IJSRM
INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY
An Official Publication of Human Journals

Human Journals
Research Article
May 2019 Vol.:12, Issue:3

Anthropogenic Factors That Affect the Structure of Mangroves in Wangeotak, North Halmahera

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Submission: 25 April 2019
Accepted: 30 April 2019
Published: 30 May 2019

Keywords: Anthropogenic Factors, Structure of Mangrove Community, Wangeotak

ABSTRACT

The present study was an attempt to reveal anthropogenic factors that affect structure of mangroves in Wangeotak, Malifut District of North Halmahera. This study employed a descriptive-quantitative method and was carried out in two stages. The first was to conduct interviews with local people related to the utilization of mangroves. Then, a direct tree-level observation was performed on the vegetation parameters, including the vegetation relative density, relative dominance, relative frequency, and Importance Value Index (IVI). Twelve observation plots were created on station 1 and 13 observation plots were created along station 2. Each of the observation plots were made 20x20m. The research data were analyzed using a formula suggested by Mueller-Dombois and Ellenberg in Telangana. The result of the analysis in the form of IVI was connected with the anthropogenic factors (human activities) that affected the mangrove community. Findings of this study suggest that human factors may have detrimental effects on mangroves in Wangeotak, Malifut District of North Halmahera. People who live near the forest make use of mangrove trees for both personal and commercial purposes. The forest's damage also influences the structure of mangroves in the area.

I. INTRODUCTION

Mangroves provide life for topical coastal communities, which are dominated by several types of plants that can grow and survive salty ocean water and tidal waves [11]. A mangrove community is also known as brackish-water vegetation. [3] Mentions that mangroves consist of different types of mangrove trees that live in muddy intertidal zones.

The largest mangrove habitat in the world can be found in Indonesia. The area of mangrove forests in Indonesia reaches 75% of the total mangrove forests in Southeast Asia or about 27% of the total mangrove forests in the world. Indonesia's mangrove forests are spread throughout the area with a total of 9.36 million hectares. About 48% or 4.51 million hectares of Indonesia's mangrove forests are moderately damaged and 23% or 2.15 million Ha are severely damaged. The destruction of mangrove forests in Indonesia is largely caused by human activity. The natural functions of mangroves have been converted into settlements, industry, recreation, and so on. North Maluku is a province that has approximately 805 islands. Its area reaches approximately 140,225.36 km2. The province is composed of 78% of the ocean and 22% of land and lies between 300 north and 300 south latitudes and 1240 and 12900 east longitude. The coast of North Maluku stretches for a staggering ± 18,000 km2, covered by ± 43,887.00 hectares of mangrove forests. North Halmahera Regency, in particular, which is located at position 01° 57 '00 "N - 03° 00' 00"N and 127° 17 '00 "E - 129° 00' 00"E has 16,438.72 hectares [6].

North Maluku has a relatively large potential of mangrove forests, but the vast mangrove forests are currently experiencing a lot of damage, which is affected by the environmental factors and human (anthropogenic) factors. Community activities greatly influence the structure of the mangrove. [12] States that there are some concrete steps that can be taken to control the physical environment. These include: (1) fostering and improving the quality of the vegetation habitat, (2) improving the recovery of the green areas through reforestation, and/or enrichment of suitable plant species, (3) restoring degraded habitats or areas whose ecosystem functions are disturbed. The restoration of the role and function of bio-ecohydrological services can be done through: (a) rehabilitation, and or (b) habitat reclamation. The physical mangrove environment can also be improved through the development of plant species that are closely related to mangrove food sources, nesting sites, and habitats. As a matter of fact, mangrove forests can restore themselves without restoration

efforts through secondary succession, but it takes ± 15-30 years within normal hydrological cycles and with available mangrove seeds or propagules.

According to [1], damage caused by humans who live in the coastal areas has an impact on reducing mangrove diversity. The efforts of fulfilling the community needs may adversely affect the structure of mangroves. Based on the explanation above, it can be concluded that human (anthropogenic) activities should be taken into account as one of the factors that can affect the structure of mangroves; therefore, this study was conducted to examine types of human activities that can influence the structure of mangroves that grow in Wangeotak Malifut of North Halmahera.

