

# DIVERSITY AND STATUS OF MANGROVES IN TABAWAN, SOUTH UBIAN, TAWI-TAWI, PHILIPPINES

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**ABSTRACT:** *Mangrove ecosystems are essential components of coastal environments, known for their rich biodiversity and critical ecological functions, including coastal protection, carbon sequestration, and habitat provision for various marine lives. This study focused on the assessment of mangrove species diversity and status on Tabawan Island, South Ubian, Tawi-Tawi, guided by specific research objectives aimed to identify the mangrove species present, determine their diversity and status. The study utilized field surveys employing Biodiversity Assessment and Monitoring System (BAMS) to collect data on mangrove species and their status. A total of 6 transect lines and 28 quadrats were laid out perpendicular to the shoreline. The results revealed that there were 21 species of mangroves identified belonging to nine (9) Families within the mangrove area of Tabawan Island. The family with the highest number of identified species was Rhizophoraceae, which includes seven (7) different species. Sonneratia alba exhibited the highest frequency, density and obtained the highest dominance. The species diversity using Shannon-Weiner Diversity Index ( $H'$ ) = 1.82, indicating less diverse and fully disturbed based on individual importance value. Timber poaching is rampant and full of dumping wastes within mangroves. This information is essential for developing effective conservation and management strategies to protect and sustain the mangrove ecosystem on the island.*

**KEYWORDS:** mangrove, assessment, diversity, status, Tabawan

## 1.0 INTRODUCTION

Mangroves are part of the coastal and marine ecosystem, which includes sea grasses and coral reefs. They are group of trees or shrubs species that lives along the coastline area that can thrive directly in salty water and serves as a crucial interface between land and sea. Mangrove forests only grow in the coastlines of tropical and subtropical latitudes near the equator because they cannot withstand freezing temperatures [1]. Mangroves are highly productive marine ecosystem offer protection from extremely events.

Mangrove forest is an important ecosystem that protects the coastline from erosion; provide human product and habitat for various marine and terrestrial species. They are also great hideout to avoid predators in the thick tangles of roots. Furthermore, mangroves are significant carbon sinks, mitigating climate change by removing atmospheric greenhouse gases through sequestration of organic matter in above and below ground biomass [2]. However, despite their importance, mangrove forests are considered one of the most threatened ecosystems across the tropics [3].

Mangrove forests also play a critical role in maintaining the health of coastal areas, sanctuaries for biodiversity, and carbon reservoirs. However, despite the importance of mangroves, it faces several threats, which already led to gradual depletion of mangrove areas worldwide [4]. Through collaborative efforts, DENR, MENRE of the Bangsamoro Region and LGUs have implemented various reforestation projects to rehabilitate, protect, conserve, manage and maintain the mangrove resources [5].

South Ubian is a 3rd class municipality in the Province of Tawi-Tawi, and is considered as the 3rd smallest municipality in terms of population as compared to other provincial municipalities. It is a coastal municipality, replete with white sand beaches, mangrove forests and rich marine resources. The majority of the inhabitants of the islands in the municipality are the Sama whose main livelihoods are fisheries and aquaculture. Majority of the

municipality's constituents live in the island of Tabawan, with a total population of 11,383 and a total number of households is 2,231 [6]. It has a coastal perimeter length of 19,465.80 meters and a total land area of 482,688 square meters taken from a municipal total land area of 27,204 hectares including forestland constituting, among others, mangroves with an aggregate total area of 44,000 hectares. From the total non-forest open land of 4,236.40 hectares, mangrove forests consist of 200.00 hectares and 104.30 hectares are swamps/marshes [7].

Tabawan Island is the largest component island in the Municipality of South Ubian and may contain variety of mangrove species that are essential to the local way of life and ecological balance. However, this ecosystem is not well studied and documented. Thus, the driving force for this study is the vital need to improve the knowledge and understanding of the ecological details in the said island's mangrove ecosystem. The primary aim was to thoroughly examine the diverse range of mangrove species that are flourishing in this area, examining their diversity and status, and to provide insightful information about conservation strategies that protect the ecosystem's sustainability while also promoting the welfare of local livelihoods, strengthening the delicate balance between human beings and the environment.

Mangrove ecosystems of Tabawan Island have remained largely unexplored in terms of its species diversity and status. This knowledge gap presents a significant challenge in understanding the island's critical mangrove ecosystem. It has been observed that mangrove have been cut for firewood collection, charcoal making, and construction materials as evidence from the remnants of the stumps and cut debris within the mangrove areas on the island. Hence, this study was pursued to address this gap by determining its diversity and status which are all vital information needed for its conservation and management.

## 2.0 METHODOLOGY

### 2.1 Study Locale

The study was conducted on the island of Tabawan (Figure 1). It is one of the component communities in the Municipality of South Ubian, an easternmost municipality in the Province of Tawi-Tawi. Tabawan consists of fifteen (15) barangays and is divided into Likud Tabawan with three (3) barangays and Lawm Tabawan with twelve (12) barangays with a total population of 11,383 and a total number of households is 2,231 [8]. It has a total land area of 482,688 square meters and has a coastal perimeter length of 19,465.80 meters. It lies between the islands of Bintaulan and Ubian within the coordinates of 120° 35' 23" E and 5° 12' 42" N.

