CONSERVATION STATUS OF NATIVE MANGROVE SPECIES IN THE PHILIPPINES

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Abstract: Despite the benefits that the mangrove ecosystem provides, large tracks disappear at an alarming rate around the world. The purpose of this paper is to assess the conservation status of native mangrove species in the Philippines. The conservation status of mangroves was assessed using the categories and criteria of DENR Administrative Order No. 2017-11 and the most recent IUCN Red List of threatened species. This study evaluated thirty-nine (39) mangrove species from thirteen (13) different families. DAO 2017-11 only identified one (1) Critically Endangered, *Kandelia candel* and two (2) Endangered species, *Pemphis acidula* and *Camptostemon philippinense*. The IUCN listed one (1) Critically Endangered species (*Bruguiera hainesii*), one (1) Endangered species (*Camptostemon philippinense*), and four (4) Nearly Threatened species (*Sonneratia ovata*, *Brownlowia tersa*, *Aegiceras floridum*, and *Ceriops decandra*). Some species listed as Critically Endangered (*Kandelia candel*) and Endangered (*Pemphis acidula*) in DAO 2017-11, are considered Least Concern in the IUCN conservation status, probably because though the overall range of these species is declining in many areas, it is not enough to reach any of the threatened category thresholds per IUCN indicators. Meanwhile, not all conservation and rehabilitation efforts in the country have been successful due to a variety of factors, such as continuing land use conversion and planting of wrong species in a mangrove zone. A framework for sustainable mangrove community-based conservation and management is proposed comprising four dimensions working in concert: political, economic, social and cultural. The study addresses UN Sustainable Development Goals (SDGs), 1 (no poverty), 8 (decent work and economic growth), SDG 10 (reduced inequality), SDG 11 (sustainable cities and communities), 12 (responsible consumption and production), 13 (climate action), 14 (life below water), and 17 (partnership to achieve the goal).

Keywords: conservation status, DAO 2017-11, IUCN, mangrove conservation, threatened species, UN Sustainable Development Goals

Introduction:

The Philippines is one of the world's seventeen mega biodiversity countries as it has exceedingly high diversity in a small piece of land in the westernmost part of the Pacific (Mittermeier et al. 1999). It has one of the most diverse coastal plant communities (Calumpong and Menez 1996) in a geographically isolated location (Garcia et al.

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2013). The country is home to 50% of the world's mangrove species, namely, the major mangrove species or true mangroves and the mangrove associates (Tomlinson 1986), with sixty-five known species distributed throughout the archipelago (Primavera, et al. 2004; Long and Chandra 2011; Kathiresan and Bingham 2001). Mangroves are one of the world's most remarkable floras, growing along tropical and subtropical coastlines and well adapted to extreme conditions such as high salinity and temperature (Kathiresan and Bingham 2001). On the other hand, this ecosystem is an important habitat that provides enormous values and benefits to both humans and other marine organisms, as well as acting as natural bridges connecting the marine and terrestrial environments (Aksornkoae et al. 1992; Doydee and Buot 2010). It also serves as a home for fish and crustaceans, a breeding ground for aquatic organisms, a sentinel of the shore communities against tidal waves and tsunamis, and a living guard of the coastal waters by screening floods from the inlands.

Despite its significance, the mangrove forest has faced serious problems in the last two decades, with approximately one-third of the mangrove area lost due to overexploitation by coastal dwellers, land reclamation, conversion to agricultural fields, salt ponds, deforestation, aquaculture, industry, and urbanization, i.e., coastal development (Macintosh et al. 2002; Penha-Lopes et al. 2011; Primavera 2000; Buot 2020). This has jeopardized the critical role of mangroves as a unique habitat for select aquatic flora and fauna of economic and ecological importance to humans (Walters 2005). Additionally, this situation compromised mangroves' ability to protect inland ecosystems from tsunamis and tidal waves, as well as marine ecosystems from flash floods (Sinfuego and Buot 2008). Furthermore, habitat loss and degradation have posed serious threats to wildlife species, particularly bird species, with 40% of the bird population declining in mangrove areas (Sandilyan et al. 2010).

