citrifolia L.*	noni, nino, apatot, bangkoro	Not listed
Sterculiaceae	*35. Kleinhovia hospita L.*	tan-ag	Not listed
Verbenaceae	*36. Premna odorata*	alagaw	Not listed
	37. Premna serratifolia L.	agdaw, alagaw-dagat	Not listed
	38. Vitex parviflora Juss.	tugas, molave, mulawin	Vulnerable/needs updating
Vitaceae (Lecythidaceae)	*39. Leea guineensis G.Don*	abang-abang, karadat, tumbosut	Not listed

Table 2. Other beach forest species identified outside of the transects considered.

Families	**Species**	**Local Names**	**Conservation Status**
Anacardiaceae	*1. Buchanania arborescens (Blume) Blume*	an-an, pasi, balinghasai	Not listed
Apocynaceae	*2. Alstonia scholaris (L.)R. Br.*	dita, bita, tangitang	Lower Risk/least concern/needs updating
	3. Wrightia pubescens subsp.laniti (Blanco) Ngan	laniti	Not listed
	4. Metroxylon sagu Rottb.	lumbia, sagu, langdang	Not listed
Casuarinaceae	*5. Casuarina equisetifolia L.*	agoho, maribuhok	Not listed
	6. Jatropha gossypifolia L.	tuba-tuba	Not listed
	7. Crotalaria retusa L.	putokan, kalog-kalog	Not listed
	8. Intsia bijuga (Colebr.) Kuntze	ipil	Vulnerable/needs updating
Moraceae	*9. Artocarpus blancoi (Elmer) Merr.*	antipolo, tipolo, kolo	Vulnerable/needs updating
Ulmaceae	*10. Trema orientalis (L.) Blume*	anabiyong	Not listed

In terms of the conservation status of the beach forest in Kling, Kiamba, a few species found in the area are now considered vulnerable by the International Union for Conservation of Nature (IUCN) such as *Vitex parviflora*, more popularly known as molave or tugas, *Intsia bijuga* (ipil) and *Artocarpus blancoi* (antipolo). This must be taken into consideration by the LGU in coming up with a protection or management plan. Most of the other species, though, are not yet listed in the IUCN Red List, denoting that these have not yet been assessed under Red List Categories and Criteria (i.e., it is Not Evaluated).

Table. 3. Structural characteristics of beach forest in Kling, Kiamba

Species	BA	SBA	Stems per Ha	Tree density	Sapling density	Seedling density	Relative Dom.	Relative Freq.	Relative Den.	Imp. Value	Species Diversity	J'
	($cm^2 m^{-2}$)	(m^2 ha^{-1})	(n ha^{-1})	(n ha^{-1})	(n ha^{-1})	(n ha^{-1})	(%)	(%)	(%)	(I_v)	H'	
Barringtonia acutangula	5930.816	5.93	550.00	10.00	360.00	140.00	10.75	4.76	10.46	25.97	0.091992	
Barringtonia asiatica	20300.58	20.30	130.00	30.00	50.00	70.00	36.80	4.76	2.47	44.04	0.122322	
Cocos nucifera	7728.88	7.73	90.00	90.00	0.00	0.00	14.01	23.81	1.71	39.53	0.12	
Kleinhovia hospita	1042.18	1.04	30.00	10	10.00	0.00	1.89	4.76	0.57	7.22	0.038961	
Leea guineensis	21.66	0.02	170.00	10.00	60.00	110.00	0.04	4.76	3.23	8.03	0.04	
Milletia pinnata	9184.26	9.18	2280.00	70	330.00	1870.00	16.65	19.05	43.35	79.04	0.152622	
Premna serratifolia	303.28	0.30	70.00	20	50.00	0.00	0.55	4.76	1.33	6.64	0.03664	
Terminalia catappa	10550.72	10.55	1690.00	40	250.00	1410.00	19.13	14.29	32.13	65.54	0.144325	
Talipariti tiliaceum	20.06	0.02	70.00	0	70.00	0.00	0.04	4.76	1.33	6.13	0.034522	
Dolichandrone spathacea	2.86	0.00	10.00	0	10.00	0.00	0.01	4.76	0.19	4.96	0.029444	
Ficus septica	71.92	0.07	170.00	0	60.00	0.00	0.13	9.52	3.23	12.89	0.058718	
TOTAL	**55157.23**	**55.16**	**5260.00**	**280.00**	**1250.00**	**3600.00**	**100.00**	**100.00**	**100.00**	**300.00**	**0.867629**	**0.59954**

Results of the data analysis showed that *Milletia pinnata* have the highest importance value with a rating of 79.04, followed by *Terminalia catappa* (65.54) and *Barringtonia asiatica* (44.04).

