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Mangroves of the Tropical Southwestern Pacific

VU

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Abstract

Mangroves of the Tropical Southwestern Pacific are a regional ecosystem subgroup (level 4 unit of the IUCN Global Ecosystem Typology). It includes the marine ecoregions of Central and Southern Great Barrier Reef, Coral Sea, Fiji Islands, New Caledonia, Tonga Islands, Torres Strait Northern Great Barrier Reef, and Vanuatu. The Tropical Southwestern Pacific province mapped extent in 2020 was 874.0 km^2, representing 0.6% of the global mangrove area. The biota is characterized by 21 species of true mangroves (15 of them assessed in the IUCN Red List of Threatened Species (RLTS)).

The Tropical Southwestern Pacific mangroves flourish on various islands with distinct climate settings that shape their unique characteristics. These islands predominantly experience a tropical climate with pronounced dry and humid seasons, except for the west coast of New Caledonia, which is semi-arid. Mangrove trees in this region are typically small, rarely exceeding 10 m in height. The local populations depend heavily on these mangrove forests for food and wood, vital for their subsistence and economic activities. This province is home to 160 mangrove-associated animal species, with 99 of them being fish, according to the IUCN RLTS. Fishing is a crucial source of income for Pacific communities, and 85% of the species caught in mangrove areas are consumed by local populations.

Despite the relatively low population density, the mangroves of the Tropical Southwestern Pacific province face significant threats from both natural and anthropogenic pressures. In Fiji, the main anthropogenic threat is the conversion of mangrove forests to agricultural land, particularly for sugarcane cultivation. In New Caledonia, urban development, mining, and aquaculture are the primary drivers of mangrove degradation. Tonga experiences pressure from population migration from smaller islands to the main island, impacting mangrove areas. In Vanuatu, while anthropogenic pressures are minimal, natural threats like cyclones pose a significant risk to mangrove forests and may surpass anthropogenic impacts in this region.

Today the Tropical Southwestern Pacific mangroves cover ≈874 km² and the net area change has been 0.7% since 1996. Particularly in the recent decade, the Tropical Southwestern Pacific mangroves rate of area gain has increased. Extrapolating this recent trend over the next 50 years suggests a projected increase of 3.6% in mangrove extent. However, under a high sea-level rise scenario (IPCC RCP8.5) ≈-45.4% of the Tropical Southwestern Pacific mangroves would be submerged by 2060. Overall, the Tropical Southwestern Pacific mangrove ecosystem is assessed as **Vulnerable** (**VU**).

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Mangroves; Tropical Southwest Pacific, Red List of ecosystems; ecosystem collapse; threats.

Ecosystem classification:
MFT1.2 Intertidal forests and shrublands

Assessment's distribution:
Tropical Southwestern Pacific province

Summary of the assessment:

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**DD**	**LC**	**DD**	**DD**	**NE**	
Subcriterion 2	**LC**	**LC**	**VU**	**LC**	**NE**	**VU**
Subcriterion 3	**DD**	**LC**	**DD**	**DD**	**NE**	

VU: Vulnerable, LC: Least Concern,
DD Data Deficient, NE: Not Evaluated

Mangroves of The Tropical Southwestern Pacific

VU

1. Ecosystem Classification

IUCN Global Ecosystem Typology (version 2.1, Keith *et al.* 2020):

Transitional Marine-Freshwater-Terrestrial realm

MFT1 Brackish tidal biome

MFT1.2 Intertidal forests and shrublands

MFT1.2_4_MP_35 Mangroves of the Tropical Southwestern Pacific

IUCN Habitats Classification Scheme (version 3.1, IUCN 2012):

1 Forest

1.7 Forest – Subtropical/tropical mangrove vegetation above high tide level *below water level*[1]

12 Marine Intertidal

12.7 Mangrove Submerged Roots

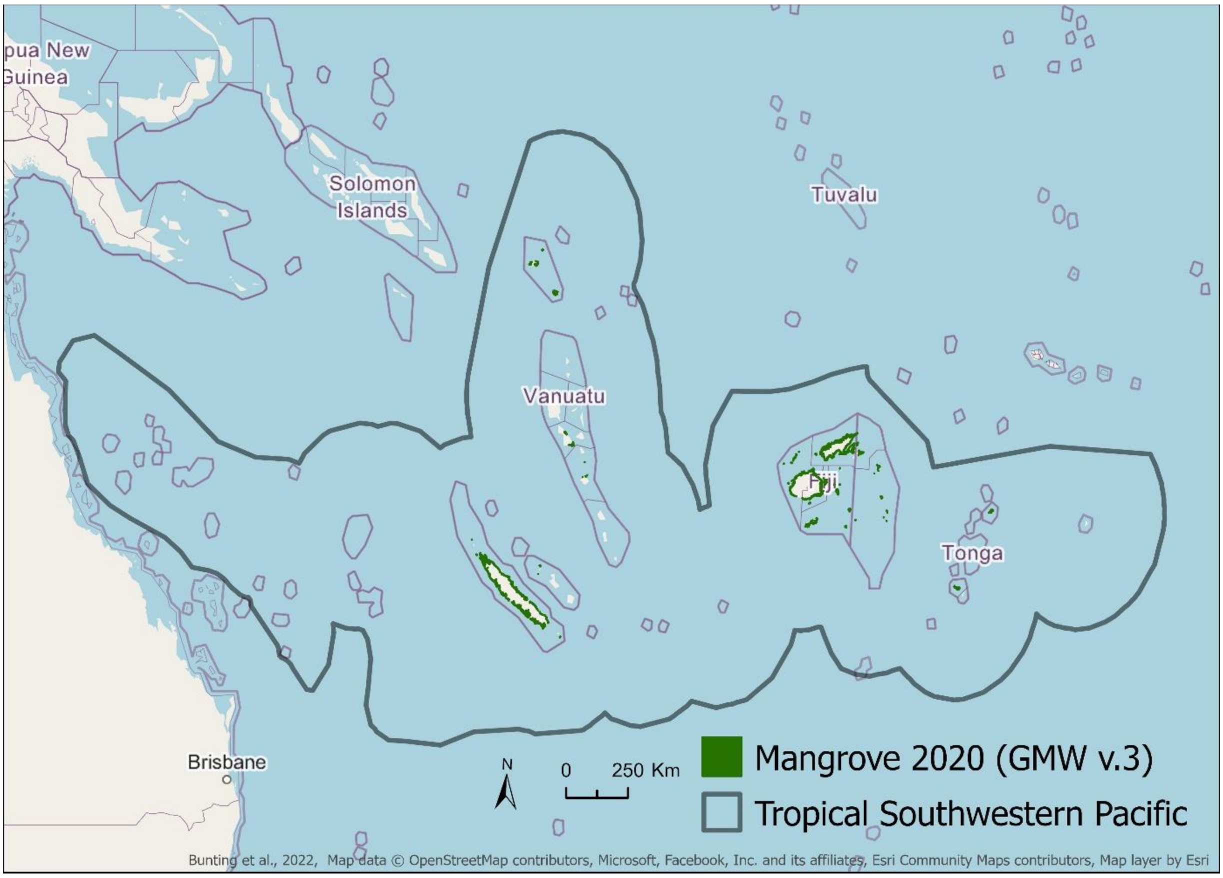

Figure 1. The mangroves of Tropical Southwestern Pacific. Mangrove extent data from Bunting *et al.* (2022); marine ecoregion province delimitation modified from Spalding *et al.* (2007).

[1] Note on the original classification scheme. This habitat should include mangrove vegetation below water level. Mangroves have spread into warm temperate regions to a limited extent and may occasionally occur in supratidal areas. However, the vast majority of the world's mangroves are found in tropical/subtropical intertidal areas.

2. Ecosystem Description

Spatial distribution

Mangroves of the Tropical Southwestern Pacific province include intertidal forests and shrublands of the marine ecoregions of Central and Southern Great Barrier Reef, Coral Sea, Fiji Islands, New Caledonia, Tonga Islands, Torres Strait Northern Great Barrier Reef, and Vanuatu, that extend across Australia, Fiji, New Caledonia, Solomon Islands, Tonga, and Vanuatu (Figure 1).

The estimated extent of mangroves in this province was 874.0 km² in 2020, representing about 0.6% of the global mangrove area and 20% of the Pacific Islands mangrove area. The province includes territories with the 2nd (Fiji), 3rd (New Caledonia), and 4th (Solomon Islands) largest mangrove cover in the Pacific Region, after Papua New Guinea. Over the period since 1996, there has been a net area change of 0.7% (Bunting *et al*., 2022).

Fiji's mangrove area is estimated at 488.2 km², with 90% observed on the islands of Viti Levu and Vanua Levu (Pearson *et al*., 2019). Between 2001 and 2018, there was a loss of 11.4 km², which occurred mainly after 2012, following cyclones Evan and Winston. Combining historical and recent data, Fiji has experienced a total loss of approximately 54.5 km² of mangrove ecosystem, accounting for 7.7% of the original extent since 1896 (Cameron *et al*., 2021a).

Rhizophora stylosa (left) and Bruguiera gymnorhiza (right) in Kubulau, southern Vanua Levu, Fiji (Photo credit: Joanna Ellison)

New Caledonia has the second-largest area of mangroves in the region, estimated at 334.2 km². Mangrove forests thrive on the main island (Grande Terre) and one of the Loyalty Islands, Ouvea. The west coast of Grande Terre is 80% covered by mangrove forests, while the east coast is less suitable for mangrove development due to a steep shoreline. However, climate is clearly different between the two coasts, the west one being semi-arid, and the east one being tropical humid. As a result, mangrove biodiversity is higher in the large estuaries of the east coast than on the west coast. Additionally, in New Caledonia, 44% of mangrove forest areas are between 0.1 and 1 km²; 26% are smaller than 0.1 km²; and only 7% are greater than 5 km² (Virly, 2006).

Regarding the Solomon Islands, only the islands of the province of Temotu are included in the Tropical Southwestern Pacific province contributing a total of 25.3 km² of mangrove forests within the province. In Vanuatu, mangrove forests cover approximately 15.8 km², distributed across 35 mangrove forest areas on nine main islands (David, 1985). The Kingdom of Tonga, consisting of 171 islands (land area 750 km²), with only 36 inhabited (Murofushi and Hori, 1997), features mangrove forests throughout multiple island groups, including the main one, Tongatapu (256 km²), Niuas, Vava'u, and Ha'apai. The total mangrove area in Tonga is estimated at 10 km², representing 1.33% of the total land area (Rohorua and Lim, 2006).

The most extensive and diverse mangrove ecosystems are found in deltas and estuaries, such as the Rewa Delta in Fiji, where rivers deposit significant quantities of sediment into lowlands. However, deltaic mangroves are exclusive to Fiji and New Caledonia in this region. In New Caledonia, mining activities has led to the accumulation of large quantities of lateritic sediments at some river mouths, on which mangroves develop such as at the Tontouta Delta and the Nepoui Delta. Some estuarine mangroves are also present in Fiji and in New Caledonia, where they represent 20% of mangrove area, with the largest mangrove (22 km²) of New Caledonia's at the Diahot estuary. Additionally, mangrove forests are found commonly in embayments, harbours, and lagoons on many islands in the region, growing on intertidal slopes formed primarily by the accumulation of vegetative detritus. Tongan mangroves of Tongatapu are mainly lagoonal formations, and a few are also observed in the Solomon Islands. In some Pacific regions, like Ouvea, New Caledonia, mangroves thrive on reef flats, characterized as carbonate mangrove forests. Finally, the mangroves of Vanuatu and the majority of the mangroves in Fiji, New Caledonia, and the Solomon Islands are open-coast forests (Bhattarai and Giri, 2011).