Despite increased conservation and localized strategy efforts, mangroves are expected to decline and degrade in the Philippines. Thus, in the face of rapidly deteriorating mangrove ecosystem functions, assessing the conservation status of mangrove species is crucial in order to determine and plan for the most effective conservation management strategy. Thus, this paper aims to 1) determine the conservation status of the mangrove species in the Philippines and 2) design a holistic framework in conserving mangroves and the ecosystem as a whole.

Materials and methods:

Conservation status of Philippine mangroves

The study made use of scholarly publications as sources of information on the threat to mangrove species and ecosystems. The conservation status of each mangrove species was determined using the Philippines' Department of Environment and Natural Resources (DENR) Administrative Order No. 11 series of 2017 (DAO 2017-11) and the IUCN Red List of Threatened Species (IUCN 2022).

Review of holistic framework for conservation

This study proposes a sustainable mangrove conservation framework based on consolidated scientific publications, existing policies, and reports, demonstrating linkages between various stakeholders through a community-based approach to strengthen mangrove forest conservation, thereby balancing livelihood and biodiversity conservation.

Results and discussion:

The mangrove flora of the country

Mangrove biologists generally classified mangrove plants into two categories: true mangroves and mangrove associates. True mangroves are those that live entirely or nearly entirely in intertidal habitats (Primavera et al. 2004) and they are found throughout the country's coastal areas, including Luzon, Visayas, and Mindanao. It is also distinguished as a major mangrove capable of forming dense pure stands (Polidoro et al. 2010; Tomlinson 1986). According to Sinfuego and Buot (2008), the diversity of true mangroves in the Philippines, like the rest of the Philippine biota, is quite high. Mangrove associates, on the other hand, are species found in areas other than intertidal zones. They may be found in other habitats near mangroves (Buot 2020), or they may be primarily distributed in terrestrial or aquatic habitats but also occur in the mangrove ecosystem (FAO 2007; Macintosh and Ashton 2002; Jayatissa et al. 2002; Duke et al. 1998). It is also classified as a minor mangrove due to its inability to form a noticeable component of mangrove vegetation (Polidoro et al. 2010; Tomlinson 1986).

A total of thirty-nine (39) species of true mangroves have been recorded and distributed throughout the Philippines (Sinfuego and Buot 2008) out of the world total of seventy (70) (Spalding et al. 1997). This demonstrates the megadiverse conditions of the Philippine mangrove ecosystem. The thirty-nine (39) species are distributed into sixteen (16) families and eighteen (18) genera. Moreover, almost all of the reported true mangroves are woody species or vascular plants of the division Magnoliophyta with *Rhizophoraceae, Avicenniaceae, Sonneratiaceae* and *Acanthaceae* as the dominant flowering plant families. Of course there is prevailing fern species, *Acrostichum* of the division Pterophyta in almost all mangrove forests.

Rhizophoraceae, with eleven (11) species, is the most well-represented family, followed by *Avicenniaceae* with six (6) species, *Sonneratiaceae*, and *Acanthaceae*, each with three (3) species (Sinfuego and Buot 2008). Furthermore, the Philippines' dominant families can be found in Thailand, Vietnam, and many other Asian mangrove ecosystems. However, studies by Sinfuego and Buot (2014) in Iloilo's Ajuy and Pedada Bays, Tinh et al. (2009) in Mui Ca Mau National Park in Vietnam, and others in the Southeastern Coast Zone facing the South China Sea and the Western Coast Zone facing the Thailand Gulf show that *Avicennia* is the most common and dominant species. Meanwhile, Primavera et al. (2004) also presented a list of 35-40 of true mangrove species that can be found in the Philippines, indicating that the figures vary between publications.