The Family Fabaceae is most represented among families assessed with seven (7) species. The most frequent trees observed along the plots are the coconuts with 23.81% relative frequency. *Milletia pinnata (*formerly *Pongamia pinnata)* is the densest of all species observed.

Both basal area and tree height can be used to determine the maturity of the beach forest (Sadaba, 2012). Higher stand basal areas, diameters and lower densities are an indication of a more mature forest (Snedaker and Snedaker, 1984).

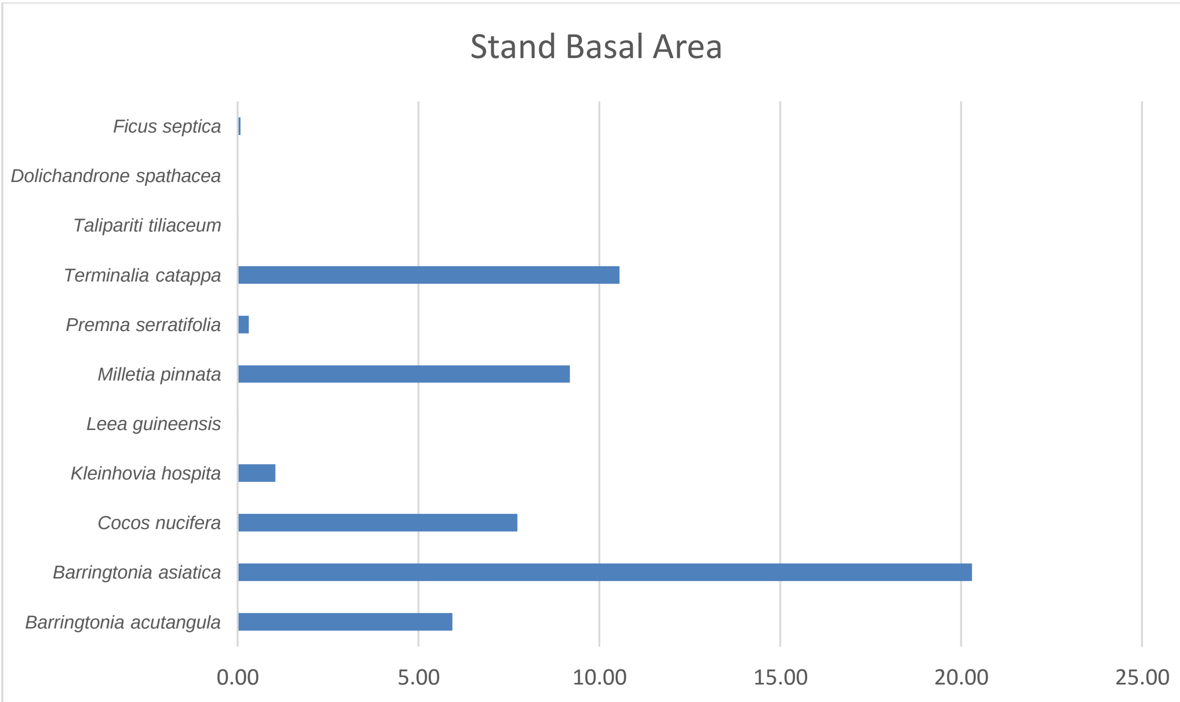

Figure 4. Stand basal area results show that *Barringtonia asiatica*, locally known as Bulobituon has the highest figure, having the largest trees, thus the most mature.

Barringtonia asiatica is the pioneer species of a natural beach forest under Family Lecythidaceae. As compared with other sturdy trees in a beach community, this species can withstand harsh natural events such as storms and strong waves. These tree species often develop extensive crowns. Their trunks are usually short and the branches are massive. This type of natural architecture is a special adaptation of not getting uprooted during storms. Even when their root system gets exposed through wave action, the branches can still support the weight of the tree. (Tobergte & Curtis, 2013)

The thick canopies of *B. asiatica* can be easily seen from the highway in Barangay Kling as trees of this species are assessed to have the largest and the most mature in the community.