II. RESEARCH METHOD

The current study employed a descriptive-quantitative method. It was carried out in the village of Wangeotak Malifut, North Halmahera Regency in November 2018. Two mangrove sites were selected. There were 12 observation plots created on the first site and 13 observation plots on the second site. The study was performed in two phases. The first phase involved the activity of interviewing local people who live nearby the mangrove forests about the utilization of mangrove trees. In the second phase, a tree-level observation was conducted using the quadrat method (plot-based technique). Each of the observation plots sized 20x20m. Mangroves were categorized based on the Introduction to Mangroves by [7]. The measurement of the vegetation parameters included:

a) Calculating the total individuals of each species (density);

b) Measuring the circumference of the stem at the chest level. The stem circumference was then converted into diameter using the formula $D = \frac{Kell}{\pi}$ (dominance);

Where: D = diameter Kell = circumference π = 3,14

c) Measuring types of mangroves that appeared on each plot (frequency). The results of the observation were analyzed using formulas suggested by [9], such as shown below.

a) Relative density $= \frac{\text{number of individuals of species}}{\text{total number of individuals}} \text{ x } 100$

b) Relative dominance $= \frac{\text{dominance of species}}{\text{dominance of all species}} \times 100$

c) Relative frequency $= \frac{\text{frequncy of species}}{\text{sum frequency of all species}} \times 100$

d) Importance value = Relative density + Relative dominance + Relative frequency

The Importance Value Index (IVI) was compared to the anthropogenic factors that affected the structure of mangroves in the area.

III. RESULTS AND DISCUSSION

A. Anthropogenic Factors

Mangrove trees in Wangeotak are mostly used to fulfill society's basic needs. Table 1 presents the forms of mangrove utilization in the area.

Table 1. Mangrove Utilization in Wangeotak

No.	Types of Mangrove	Use of Mangrove	Images
1.	*Rhizophora apiculata* Blume.	Used as firewood and port	 Firewood  Portpole
2.	*Rhizophora mucronata* Lmk	Firewood	  Firewood
3.	*Bruguiera gymnorrhiza* (L.) Lam.	Used as home walls, and	 House wall  Fence pole
4.	*Xylocarpus granatum* Koen	used as a boat body	 Made into a boat

B. The Structure of Mangroves in Wangeotak

Mangroves in Wangeotak, Malifut District of North Halmahera Regency are composed of four vegetation types. They are *Rhizophora apiculata Blume., Rhizophora mucronata Lamk., Bruguiera gymnorrhiza* (L.) Lam., and *Xylocarpus granatum* Koen. The Importance Value Index (IVI) of each mangrove species from two observation stations are presented in Figure 1 and Figure 2.

Figure 1 below shows the Importance Value Index (IVI) of mangrove species found in station 1 (12 observation plots).

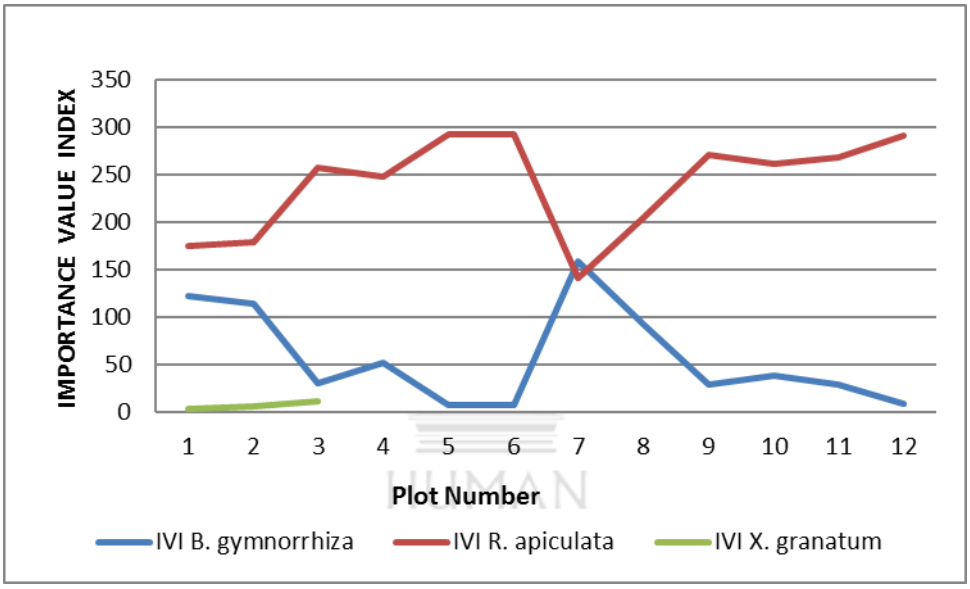

Figure 1. IVI of Mangrove Species on Station 1

Figure 1 explains that the IVI of each mangrove species is not evenly distributed in each observation plot. It illustrates that every mangrove type has a divergent number of individuals and dominance values. The highest number of individuals and dominance value is reported by *Rhizophora apiculata Blume*. This species has recently experienced shocks in terms of its individual numbers, because the surrounding community continues to use it as firewood and stackpole. As a result, the IVI of this species cannot reach a maximum value of 300%.