The National Forest Resource Inventory revealed that mangroves have been declining rapidly and sharply since 1988 (Pulhin 2003, PCARRD 1991), indicating that the mangrove ecosystem is truly vulnerable (Sinfuego and Buot 2008). In addition, approximately 18 million hectares of mangrove forests worldwide (Primavera et al. 2004) and half a million hectares in the Philippines in the early 1900s are now declining and facing extreme anthropogenic activities, resulting in habitat loss and possibly extinction of mangrove species in the near future. According to other studies, unregulated fishpond culture (Primavera 2000), urbanization and the development of coastal shrimp farming in Thailand's Ranong mangrove forests (Macintosh 1996), increasing population in Vietnam (Tinh et al. 2009), and payment of taxes by mangrove residents or even non-residents as a strategy to acquire land and the claims of ownership are handed over even to the succeeding generation are all major factors in the decline of the mangrove forest (Buot 2020). As a result of continued anthropogenic activities, the mangrove ecosystem may be degraded due to conversion to other land uses.

As the mangrove area declines, so does the ecosystem services provided by the

mangroves (Buot 2020). Fisherfolks in Ajuy and Pedada, Iloilo, were also dependent on the mangroves, according to Sinfuego and Buot (2014). These included women picking shells on the mudflats and harvesting fuel wood, as well as males undertaking offshore fishing activities. Similarly, likewise, people understood mangroves' protective roles as a buffer against storms and strong winds, control coastal erosion and serving as a breeding ground and habitat/shelter for a variety of wildlife. They are always the first to see and feel the effects of even the slightest alteration in the ecosystem. As a result, the decrease and deterioration of mangrove forests have a negative impact on people's lives, particularly those who reside in coastal areas.

Conservation status of the mangrove flora of the Philippines

Table 1 (Annexes) illustrates the conservation status of mangrove species in the Philippines, based on the Department of Environment and Natural Resources' DAO 2017-11 and the Red List of Threatened Species of the International Union for Conservation of Nature (IUCN 2022).

In the table, there are a total of thirty-nine (39) mangrove species that belong to thirteen (13) different families. The *Rhizophoraceae* family has the highest species composition with twelve (12) mangrove species, followed by the *Acanthaceae* family with six (6) species.

One (1) species, *Kandelia candel* (L.) Druce (Fig. 1, Annexes) was recognized as Critically Endangered (CR) and two (2), *Camptostemon philippinense* (S.Vidal) Becc. (Fig. 2a, Annexes) and *Pemphis acidula* J.R. Forst. & G. Forst. (Fig. 2b, Annexes) - as Endangered among the thirty-nine (39) mangrove species (Tab. 1, Annexes). According to DENR Administrative Order No. 11 series of 2017, the other species that are not listed are considered non-threatened and are classified as other wildlife species (DAO 2017-11).

Meanwhile, the DAO 2017-11 classification of threatened species as Critically Endangered, Vulnerable, and Other Threatened Species was based on the best scientific and internationally accepted criteria for determining threatened species and their categories, including but not limited to the following: (1) present destruction, modification or curtailment of its habitat or range; (2) over utilization for commercial, recreational, scientific or educational purposes; (3) other natural or man-made factors affecting existence of wildlife; (4) perceived/observed population size reduction; (5) species geographic range (extent of occurrence and/or area of occupancy); (6) small population size and continuing decline in such population; and (7) very small or restricted population.

Additionally, based on DAO 2017-11, the CR (Critically Endangered) refers to a species, subspecies, varieties, or other infraspecific categories facing extremely high risk of extinction in the wild in the immediate future. On the other hand, EN (Endangered) refers to species, subspecies, varieties, or forma that are not critically endangered but whose survival in the wild is unlikely if the causal factors continue operating.