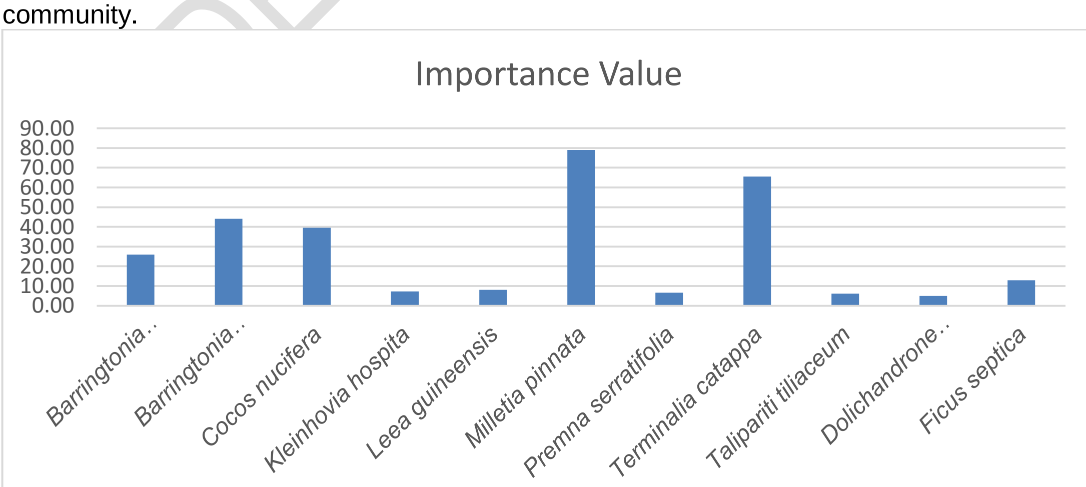

Figure 5. *Milletia pinnata* has the highest importance value among all the species observed in Barangay Kling's coastal area. This is followed by Talisay (*Terminalia catappa).*

Importance Value measures how dominant a species is in a given vegetative area. This is a standard tool used by foresters and researchers alike to inventory a forest. Foresters generally do not survey a forest by counting all the trees, but by tracing points in the stand and sampling a specified area around those points. The Importance Value is the sum of the three measures mentioned above: relative density, relative frequency and relative dominance/basal area, and can range from 0 to 300. A high importance value tells that a species is well represented in the stand because of certain combination of a) a great number of individuals of a species compared with other species in the stand, or b) a smaller number of individuals of a species, but the trees are large as compared with others in the stand. (http://www.venerabletrees.org/trees/importance-value)

Talisay species or *Terminalia catappa* are common and the most recognized by coastal communities when it comes to beach forest but upon assessment conducted, *Milletia pinnata,* which is locally known as *bani* in some localities in the Philippines, is the most dominant in Barangay Kling, Kiamba with the highest importance value of 79.04. Observably, this species, along with the coconut trees and Talisay, is also quite common in the coasts of Sarangani. *Millettia pinnata* is a semi-mangrove (also called 'mangrove associate') that can grow in either freshwater or seawater habitats.

Terminalia catappa, also known as tropical almond, being the second most important in the area, is known to be tolerant of strong winds, salt spray, and moderately high salinity in the root zone. This fact makes the species excellent for its main agroforestry uses such as soil stabilization and coastal protection (Thomson & Evans, 2006).

The coconut palm *Cocos nucifera*, on the other hand, being the fourth most important species in the studied forest, is a known popular beach forest species. Although scientist claims that pure stands of palms are not the natural vegetation of this ecosystem and it is not yet even known if coconut is really a native of Southeast Asia. The coconut palm occurs along all tropical coasts and is cultivated far inland. However, as also observed in Sarangani, in natural stands of beach forest, coconuts are widely lacking for unknown reasons (Tobergte & Curtis, 2013).

Centuries-old trees are common sights in the coastal area of Kling such as *Barringtonia asiatica, Milletia pinnata, Cocos nucifera* and *Terminalia catappa.*

Trees of higher heights are also an indication of a more mature forest as heights can only be attained over a long period of time (Sadaba, 2012).