Bruguiera forest developing on carbonate soil in Ouvea, New Caledonia (Photo credit: Sarah Robin)

Biotic components of the ecosystem (characteristic native biota)

During the 21st century, efforts have been made to identify mangrove tree species in the province. Previous reports for some of these islands dated back half a century. In total, 34 mangrove tree species were recorded as present on at least one of the islands, while three other species were uncertain. Out of these 37 species, 21 are true mangrove species in the geographic range but only 15 are assessed as true mangroves according to the Red List of Threatened Species (RLTS) (IUCN, 2022). Out of these 21 species, one of them, *R. samoensis*, is near threatened (NT) (IUCN, 2022). Eight other species are also true mangrove species but are not within the province's geographical range according to the RLTS; one of these species, *A. rumphiana*, is classified as vulnerable (VU). Finally, eight mangrove species observed in this province are hybrid species, not recorded in the RLTS except for *B. hainesii*, which is critically endangered (CR) but is not within the geographical range according to the RLTS.

The 37 species come from 19 different genera and 14 families. The Solomon Islands are the richest in terms of species in this region, with a total of 29 confirmed species and two uncertain. Nine mangrove tree species solely grow in this region in the Solomon Islands. New Caledonia is the second territory with the most mangrove species (23±1), followed by Vanuatu (18±2). New Caledonia harbours three mangrove species that are not observed in other territories of the region and one hybrid is endemic to this French archipelago (*Rhizophora X neocaledonica*). Fiji and Tonga share most of their mangrove species with a species richness of 9±1 and 10, respectively (Table 1).

Table 1. Mangrove tree species and families in the Tropical Southwest Pacific region from Duke *et al.* (2012) and Marchand *et al*. (2007). "X" means present and "?" not confirmed. *True mangrove species within this province and in the RLTS (see annex 1)

Mangrove family	Mangrove species	Fiji	New Caledonia	Solomon Islands	Vanuatu	Tonga
Acanthaceae	*Acanthus ebracteatus*			X		
Acanthaceae	*Acanthus ilicifolius*		X	X		
Pteridaceae	*Acrostichum aureum*		X	X		
Pteridaceae	*Acrostichum speciosum*	?	X	X	X	X
Myrsinaceae	*Aegiceras corniculatum*			X		
Acanthaceae	*Avicennia alba*			X		
Acanthaceae	*Avicennia marina**		X	X	X	
Acanthaceae	*Avicennia rumphiana*			X		
Lecythidaceae	*Barringtonia racemosa*	X		X		
Rhizophoraceae	*Bruguiera cylindrica*			X		
Rhizophoraceae	*Bruguiera gymnorhiza**	X	X	X	X	X
Rhizophoraceae	*Bruguiera X hainesii*			X		
Rhizophoraceae	*Bruguiera parviflora**			X	X	
Rhizophoraceae	*Ceriops tagal**		X	X	X	
Fabaceae	*Cynometra iripa*		?	?		
Bignoniaceae	*Dolichandrone spathacea*		X	X	X	
Euphorbiaceae	*Excoecaria agallocha**	X	X	X	X	X
Malvaceae	*Heritiera littoralis*	X	X	X	X	X

Combretaceae	*Lumnitzera littorea**	X	X	X	X	X
Combretaceae	*Lumnitzera racemosa**		X			
Combretaceae	*Lumnitzera X rosea*		X			
Arecaceae	*Nypa fruticans*			X		
Lythraceae	*Pemphis acidula*	?	X	X	?	X
Rhizophoraceae	*Rhizophora X annamalayan*			?		
Rhizophoraceae	*Rhizophora apiculata**		X	X	X	
Rhizophoraceae	*Rhizophora samoensis**	X	X		X	X
Rhizophoraceae	*Rhizophora mucronata**			X		
Rhizophoraceae	*Rhizophora X selala*	X	X		X	X
Rhizophoraceae	*Rhizophora stylosa**	X	X	X	X	X
Rhizophoraceae	*Rhizophora X lamarckii*		X	X	X	
Rhizophoraceae	*Rhizophora X tomlinsonii*				?	
Rhizophoraceae	*Rhizophora X neocaledonica*		X			
Rubiaceae	*Scyphiphora hydrophylacea**		X	X		
Lythraceae	*Sonneratia alba**		X	X	X	
Lythraceae	*Sonneratia caseolaris**		X	X	X	
Lythraceae	*Sonneratia X gulngai*			X	X	
Meliaceae	*Xylocarpus granatum**	X	X	X	X	X
	Total species	9±2	23±1	29±2	18±2	10

The presence of *R. mangle* in the Pacific region is surprising considering it originates from the American continent. Outlier populations are observed in Samoa, Tonga, Fiji, and New Caledonia, prompting speculation about its natural establishment in the Southwest Pacific due to the perceived barrier posed by the Pacific Ocean. Some researchers proposed that early Polynesians might have introduced this species, challenging assumptions about its natural range. However, *R. mangle* exhibits remarkable viability, with floatation periods lasting eight times longer than *B. gymnorhiza*. Genetic studies in Fiji, Tonga, Samoa, and Ecuador have revealed reduced genetic variation in the Southwest Pacific, indicating a likely colonization from South America. This evidence suggests that *R. mangle* was present in the Southwest Pacific before Polynesian voyages.

Tonga serves as the easternmost limit for most mangrove species found in Fiji and Tonga, excluding *E. agallocha* (Steele, 2006). Tonga's mangrove ecosystems are characterized by a limited diversity of species, a consequence of the region's isolation, restricted sediment sources, and microtidal conditions. The primary mangrove species include *L. littorea*, *B. gymnorhiza*, *R. mangle*, *R. samoensis*, and *R. stylosa*, with other species occupying peripheral habitats and rarely forming pure stands. However, *E. agallocha* can form pure stands on the main island of Tongatapu. The seaward stands, dominated by *R. mangle*, *R. samoensis*, and *R. stylosa*, generally exhibit a dwarf forest structure, with an average height of less than 5 m. Conversely, landward areas are dominated by *B. gymnorhiza* and *E. agallocha*, reaching heights of 10-15 m (Murofushi and Hori, 1997).

As in Tonga, mangrove trees in the Tropical Southwestern Pacific province are considered small compared to the mangrove trees from tropical areas and rarely exceed 10 m in height. In New Caledonia, the dominant mangrove species are *A. ilicifolius*, *A. marina*, *B. gymnorhiza*, *E. agallocha*, *R. samoensis*, and *R. stylosa*. The genus *Rhizophora* represents 55% of mangrove tree species in the entire territory, while *A. marina* represents 14% (Virly, 2006). The typical mangrove zonation of the west coast of the main island consists of *Rhizophora* spp. on the seaward side (trees 2-5 m in height); *A. marina* occurs higher on the shore (trees < 2 m in height); and the saltmarsh on the landward side. Porewater salinity, mainly depending on soil surface elevation, is the main driver of this zonation (Deborde *et al*., 2015).

Mangrove taxa exhibit regional distribution patterns that can be categorized into four groups: 1) generalists: seven species are widely spread and can be found in most estuaries across New Caledonia; 2) north restricted: eight species are limited to northern latitudes; 3) moisture preferring: 10 species are found predominantly in areas with higher rainfall; and 4) arid tolerant: one species, *L. racemosa*, is confined mainly to regions with low rainfall, particularly along the western coastline (Marchand *et al*., 2007). In Fiji, the mangroves in the central and northern divisions exhibit a distinct flora compared to those in the western division, primarily due to the relatively dry climate prevalent in the west (Lal, 1990). The dominant mangrove species are *B. gymnorhiza* to landward, and *R. stylosa* and *R. samoensis* to seaward (Lal, 1990).

Rhizophora stylosa forest in New Caledonia (Photo credit: Sarah Robin)

According to the Red List of Threatened Species (IUCN, 2022), there are 160 animal species and six plant species associated with mangrove habitats in the Tropical Southwestern Pacific province that have natural history collection records, or observations, within the distribution of this province. Out of these 160 species, 99 species are fish (some estimates give higher numbers): half of the fish species are in the Order Perciformes and one third are in the Family Gobiidae. Of the other species, 33 are birds, mainly Passeriformes (15), and gastropods (13 species), mainly in the Family Ellobiidae (seven species). The other species are sharks, mammals, and reptiles (annex 2).

Among the 160 animal species, the Green sawfish, *Pristis zijsron*, is classified as critically endangered (CR), while two species of flying foxes (*Pteropus nitendiensis* and *Pteropus tuberculatus*), and two fish species in the Class Chondrichthyes (*Negaprion acutidens* and *Anoxypristis cuspidata*), are endangered (EN). Six species are recognized as vulnerable (VU) including four Chondrichthyes species (three sharks and one ray), the dugong (Dugong dugong), and one species of parrot (*Prosopeia splendens*); another species of parrot, *P. personata* is near threatened (NT) (see complete list in annex 2).

The Bruguiera gymnorhiza mangrove, located in Marovo lagoon in the western Solomon Islands, is a space where people harvest mangrove propagules for food and wood for firewood (Photo credit: Mary Tahu)

Abiotic components of the ecosystem

In the Tropical Southwestern Pacific, the general climate is tropical with distinctive humid and dry seasons. Fiji, Solomon Islands, Tonga, and Vanuatu have an average annual rainfall around 2,500 mm, whereas the average annual rainfall in New Caledonia is 1,066 mm (WorldData.info) (Figure 2). The west coast of New Caledonia, where the majority of mangrove forests are located, is characterized as semi-arid.

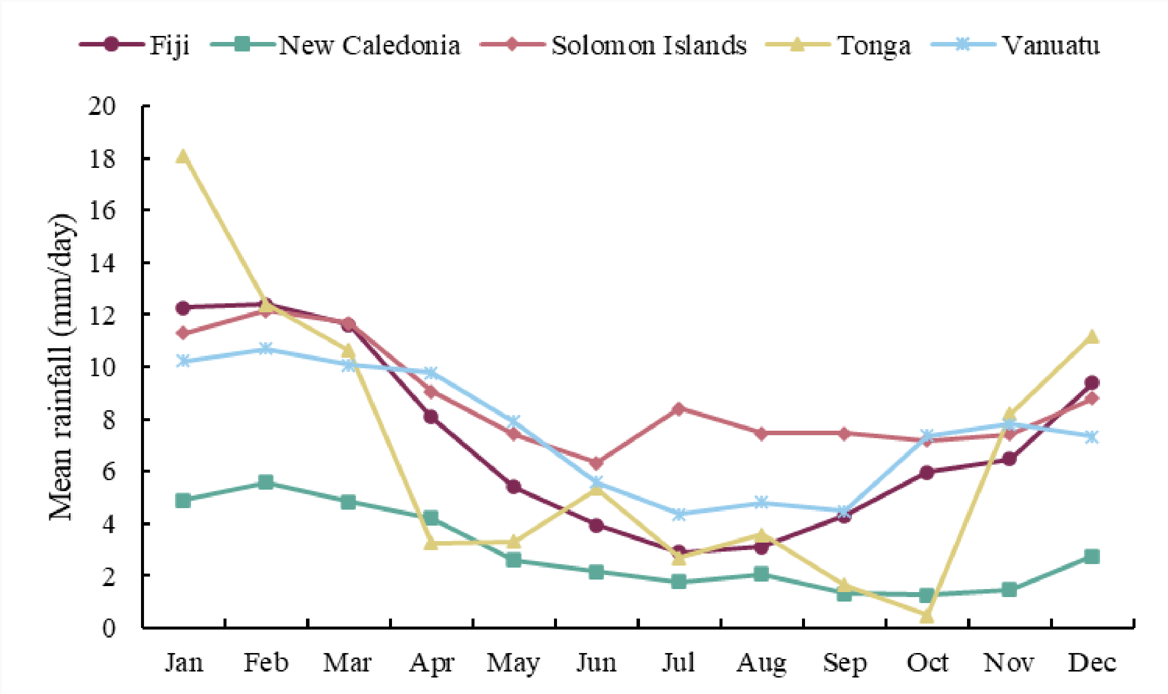

Figure 2. Mean rainfall (mm/day) in the islands of the Tropical Southwestern Pacific.