Regarding IUCN criteria and categories, on the other hand, it is revealed that only one (1) species has been recorded Critically Endangered (*Bruguiera hainesii* C.G.Rogers), one (1) - Endangered species (*Camptostemon philippinense* (S.Vidal) Becc.) and four (4) Nearly Threatened (NT) (*Sonneratia ovata* Backer, *Brownlowia tersa* (L.) Kosterm., *Aegiceras floridum* Roem. & Schult., and *Ceriops decandra* (Griff.) W.Theob.) The remaining species were classified as Least Concern (LC) species (Tab. 1, Annexes).

The IUCN Red List of Threatened Species is widely regarded as the most comprehensive and objective global approach for assessing the conservation status of floras and faunas on the planet (IUCN 2017), with accompanying criteria explaining each species' classification.

Table 2 (Annexes) depicts the IUCN assessment and justification for species classified as Critically Endangered (CR), Endangered (EN), and Near Threatened (NT). All of the species listed were evaluated on March 7, 2008, and the results were published in 2010 at https://www.iucnredlist.org/ (IUCN 2022). The IUCN Red List threat categories show that species that are Critically Endangered, Endangered, and Vulnerable are threatened with global extinction. Species that are Near Threatened are close to the threatened thresholds or would be threatened if ongoing conservation measures were not implemented. Species that are Least Concern are evaluated with a lower risk of extinction, while species that are Data Deficient are evaluated with insufficient data (IUCN 2022).

Surprisingly, among the species listed in Table 1 (Annexes), only one (1), *Camptostemon philippinense*, is listed in both the DAO 2017-11 and the IUCN as Endangered. In one case, *Pemphis acidula* was classified as Endangered and *Kandelia candel* was classified as Critically Endangered in DAO 2017-11, despite the fact that the IUCN classifies both species as Least Concern. According to the justification of IUCN, while the species' overall range is declining in many areas, it is not enough to reach any of the threatened category thresholds as judged by the IUCN authorities.

Although the DAO 2017-11 and IUCN differ in their listing of threatened species, Malabrigo and Gibe (2020) found out that the IUCN and Philippine Red List threatened categories (CR, EN, and VU) are identical. The OTS (Other Threatened Species) category of Philippine Red List can be interpreted as the Near Threatened (NT) category of IUCN. IUCN includes information to justify why a particular species belongs to a specific category which is not present in DAO 2017-11. In addition, Vie et al. (2008) discussed in their paper that the global IUCN Red List only includes information on species, subspecies, or populations that have been assessed globally. As a result, regional and national assessments are currently excluded unless there are also global assessments (for example, a species that is only found in one country (i.e., is endemic) and thus has the same Red List status at both the national and global levels).

The Philippine Red List is usually the initiative of the Philippines' Environment Agency, the DENR, and it may not be true in all other regions of the country. They differ greatly in scope and quality, but they are extremely useful in guiding conservation priorities by identifying key sites and habitats that must be protected. Locals, in fact, can determine which species are abundant and rare in their area, particularly those that are threatened. It is critical in conservation efforts, particularly for species that are economically important to the locals and have been red listed by the DENR and IUCN.

Conservation Concerns

Primavera (2000) cited approximately 19 Philippine laws on mangrove jurisdiction, zoning, and fishpond conversion, 18 laws on mangrove protection, and 11 laws on mangrove use, tenure, and rehabilitation. However, according to Garcia et al. (2013), even though several mangrove conservation and rehabilitation efforts have been completed in the country, some were quite successful while others were not that lucky. There is no doubt that mangrove forests are one of the world's most threatened tropical ecosystems in the country, with the ongoing land use conversion along the swamps. The threat is not only to the ecosystem, but to the mangrove species diversity as well. While aquaculture development has been identified as the most significant cause of mangrove degradation from the early years to the present, there are a number of other serious threats such as rice paddy and reclamation for settlement, urbanization, conversion to agriculture, industrial development, overharvesting for industrial uses such as timber and charcoal, and climate change, among others (Agaloos 1994; Alongi 2002; Primavera 2000; Boquiren et al. 2010; Camacho et al. 2020). Despite the adoption of Executive Order No. 263 (CBFM 1995),

which has spurred collaborative efforts to rehabilitate other degraded coastal areas, challenges remain.

