SPECIES COMPOSITION OF ARGAO MANGROVE FOREST, CEBU, PHILIPPINES

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Abstract: The primary aim of the study has been to determine the species composition of the mangrove forest in Argao, Cebu, Philippines. At an interval of 250 m, 20 m x 20 m squares were established within three transect lines, creating a total of 11 plots typical of the site. All the plant species within the squares were identified and recorded. Results have shown that there are 22 species of mangrove trees in Argao belonging to 11 families and 14 genera. The common species that can be found in Argao mangrove forest are *Rhizophora stylosa* Griff, *Ceriops decandra* Ding Hou and *Lumnitzera racemosa* Willd. The most abundant family is Rhizophoraceae with eight species, followed by Avicenniaceae with three species, while the families of Combretaceae, Myrsinaceae and Sonneratiaceae have two species each, and the families of Bombacaceae, Meliaceae, Myrtaceae, Euphorbiaceae and Arecaceae have one species each. It was also found out that medicinal properties and commercial values may be derived from the resin of some of the mangrove species in the site. The fruits of *Bruguiera gymnorrhiza* (Busain) can be a substitute medicine for sore eyes and *Sonneratia caseolaris* (Pedada) for hemorrhage control. The mangrove forest of Argao needs to be protected and conserved because of its diversity and medicinal value and because it represents the remaining intact mangrove forest in the southern part of Cebu province.

Keywords: Argao, medicinal value, species composition, Taloot mangrove forest

Introduction:

Throughout their range, mangroves and their associated biota are threatened by human activities, such as over-exploitation and destruction, as well as by more indirect anthropogenic factors, such as pollution and climate change. From 1980 to 2001, the world had lost 19% to 35% of its total mangrove forest area (Valiela et al. 2001; FAO 2003). On average, 3,000 sq. km of mangrove forests were lost each year between the early 1980s and 2001, approximately 2.1% loss per year. At this rate of loss, mangroves could become extinct in 100 years (Duke et al. 2007). Mangroves are already critically endangered or approaching extinction in 26 of the 120 countries where they exist (FAO 2003).

Growing pressures from urban and industrial development along coastlines, combined with climate change and sea level rise prompt the need to conserve, protect and restore tidal wetlands singnificantly and

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urgently (Barbier 2007). If the destruction of mangroves continues, these forests might be reduced to relic patches – too small to support the diversity of organisms which depend on them.

In Thailand, Ranong mangrove already features patches and is in fact fragmented due to the combined effect of natural disasters and anthropogenic disturbances, worsened by the conversion of the forest into extensive tracks of fish ponds, shrimp ponds, and salt ponds, and even to residential villages (Doydee and Buot 2010). Furthermore, the reclamation of settlements and conversion of coastal areas for commercial purposes endanger this ecosystem. According to Roldan and Sievert (1993), the mangrove forest is one of the most abused coastal habitats.

The total mangrove area in the world is approximately 15,429,000 ha, distributed along many countries (Miles et al. 1999). In the Philippines, the estimated denudation rate of mangrove forests is 4,432.5 ha per year. The government's objective to increase fish production by converting mangroves to fishponds was not achieved, but instead created adverse impacts, such as the loss of significant habitats and biodiversity, loss of fishery value having resulted from the decline of the protective and ecological functions of mangroves as an ecosystem, and problems of unequal resource access (Melana 1982). Consequently, the remaining mangrove forest in the Philippines was then down to approximately 139,725.

Human activities are also a culprit of mangrove destruction. Coastal inhabitants in Argao use mangroves for crafting poles for fencing and house construction, as well as for fuel wood, even as medicine. These practices undoubtedly destroy mangroves. Consequently, the productivity of coastal fisheries, which is measured in terms of fish catch, also recorded a serious decline. It is estimated that fish catch is reduced by 670 kg for every hectare of mangrove forest that is clear-cut (CRMP 1998). The present exploitation rate of our coastal resources thus raises the need to assess our remaining mangrove resources (DENR 2001).