Zonation of mangroves results from a combination of parameters related to the nature of the draining waters and the frequency and duration of immersion by these waters. These parameters include elevation, positioning in relation to continental freshwater inflows and seawater inputs, substratum texture and salinity, and more. The sediment geochemistry is strongly influenced by the mangroves. For example, studies in New Caledonia showed that mangroves in the Genus *Rhizophora* are best adapted to immersion and waterlogged soils because they can resist anoxia. *Rhizophora* mangroves thrive in areas swept by daily tides, with salinities homogenized by water mixing. They play a pioneering role on new colonization where the environment is calm enough for seedling establishment, enabling them to develop on mud, sand, and even old reefs. Species in the Genus *Bruguiera* do not tolerate high salinity and are associated with the less saline zones of the mangrove. The highest areas of the mangroves are occupied by *Avicennia*, which can tolerate high salinities while living at the edges of tidal creeks, but this requires an energy cost that restricts their growth. *Avicennia* can thrive along hypersaline tidal creeks, which developed at the expense of *Rhizophora* forests (Marchand *et al*., 2007).

The transition from one zone to another depends on variations in precipitation and hydrocirculation. Therefore, a drained tidal creek can be recolonized by *Avicennia*. Surface and subsurface hydrocirculations play a major role in mangrove zonation and exchanges between the mainland and the lagoon. The respective influences of *Avicennia* and *Rhizophora* on sediment geochemistry are opposed, primarily because *Avicennia* can oxygenate the sediment from their root system. This characteristic explains the suboxic to oxic conditions observed in the upper parts of cores under this mangrove genus. The substratum under *Rhizophora* is mainly anoxic, except in areas with strong bioturbation caused by crabs, or in areas with higher topographic elevation leading to periodic sediment drying (Marchand *et al*., 2007).

Key processes and interactions

Mangroves act as structural engineers possessing traits such as pneumatophores, salt excretion glands, vivipary, and propagule buoyancy that promote survival and recruitment in poorly aerated, saline, mobile, and tidally inundated substrata. They exhibit high efficiency in nitrogen use and nutrient resorption. Mangroves produce large amounts of detritus (e.g., leaves, twigs, and bark), which is either buried in waterlogged sediments, consumed by crabs and gastropods, then decomposed further by meiofauna, fungi and bacteria, thereby mobilising carbon, and nutrients to other trophic levels in the mangrove and coastal food web. These ecosystems also serve as major blue carbon sinks, incorporating organic matter into sediments and living biomass.

The mangroves in the Tropical Southwestern Pacific province serve as crucial habitats for numerous fish and crustacean species. Fishing plays a vital role in the livelihoods of coastal communities across the Pacific Islands, with around 47% of these communities relying on fishing as a source of household income (Singh *et al*., 2021). Eighty-five percent of the species caught regularly in mangroves in this province are food sources for local communities, while 80% have commercial value (Lal, 1990; Thollot, 1996). The mangroves are often found alongside seagrass beds and coral reefs, forming a specialized ecosystem known as a seascape. In this ecosystem, mangroves and seagrass beds act as natural filters for water discharges and intercept sediments from the land, thereby promoting reef growth. Conversely, coral reefs serve as a buffer against waves and strong currents, creating a conducive environment for the growth and sustainability of mangroves and seagrasses (Gilman *et al*., 2006; Singh *et al*., 2021).

The mangrove ecosystems in the Tropical Southwestern Pacific province have experienced significant changes in their extent and carbon stocks over the Holocene due to sea-level fluctuations. Around 4,000 cal BP, the relative sea-level (RSL) in the region was higher than the present state resulting in a different mangrove forest area of occupancy. Analysis of organic matter beneath mangrove stands in New Caledonia revealed varying carbon stocks, with lower levels directly attributed to the dry climate limiting mangrove productivity. However, buried layers enriched in mangrove-derived organic matter suggest periods of sea-level stability with higher sea-level in the late Holocene, leading to substantial carbon accumulation, with values reaching up to 665 Mg C ha^{-1} (Jacotot *et al*., 2018).

A local man of Ouvea island, New Caledonia, with a mangrove crab he caught for dinner (Photo credit: Sarah Robin)

With similar scenarios of sea-level change in the province, high soil carbon sequestration is expected in mangrove ecosystems on other islands such as Tonga or Vanuatu after their seaward migration or re-establishment (Ellison, 2006, Combettes *et al*., 2015, Strandberg *et al*., 2023). Despite variations in structural complexity and carbon stocks among mangrove sites in Fiji, all assessed areas were significant carbon reservoirs, with carbon storage corresponding to 73% of carbon stock of the archipelago, while representing only 7% of total forest area (Cameron *et al*., 2021b). Still, geomorphological settings influence carbon sequestration with carbon stocks typically found to be highest in deltaic hinterlands (e.g., Rewa: 473.5 ± 47.5 Mg C ha^{-1}) and riverine/coastal margin forests (e.g., Ba: 490.3 ± 43.3 Mg C ha^{-1}), while the lowest stocks were observed in over-wash mangrove forests (e.g., Yanuca Island: 83.9 ± 10.8 Mg C ha^{-1}) (Cameron *et al*., 2021b).

3. Ecosystem Threats and vulnerabilities

Main threatening process and pathways to degradation

Mangrove deforestation arises from various factors, including aquaculture, urbanization, associated coastal development, over-harvesting, and pollution stemming from domestic, industrial, and agricultural land use. The location of mangrove forests within intertidal areas renders them vulnerable to predicted sea-level rise as a result of climate change. Tropical storms can damage mangrove forests through direct defoliation and destruction of trees, as well as through the mass mortality of animal communities within the ecosystems. Mangrove forests in the Tropical Southwestern Pacific province face various threats, both anthropogenic and natural, each posing unique challenges to these vital ecosystems.

Visual anthropogenic pollution in urban mangrove forest, Dumbea, New Caledonia (Photo credit: Sarah Robin)

The most prominent anthropogenic threat to mangrove forests in Fiji is the conversion of mangrove land for non-renewable uses, primarily agriculture. Government initiatives, particularly for sugarcane cultivation, have led to significant mangrove area loss, accounting for approximately 6% of Fiji's mangroves by 1986. Reclamation for industrial and service uses, including sewerage oxidation ponds and treatment plants, has further contributed to the deforestation of these coastal ecosystems (Lal, 1990, Agrawala *et al*., 2003). Human activities, including excessive exploitation for firewood and building materials, reclamation of mangrove land for various purposes, and increased sediment loads from upland logging and agriculture, contribute significantly to mangrove deforestation and degradation. The local communities living near the relatively pristine mangroves of the Rewa Delta on the windward western coast of Viti Levu are aware of sustainable use practices, but extensive damage from tree and bark removal, sapling damage, domestic waste and disturbance by domestic animals has been reported (Dayal *et al*., 2022).

In Tonga, rapid population growth, driven by immigration from the outer islands with limited wage opportunities, is exacerbating the pressure on mangrove resources. Historical events, such as Hurricane Isaac in 1982, led to the settlement of refugees in reclaimed mangrove habitats, resulting in further habitat degradation. Destructive practices, including cutting for rubbish dumps and residential areas, coupled with a shift from kerosene to firewood for cooking, contribute to mangrove loss. On the most populated islands, urban development, tourism infrastructure, and uncontrolled tourist activities are exacerbating mangrove loss, such as on Viti Levu, Fiji. In contrast, Bua Province on Vanua Levu boasts extensive mangrove communities that remain largely unaffected by significant large-scale development (Pearson *et al*., 2019).

The mangrove area in Marovo Lagoon shows evidence of logging activities, as indicated by the muddy waters (Photo credit: Mary Tahu)

New Caledonia has important ecological wealth to be preserved; the longest barrier reef in the world (1,600 km), which delimits a lagoon of 15,000 km² that is classified as a World Heritage site by the UNESCO. Mangroves act as a filter between this lagoon and the main island on which some anthropogenic pressures develop. At the end of the 60's, the rapid development on Ni industry led to massive urban development in Noumea, the capital, resulting in the embayment of 380 ha of mangrove forests (Robin, 2023). Nowadays, urban development is still ongoing and prevents mangrove landward migration due to sea level rise, which is really concerning for the future of the ecosystem. Outside Noumea and its suburbs, population density is low with less than 10 inhabitants per km², but two main pressures are exerted on mangroves: aquaculture and Ni mining. Shrimp farming was developed at the beginning of the 1980s and now represents the second largest export activity of the archipelago, after Ni mining (Tiennot, 2019). Unlike in other countries, shrimp ponds were installed in salt flats, behind mangrove forests. However, even if mangroves were preserved from deforestation, aquaculture impacts the ecosystem by using it as a natural filter of effluents to reduce its impact on the adjacent lagoon. Recently, several studies were interested in the influence of this practice on water and sediment quality of the receiving mangrove (Molnar *et al*., 2013, 2014; Aschenbroich *et al*., 2015) and on the meiobenthos biodiversity and biomass (Debenay *et al*., 2015; Della Patrona *et al*., 2016). These studies demonstrated that mangroves act only as a partial filter of the effluents because increased levels of nutrients were measured outside the mangrove (Molnar *et al*., 2013). Additionally, inputs of organic matter from the ponds led to an increase in phytobenthic production within the mangrove (Molnar *et al*., 2014). Eventually, the continuous release of water from the ponds to the mangrove modifies porewater salinity, and as a result a modification of mangrove structure was observed with the disappearance of *A. marina* for the benefit of *Rhizophora* spp. New Caledonia is currently the third largest Ni producing country in the world. Processes of erosion and sedimentation along the coastline, which occur naturally, are strongly amplified by open-cast mining activities. The deposition of large amount of lateritic sediments can asphyxiate aerial roots leading to the death of the trees. In addition, large amount of trace metals can be deposited in mangrove ecosystems (Marchand *et al*., 2012; Noël *et al*., 2014).

Vanuatu's mangrove forests have experienced minimal impact from recent economic development, maintaining traditional agricultural practices with limited chemical pollution. However, threats arise primarily from coastal development, as seen in the construction of the Aquana Beach resort, leading to mangrove habitat degradation. While Vanuatu avoids significant anthropogenic pressures, localized instances of coastal development pose considerable risks (Mackenzie *et al*., 2013a). Despite recognition of threats and government's measures, such as prohibiting mangrove cutting around the Fanga’uta lagoon in Tonga, mangrove loss continues due to deforestation for coastal developments, land reclamation for tourism, and urban expansion. Fiji's Denarau Island resort development resulted in the clearing of 130 hectares of mangrove forest for a golf course and artificial marina (Singh *et al*., 2021). Efforts toward mangrove conservation and sustainable management are crucial, and Fiji has established a Mangrove Management Plan under the 2013 Mangrove Ecosystems for Climate Change Adaptation and Livelihoods Project. However, the effective implementation of these plans remains a challenge, as evidenced by ongoing mangrove loss (Cameron *et al*., 2021a).