In terms of regeneration of trees in the beach, the most important species (the one having the highest importance value) has the highest number of seedlings counted and computed per hectare with 1870 seedlings and 330 saplings. The most dominant *Barringtonia asiatica* though has the least regeneration of only 70 seedlings in a hectare.

Vines and creepers are very abundant in the area, forming beds of them in the whole stretch of Kling coastal area. Very noticeable is the presence of *Ipomoea pes-caprae* and *Canavalia maritima* which are quite common on every coast of Sarangani.

4. SUMMARY, CONCLUSION AND RECOMMENDATION

There is a total of 39 beach forest species distributed among 23 families identified in the established transects in the study area in Kling Kiamba Sarangani of which *Milletia pinnata* has the highest importance value. There are also ten (10) species observed outside the transects. The results show that the area has a huge potential for developing into a beach forest park considering the diversity and maturity of the stand. The ecosystem has fairly high diversity and species richness/evenness (0.86 diversity index and 0.59 species richness index, respectively). *Barringtonia asiatica* as beach forest pioneer species, is very notable, having the largest and the most mature trees in the area. In addition, management, protection, and rehabilitation of beach forest are also highly recommended to maximize their potential as climate change mitigators and their role in coastal protection.

Before the area can be populated by adjacent communities of the barangay, the remnants of natural beach forest should be conserved and protected, considering also that there are vulnerable species found in the area such as the molave, *Vitex parviflora, Intsia bijuga (*ipil) and *Artocarpus blancoi* (antipolo). Wherever feasible, attempts such as creating local ordinances on forest protection should be made to make its ecosystem functional, particularly to protect sandy beaches against coastal erosion or prevent damage caused by salt spray, and to cultivation or constructions. Some tree species also have economic value because of their timber, fruits, and fiber uses by many as for medicinal potentials of some plant parts. (Göltenboth, et al. 2006). These potentials need to be studied and evaluated more in Sarangani.

There is also ecotourism potential in the area as the forest concerned is highly diverse and has mature stands, and this can be a first in Sarangani or in the Philippines to have a Beach Forest Eco-Park.

It also recommended that the fauna diversity is included in the next studies regarding beach forest in Sarangani.

REFERENCES

1. B.O, A., A.O, O., & O.S, K. (2014). Chemical Composition And Nutritional Evaluation Of Leea Guineensis Seed. *Int J Food Sci Nutr Diet.*, *3*(2), 94–98. https://doi.org/dx.doi.org/10.19070/2326-3350-1400019
2. Balaji, P., Thirumal, M., Kumudhaveni, B., Kishore, G., & Aliya, A. (2012). Central nervous system depressant activity of Barringtonia acutangula (Linn.) gaertn. *Der Pharmacia Lettre*, *4*(6), 1786–1792.
3. Calumpong, Hilconida P. (1997). Field Guide to the Common Mangroves, Seagrass and Algae of the Philippines. Bookmark. Makati City. 1997.
4. English S., et al. (1994). Survey Manual for Tropical Marine Resources. Australian Institute of Marine Science, Townsville, Australia.
5. Fedor, P. J., & Spellerberg, I. F. (2013). Shannon–Wiener Index. In *Reference Module in Earth Systems and Environmental Sciences* (pp. 1–4). Elsevier. https://doi.org/10.1016/B978-0-12-409548-9.00602-3
6. Göltenboth, F., Langenberger, G., & Widmann, P. (2006). *Beach Forests*. *Ecology of Insular Southeast Asia*. https://doi.org/10.1016/B978-044452739-4/50016-4
7. Kumar, S., Nabin, N., & Dhal, K. (2009). Antimicrobial Investigation of Leaves of Barringtonia acutangula Linn .
8. McLachlan, A., & Defeo, O. (2013). Coastal Beach Ecosystems. In *Encyclopedia of Biodiversity (Second Edition)* (pp. 128–136). https://doi.org/http://dx.doi.org/10.1016/B978-0-12-384719-5.00294-X