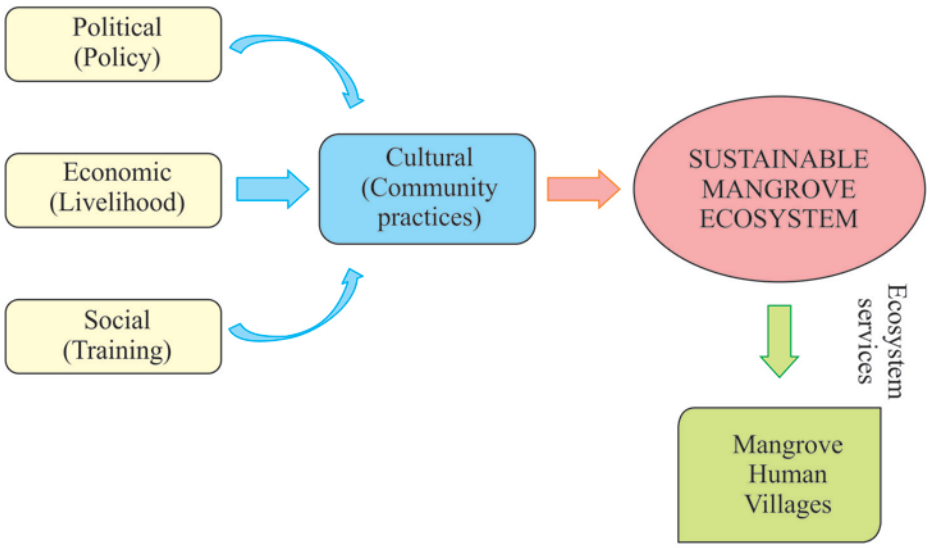
According to Garcia et al. (2013) and Camacho et al. (2020), there are factors explaining why several efforts on mangrove conservation and rehabilitation have been unsuccessful. First, it is the inappropriate species used in mangrove reforestation. Thus, the poor survival rate of mangroves and eventual death due to wrong species selection for planting. Also, there is the general trend to avoid planting near fishponds and shrimp ponds. In fact, mangroves should be planted in the vicinities of ponds, not on seagrass beds and tidal flats where they did not previously exist. When mangroves are present near fishponds and shrimp ponds, they can help enhance the detritus food chain, and hence stabilizing mangrove structure and dynamics. Other factors mentioned by Agaloos (1994), Alongi (2002), Primavera (2000), Boquiren et al. (2010), and Camacho et al. (2020) include mangrove management that is not sustainable. Incidentally, CBFM participants in mangrove areas do not have access to the same incentives as CBFM participants in upland areas, such as security of tenure and exemption from forest charges for harvesting.

Additionally, Primavera (2000) outlined some of the institutional issues affecting mangrove development and conservation in the Philippines. These include aquaculture promotion as a development strategy, low economic rent for mangroves, conflicting policies, and ineffective government management.

Framework for sustainable mangrove conservation and management

A framework for sustainable mangrove conservation and management needs to be proposed and developed. Figure 3 illustrates the four (4) major dimensions that can contribute to a sustainable mangrove ecosystem exuding ecosystem services for the communities. These are the political, economic, social and cultural dimensions. This framework can serve as a guide in protecting, conserving, and utilizing mangrove resources in a sustainable way.