New urban suburb built on the edge of a mangrove forest, Dumbea, New Caledonia (Photo credit: Benjamin Lucas)

Natural threats to small and isolated islands in the Tropical Southwestern Pacific province also have great impacts on mangrove ecosystems. Climate change exacerbates challenges faced by mangroves, with rising temperatures, sea-level, and unpredictable precipitation changes, disturbing propagules settlement. Increased climatic variability intensifies the severity and frequency of extreme events such as cyclones, floods, and droughts, collectively threatening the integrity of mangrove communities (Agrawala *et al*., 2003). Natural disturbances, primarily tropical cyclones, have even surpassed anthropogenic stressors as the predominant drivers of mangrove degradation in the Pacific, with examples of great mangrove loss seen in Fiji and Vanuatu (Cameron *et al*., 2021a; Mackenzie *et al*., 2013a).

Definition of the collapsed state of the ecosystem

Mangroves, acting as structural engineers, possess specialized traits that facilitate high nitrogen use efficiency and nutrient resorption, influencing critical processes and functions within their ecosystem. Ecosystem collapse is recognized when the tree cover of diagnostic true mangrove species dwindles to zero, indicating complete loss (100%).

These ecosystems exhibit remarkable dynamism, with species distributions adapting to local shifts in sediment distribution, tidal patterns, and variations in local inundation and salinity gradients. Disruptive processes can trigger shifts in this dynamism, potentially leading to ecosystem collapse. Ecosystem collapse may manifest through the following mechanisms: a) restricted recruitment and survival of diagnostic true mangroves due to adverse climatic conditions (e.g., low temperatures); b) alterations in rainfall, river inputs, waves, and tidal currents that destabilize and erode soft substrata, hindering recruitment and growth; c) shifts in rainfall patterns and tidal flushing altering salinity stress and nutrient loadings, impacting overall survival.

Evidence of mangrove die backs due to sea level rise in Marovo Lagoon, Western Solomon Islands (Photo credit: Mary Tahu)

The main human-induced impacts on mangrove forests in the Tropical Southwestern Pacific province, such as wood harvesting, industrial development, and agricultural conversion, result in mangrove deforestation. Urban coastal development will also inhibit mangrove landward migration with expected sea-level rise.

Other impacts of human development on small islands are habitat degradation through changes in hydrological and sedimentary fluxes. For example, in Tongatapu interior mangroves were observed in to be undergoing an ecotone shift with extreme dieback and large-scale death of trees (Mackenzie *et al*. 2013b). Studies in New Caledonia showed that urban rainwater runoff into mangrove forests influenced salinity, pH and other physico-chemical parameters, leading to a higher leaf litter degradation rate, lower trace metals storage ability, and higher trace metals transfer to mangrove tissues (Robin *et al*., 2022, Robin *et al*., 2024). The natural threats including cyclones, droughts and precipitation changes impact mangrove trees density, recruitment, and health. Additionally, climate changes are strongly modifying carbon cycling in mangrove ecosystems (Marchand *et al*., 2022), which is one of the main ecosystem services provided by mangroves.

Nukuhetulu mangrove forest, Tongatapu in 2023 (Google Earth Pro 2024), showing die-off of 100 hectares attributed to road construction, interrupted tidal flow and poor water flushing (Tonga Geological Services 2023)

Threat Classification

IUCN Threat Classification (version 3.3, IUCN CMP, 2022) relevant to mangroves of the Tropical Southwestern Pacific province:

1. Residential & commercial development
- 1.1 Housing & urban areas
- 1.2 Commercial & industrial areas
- 1.3 Tourism & recreation areas

2. Agriculture & aquaculture
- 2.1 Annual & perennial non-timber crops
  - 2.1.1 Shifting agriculture
  - 2.1.2 Small-holder farming
- 2.3 Livestock farming & ranching
  - 2.3.1 Nomadic grazing
- 2.4 Marine & freshwater aquaculture
  - 2.4.1 Subsistence/artisanal aquaculture
  - 2.4.2 Industrial aquaculture

3. Energy production & mining
- 3.2 Mining & quarrying

4. Transportation & service corridors
- 4.1 Roads & railroads

5. Biological resource use
- 5.1 Hunting & collecting terrestrial animals
  - 5.1.1 Intentional use (species being assessed is the target)
- 5.2 Gathering terrestrial plants
  - 5.2.1 Intentional use (species being assessed is the target)
- 5.3 Logging & wood harvesting
  - 5.3.1 Intentional use: subsistence/small scale (species being assessed is the target [harvest]
- 5.4 Fishing & harvesting aquatic resources
  - 5.4.1 Intentional use: subsistence/small scale (species being assessed is the target)[harvest]

6. Human intrusions & disturbance
- 6.1 Recreational activities

7. Natural system modifications
- 7.2 Dams & water management/use
  - 7.2.9 Small dams

9. Pollution
- 9.1 Domestic & urban waste water
  - 9.1.1 Sewage
  - 9.1.2 Run-off
  - 9.1.3 Type Unknown/Unrecorded
- 9.2 Industrial & military effluents
  - 9.2.2 Seepage from mining
- **9.3 Agricultural & forestry effluents**
  - 9.3.1 Nutrient loads
  - 9.3.2 Soil erosion, sedimentation
- **9.4 Garbage & solid waste**
  - 10. Geological events
    - 10.1 Volcanoes
    - 10.2 Earthquakes/tsunamis

11. Climate change & severe weather
- 11.1 Habitat shifting & alteration
- 11.2 Droughts
- 11.3 Temperature extremes
- 11.4 Storms & flooding

4. Ecosystem Assessment

Criterion A: Reduction in Geographic Distribution

Subcriterion A1 measures the trend in ecosystem extent during the last 50-year time window. Unfortunately, there is currently no common regional or national datasets that provides information for 1970 (or closer periods). Therefore, the Tropical Southwestern Pacific mangrove ecosystem is classified as **Data Deficient (DD)** for Subcriterion A1.

Subcriterion A2 measures the change in ecosystem extent in any 50-year period, including from the present to the future: The Tropical Southwestern Pacific mangrove area from 1996 to 2020, was estimated using the most recent version of the Global Mangrove Watch (GMW v3.0) spatial dataset. The mangrove area in the province (and in the corresponding countries) was corrected for both omission and commission errors, utilizing the equations in Bunting *et al*. (2022).

Rate of change: 0.096 % / Year **R^2=0.69**

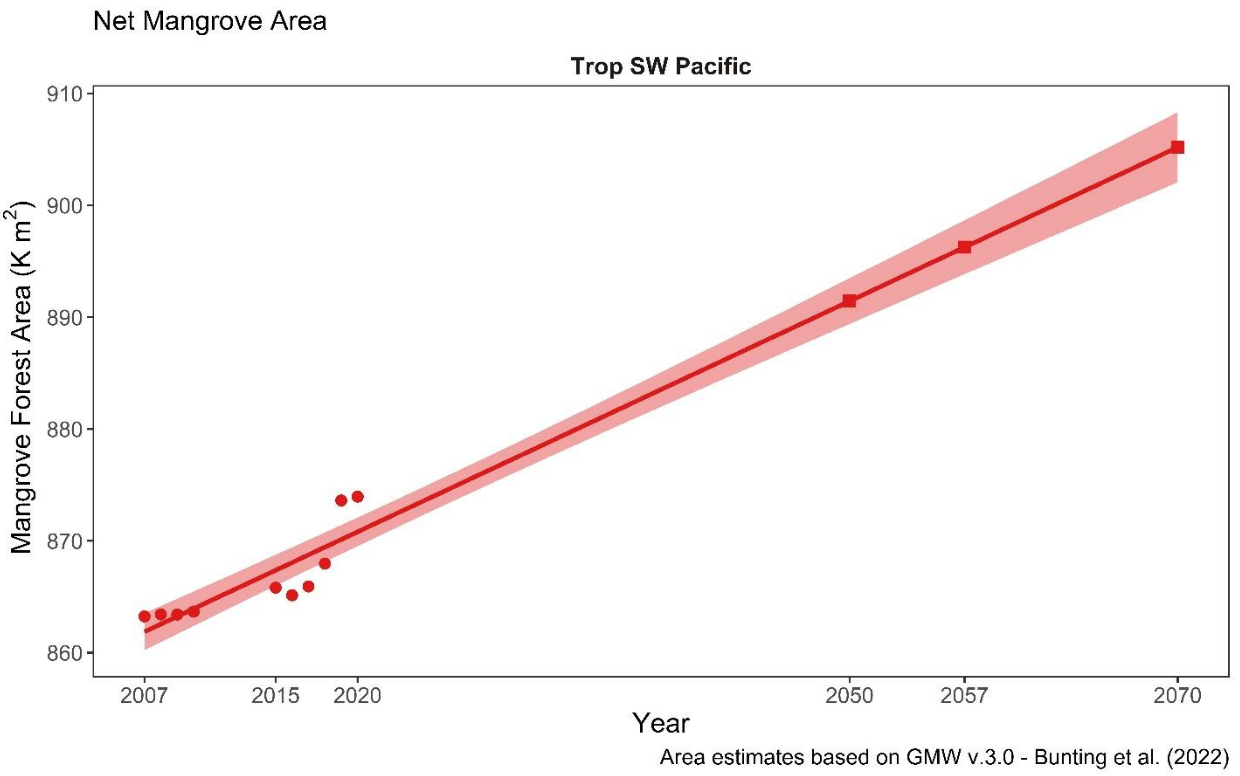

Figure 3. Projected extent of the Tropical Southwestern Pacific mangrove ecosystem to 2070. Circles represent the province mangrove area between 2007 and 2020 based on the GMW v3.0 dataset and equations in Bunting et al., (2022). The solid line and shaded area are the linear regression and 95% confidence intervals. Squares show the Tropical Southwestern Pacific province predicted mangrove area for 2057 and 2070. It is important to note that an exponential model (proportional rate of decline) did not give a better fit to the data (R^2 = 0.69).

The Tropical Southwestern Pacific province mangroves show a net area change of +0.7% (1996-2020) based on the Global Mangrove Watch time series (Bunting *et al*., 2022). This value reflects the offset between areas gained (+0.1%/year) and lost (-0.1%/year). The largest decrease in mangrove area in this time series occurred between 1996 and 2007 (-0.5%), which was observed on every group of islands except Vanuatu. While analysing area estimations from 1996 to 2020, we found insufficient evidence of linearity, as reflected by an R^2 value of 0.23. However, a notable linear relationship emerges when focusing on the period from 2007 to 2020 (Figure 3), with an R^2 value of 0.69 and a mangrove area change of +0.82 km^2 per year. this trend continues in the future, it is predicted that the extent of mangroves in the Tropical Southwestern Pacific region will increase by 3.6% by 2070. The Tropical

Southwestern Pacific mangrove ecosystem is therefore assessed as **Least Concerned** under subcriterion A2.

However, these predicted values should be taken with care. The increase in mangrove surface area in this region is attributed to better management of coastal ecosystems. However, mangrove forests are adapted to intertidal environments only and, on small-scale islands, cannot infinitely increase their area. Furthermore, sea-level rise associated with the urbanization of the littoral may significantly influence the landward migration of mangrove forests and, therefore, their potential for development.

Subcriterion A3 measures changes in mangrove area since 1750. Unfortunately, there are no reliable data on the mangrove extent for the entire province during this period, and therefore the Tropical Southwestern Pacific mangrove ecosystem is classified as **Data Deficient (DD)** for this subcriterion.

Overall, the ecosystem is assessed as **Least Concern (LC)** under criterion A.

Criterion B: Restricted Geographic Distribution

Criterion B measures the risk of ecosystem collapse associated with restricted geographical distribution, based on standard metrics (Extent of Occurrence EOO, Area of Occupancy AOO, and Threat-defined locations). These parameters were calculated based on the 2020 Tropical Southwestern Pacific province mangrove extent (GMW v.3).

