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Mangrove assessment and diversity in Coastal area of Brgy. Julita, Biliran, Biliran, Philippines

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Abstract

Mangrove forest plays a vital role not only in life beings but as well as other lives living on it. It serves as the habitat of thousands of marine and terrestrial life and consider as one of the most productive ecosystems in the world, contributing significantly to global carbon sequestration. Unfortunately, mangrove forests are under threat from human activities such as logging, aquaculture and coastal development and as a result, many have been degrades in recent decades. The main purpose of this study is to assess mangroves' diversity, species composition, and ecological status in Brgy. Julita, Biliran, Biliran. Specifically, it aims to determine the species composition and ecological status; calculate diversity indices and mangroves species; and calculate vegetation analysis of mangrove species. Six permanent sampling stations were established within the mangrove area which further divided into transect line (3) three 10 x 10 plots were established randomly with a distance ranges 15-30 meters. Results showed a total of six (6) species belonging to four (4) families which was dominated with Rhizophoraceae family. Five species were recorded to be Least Concern and one species was considered Near Threatened (*Ceriops decandra*). Among the species, four showed decreasing population trend. Based on the results, mangrove areas of Brgy. Julita, Biliran, Biliran experienced moderate and noticeable cuttings.

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Introduction

A mangrove is a woody tree or shrub that lives along shores, rivers, and estuaries in the tropics and subtropics (Feller, 2018). Mangroves are remarkably tough. Most live on muddy soil, but some also grow on sand, peat, and coral rock. They live in water up to 100 times saltier than most other plants can tolerate. They thrive despite twice-daily flooding by ocean tides; even if this water were fresh, the flooding alone would drown most trees. Growing where land and water meet, mangroves bear the brunt of ocean-borne storms and hurricanes. Mangrove forests provide ecosystem services, such as support for local livelihoods through the provision of fuel, food, and construction materials (Thomas, *et al.*, 2017), ethnomedicinal, clean air, and typhoon/flood protection (Goloran, Demetillo, & Betco, 2020).

Furthermore, these forests provide vital ecological services such as bioprotection from coastal erosion, nursery and feeding sites for marine species, and the possible reduction of the devastating impacts of tropical storms and tsunamis (Long & Giri, 2011). The Philippines, regarded as one of the 17 mega-biodiversity countries, holds 50% of the world's mangrove species from 65 known species of mangroves in the world 2 (Goloran, Demetillo, & Betco, 2020). The country has about 18,000 km of shorelines and vast areas of mangroves totaling to 500,000 hectares (Goloran, Demetillo, & Betco, 2020). Despite of this, mangrove forests are greatly threatened across their range. Mangrove losses over the period 1980-2005 were estimated to be greater than 3 million ha with the rate of degradation over the period 1990-2000 estimated at 1% per year, a rate twice that of terrestrial rainforests (Mayaux, *et al.*, 2005). The development in the coastal areas in the Philippines which includes mangrove areas still continues today (Goloran, Demetillo, & Betco, 2020).

To address some issues on mangrove degradation and habitat loss in Brgy. Julita, Biliran, Biliran, this study purposely conducted to identify mangrove diversity, species composition, and ecological status as basis for proper and systematic approach of mangroves protection and rehabilitation. This will also serve as the basis for the creation of ordinance and other related policies to promote mangrove protection.

Generally, this study aims to assess mangroves' diversity, species composition, and ecological status in Brgy. Julita, Biliran, Biliran. Specifically, it aims to: 1. Determine the species composition and ecological status; 2. Calculate diversity indices and mangroves species; and 3. Calculate vegetation analysis of mangrove species.

Materials and methods

Study Area

The selected area for this study was Brgy. Julita, Biliran, Biliran, Philippines. Fig. 1 shows the aerial view of the study using Google Earth Version 9.182.0.1.

Transect line and sampling station establishment

Three permanent sampling stations were established within the mangrove areas. Each station had a transect line ranging from 100 to 200 meters perpendicular to the shoreline. Every station and transect line (3) three 10 x 10 plots were established randomly with a distance ranges 15-30 meters and depend on the structure of mangrove community (Goloran, Demetillo, & Betco, 2020).

Random sampling allows the researcher to easily determine the composition of mangroves and its type of species. Because individuals are rarely evenly distributed within an area, it is important to 13 sample randomly to ensure that we get a true representation of the population.