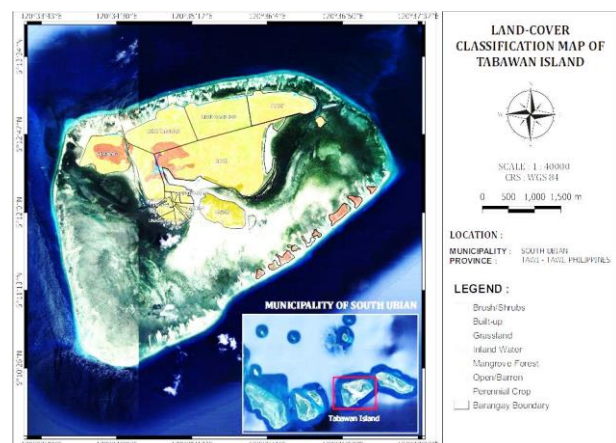


Figure 1. Land-Cover Classification Map of Tabawan Island

### 2.2 Data Collection Methods

In this assessment study, a combination of transect line and quadrat methods for data collection were employed. A belt transect line is the most applicable sampling technique for mangrove forest. A baseline transect should be laid out parallel to the shore, the length of which will depend on the extent of the mangrove forest in the study area. Belt transects lines were established perpendicular to the baseline at every 100-meter interval. The length of the

transect lines may vary depending on the extent of the mangrove forest, but as much as possible, the transect lines should extend to the most landward zone of the mangrove forest. A nested 10m x 10m quadrats were also alternately established at certain interval along the transect lines depending on the extent of mangrove forest. All trees inside the 10m x 10m with diameter of equal or greater than 5 centimeters were identified and measured (DBH & Tree Height). While small trees (< 5 cm DBH), and other non-tree floral species (shrubs, vines, herbs, ferns) were identified and counted inside the 2m x 2m quadrats. From the 100-meter transect lines, all plant species encountered along the transect lines were identified, measured and recorded. However, the identification and recording of plant species were taken from 2.5 meters away from both sides of the transect lines [9].

### 2.3 Data Analysis

Shannon Diversity Index ( $H'$ ) and Species Importance Value were used to determine the mangrove species diversity and status. The  $H'$  values (Table 1) of the biodiversity indices are based from the work of Fernando *et al.*, [10].

Table 1.  $H'$  Values and Its Equivalent

Shannon ( $H'$ ) Values	Descriptive Equivalent
>3.50 and above	Very High
3.00-3.49	High
2.50-2.99	Moderate
2.00-2.49	Low
1.99 and below	Very Low

## 3.0 RESULTS AND DISCUSSION

### 3.1 Mangrove Species Identification

Based on the assessment of mangroves on Tabawan Island using a combination of methods such as line intercept, quadrat and meander methods, there are twenty-one (21) mangrove species identified (Table 2).

Table 2. Mangrove Species and Their Conservation Status

Family	Species	Status
Acanthaceae	<i>Acanthus ebracteatus</i>	Least Concern
Acanthaceae	<i>Acanthus ilicifolius</i>	Least Concern
Alzooaceae	<i>Sesuvium portulacastrum</i>	Least Concern
Avicenniaceae	<i>Avicennia lanata</i>	Vulnerable
Avicenniaceae	<i>Avicennia marina</i>	Least Concern
Avicenniaceae	<i>Avicennia rumphiana</i>	Vulnerable
Combretaceae	<i>Lumnitzera littorea</i>	Least Concern
Combretaceae	<i>Lumnitzera racemosa</i>	Least Concern
Lythraceae	<i>Pemphis acidula</i>	Least Concern
Myrsinaceae	<i>Aegiceras corniculatum</i>	Least concern
Myrsinaceae	<i>Aegiceras floridum</i>	Near Threatened
Rhizophoraceae	<i>Bruguiera gymnorhiza</i>	Least Concern
Rhizophoraceae	<i>Bruguiera parviflora</i>	Least Concern
Rhizophoraceae	<i>Bruguiera sexangula</i>	Least Concern
Rhizophoraceae	<i>Ceriops tagal</i>	Least Concern
Rhizophoraceae	<i>Rhizophora apiculata</i>	Least Concern
Rhizophoraceae	<i>Rhizophora mucronata</i>	Least Concern
Rhizophoraceae	<i>Rhizophora stylosa</i>	Least Concern
Rubiaceae	<i>Scyphiphora hydrophyllacea</i>	Least Concern
Sonneratiaceae	<i>Sonneratia alba</i>	Least Concern
Sonneratiaceae	<i>Sonneratia caseolaris</i>	Least Concern

### 3.2 Frequency of Mangrove Species

There are 21 mangrove species encountered on Tabawan Island, South Ubian, Tawi-Tawi. The frequency distribution of all the species observed for this study had a variable frequency distribution that varied depending on the kind of tree species; some had a high frequency while others had a low frequency [11]. *Sonneratia alba* (Pagatpat) had a frequency of 1%, making it the most highly distributed species in the study area. Followed by *Avicennia rumphiana* (Bungalon) and *Lumnitzera littorea* (Tabau) with the same frequency of 0.73%. *Sonneratia* species have a high tolerance to high salinity and water levels; hence, it can survive in a zone of harsh conditions, such as the seaward zone. It was closely followed by *Avicennia marina* (Api-API) and *Lumnitzera racemosa* (Kulasi) also had the same frequency value of 0.5%. and *Aegiceras* spp. with a value of 0.10% that obtained the

lowest frequency and considered the least distributed mangrove species on the island.