Figure no. 3 Proposed framework for sustainable mangrove management and conservation



In short, there should be political will on the part of the government to formulate needed policies or enforce existing ones and a concerted effort to diversify mangrove ecosystem-based livelihood opportunities in order to stabilize mangrove based household economy. The political and economic dimensions need strong will on the part of the local government to achieve the goal of sustainably managing mangroves and estuaries. Alongside these, sincere dedication in organizing massive community training campaign and capacity building, utilizing strategies which have been thought about carefully considering the cultural character and aspirations of the mangrove human villages. Doing so, we will hopefully lead to achieving maximum participation and social transformation towards sustainable community-based mangrove conservation and management. A sustainable mangrove ecosystem can be characterized by optimum biophysical features enhancing biotic diversity stimulating energy flow and nutrient cycling dynamics, leading to production of ample ecosystem services for the nearby mangrove villages.

Conclusion:

The mangrove forest provides enormous goods and ecosystem services to the community. However, it is one of the world's most threatened tropical ecosystems in the country. Despite several efforts in mangrove reforestation and conservation, it is still declining and under threat. In fact, practically, due to massive land use conversion in a number of localities, almost all mangrove species are under threat. But based on the findings of this study, out of the thirty-nine (39) native mangroves in the Philippines, only three (3) species are listed in the country's Department of Environment and Natural Resources' DAO 2017-11 Red List as threatened: Kandelia candel (Critically Endangered), Pemphis acidula and Camptostemon philippinense (Endangered). In the IUCN Red List, six (6) species are listed as threatened: Bruguiera hainesii (Critically Endangered), Camptostemon philippinense (Endangered) and Sonneratia ovata, Brownlowia tersa, Aegiceras floridum and Ceriops decandra (Near Threatened).

The conservation status released by DAO 2017-11 and the IUCN Red List produced significant information that aid in the enhancement of policies, planning for diversified mangrove ecosystem-based livelihood opportunities, designing training and capacity building activities which consider the cultural practices, norms, values and aspirations of mangrove village communities for the overall goal of sustainably managing community-based mangrove conservation. A framework has been proposed in this paper to serve as guide in sustainable conservation and management of mangrove ecosystem comprising four dimensions that should be working in concert: political, economic, social and cultural.

The success or failure of mangrove conservation and the sustained availability of ecosystem services indeed remain to be largely dependent on the response of local people.

The study directly contributes to the attainment of the United Nations Sustainable Development Goals (SDGs), specifically, SDG 1 (no poverty), SDG 8 (decent work and economic growth), SDG 10 (reduced inequality), SDG 11 (sustainable cities and communities), SDG 12 (responsible consumption and production), SDG 13 (climate action), SDG 14 (life below water), and SDG 17 (partnership to achieve the goal).

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Rezumat:

STAREA DE CONSERVARE A SPECIILOR DE MANGROVE NATIVE DIN FILIPINE

În ciuda beneficiilor pe care le oferă ecosistemul de mangrove, fâșii mari dispar într-un ritm alarmant în întreaga lume. Scopul acestei lucrări este de a evalua starea de conservare a speciilor de mangrove native din Filipine. Starea de conservare a mangrovelor a fost evaluată folosind categoriile și criteriile din Ordinul Administrativ DENR nr. 2017-11 și cea mai recentă Listă Roșie a speciilor amenințate IUCN. Acest studiu a evaluat treizeci și nouă (39) de specii de mangrove din treisprezece (13) familii diferite. Conform DAO 2017-11 au fost identificate doar o singură specie grav periclitată, *Kandelia candel* și două periclitate, *Pemphis acidula* și *Camptostemon philippinense*. Potrivit cu IUCN au fost înregistrate o specie grav periclitată (*Bruguiera hainesii*), una periclitată (*Camptostemon philippinense*) și patru specii în prag de amenințare (*Sonneratia ovata*, *Brownlowia tersa*, *Aegiceras floridum* și *Ceriops decandra*). Unele specii enumerate ca și grav periclitate (*Kandelia candel*) și periclitate (*Pemphis acidula*) în DAO 2017-11, după IUCN sunt considerate ca specii mai puțin amenințate, probabil pentru că, deși abundența acestor specii este în scădere în multe zone, totuși nu este suficient pentru a atinge oricare dintre pragurile categoriilor amenințate conform indicatorilor IUCN. Pe de altă parte, nu toate eforturile de conservare și reabilitare din țară au avut succes, datorită unor diverși factori, cum ar fi conversia continuă a utilizării terenurilor și plantarea de specii nepotrivite în zonele de mangrove. Este propus un cadru pentru conservarea și gestionarea durabilă a populației de mangrove, care să cuprindă patru dimensiuni menite să lucreaze împreună: politic, economic, social și cultural. Studiul abordează Obiectivele ONU de Dezvoltare Durabilă (ODD), respectiv 1 (fără sărăcie), 8 (muncă decentă și creștere economică), SDG 10 (reducerea inegalității), SDG 11 (orașe și comunități durabile), 12 (consum responsabil și producție), 13 (acțiunea climatică), 14 (viața sub apă) și 17 (parteneriat pentru atingerea obiectivului).