Mangrove species inside the plot were identified and counted including diameter breast height (dbh), canopy cover (cc), density and height were measured as described by English *et al.* Three (3) 1x1m subplots were established in counting of individuals for seedlings and saplings (planted seedlings not included in the counting). Each mangrove within the plots was characterized as seedling, sapling and mature tree based on the definition of Deguit *et al.* (2004).

Fig. 1. Study area and sampling stations of mangrove assessment along Brgy. Julita, Biliran, Biliran, Philippines.

Mangrove Identification

The mangroves within sub-plots and plots were identified and classified taxonomically using the field guide manual to Philippines Mangroves by Primavera *et al.* (2004).

Diversity Indices and Scale

Using Paleontological Statistical Software Package (PAST) developed by Hammer *et al.* (2001), Shannon-Weiner diversity index, species richness, relative abundance, and evenness were calculated. PAST software is the freeware widely used by many researchers for flora and fauna inventory including mangroves (Goloran, Demetillo, & Betco, 2020).

Ecological Status of Mangrove Species

Mangrove species, status, occurrences, and trends are classified and identified using the recorded online tool, the International Union for Conservation of Nature (IUCN) red list and the DENR Administrative Order No. 11 series 2017 known as the Updated List of Threatened Philippine Plants and their Categories (DENR, 2017).

Results and discussion

Species Composition and Ecological Status

A total of six (6) species under four (4) families were recorded and identified in the selected mangrove areas in Brgy. Julita, Biliran, Biliran. The Rhizophoraceae family dominated the area (75%) followed by Sonneratiaceae/Lythraceae (15%), Avicenniaceae (7%), and Palmae/Arecaceae (3%) (Fig. 2).

Among the observed species, *Rhizophora apiculata* dominated the area in terms of relative abundance and relative density followed by *Sonneratia alba*, *Avicennia alba*, *Nypa fruticans* and *Rizophora mucronata*, and *Ceriops decandra*, respectively. For the conversation status, only *Ceriops decandra* is considered Near Threatened (NT) species while the other five (5) are of Least Concern (LC) based on International Union for Conservation of Nature (IUCN) red list (Table 1). Also, the four (4) of the identified show decreasing population trends while the two (2) species, *Nypa fruticans* and *Rizophora mucronata*, are currently unknown.

Table 1. Species composition and ecological status of mangroves noted in Brgy. Julita, Biliran, Biliran, Philippines.

SL	Family	Scientific Name (Species)	Common Name	Ecological Status	Population Trend	Occurrences
1	Rhizophoraceae	*Rhizophora apiculata*	Bakhaw lalaki	Least concern	Decreasing	Global
2	Sonneratiaceae Lythraceae	*Sonneratia alba*	Pagatpat	Least concern	Decreasing	Global
3	Avicenniaceae	*Avicennia alba*	Bungalon	Least concern	Decreasing	Global
4	Palmae/ Arecaceae	*Nypa fruticans*	Nipa	Least concern	Unknown	Global
5	Rhizophoraceae	*Ceriops decandra*	Malatangal	Near Threatened	Decreasing	Global
6	Rhizophoraceae	*Rizophora mucronata*	Bakauan babae	Least concern	Unknown	Unknown

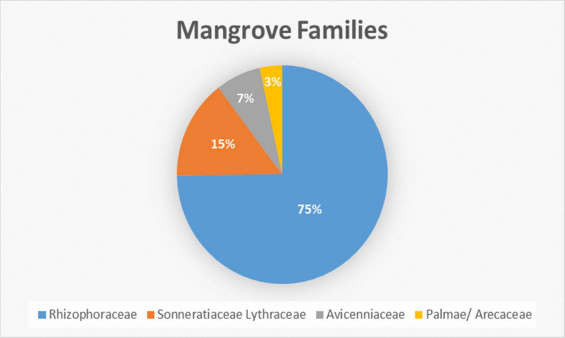

Fig. 2. Mangrove families noted in Brgy. Julita, Biliran, Biliran, Philippines.

Relative Abundance and Diversity Indices

The relative percent abundance and diversity indices of all species noted in sampling areas are shown in Figs. 2 and 3, respectively. Among the species noted in the sampling area, *Rhizophora apiculata* showed the highest abundance value of 60.00% followed by *Sonneratia alba* (14.94%), *Avicennia alba* (6.90%), *Nypa fruticans* and *Rizophora mucronata* (3.45%), and *Ceriops decandra* with the least abundance value of 2.30%. The mangrove species noted a Richness value of 6.0, Dominance of 0.5056, Shannon_H of 1.044, and Evenness value of 0.4733.