Province	**Extent of Occurrence EOO (km^2)**	**Area of Occupancy (AOO)** >1%	**Criterion B**
The Tropical Southwestern Pacific	1’947’790.0	193	**LC**

For 2020, AOO and EOO were measured as 193 grid cells 10 x 10 km and 1,947,790.0 km^2, respectively (Figure 4). Excluding from the total of 448 those grid cells that contain patches of mangrove forest that account for less than 1% of the grid cell area, (< 1 km^2), the AOO is measured as **193,10 x 10 km grid cells** (Figure 4, red grids).

Considering the very high number of threat-defined-locations, there is no evidence of plausible catastrophic threats leading to potential disappearance of mangroves across their extent. As a result, the Tropical Southwestern Pacific mangrove ecosystem is assessed as **Least Concern (LC)** under criterion B.

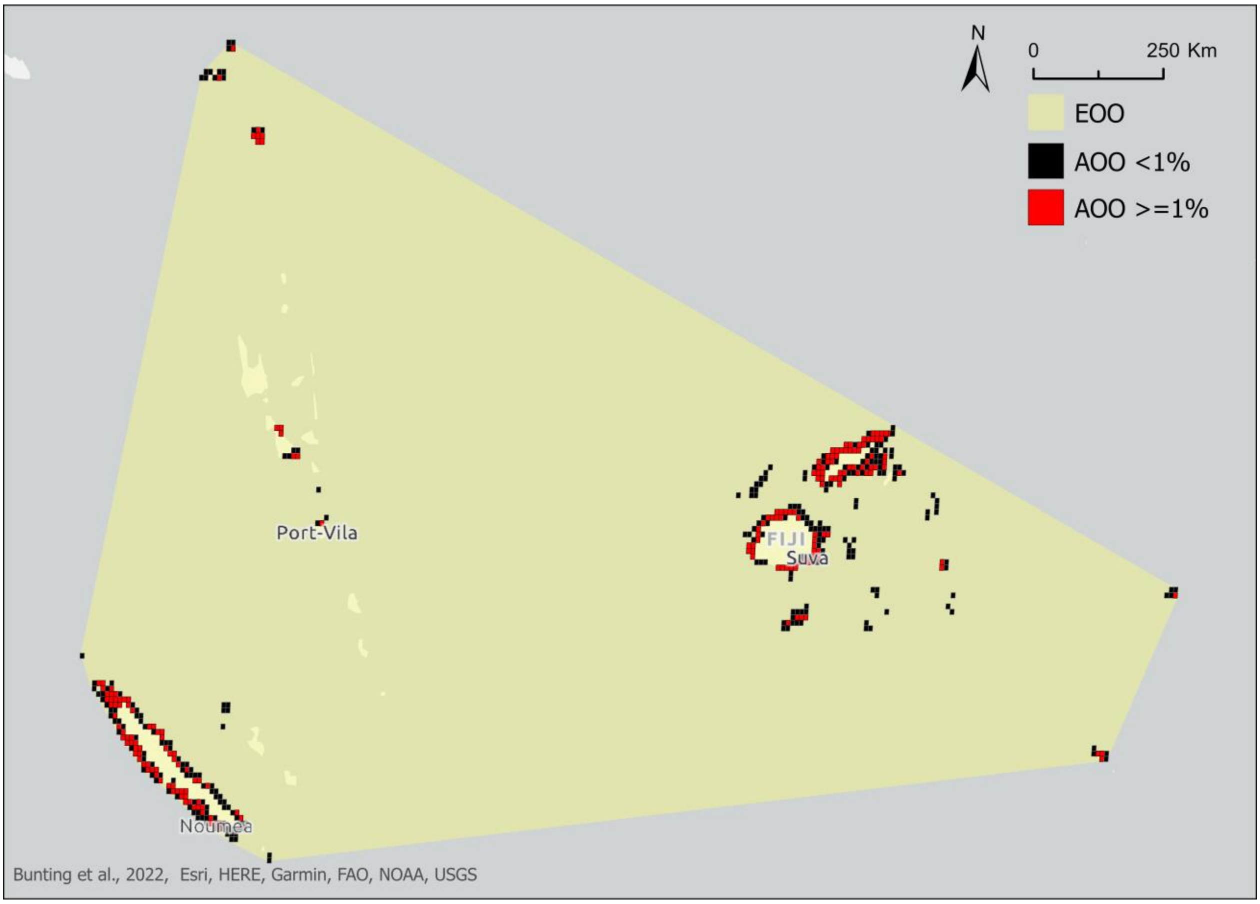

Figure 4. The Tropical Southwestern Pacific Mangrove Extent Of Occurrence (EOO) and Area Of Occupancy (AOO) in 2020. Estimates based on 2020 GMW v3.0 spatial layer (Bunting et al., 2022). The red 10 x 10 km grids (n=193.) are more than 1% covered by the ecosystem, and the black grids <1% (n= 255).

Criterion C: Environmental Degradation

Criterion C measures the environmental degradation of abiotic variables necessary to support the ecosystem.

Subcriterion C1 measures environmental degradation over the past 50 years: There are no reliable data to evaluate this subcriterion for the entire province, and therefore the Tropical Southwestern Pacific mangrove ecosystem is classified as **Data Deficient (DD)** for subcriterion C1.

Subcriterion C2 measures environmental degradation in the future, or over any 50-year period, including from the present. In this context, the impact of future sea-level rise (SLR) on mangrove ecosystems was assessed by adopting the methodology presented by Schuerch *et al.* (2018). The published model was designed to calculate both absolute and relative change in the extent of wetland ecosystems under various regional SLR scenarios (i.e medium: RCP 4.5 and high: RCP 8.5), with consideration for sediment accretion. Therefore, Schuerch *et al*. (2018) model was applied to the Tropical Southwestern Pacific mangrove ecosystem boundary, using the spatial extent in 2010 (Giri *et al*., 2011) and assuming mangrove landward migration was not possible.

According to the results, under an extreme sea-level rise scenario of a 1.1 m rise by 2100, the projected submerged area is ~ -45.4% by 2060, which is above 30% but below the 50% risk threshold. Therefore, considering that no mangrove recruitment can occur in a submerged system (100% relative severity), but that -45.4% of the ecosystem extent will be affected by SLR, the Tropical Southwestern Pacific mangrove ecosystem is assessed as **Vulnerable (VU)** for subcriterion C2.

Subcriterion C3 measures change in abiotic variables since 1750. There is a lack of reliable historic data on environmental degradation covering the entire province, and therefore the Tropical Southwestern Pacific province is classified as **Data Deficient (DD)** for this subcriterion.

Overall, the ecosystem is assessed as **Vulnerable (VU)** under criterion C.

Criterion D: Disruption of biotic processes or interactions

The global mangrove degradation map developed by Worthington and Spalding (2018) was used to assess the level of biotic degradation in the Tropical Southwestern Pacific province. This map is based on degradation metrics calculated from vegetation indices (NDVI, EVI, SAVI, NDMI) using Landsat time series (≈2000 and 2017). These indices represent vegetation greenness and moisture condition.

Mangrove degradation was calculated at a pixel scale (3 0m resolution), on areas intersecting with the 2017 mangrove extent map (GMW v2). Mangrove pixels were classified as degraded if two conditions were met: 1) at least 10 out of 12 degradation indices showed a decrease of more than 40% compared to the previous period; and 2) all twelve indices did not recover to within 20% of their pre-2000 value (detailed methods and data are available at: maps.oceanwealth.org/mangrove-restoration/). The decay in vegetation indices has been used to identify mangrove degradation and abrupt changes, including mangrove die-back events, clear-cutting, fire damage, and logging; as well as to track mangrove regeneration (Lovelock *et al.*, 2017; Santana, 2018; Murray *et al.*, 2020; Aljahdali *et al.*, 2021; Lee *et al.*, 2021). However, it is important to consider that changes observed in the vegetation indices can also be influenced by data artifacts (Akbar *et al.*, 2020). Therefore, a relative severity level of more than 50%, but less than 80%, was assumed.

The results from this analysis show that over a period of 17 years (~2000 to 2017), 1.6% of the Tropical Southwestern Pacific mangrove area is classified as degraded, resulting in an average annual rate of degradation of 0.09%. Assuming this trend remains constant, +4.7 % of the Tropical Southwestern Pacific mangrove area will be classified as degraded over a 50-year period. Since less than 30% of the ecosystem will meet the category thresholds for criterion D, the Tropical Southwestern Pacific mangrove province is assessed as **Least Concern** (**LC)** under subcriterion D2b.

No data were found to assess the disruption of biotic processes and degradation over the past 50 years (subcriterion D1) or since 1750 (subcriterion D3). Thus, both subcriteria are classified as **Data Deficient (DD).**

Overall, the Tropical Southwestern Pacific ecosystem remains **Least Concern (LC)** under criterion D.

Criterion E: Quantitative Risk

No model was used to quantitatively assess the risk of ecosystem collapse for this ecosystem; hence criterion E was **Not Evaluated (NE)**.

5. Summary of the Assessment

CRITERION			
A. Reduction in Geographic Distribution	**A1** Past 50 years	**A2** Future or any 50y period	**A3** Historical (1750)
	DD	**LC**	**DD**
B. Restricted Geo. Distribution	**B1** Extent of Occurrence	**B2** Area of Occupancy	**B3** # Threat-defined Locations < 5
	LC	**LC**	**LC**
C. Environmental Degradation	**C1** Past 50 years (1970)	**C2** Future or any 50y period	**C3** Historical (1750)
	DD	**VU**	**DD**
D. Disruption of biotic processes	**D1** Past 50 years (1970)	**D2** Future or Any 50y period	**D3** Historical (1750)
	DD	**LC**	**DD**
E. Quantitative Risk analysis		**NE**	
OVERALL RISK CATEGORY		**VU**	

DD = Data Deficient; LC = Least Concern; NE = Not Evaluated; VU = Vulnerable

Overall, the status of the Tropical Southwestern Pacific mangrove ecosystem is assessed as **Vulnerable (VU).**

6. References

Agrawala, S., Ota, T., Risbey, J., Hegenstad, M., Smith, J., Van Aalst, M., Koshy, K., & Prasad, B. (2003). Development and climate change in Fiji: Focus on coastal mangroves.

Akbar, M.R., Arisanto, P.A.A., Sukirno, B.A., Merdeka, P.H., Priadhi, M.M., & Zallesa, S. (2020) Mangrove vegetation health index analysis by implementing NDVI (normalized difference vegetation index) classification method on sentinel-2 image data case study: Segara Anakan, Kabupaten Cilacap', IOP Conference Series: Earth and Environmental Science 584(1), p. 012069. https://doi.org/10.1088/1755-1315/584/1/012069.

Aljahdali, M.O., Munawar, S., & Khan, W.R. (2021). Monitoring mangrove forest degradation and regeneration: Landsat time series analysis of moisture and vegetation indices at Rabigh Lagoon, Red Sea. Forests 12(1), 52. https://doi.org/10.3390/f12010052.

Aschenbroich, A., Marchand, C., Molnar, N., Deborde, J., Hubas, C., Rybarczyk, H., & Meziane, T. (2015). Spatio-temporal variations of the composition of organic matter at surface sediments in a mangrove receiving shrimp farm effluents (Saint Vincent Bay, New Caledonia). Science of the Total Environment 512-513, 296-307. https://doi.org/10.1016/j.scitotenv.2014.12.082.