Mangroves are a coastal wetland ecosystem composed of various species of trees, shrubs and herbs capable of growing in seawater (Smith and Smith 2004; Doydee et al. 2008). This unique ecosystem is a vital habitat and is very important for biodiversity conservation in coastal landscape. They serve as natural bridges that link the marine and terrestrial environments (Aksornkoae et al. 1992; Doydee and Buot 2010).

The Philippines have relatively high mangrove diversity with 35 true mangrove species. The country ranks fifth among countries with the most number of endemic species (i.e. Indonesia, 43; Malaysia, 41; Australia, 37; Papua New Guinea, 37) (Long and Giri 2011). The most common genera are *Rhizophora*, *Avicennia*, *Bruguiera* and *Sonneratia* (Calumpong and Menez 1996). At least fourteen species have previously been recorded from Negros Island (Walters 2000). Overall, there are three dominant mangrove groups found in the Philippines: Bakauan group, i.e. *Rhizophora apiculata* (Bakauan lalaki), *Rhizophora mucronata* (Bakauan babae) and *Rhizophora stylosa* (Bakauan bato or Bangkau); Bungalon group, i.e. *Avicennia marina* (Bungalon), *Avicennia officinalis* (Api-api) and *Avicennia lanata* (Piapi) and Pagatpat group, i.e. *Sonneratia alba* (Pagatpat), *Sonneratia caseolaris* (Pedada) and *Sonneratia ovata* (Pagatpat baye) (Primavera 2000).

Mangrove-dependent fauna are equally diverse. Studies have recorded as many as 128 fish species from 54 families in the mangrove ecosystem of Pagbilao Bay, Quezon, 56 species of birds belonging to 28 families in 11 sites in Central Visayas and nine species of penaeid shrimps in a riverine and an island mangrove in Guimaras Island (Primavera 2000).

Botanical assessments, such as floristic composition and species diversity, are essential in providing information on species' richness in the forests, in managing forests, and in understanding forest ecology and ecosystem functions (Giriraj et al. 2008;

Pappoe et al. 2010). Hence, the study has been handled.

The primary aim of the study has been to determine the species composition of the mangrove forest in Argao, Cebu, Philippines. The study included preparing a list of mangrove plant species and conducting a survey of their medicinal value.

Materials and methods:

Study area

The study has been conducted in the mangrove forest of Barangay Taloot in the municipality of Argao, Cebu (Fig. 1). The area is located on coordinates N 9.95488^{o} and E 123.619^{o}. The Barangay is situated 9 km away from the municipality of Argao. Barangay Taloot spans on a total land area of 346.52 ha. To the north it is bound by Barangay Guiwanon, to the south by Sumaguan, to the east by Argao Sea and to the west by Bulasa. The Barangay served as an entry point for traders and travelers in pre-colonial Philippines. Nowadays, the place serves as a harbour for traders and travelers from Cebu to Bohol province.

The Barangay's mangrove forest is considered to be the last ecological frontier in the southern part of Cebu province. It is estimated to have an area of 36 ha (DENR 2001). Argao mangrove forest was deemed to be the most dense mangrove forest in terms of timber stand in the southern part of Cebu province.

The study sites were categorized as riverine forest types, which are tall floodplain forests along flowing waters, such as tidal rivers and creeks. Conditions in this type of forest are favorable for extensive growth due to daily tidal flushing. In addition, freshwater runoff and terrestrial nutrient influx enhance this type of mangrove community.

Species composition

The study included the inventory of mangrove plant species. A line transect of a minimum length of 500 m was established in the area. Three lines transect were established by following the existing trail, at an interval of about 100 m per line transect.

Quadrats of 20 m x 20 m were then established within the three lines transect at an interval of 250 m, creating a total of 11 plots herein the site. All the plant species within the quadrats were recorded and identified based on the DENR mangrove field guide.

Survey of medicinal species

A direct interview of the people on the coastal areas surrounding the Argao mangrove forest was conducted to know their perception or ideas on the medicinal value of these mangrove plant species. Old literature was also consulted to determine the accredited medicinal value of the mangrove species.

Results and discussion:

Species composition

The study identified 22 species of mangrove trees in Argao, Cebu belonging to 11 families and 14 genera (Tab. 1). These represent almost 50% of the 54 mangrove species all over the world and just over 50% of the 35 species in the Philippines (Ong et al. 2002).