### 3.3 Density of Mangrove Species

*Sonneratia alba* (Pagatpat) with a density of 0.32% has the highest density, indicating that it is the most common species found on the Tabawan Island. It was closely followed by *Avicennia rumphiana* (Bungalón) with a density of 0.25%, followed by *Lumnitzera spp.* had a density of 0.15%, *Sonneratia caseolaris* (Pagatpat) had a density of 0.09%, *Avicennia marina* (Api-Api) had density of 0.07%, *Pemphis acidula* has a much lower density with 0.007%, suggesting it is less abundant.

### 3.4 Dominance of Mangrove Species

In terms of dominance, *Sonneratia alba* (Pagatpat) has the highest value at 0.047% that contains large number of diameters at breast height among all the species on Tabawan Island. Followed by *Avicennia rumphiana* (Bungalón) and *Avicennia marina* (Api-Api) had a dominance of 0.46%, it was closely followed by *Avicennia alba* (Bungalón-Puti) with a dominance of 0.042%, and *Lumnitzera spp.* with 0.007% obtained the lowest dominance of all species encountered in the area.

The distribution and density of *Avicennia rhumpiana* within the study area revealed significant insights into its ecological dominance. The species is found to be well-distributed throughout the study area, with a high frequency of occurrence across all the transects. This suggests that *Avicennia rhumpiana* thrives in the area, occupying most of the available space. Its abundance is evident from the data, as it is the most prevalent species in the study area.

In terms of density, *Sonneratia alba* has fully occupied the area, indicating a high concentration of this species on Tabawan Island. The presence of *Sonneratia alba* is not just frequent but also dense, meaning that individuals of this species are closely packed together. This high density suggests that the environmental conditions in the study area are highly suitable for the species, allowing it to thrive and dominate the landscape. *Avicennia rhumpiana* is not only widespread but also occupies a significant portion of the study area.

### 3.5 Diversity of Mangroves Species

Table 3. Diversity Index of Mangrove Species

Diversity Index	Value	Descriptive Equivalent
Shannon-Weiner Index ( $H'$ )	1.82	Very Low

The calculated diversity index (Shannon-Wiener's index) was  $H'=1.82$  was considered very low (Table 3) based on the classification scheme by Fernando et al. [12]. The low diversity in the mangrove areas is primarily due to the lack of species variation in the mangrove stands [13]. A number of studies coincidentally concluded that the mangrove stands have very low diversity indices due to their unique stand formation compared to other tropical forest ecosystems [14].

### 3.6 Importance Value of Mangrove Species

*Sonneratia alba* locally known as Pahapat obtained the highest number of Importance Value of 54.9% and followed by the *Avicennia rumphiana* with Importance Value index of 49.1%, the next species is the *Lumnitzera spp* with an Importance Value of 39.4%, and *Aegicearas spp* with an Importance Value of 4.8% that obtained the lowest value among all species of mangroves on Tabawan Island. The Importance Value of a species was determined based on the total contribution that a species made to the community in relation to the number of plants within the quadrats (relative abundance), its influence on the other species through its competition, shading, or aggressiveness (relative dominance), and its contribution to the community by means of distribution (relative frequency) in a study plot [15].

### 4.0 CONCLUSION

There are twenty-one (21) species of mangroves identified under nine (9) families within the mangrove area of Tabawan Island. These mangrove species have varied in terms of frequencies, densities, and dominance values. *Sonneratia alba* was the most widely distributed species, with the highest frequency and density, suggesting it is the most common mangrove in the area. *Sonneratia alba* (Pagatpat) and *Avicennia rhumpiana* (Bungalón) followed closely in both frequency and density, with *Sonneratia alba* also exhibited the highest dominance, indicating it contains a significant number of larger trees. The results of the diversity indices showed that the study area has a very low diversity ( $H'=1.82$ ) considering the standard as rated by Fernando et al., [16]. The Importance Value Index (IVI) analysis revealed that *Sonneratia alba* and *Avicennia rhumpiana* (Bungalón) are the most ecologically significant species in the mangrove ecosystem of Tabawan Island due its dominant presence in terms of both frequency and dominance within the mangrove forest stand. Mangrove timber poaching is pervasive in the area especially *Sonneratia spp.* which is harvested for material construction and other purposes coupled with continuous dumping of domestic wastes which may have impacted the growth of mangroves. Other mangroves species such as *Memphis acidula*, and *Lumnitzera spp.* are harvested for domestic firewood. These mangrove species have no chance to attain their full growth as they are being harvested at young age due to their good source of firewood.

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