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Annexes:

Table no. 1 Conservation status of native mangrove species in the Philippines per DAO 2017-11 of the Department of Environment and Natural Resources and the International Union for the Conservation of Nature (IUCN)

Family / Species	Common name	Conservation status	
		DAO	IUCN
Acanthaceae			
Acanthus ebracteatus Vahl	tigbau	-	LC
Acanthus ilicifolius L.	tigbau/diliuario	-	LC
Acanthus volubilis Wall.	diliuario	-	LC
Avicennia alba Blume	bungalon-puti	-	LC
Avicennia officinalis L.	api-api	-	LC
Avicennia marina (Forssk.) Vierh.	bungalon/piapi	-	LC
Arecaceae			
Nypa fruticans Wurmb.	nipa/sasa	-	LC
Combretaceae			
Lumnitzera littorea (Jack) Voigt	tabau	-	LC
Lumnitzera racemosa Willd.	kulasi	-	LC
Euphorbiaceae			
Excoecaria agallocha L.	buta-buta/alipata	-	LC
Lythraceae			
Pemphis acidula J.R. Forst. & G. Forst.	bantigi	EN	LC
Sonneratia alba Sm.	pagatpat	-	LC
Sonneratia caseolaris (L.) Engl.	pedada	-	LC
Sonneratia ovata Backer	pagatpat baye	-	NT
Malvaceae			
Camptostemon philippinense (S.Vidal) Becc.	gapas-gapas	EN	EN
Brownlowia argentata Kurz	maragomon-puti	-	DD
Brownlowia tersa (L.) Kosterm.		-	NT
Heritiera littoralis Dryand. in Aiton	dungon late	-	LC
Meliaceae			
Xylocarpus granatum J.Koenig	tabigi	-	LC
Xylocarpus rumphii (Kostel.) Mabb.	malapiagaw/tabigi	-	-
Myrtaceae			
Osbornia octodonta F.Muell.	taualis/tualis	-	LC
Plumbaginaceae			
Aegialitis annulata R.Br.		-	LC
Primulaceae			
Aegiceras corniculatum (L.) Blanco	saging-saging	-	LC
Aegiceras floridum Roem. & Schult.	tinduk-tindukan	-	NT
Pteridaceae			
Acrostichum aureum L.	bagakay/lagolo/lapole/ pako-laot/paku-pakuan/piay/ ugab-ugab	-	LC
Acrostichum speciosum Willd.		-	LC
Rhizophoraceae			
Bruguiera cylindrica (L.) Blume	pototan-lalake	-	LC
Bruguiera exaristata Ding Hou		-	LC
Bruguiera hainesii C.G.Rogers		-	CR
Bruguiera gymnorhiza (L.) Savigny in Lam.	busain	-	LC
Bruguiera parviflora (Roxb.) Wight & Arn. ex Griff.	angarai/langaria	-	LC