The most represented family is Rhizophoraceae (eight species). The abundant genera are *Bruguiera* (four species) and *Avicennia* (three species), which are also some of the most common genera in the Philippines (Calumpong and Menez 1996). Out of the 22 mangrove plant species identified within the site, *Rhizophora stylosa* Griff, *Ceriops decandra* Ding Hou and *Lumnitzera racemosa* Willd dominated the whole mangrove forest.

The results imply that the Argao mangrove forest studied was dominated by

the species under the genera Rhizophora, Ceriops and Lumnitzera. These three genera belonging to the group of bakauan are considered as some of the dominant groups in the Philippine mangrove forest (Primavera 2000). For reference, see the list of mangrove plant species (Tab. 1).

Meanwhile, based on observation during the conduct of the study, the researchers revealed some destructive human activities affecting the survival of the mangrove species. The people of Argao, particularly those on the coastal areas, use harvest mangrove trees for firewood, charcoal-making, livestock forage, and house construction. The presence of a few stumps in the area proves that people are felling the trees in the mangrove forest.

Figure no. 1 The study area, Taloot, Argao, Cebu, Philippines. A shows the location of Cebu province in the Philippine Islands (encircled area), B shows the location of Argao town in Cebu province (encircled area) and C shows the mangrove forest located in Taloot, Argao, Cebu (encircled area) (FLUP 2014).