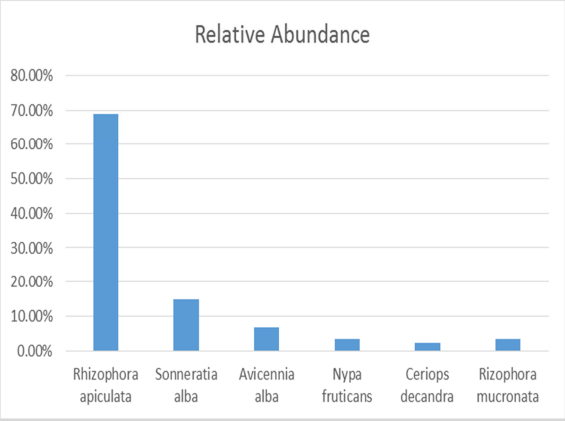

Fig. 3. Relative abundance of mangrove species noted in Brgy. Julita, Biliran, Biliran, Philippines.

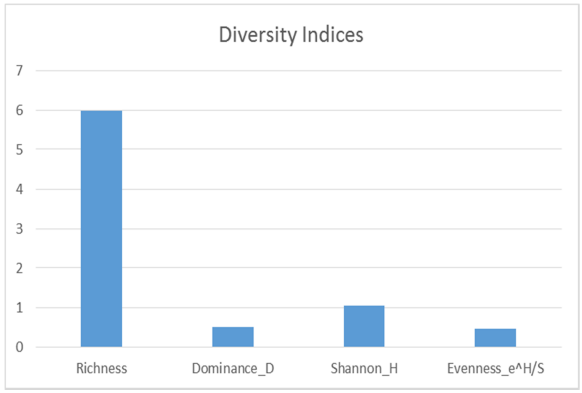

Fig. 4. Diversity indices of mangrove species noted in Brgy. Julita, Biliran, Biliran, Philippines.

Canopy Cover

Canopy cover plays an important role in the amount of sunlight that penetrates the forest floor. Scientists classify forest canopies as open (10-39% of the sky is obstructed by tree canopies), moderately closed (40-69% of the sky is obstructed by tree canopies) or closed (70-100% of the sky is obstructed by tree canopies). Densiometer is used to measure this light however because of resources, many researchers used the alternative way in measuring canopy cover and this is to position at the center of every quadrat.

Fig. 5 shows the percent canopy cover of the three (3) transects. Transect 3 (T3) showed the highest percent canopy cover of 45.78%, followed by Transect 2 (T2) with 40.36%, and Transect 1 (T1) with 28.57%. On the average, the average percentage cover of the mangroves observed in the area was 40.07%. Based on the classification given by Deguit *et al.* (2014), the canopy cover noted in Brgy. Julita, Biliran, Biliran was considered fair (25-50% crown cover) which means there is moderate disturbance and noticeable cuttings in the area.

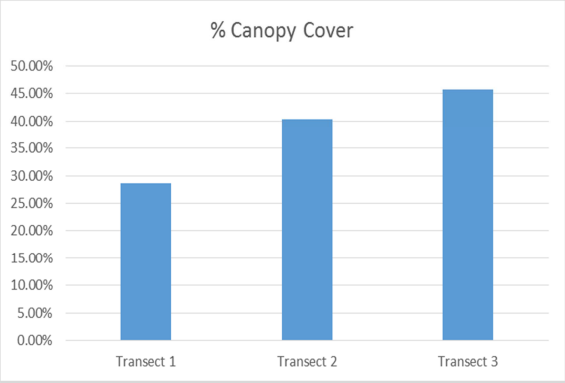

Fig. 5. Estimated canopy cover in all sampling areas in Brgy. Julita, Biliran, Biliran, Philippines.