Bhattarai, B., & Giri, C. (2011). Assessment of mangrove forests in the Pacific region using Landsat imagery. Journal of Applied Remote Sensing 5, 053509. https://doi.org/10.1117/1.3563584.

Bunting, P., Rosenqvist, A., Hilarides, L., Lucas, R.M., Thomas, N., Tadono, T., Worthington, T.A., Spalding, M.D., Murray, N.J., & Rebelo, L.-M. (2022). Global Mangrove Extent Change 1996–2020: Global Mangrove Watch Version 3.0. Remote Sensing 14(15), 3657. https://doi.org/10.3390/rs14153657.

Cameron, C., Maharaj, A., Kennedy, B., Tuiwawa, S., Goldwater, N., Soapi, K., & Lovelock, C. E. (2021a). Landcover change in mangroves of Fiji: Implications for climate change mitigation and adaptation in the Pacific. Environmental Challenges 2, 100018. https://doi.org/10.1016/j.envc.2020.100018.

Cameron, C., Kennedy, B., Tuiwawa, S., Goldwater, N., Soapi, K., & Lovelock, C.E. (2021b). High variance in community structure and ecosystem carbon stocks of Fijian mangroves driven by differences in geomorphology and climate. Environmental Research 192, 110213. https://doi.org/10.1016/j.envres.2020.110213.

Combettes, C., Sémah, A.-M., & Wirrmann, D. (2015). High-resolution pollen record from Efate Island, central Vanuatu: Highlighting climatic and human influences on Late Holocene vegetation dynamics. Comptes Rendus Pelevol 14, 251-261. https://dx.doi.org/10.1016/j.crpv.2015.02.003.

David, G. (1985). Les mangroves de Vanuatu. O.R.S.T.O.M. 61 pp.

Dayal, K.K., Cater, J.E., Kingan, M.J., Bellon, G., & Sharma, R.N. (2022). An analysis of the 10 MW Butoni wind farm in the Tropical Southwest Pacific Island of Fiji. Wind Engineering 46(4), 1264-1280. https://doi.org/10.1177/0309524X221075808.

Deborde, J., Marchand, C., Molnar, N., Della Patrona, L., & Meziane, T. (2015). Concentrations and fractionation of C, N, P, Fe, and S in mangrove sediments along an intertidal gradient (New Caledonia). Journal of Marine Science and Engineering 3, 52-7. https://doi.org/10.3390/jmse3010052.

Debenay, J.-P., Marchand C., Molnar, N., Aschenbroich, A., & Meziane, T. (2015). Foraminiferal assemblages as bioindicators to assess potential pollution of mangroves acting as a natural biofilter for shrimp farm effluents (New Caledonia). Marine Pollution Bulletin 93, 103-120. https://doi.org/10.1016/j.marpolbul.2015.02.009.

Della Patrona, L., Marchand, C., Hubas, C., Molnar, N., Deborde, J., & Meziane, T. (2016). Meiofauna as an indicator for assessing the impact of shrimp farming effluents in a mangrove forest (New Caledonia). Marine Environmental Research 119, 100-113. https://doi.org/10.1016/j.marenvres.2016.05.028.

Duke, N.C., Mackenzie, J., & Wood, A. (2012). A revision of mangrove plants of the Solomon Islands, Vanuatu, Fiji, Tonga and Samoa. Centre for Tropical Water & Aquatic Ecosystem Research (TropWATER) Publication 12/13, James Cook University, Townsville, 22 pp.

Ellison, J. (2006). Mangrove palaeoenvironmental response to climate change. Proceedings of the Symposium on Mangrove Responses to Relative Sea-Level Rise and Other Climate Change Effects, Cairns, 8 pp.

Google Earth Pro (2024) Nukuhetulu, 21°10'25.69"S, 175°11'37.80"W, Tongatapu image sourced from Maxar Technologies (2002) and Airbus (2023), Google Maps [accessed 18 March 2024].

Gilman, E., Van Lavieren, H., Ellison, J., Jungblut, V., Wilson, L., Areki, F., Brighouse, G., Bungitak, J., Dus, E., Henry, M., & Kilman, M., (2006). Pacific island mangroves in a changing climate and rising sea. UNEP Regional Seas Reports and Studies No. 179. Nairobi, Kenya: United Nations Environment Programme.

Giri, C., Ochien, E., Tieszen, L.L., Zhu, Z., Sing, A., Loveland, T., Masek, J., & Duke, N. (2011). Status and distribution of mangrove forests of the world using earth observation satellite data. Global Ecology Biogeography 20, 54–159. https://doi.org/10.1111/j.1466-8238.2010.00584.x.

IUCN (2012). IUCN Habitats classification scheme (3.1). [Data set]. https://www.iucnredlist.org/resources/habitat-classification-scheme.

IUCN (2022). The IUCN Red List of Threatened Species. (Version 2022-2) [Data set]. https://www.iucnredlist.org

IUCN-CMP (2022). Unified Classification of Direct Threats (3.3) [Data set]. https://www.iucnredlist.org/resources/threat-classification-scheme.

Jacotot, A., Marchand, C., Rosenheim, B.E., Domack, E.W., & Allenbach, M. (2018). Mangrove sediment carbon stocks along an elevation gradient: Influence of the late Holocene marine regression (New Caledonia). Marine Geology 404, 60-70. https://doi.org/10.1016/j.margeo.2018.07.005.

Keith, D.A., Ferrer-Paris, J.R., Nicholson, E., & Kingsford, R.T. (Eds.) (2020). IUCN Global Ecosystem Typology 2.0: Descriptive profiles for biomes and ecosystem functional groups. IUCN, International Union for Conservation of Nature. https://doi.org/10.2305/IUCN.CH.2020.13.en.

Lal, P.N. (1990). Conservation or conversion of mangroves in Fiji: An ecological economic analysis. Environment and Policy Institute East-West Center Occasional Paper 11.

Lee, C.K.F., Duncan, C., Nicholson, E., Fatoyinbo, T.E., Lagomasino, D., Thomas, N., Worthington, T.A., & Murray, N.J. (2021). Mapping the extent of mangrove ecosystem degradation by integrating an ecological conceptual model with satellite data. Remote Sensing 13(11), 2047. https://doi.org/10.3390/rs13112047.

Lovelock, C.E., Feller, I.C., Reef, R., Hickey, S., & Ball, M.C. (2017). Mangrove dieback during fluctuating sea levels. Scientific Reports 7(1), 1680. https://doi.org/10.1038/s41598-017-01927-6.

Mackenzie, J., Duke, N.C., & Wood, A. (2013a). MangroveWatch assessment of shoreline mangroves in Vanuatu. Centre for Tropical Water & Aquatic Ecosystem Research (TropWATER) Publication 13/50, James Cook University, Townsville, 44 pp.

Mackenzie, J., Duke, N.C., & Wood, A. (2013b). MangroveWatch assessment of shoreline mangroves in Tonga. Centre for Tropical Water & Aquatic Ecosystem Research (TropWATER) Publication 13/51, James Cook University, Townsville, 31 pp.

Marchand, C., Dumas, P., Buisson, D., Virly, S., & Duke, N. (2007). Relations entre les caractéristiques physico-chimiques des sédiments de mangrove et le type des palétuviers. 18 pp.

Marchand, C., Fernandez, J.-M., Moreton, B., Landi, L., Lallier-Vergès, E., & Baltzer, F. (2012). The partitioning of transitional metals (Fe, Mn, Ni, Cr) in mangrove sediments downstream of a ferralitised ultramafic watershed. Chemical Geology 300-301, 70–80. https://doi.org/10.1016/j.chemgeo.2012.01.018.

Marchand, C., Ouyang, X., Wang, F., & Leopold, A. (2022). Impact of climate changes and related disturbances on CO2 and CH4 cycling in coastal wetlands. In Carbon mineralization in coastal wetlands: from litter decomposition to greenhouse gas dynamics. Eds.: S.Y. Lee, X. Ouyang, Y.F.D. Lai, C. Marchand. Elsevier. 197-231.

Molnar, N, Welsh, D.T., Marchand, C., Deborde, J., & Meziane, T. (2013). Impacts of shrimp farm effluents on water quality, benthic metabolism and N-dynamics in a mangrove forest (New

Caledonia). Estuarine Coastal and Shelf Sciences 117, 12-21. https://doi.org/10.1016/j.ecss.2012.07.012.

Molnar, N., Marchand, C., Deborde, J., Della Patrona, L., & Meziane, T. (2014). Seasonal pattern of the biogeochemical properties of mangrove sediments receiving shrimp farm effluents (New Caledonia). Journal of Aquaculture and Research Development 5(5), 262. https://doi.org/10.4172/2155-9546.1000262.

Murofushi, T., & Hori, N. (1997). Human impact on mangrove habitats maintenance against sea-level change: Case study of Tongatapu Island, the Kingdom of Tonga, South Pacific. 27-42.

Murray, N.J., Keith, D.A., Tizard, R., Duncan, A., Htut, W.T., Oo, A.H., Ya, K.Z., & Grantham, M. (2020). Threatened ecosystems of Myanmar: An IUCN Red List of Ecosystems Assessment. Version 1. Wildlife Conservation Society. https://doi.org/10.19121/2019.Report.37457.

Noël, V., Marchand, C., Juillot, F., Ona-Nguema, G., Viollier, E., Marakovic, G., Olivi, L., Delbes, L., Gelebart, F., & Morin, G. (2014). EXAFS analysis of iron cycling in mangrove sediments downstream a lateritized ultramafic watershed (Vavouto Bay, New Caledonia). Geochimica et Cosmochimica Acta 136, 211-228. https://doi.org/10.1016/j.gca.2014.03.019.

Pearson, J., McNamara, K.E., & Nunn, P.D. (2019). Gender-specific perspectives of mangrove ecosystem services: Case study from Bua Province, Fiji Islands. Ecosystem Services 38, 100970. https://doi.org/10.1016/j.ecoser.2019.100970.

Robin, S.L., Marchand, C., Mathian, M., Baudin, F., & Alfaro, A.C. (2022). Distribution and bioaccumulation of trace metals in urban semi-arid mangrove ecosystems. Frontiers in Environmental Science 17. https://doi.org/10.3389/fenvs.2022.1054554

Robin, S.L. (2023). Influence of urbanisation on organic matter and trace metals dynamics in mangrove forests. Thesis. University of New Caledonia.

Robin, S.L., Le Milbeau, C., Gututauava, K., & Marchand, C. (2024). Influence of species and stand position on isotopic and molecular composition of leaf litter during degradation in an urban mangrove forest. Geochimica et Cosmochimica Acta 372, 1–12. https://doi.org/10.1016/j.gca.2024.03.008.

Rohorua, H., & Lim, S. (2006). An inter-sectoral economic model for optimal sustainable mangrove use in the small island economy of Tonga. New Zealand Agricultural and Resource Economics Society Conference.

Santana, N. (2018). Fire recurrence and normalized difference vegetation index (NDVI) dynamics in brazilian savanna. Fire 2(1), 1. https://doi.org/10.3390/fire2010001.

Schuerch, M., Spencer, T., Temmerman, S., Kirwan, M.L., Wolff, C., Lincke, D., McOwen, C.J., Pickering, M.D., Reef, R., Vafeidis, A.T., Hinkel, J., Nicholls, R.J., & Brown, S. (2018). Future response of global coastal wetlands to sea-level rise. Nature 561(7722), 231–234. https://doi.org/10.1038/s41586-018-0476-5.

Singh, S., Bhat, J.A., Shah, S., & Pala, N.A. (2021). Coastal resource management and tourism development in Fiji Islands: a conservation challenge. Environment, Development and Sustainability 23, 3009-3027. https://doi.org/10.1007/s10668-020-00764-4.