9. Nguyen, V. Du, Nguyen, T. L., Tran, H. T., Ha, T. A., Bui, V. H., Nguyen, H. N., & Nguyen, T. D. (2014). Flavan-3-ols from the barks of Barringtonia acutangula. *Biochemical Systematics and Ecology*, *55*, 219–221. https://doi.org/10.1016/j.bse.2014.03.033
10. Odum, E.P., and G.W. Barrett. (2005). *Fundamentals of ecology*, 598. Belmont, CA: Thomson Brooks/Cole.
11. Patil, K. R., & Patil, C. R. (2017). Anti-inflammatory activity of bartogenic acid containing fraction of fruits of Barringtonia racemosa Roxb. in acute and chronic animal models of inflammation. *Journal of Traditional and Complementary Medicine*, *7*(1), 86–93. https://doi.org/10.1016/j.jtcme.2016.02.001
12. Primavera, Jurgenne H. & Sadaba, Resurreccion B. (2012). Beach Forest Species and Mangrove Associates in the Philippines. SEAFDEC Aquaculture Department, Iloilo Philippines.
13. Rajendran, R. (2010). Antimicrobial activity of different bark and wood of Premna serratifolia Lin. *International Journal of Pharma and Bio Sciences*, *1*(1).
14. Rajendran, R., L, S., R, M. S., & N, S. B. (2008). Cardiac stimulant activity of bark and wood of Premna serratifolia. *Bangladesh Journal of Pharmacology*, *3*(2). https://doi.org/10.3329/bjp.v3i2.952
15. Rativanich, T., & Dietrichs, H. (1971). Alkaloids from Thai tree used in folk medicine. *Natural History Bulletin of the Siam Society*, *24*(1–2), 145–151. Retrieved from http://www.siamese-heritage.org/nhbsspdf/vol021-030/NHBSS_024_1-2i_Rativanich_AlkaloidsromTh.pdf
16. Ravikumar, T., Nagesh-Ram, Dam-Roy, S., Krishnan, P., Grinson-George, Sankaran, M., & Sachithanandam, V. (2015). Traditional usages of ichthyotoxic plant Barringtonia asiatica (L.) Kurz. by the Nicobari tribes. *Journal of Marine and Island Cultures*, *4*(2), 76–80. https://doi.org/10.1016/j.imic.2015.10.001
17. Schlacher, T. A., Schoeman, D. S., Dugan, J., Lastra, M., Jones, A., Scapini, F., & Mclachlan, A. (2008). Sandy beach ecosystems: Key features, sampling issues, management challenges and climate change impacts. *Marine Ecology*, *29*(SUPPL. 1), 70–90. https://doi.org/10.1111/j.1439-0485.2007.00204.x
18. Schlacher, T. A., & Thompson, L. (2012). Beach recreation impacts benthic invertebrates on ocean-exposed sandy shores. *Biological Conservation*, *147*(1), 123–132. https://doi.org/10.1016/j.biocon.2011.12.022
19. Snedaker, Samuel C., Snedaker, Jane G. (1984), Ed. The mangrove ecosystem: research methods. UNESCO. United Kingdom.
20. Soares, A. G. (2003). *SANDY BEACH MORPHODYNAMICS AND MACROBENTHIC COMMUNITIES IN TEMPERATE , SUBTROPICAL AND TROPICAL REGIONS - A MACROECOLOGICAL APPROACH Alexandre Goulart Soares*. *Africa*.
21. Tanaka, N., Sasaki, Y., Mowjood, M. I. M., Jinadasa, K. B. S. N., & Homchuen, S. (2007). Coastal vegetation structures and their functions in tsunami protection: Experience of the recent Indian Ocean tsunami. *Landscape and Ecological Engineering*, *3*(1), 33–45. https://doi.org/10.1007/s11355-006-0013-9
22. Thomson, L., & Evans, B. (2006). Terminalia catappa (tropical almond). *Species Profiles for Pacific Island …*, *ver.2.2*(April), 1–20. Retrieved from http://agroforestry.net/tti/T.catappa-tropical-almond.pdf
23. Tobergte, D. R., & Curtis, S. (2013). *Ecology of Insular Southeast Asia-THE INDONESIAN ARCHIPELAGO*. *Journal of Chemical Information and Modeling* (Vol. 53). https://doi.org/10.1017/CBO9781107415324.004
24. Sarangani Provincial Development and Physical Framework Plan, 2010-2030. (Unpublished)
25. http://www.venerabletrees.org/trees/importance-value)
26. http://www.iucnredlist.org