Regeneration and Estimated Average Height

The regeneration count for sapling and seedlings was calculated using the formula described in the methodology. Planted seedlings by the personnel were not included and only natural seedlings/saplings were recorded below the mangrove tree species. Fig. 6 shows the regeneration per square meter (m^2) and the estimated average height of mangrove trees. Based on the classification given by Deguit *et al.* (2014), the average height (7.35m) and regeneration ($1.7/m^2$) noted in Brgy. Julita, Biliran, Biliran was considered excellent (above 5 m in average tree height and 1 regeneration per m^2, respectively) which means that the area is undisturbed to negligible disturbance.

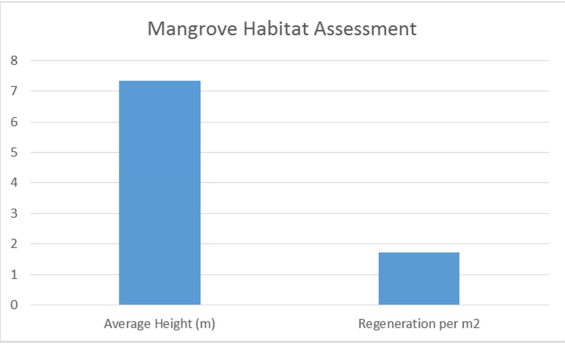

Fig. 6. Mangrove habitat assessment within the mangrove area of Brgy. Julita, Biliran, Biliran, Philippines.

Vegetation Analysis

The mangroves community structure was evaluated by using the values of population density, relative density, frequency, relative frequency, dominance and relative dominance. The summations of these values were added to attain species importance value (SIV) in the entire sampling area. The species *Rhizophora apiculata* was noted of having the highest population density indicating that this species has the highest count per unit area, followed by *Sonneratia alba*, *Avicennia alba, Rizophora mucronata, Nypa fruticans, and Ceriops tagal* (Fig. 7). For the relative frequency, *Rhizophora apiculata* and *Sonneratia alba* noted the highest value (Fig. 8). Dominance was dominated by *Sonneratia alba* (Fig. 9).

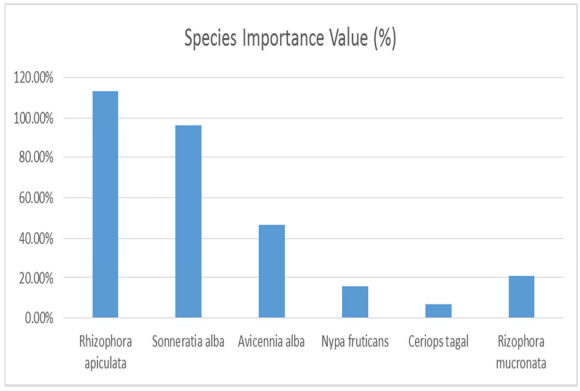

Fig. 7. Relative importance of mangrove species noted in Brgy. Julita, Biliran, Biliran, Philippines.

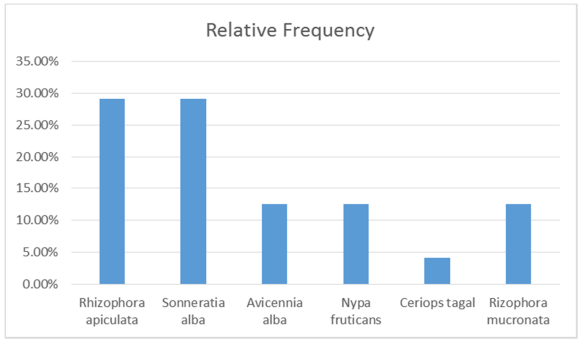

Fig. 8. Relative frequency of mangrove species noted in Brgy. Julita, Biliran, Biliran, Philippines.

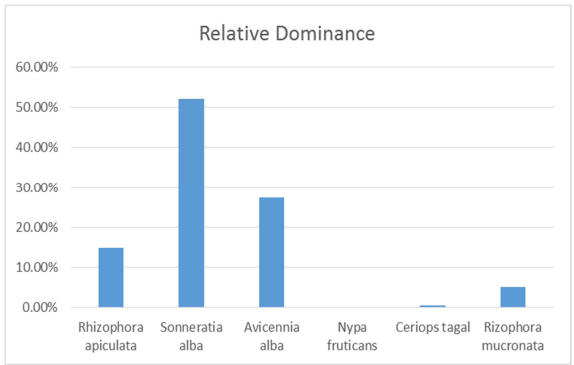

Fig. 9. Relative dominance of mangrove species noted in Brgy. Julita, Biliran, Biliran, Philippines.

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