Spalding, M.D., Fox, H.E., Allen, G.R., Davidson, N., Ferdaña, Z.A., Finlayson, M., Halpern, B.S., Jorge, M.A., Lombana, A., Lourie, S.A., Martin, K.D., McManus, E., Molnar, J., Recchia, C.A., & Robertson, J. (2007). Marine ecoregions of the world: A bioregionalization of coastal and shelf areas. BioScience 57(7), 573–583. https://doi.org/10.1641/B570707.

Strandberg, N.A., Edwards, M., Ellison, J.C., Steinbauer, M.J., Walentowitz, A., Fall, P.L., Sear, D., Langdon, P., Cronin, S., Castilla-Beltràn, A., Croudace, I.W., Prebble, M., Gosling, W.D., & Nogué, S. (2023). Influences of sea level changes and volcanic eruptions on Holocene vegetation in Tonga. Biotropica 55, 816-827. https://doi.org/10.1111.btp.13231.

Steel, O.C. (2006). Natural and anthropogenic biogeography of mangroves in the Southwest Pacific. Thesis. University of Hawaii.

Tiennot, C.V.A. Growth Diagnosis of New Caledonia (October 22, 2019). Available at SSRN: https://ssrn.com/abstract=3591142 or http://dx.doi.org/10.2139/ssrn.3591142.

Tonga Geological Services (2023). Dying Eco-Heritage, Oldest Mangrove Forest in the Pacific. Geoscience Tonga, https://www.youtube.com/watch?v=Hp7SjgO-HP4.

Thollot, P. (1996). Les poissons de mangrove du lagon sud-ouest de Nouvelle-Calédonie. Paris : ORSTOM.

Virly, S. (2006). Cartographie des mangroves de Nouvelle-Calédonie. 59 pp.

WorldData.info (2024) Climate comparison Tonga/Fiji/New Caledonia/Vanuatu. Accessed 18th March 2024.

Worthington, T.A., & Spalding, M.D. (2018). Mangrove restoration potential: A global map highlighting a critical opportunity. Apollo - University of Cambridge Repository. https://doi.org/10.17863/CAM.39153.

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7. Appendices

1. List of Key Mangrove Species

List of plant species considered true mangroves according to Red List of Threatened Species (RLTS) spatial data (IUCN, 2022). We only included species whose range maps intersected with the boundary of the marine provinces/ecoregions described in the distribution section.

Class	Order	Family	Scientific name	RLTS category
Magnoliopsida	Gentianales	Rubiaceae	*Scyphiphora hydrophylacea*	LC
Magnoliopsida	Lamiales	Acanthaceae	*Avicennia marina*	LC
Magnoliopsida	Malpighiales	Rhizophoraceae	*Bruguiera gymnorhiza*	LC
Magnoliopsida	Malpighiales	Rhizophoraceae	*Bruguiera parviflora*	LC
Magnoliopsida	Malpighiales	Rhizophoraceae	*Ceriops tagal*	LC
Magnoliopsida	Malpighiales	Euphorbiaceae	*Excoecaria agallocha*	LC
Magnoliopsida	Malpighiales	Rhizophoraceae	*Rhizophora apiculata*	LC
Magnoliopsida	Malpighiales	Rhizophoraceae	*Rhizophora mucronata*	LC
Magnoliopsida	Malpighiales	Rhizophoraceae	*Rhizophora samoensis*	NT
Magnoliopsida	Malpighiales	Rhizophoraceae	*Rhizophora stylosa*	LC
Magnoliopsida	Myrtales	Combretaceae	*Lumnitzera littorea*	LC
Magnoliopsida	Myrtales	Combretaceae	*Lumnitzera racemosa*	LC
Magnoliopsida	Myrtales	Lythraceae	*Sonneratia alba*	LC
Magnoliopsida	Myrtales	Lythraceae	*Sonneratia caseolaris*	LC
Magnoliopsida	Sapindales	Meliaceae	*Xylocarpus granatum*	LC

2. List of Associated Species

List of taxa that are associated with mangrove habitats in the Red List of Threatened Species (RLTS) database (IUCN, 2022). We included only species with entries for Habitat 1.7: "Forest - Subtropical/Tropical Mangrove Vegetation Above High Tide Level" or Habitat 12.7 for "Marine Intertidal - Mangrove Submerged Roots", and with presence recorded as "Extant", "Possibly Extant" or "Possibly Extinct", Origin recorded as "Native" or "Reintroduced", with any value of Seasonality except "Passage", suitability recorded as "Suitable", and with "Major Importance" recorded as "Yes". The common names are those shown in the RLTS, except common names in brackets, which are from other sources.

Class	Order	Family	Scientific name	RLTS category	Common name
Polypodiopsida	Polypodiales	Pteridaceae	*Acrostichum speciosum*	LC	
Magnoliopsida	Fabales	Fabaceae	*Cynometra ramiflora*	LC	Katong
Magnoliopsida	Fabales	Fabaceae	*Dalbergia candenatensis*	LC	trắc một hột
Magnoliopsida	Lamiales	Bignoniaceae	*Dolichandrone spathacea*	LC	
Magnoliopsida	Malvales	Malvaceae	*Heritiera littoralis*	LC	
Magnoliopsida	Myrtales	Lythraceae	*Pemphis acidula*	LC	
Actinopterygii	Perciformes	Sparidae	*Acanthopagrus australis*	LC	Yellowfin bream

Actinopterygii	Gobiiformes	Gobiidae	*Amblygobius linki*	LC	Link's goby
Actinopterygii	Clupeiformes	Clupeidae	*Anodontostoma selangkat*	LC	Indonesian gizzard shad
Actinopterygii	Perciformes	Apogonidae	*Apogonichthyoides melas*	LC	Black cardinalfish
Actinopterygii	Tetraodontiformes	Tetraodontidae	*Arothron manilensis*	LC	Narrow-lined Puffer
Actinopterygii	Tetraodontiformes	Tetraodontidae	*Arothron reticularis*	LC	Reticulated pufferfish
Actinopterygii	Tetraodontiformes	Tetraodontidae	*Arothron stellatus*	LC	Stellate puffer
Actinopterygii	Gobiiformes	Gobiidae	*Asterropteryx semipunctata*	LC	
Actinopterygii	Atheriniformes	Atherinidae	*Atherinomorus lacunosus*	LC	Hardyhead silverside
Actinopterygii	Perciformes	Carangidae	*Atule mate*	LC	Yellowtail scad
Actinopterygii	Gobiiformes	Eleotridae	*Bostrychus sinensis*	LC	Four-eyed Sleeper
Actinopterygii	Gobiiformes	Eleotridae	*Butis amboinensis*	LC	Ambon gudgeon
Actinopterygii	Gobiiformes	Eleotridae	*Butis butis*	LC	Crimson-tipped Gudgeon
Actinopterygii	Gobiiformes	Eleotridae	*Butis koilomatodon*	LC	Marblecheek sleeper
Actinopterygii	Perciformes	Caesionidae	*Caesio cuning*	LC	Redbelly yellowtail fusilier
Actinopterygii	Gobiiformes	Gobiidae	*Caragobius urolepis*	LC	Scaleless worm goby
Actinopterygii	Gobiiformes	Gobiidae	*Cryptocentrus leptocephalus*	LC	Pink-speckled Shrimpgoby
Actinopterygii	Scorpaeniformes	Platycephalidae	*Cymbacephalus beauforti*	LC	Crocodile fish
Actinopterygii	Perciformes	Pomacentridae	*Dascyllus trimaculatus*	LC	Threespot damselfish
Actinopterygii	Perciformes	Haemulidae	*Diagramma labiosum*	LC	Painted sweetlips
Actinopterygii	Perciformes	Pomacentridae	*Dischistodus perspicillatus*	LC	White damsel
Actinopterygii	Perciformes	Pomacentridae	*Dischistodus pseudochrysopoecilus*	LC	Monarch damsel
Actinopterygii	Gobiiformes	Gobiidae	*Drombus triangularis*	LC	Brown drombus
Actinopterygii	Gobiiformes	Eleotridae	*Eleotris fusca*	LC	Brown spinecheek gudgeon
Actinopterygii	Gobiiformes	Eleotridae	*Eleotris melanosoma*	LC	Broadhead sleeper
Actinopterygii	Elopiformes	Elopidae	*Elops hawaiensis*	DD	Giant herring
Actinopterygii	Ophidiiformes	Carapidae	*Encheliophis homei*	LC	Silver pearlfish
Actinopterygii	Clupeiformes	Engraulidae	*Encrasicholina punctifer*	LC	Buccaneer anchovy
Actinopterygii	Perciformes	Epinephelidae	*Epinephelus coeruleopunctatus*	LC	Whitespotted grouper
Actinopterygii	Perciformes	Epinephelidae	*Epinephelus coioides*	LC	Orange-spotted Grouper
Actinopterygii	Perciformes	Epinephelidae	*Epinephelus malabaricus*	LC	
Actinopterygii	Perciformes	Epinephelidae	*Epinephelus miliaris*	LC	Netfin grouper
Actinopterygii	Perciformes	Epinephelidae	*Epinephelus tauvina*	DD	Greasy grouper
Actinopterygii	Gobiiformes	Gobiidae	*Eugnathogobius mindora*	LC	
Actinopterygii	Gobiiformes	Gobiidae	*Feia nympha*	LC	Nymph goby

Actinopterygii	Perciformes	Apogonidae	*Fowleria variegata*	LC	Variegated cardinalfish
Actinopterygii	Perciformes	Leiognathidae	*Gazza minuta*	LC	Toothed ponyfish
Actinopterygii	Perciformes	Gerreidae	*Gerres erythrourus*	LC	Deep-bodied Mojarra
Actinopterygii	Gobiiformes	Gobiidae	*Glossogobius circumspectus*	LC	Circumspect goby
Actinopterygii	Gobiiformes	Gobiidae	*Gnatholepis ophthalmotaenia*	LC	
Actinopterygii	Anguilliformes	Muraenidae	*Gymnothorax monochrous*	LC	
Actinopterygii	Anguilliformes	Muraenidae	*Gymnothorax punctatofasciatus*	LC	Bars'n spots moray
Actinopterygii	Syngnathiformes	Syngnathidae	*Hippichthys penicillus*	LC	Beady pipefish
Actinopterygii	Perciformes	Sciaenidae	*Johnius australis*	LC	Bottlenose jewfish
Actinopterygii	Perciformes	Sciaenidae	*Johnius borneensis*	LC	Hammer croaker
Actinopterygii	Perciformes	Kuhliidae	*Kuhlia munda*	DD	Silver flagtail
Actinopterygii	Perciformes	Leiognathidae	*Leiognathus equulus*	LC	Common ponyfish
Actinopterygii	Perciformes	Lethrinidae	*Lethrinus harak*	LC	Thumbprint emperor
Actinopterygii	Perciformes	Lethrinidae	*Lethrinus laticaudis*	LC	Grass emperor
Actinopterygii	Perciformes	Lethrinidae	*Lethrinus nebulosus*	LC	Spangled emperor
Actinopterygii	Perciformes	Lethrinidae	*Lethrinus ornatus*	LC	Ornate emperor
Actinopterygii	Perciformes	Lethrinidae	*Lethrinus semicinctus*	LC	Black-spot emperor
Actinopterygii	Perciformes	Lutjanidae	*Lutjanus fulviflamma*	LC	Dory snapper
Actinopterygii	Perciformes	Lutjanidae	*Lutjanus fulvus*	LC	Blacktail snapper
Actinopterygii	Gobiiformes	Gobiidae	*Mahidolia mystacina*	LC	Flagfin prawn goby
Actinopterygii	Elopiformes	Megalopidae	*Megalops cyprinoides*	DD	Indo-pacific tarpon
Actinopterygii	Perciformes	Terapontidae	*Mesopristes argenteus*	LC	Silver grunter
Actinopterygii	Perciformes	Terapontidae	*Mesopristes cancellatus*	LC	Tapiroid grunter
Actinopterygii	Perciformes	Pomacentridae	*Neopomacentrus azysron*	LC	Yellowtail damsel
Actinopterygii	Perciformes	Pomacentridae	*Neopomacentrus taeniurus*	DD	Freshwater damsel
Actinopterygii	Gobiiformes	Gobiidae	*Oligolepis stomias*	DD	Plain teardrop goby
Actinopterygii	Gobiiformes	Eleotridae	*Ophiocara porocephala*	LC	Spangled gudgeon
Actinopterygii	Gobiiformes	Gobiidae	*Oxyurichthys ophthalmonema*	LC	Eyebrow goby
Actinopterygii	Gobiiformes	Gobiidae	*Oxyurichthys takagi*	LC	
Actinopterygii	Gobiiformes	Gobiidae	*Parachaeturichthys polynema*	LC	Lancet-tail Goby
Actinopterygii	Pleuronectiformes	Cynoglossidae	*Paraplagusia guttata*	DD	
Actinopterygii	Pleuronectiformes	Cynoglossidae	*Paraplagusia sinerama*	LC	Dusky tongue sole
Actinopterygii	Gobiiformes	Gobiidae	*Paratrypauchen microcephalus*	LC	Comb goby
Actinopterygii	Perciformes	Microdesmidae	*Parioglossus formosus*	LC	