Bruguiera sexangula (Lour.) Poir.	pototan-babae	-	LC
Ceriops decandra (Griff.) W.Theob.	malatangal/malatungog	-	NT
Ceriops tagal (Perr.) C.B.Rob.	tangal/tungog	-	LC
Kandelia candel (L.) Druce	Baler bakauan	CR	LC
Rhizophora apiculata Blume	bakauan-lalake	-	LC
Rhizophora mucronata Lam.	bakauan-babae	-	LC
Rhizophora stylosa Griff.	bakauan-bato/bankau	-	LC
Rubiaceae			LC
Scyphiphora hydrophylacea C.F.Gaertn.	nilad	-	LC

Note: CR: Critically Endangered; EN: Endangered; NT: Near Threatened; LC: Least Concern; Data Deficient

Table no. 2 Justification of Critically Endangered (CR), Endangered (EN), and Near Threatened (NT) species based on IUCN categories and criteria (IUCN 2022)

Species	Status	Justification
Bruguiera hainesii C.G.Rogers	CR	This species is very rare and has a limited and patchy distribution. There are approximately 200 known mature individuals remaining in Singapore, Malaysia, and Papua New Guinea, and there has been at least 27% loss of mangrove area in this species range over a 25-year period (less than one generation length) due to extensive coastal development. More research is needed to determine this status of this species population in Thailand, Indonesia, Myanmar, Philippines, and Viet Nam.
Camptostemon philippinense (S.Vidal) Becc.	EN	This species is very rare and has a limited and patchy distribution in Indonesia and the Philippines. It is highly threatened by the removal of mangrove area for fish and shrimp aquaculture, and coastal development throughout its range. It is estimated that there are less than 2,500 mature individuals remaining and there has been a least 30% decline of mangrove area within this species range since 1980 (one generation length).
Sonneratia ovata Backer	NT	This species can be locally common within its range but is increasingly rare at the extremities of its range. This species is threatened by the loss of mangrove habitat throughout its range, primarily due to the clearing of mangroves for fish and shrimp pond development. Although there is no data available on mangrove area loss over three generation lengths (120 years), mangrove loss within this species range is estimated to be 28% since the 1980s. There is reason to believe that this species may quality for a threatened category in the future due to the fact that it occurs only on the landward margin where it is the most vulnerable to coastal development and human activities in many parts of its range.
Brownlowia tersa (L.) Kosterm	NT	This species has a disjunct range, is common within at least parts of its range, and is fast-growing. This species is threatened by habitat loss from coastal development, erosion, and the construction of shrimp and fishponds throughout its range. Although there is no data available on mangrove area loss over three generation lengths (60 years), mangrove loss within this species range is estimated to be approximately 26% since the 1980s. There is reason to believe that this species may qualify for a threatened category in the near future due to the fact that it occurs only on the landward margin where it is the most vulnerable to coastal development and human activities.
Aegiceras floridum Roem. & Schult.	NT	This species has a restricted distribution and is uncommon. There has been an estimated 29% decline in mangrove area within this species range since 1980. It has a very a narrow range of appropriate habitat as it requires very high salinity.

Ceriops decandra (Griff.) W.Theob.	NT	This species is rare with a restricted distribution. It has an area of occupancy estimated to be less than 4,500km^2. It is threatened by habitat loss from coastal development throughout its range. Although exact population reduction is unknown, it is estimated to be between 12 - 26% over a twenty-year period (1980-2000). However, with more information to estimate population reduction over a period of three generation lengths (120 years) declines would likely be much higher, and this species may likely qualify for a threatened category.

Note: CR: Critically Endangered; EN: Endangered; NT: Near Threatened

Figure no. 1 Critically Endangered species (*Kandelia candel*)

Figure no. 2 Endangered species: a. *Pemphis acidula*; b. *Camptostemon philippinense*

a.

b.