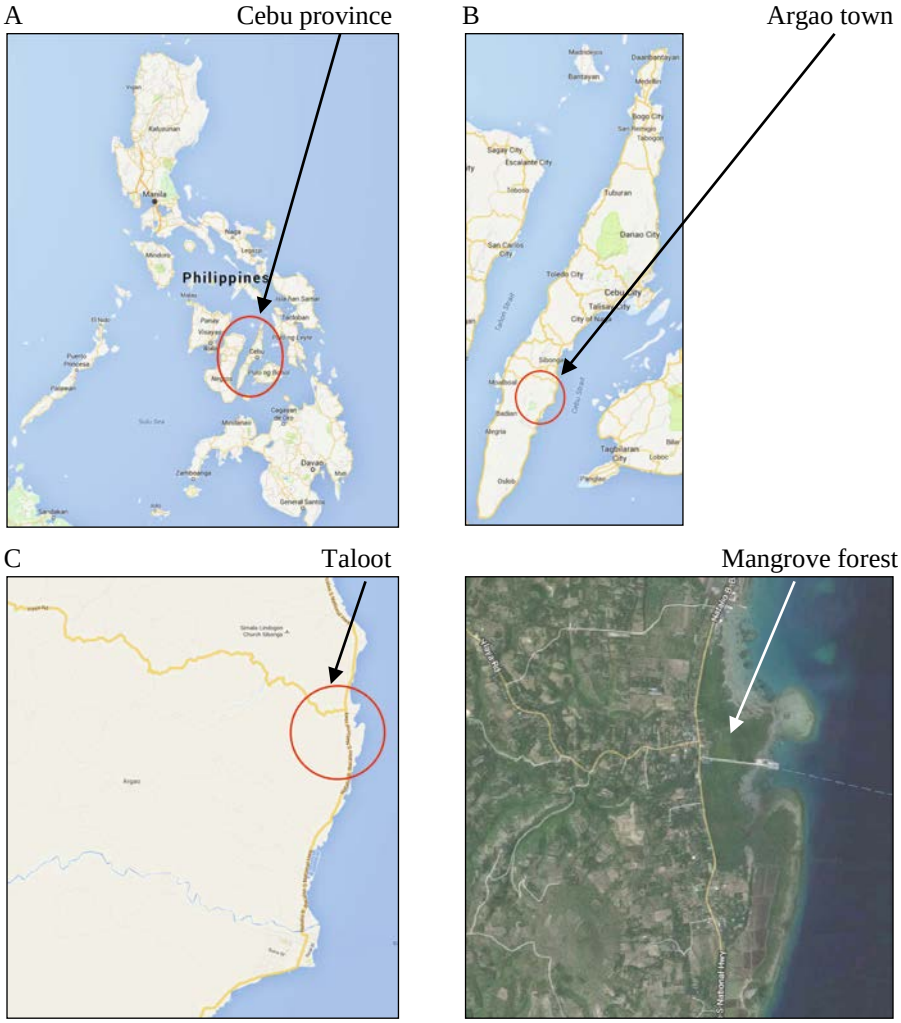

Table no. 1 List of mangrove plant species in Argao

No.	Scientific name	Common name
	Fam. Arecaceae	
1	*Nypa fruticans* Wurmb	Nipa
	Fam. Avicenniaceae	
2	*Avicennia lanata* Ridley	Piapi
3	*Avicennia marina* Vierh	Bungalon
4	*Avicennia officinalis* L.	Apiapi
	Fam. Bombacaceae	
5	*Camptostemon philippinense* Becc.	Gapas-gapas
	Fam. Combretaceae	
6	*Lumnitzera littorea* Voigt	Tabau
7	*Lumnitzera racemosa* Willd	Kulasi
	Fam. Euphorbiaceae	
8	*Excoecaria agallocha* L.	Buta-buta
	Fam. Meliaceae	
9	*Xylocarpus granatum* J. König	Tabigi
	Fam. Myrsinaceae	
10	*Aegiceras corniculatum* Blanco	Saging-saging
11	*Aegiceras floridum* Roem. & Schult.	Tinduk tindukan
	Fam. Myrtaceae	
12	*Osbornia octodonta* F. Muell	Taualis
	Fam. Sonneratiaceae	
13	*Sonneratia alba* Sm.	Pagatpat
14	*Sonneratia caseolaris* Engl.	Pedada
	Fam. Rhizophoraceae	
15	*Bruguiera cylindrica* (L.) Blume	Pototan lalaki
16	*Bruguiera gymnorrhiza* (L.) Lam	Busain
17	*Bruguiera parviflora* Wight & Arn.	Langarai
18	*Bruguiera sexangula* (Lour.)Poir	Pototan
19	*Ceriops decandra* Ding Hou	Malatangal
20	*Ceriops tagal* C.B. Rob.	Tangal
21	*Rhizophora apiculata* Blume	Bakauan lalaki
22	*Rhizophora stylosa* Griff	Bakauan bankau

Medicinal value and other uses of mangrove species

Based on survey results, 100% of the respondents do not recognize the medicinal value of the mangrove species (Tab. 2). As far as they are concerned, they do not use the mangrove species as herbal medicine. They only recognize the species as forage for their livestock.

But according to the literature reviewed, medicinal value can mostly be derived from the resin of the species in Argao mangrove forest. The fruits of *Bruguiera gymnorrhiza* (Busain) can be used as substitute medicine for sore eyes and *Sonneratia caseolaris* (Pedada) for hemorrhage control. Other medicinal values of the mangroves plant species could be found in Table 3 (Miles et al. 1999).

The mangrove forest of Argao was dominated by the Rhizophoraceae family, particularly the species of *Rhizophora stylosa* Griff, *Ceriops decandra* Ding Hou and *Lumnitzera racemosa* Willd. According to Hong and San (1993), mangrove species such as *Rhizophora* sp. and *Avicennia* sp. can adjust to different salinity levels and can tolerate high soil salinity during the dry season and low soil salinity during the rainy season.

Table no. 2 Respondent perception on the medicinal value of mangrove plant species in Argao, Cebu

Mangrove plant species	Respondent preception on the medicinal value of the species	Other uses
Bruguiera cylindrica (L.) Blume	none	forage
Bruguiera gymnorrhiza (L.) Lam	none	forage
Ceriops decandra Ding Hou	none	forage
Ceriops tagal C.B. Rob	none	forage
Rhizophora stylosa Griff	none	forage
Sonneratia alba Sm.	none	forage
Osbornia octodonta F. Muell	none	forage
Other mangrove plant species	none	forage

Table no. 3 Literature survey on the medicinal value of the mangrove plant species (Miles et al. 1999)