Actinopterygii	Perciformes	Microdesmidae	*Parioglossus raoi*	LC	Yellow dartfish
Actinopterygii	Perciformes	Mullidae	*Parupeneus barberinus*	LC	Dash-and-dot goatfish
Actinopterygii	Gobiiformes	Gobiidae	*Periophthalmus minutus*	LC	Minute mudskipper
Actinopterygii	Pleuronectiformes	Soleidae	*Phyllichthys sclerolepis*	DD	Hardscale sole
Actinopterygii	Mugiliformes	Mugilidae	*Planiliza subviridis*	LC	Greenback mullet
Actinopterygii	Perciformes	Ephippidae	*Platax orbicularis*	LC	Orbiculate batfish
Actinopterygii	Perciformes	Haemulidae	*Plectorhinchus gibbosus*	LC	Brown sweetlips
Actinopterygii	Perciformes	Haemulidae	*Pomadasys argenteus*	LC	Silver javelin
Actinopterygii	Perciformes	Haemulidae	*Pomadasys kaakan*	LC	Javelin grunter
Actinopterygii	Gobiiformes	Gobiidae	*Psammogobius biocellatus*	LC	Sleepy goby
Actinopterygii	Perciformes	Apogonidae	*Pseudamia amblyuroptera*	LC	White-jawed Cardinalfish
Actinopterygii	Pleuronectiformes	Paralichthyidae	*Pseudorhombus arsius*	LC	Largetooth flounder
Actinopterygii	Gobiiformes	Gobiidae	*Redigobius balteatus*	LC	Girdled goby
Actinopterygii	Clupeiformes	Clupeidae	*Sardinella fijiense*	LC	Fiji sardinella
Actinopterygii	Clupeiformes	Clupeidae	*Sardinella melanura*	LC	Blacktip sardinella
Actinopterygii	Aulopiformes	Synodontidae	*Saurida nebulosa*	LC	Clouded lizardfish
Actinopterygii	Anguilliformes	Ophichthidae	*Scolecenchelys macroptera*	LC	
Actinopterygii	Perciformes	Nemipteridae	*Scolopsis ciliata*	LC	Saw-jawed Monocle Bream
Actinopterygii	Gobiiformes	Gobiidae	*Sicyopterus lagocephalus*	LC	
Actinopterygii	Perciformes	Siganidae	*Siganus lineatus*	LC	Lined rabbitfish
Actinopterygii	Perciformes	Siganidae	*Siganus vermiculatus*	LC	Vermiculated spinefoot
Actinopterygii	Perciformes	Apogonidae	*Sphaeramia orbicularis*	LC	Orbiculate cardinalfish
Actinopterygii	Aulopiformes	Synodontidae	*Synodus sageneus*	LC	Speartoothed grinner
Actinopterygii	Gobiiformes	Gobiidae	*Taenioides cirratus*	DD	Whiskered eel goby
Actinopterygii	Perciformes	Toxotidae	*Toxotes jaculatrix*	LC	Banded archerfish
Actinopterygii	Gobiiformes	Gobiidae	*Trypauchen vagina*	LC	Burrowing goby
Actinopterygii	Anguilliformes	Muraenidae	*Uropterygius concolor*	LC	Brown moray eel
Actinopterygii	Perciformes	Apogonidae	*Yarica hyalosoma*	LC	Mangrove cardinalfish
Actinopterygii	Beloniformes	Zenarchopteridae	*Zenarchopterus dispar*	LC	Feathered River-garfish
Actinopterygii	Beloniformes	Zenarchopteridae	*Zenarchopterus gilli*	LC	Shortnose river garfish
Aves	Charadriiformes	Scolopacidae	*Actitis hypoleucos*	LC	Common sandpiper
Aves	Pelecaniformes	Ardeidae	*Butorides striata*	LC	Green-backed Heron
Aves	Charadriiformes	Charadriidae	*Charadrius mongolus*	LC	Lesser sandplover

Aves	Passeriformes	Campephagidae	*Coracina caledonica*	LC	South melanesian cuckooshrike
Aves	Pelecaniformes	Ardeidae	*Egretta garzetta*	LC	Little egret
Aves	Pelecaniformes	Ardeidae	*Egretta sacra*	LC	Pacific Reef-egret
Aves	Falconiformes	Falconidae	*Falco severus*	LC	Oriental hobby
Aves	Passeriformes	Meliphagidae	*Foulehaio carunculatus*	LC	Polynesian wattled honeyeater
Aves	Passeriformes	Meliphagidae	*Foulehaio procerior*	LC	Kikau
Aves	Passeriformes	Meliphagidae	*Foulehaio taviunensis*	LC	Fiji wattled honeyeater
Aves	Suliformes	Fregatidae	*Fregata ariel*	LC	Lesser frigatebird
Aves	Suliformes	Fregatidae	*Fregata minor*	LC	Great frigatebird
Aves	Passeriformes	Acanthizidae	*Gerygone levigaster*	LC	Mangrove gerygone
Aves	Passeriformes	Acanthizidae	*Gerygone mouki*	LC	Brown gerygone
Aves	Passeriformes	Meliphagidae	*Lichmera incana*	LC	Grey-eared Honeyeater
Aves	Suliformes	Phalacrocoracidae	*Microcarbo melanoleucos*	LC	Little pied cormorant
Aves	Passeriformes	Monarchidae	*Myiagra caledonica*	LC	Melanesian flycatcher
Aves	Passeriformes	Meliphagidae	*Myzomela cardinalis*	LC	Cardinal myzomela
Aves	Passeriformes	Meliphagidae	*Myzomela jugularis*	LC	Orange-breasted Myzomela
Aves	Passeriformes	Pachycephalidae	*Pachycephala pectoralis*	LC	Golden whistler
Aves	Passeriformes	Pachycephalidae	*Pachycephala rufiventris*	LC	Rufous whistler
Aves	Passeriformes	Pachycephalidae	*Pachycephala vitiensis*	LC	Fiji whistler
Aves	Suliformes	Phalacrocoracidae	*Phalacrocorax varius*	LC	Great pied cormorant
Aves	Charadriiformes	Charadriidae	*Pluvialis fulva*	LC	Pacific golden plover
Aves	Psittaciformes	Psittacidae	*Prosopeia personata*	NT	Masked Shining-parrot
Aves	Psittaciformes	Psittacidae	*Prosopeia splendens*	VU	Crimson Shining-parrot
Aves	Columbiformes	Columbidae	*Ptilinopus porphyraceus*	LC	Tongan Fruit-dove
Aves	Passeriformes	Rhipiduridae	*Rhipidura melanolaema*	LC	White-fronted Fantail
Aves	Passeriformes	Rhipiduridae	*Rhipidura rufifrons*	LC	Rufous fantail
Aves	Coraciiformes	Alcedinidae	*Todiramphus chloris*	LC	Collared kingfisher
Aves	Coraciiformes	Alcedinidae	*Todiramphus macleayii*	LC	Forest kingfisher
Aves	Coraciiformes	Alcedinidae	*Todiramphus sanctus*	LC	Sacred kingfisher
Chondrichthyes	Rhinopristiformes	Pristidae	*Anoxypristis cuspidata*	EN	Narrow sawfish
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Carcharhinus amblyrhynchoides*	VU	Graceful shark
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Carcharhinus*	VU	Pigeye shark

			amboinensis		
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Carcharhinus melanopterus*	VU	Blacktip reef shark
Chondrichthyes	Myliobatiformes	Dasyatidae	*Maculabatis toshi*	LC	Brown whipray
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Negaprion acutidens*	EN	Sharptooth lemon shark
Chondrichthyes	Myliobatiformes	Dasyatidae	*Pastinachus ater*	VU	Broad cowtail ray
Chondrichthyes	Rhinopristiformes	Pristidae	*Pristis zijsron*	CR	Green sawfish
Chondrichthyes	Myliobatiformes	Dasyatidae	*Taeniura lymma*	LC	Bluespotted lagoon ray
Gastropoda	Ellobiida	Ellobiidae	*Auriculastra elongata*	LC	
Gastropoda	Ellobiida	Ellobiidae	*Auriculastra subula*	LC	
Gastropoda	Ellobiida	Ellobiidae	*Cassidula crassiuscula*	LC	
Gastropoda	Neogastropoda	Conidae	*Conus frigidus*	LC	Frigid cone
Gastropoda	Neogastropoda	Conidae	*Conus varius*	LC	
Gastropoda	Ellobiida	Ellobiidae	*Laemodonta bella*	LC	
Gastropoda	Ellobiida	Ellobiidae	*Laemodonta punctigera*	LC	
Gastropoda	Ellobiida	Ellobiidae	*Laemodonta striata*	LC	
Gastropoda	Stylommatophora	Achatinellidae	*Lamellidea oblonga*	LC	
Gastropoda	Stylommatophora	Achatinellidae	*Lamellidea pusilla*	LC	
Gastropoda	Littorinimorpha	Littorinidae	*Littoraria undulata*	LC	
Gastropoda	Ellobiida	Ellobiidae	*Melampus striatus*	LC	
Gastropoda	Cycloneritida	Neritidae	*Neritodryas subsulcata*	DD	Weakly cut nerite
Mammalia	Chiroptera	Hipposideridae	*Aselliscus tricuspidatus*	LC	Trident Leaf-nosed Bat
Mammalia	Sirenia	Dugongidae	*Dugong dugon*	VU	Dugong
Mammalia	Chiroptera	Pteropodidae	*Pteropus nitendiensis*	EN	Temotu flying fox
Mammalia	Chiroptera	Pteropodidae	*Pteropus tuberculatus*	EN	Vanikoro flying fox
Reptilia	Squamata	Boidae	*Candoia bibroni*	LC	Pacific boa
Reptilia	Squamata	Scincidae	*Cryptoblepharus novocaledonicus*	LC	New caledonian shore skink
Reptilia	Squamata	Scincidae	*Emoia atrocostata*	LC	Littoral Whiptail-skink