Acanthus illicifolius L.	Leaf juice used as hair preserver, fruit pulp as blood purifier, dressing for boils and snake bite, leaf preparation used for rheumatism.
Acanthus ebracteatus Vahl.	
Aegiceras corniculatum Blanco	Bark and seed used as fish poison.
Avicennia alba Blume	Bark and seed used as fish poison, resin used in birth control, seed ointment relieves smallpox, ulcer.
Aegiceras floridium Roem. & Schult.	
Ceriops tagal C.B. Rob	Source of firewood and tannins, yields high quality dyes, bark stops hemorrhaging (source of anticoagulant).
Derris trifoliate Lour.	Used to kill fish.
Excoecaria agallocha L.	Fish and arrowhead poison in Thailand it is known to cause blindness and skin eruptions in the Philippines it is used as medication for toothache, in Malaysia bark extract is taken as a purgative.
Rhizophora sp.	Timber, fishing stakes, piles, firewood, charcoal, and tannins.
Rhizophora mucronata Lam	Bark used to treat diarrhea, dysentery, and leprosy; fruit sap used as a mosquito repellent; wine is made from fruit and honey from the nectar.
Sonneratia caseolaris Engl	Fruit is eatable, sap is used as a skin cosmetic, leaves are used for goat food.
Sonneratia ovata Backer	Fruit is eatable and used to treat sprains, fermented; juice used as anticoagulant.
Xylocarpus granatum J. König	Firewood, timber, and tannin; bark extract is used to treat cholera.

Mangrove habitat has an array of environmental conditions which require specialized adaptations for survival, growth, and reproduction of plant species (Lika and Marsha 1996). Hence, the species with similar adaptive strategies tend to grow together in places that feature similar favorable conditions and vice versa.

All of the respondents do not acknowledge the medicinal value of the mangrove species. However some of the respondents mention the other uses of the species such as raw material for soap-making, for example *Avicennia lanata* (Piapi). In terms of other uses, some species serve as source of tannin like *Sonneratia*

alba (Pagatpat), *Rhizophora apiculata* (Bakauan lalaki) and *Ceriops tagal* (Tangal) (Figs. 2 and 3).

Figure no. 2 Stem of *Sonneratia alba* Sm.

Figure no. 3 Stem of *Rhizophora apiculata* Blume

a. Upper part of the stem

b. Lower part of the stem

Rezumat:

COMPOZIȚIA SPECIILOR DIN PADUREA DE MANGROVE ARGAO, CEBU, FILIPINE

Scopul principal al studiului a fost determinarea compoziției speciilor din pădurea de mangrove de la Argao, Cebu, Filipine. La un interval de 250 m au fost folosite pătrate de 20 m x 20 m în cadrul a trei linii de transecte, creând un total de 11 parcele tipice de studiu. Toate speciile de plante din interiorul pătratelor au fost identificate și înregistrate. Rezultatele au arătat prezența a 22 de specii de arbori mangrove în Argao, aparținând la 11 familii și 14 genuri. Cele mai comune specii întâlnite în pădurea de mangrove Argao sunt *Rhizophora stylosa* Griff, *Ceriops decandra* Ding Hou și *Lumnitzera racemosa* Willd. Familia cea mai abundentă este Rhizophoraceae cu opt specii, urmată de Avicenniaceae cu trei specii, în timp ce familiile Combretaceae, Myrsinaceae și Sonneratiaceae au două specii fiecare, iar familiile Bombacaceae, Meliaceae, Myrtaceae, Euphorbiaceae și Arecaceae au fiecare câte o specie. De asemenea, s-a constatat că datorită proprietăților medicinale ale unor specii din pădurea de mangrove, valoarea comercială poate fi obținută prin exploatarea rășinei. Fructele speciei *Bruguiera gymnorrhiza* (Busain) pot fi un medicament substitut pentru durerea de ochi, iar *Sonneratia caseolaris* (Pedada) pentru controlul hemoragiei. Pădurea de mangrove din Argao are nevoie să fie protejată și conservată datorită diversității și valorii sale medicinale, dar și pentru faptul că ea reprezintă singura pădure de mangrove intactă din partea de sud a provinciei Cebu.

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