The second highest dominance value is found in *Bruguiera gymnorrhiza (L.) Lam.*Similar to *Rhizophora apiculata Blume.*, this species individuals keep decreasing as it has been continuously exploited by the society who normally use it to build house walls and house fences. Therefore, the IVI of the species cannot reach its maximum value. The next mangrove

type reported is *Xylocarpus granatum* Koen. This mangrove tree can be used as the main material to build a boat body. The result of the analysis showed that this species had a limited number of individuals and insignificant IVI.

Figure 2 below shows the IVI of mangrove species found in station 2 (13 observation plots).

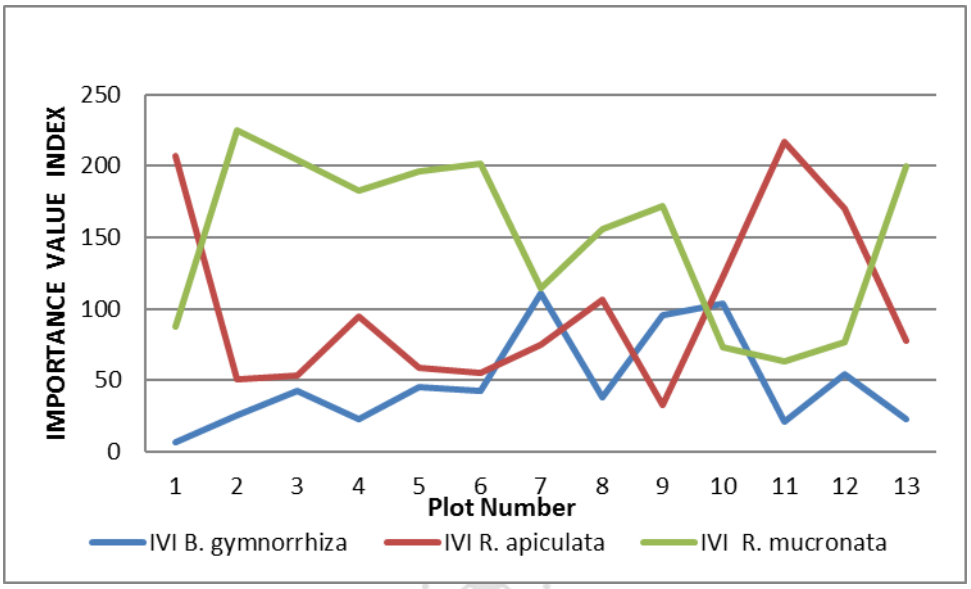

Figure 2. IVI of Mangrove Species on Station 2

Figure 2 displays an uneven distribution of IVI on the 13 observation plots. This information suggests that each of the mangrove types has a different number of individuals and dominance value. Based on Figure 2, it can be concluded that *Bruguiera gymnorrhiza* (L.) Lam. has a small number of individuals and dominance value. The IVI of the species cannot, obviously, reach 300%. This mangrove tree is usually utilized by local people to build house walls and house fences.

Another type of mangrove reported is *Rhizophora apiculata* Blume., which has a small dominance value. The number of individuals in this species is getting smaller because this species is more frequently used as firewood and stackpole constructing a quay. This condition has impacted its lower IVI, which cannot reach the optimum point.

The other mangrove species found on station 2 is *Rhizophora mucronata* Lmk. The initial observation showed that this species had a high number of individuals and the highest dominance value. However, the IVI of this species keeps getting lower and cannot reach 300% because the mangrove tree has been used as firewood.

All in all, there are four types of mangrove that can be found on two observation stations. They include *Rhizophora apiculata Blume.*, *Rhizophora mucronata Lamk.*, *Bruguiera gymnorrhiza* (L.) Lam., and *Xylocarpus granatum* Koen. Each of the mangrove species has its own benefits for fulfilling human's basic needs, such as presented in Table 1. The direct use of wood from mangrove forests by the community has an impact on the destruction of mangrove forests. The following will discuss the usefulness of each type of mangrove.

C. DISCUSSION

1. *Rhizophora apiculata* Blume.

Rhizophora apiculata Blume. belongs to the Rhizophoraceae family. Among local people, it is popular as *Soki*. It can grow to be about 30 meters tall and 5 meters in diameter. The data presented in Table 1 shows that the wood is gathered by local people for fuel. The firewood is normally used for either personal or commercial purposes. It is cut into 50-60 cm size, then tied and sold at Rp. 15,000,-/tie. In addition, due to its strength and resistance to attacks from sea borers, the wood can be used to build port poles.

This finding is confirmed by [10] who state that the majority of people living around mangrove forests normally use *R. acpiculata* wood as firewood and to build port poles. Furthermore, [5] categorizes Rhizophora as a strong wood and can be used as a building material, charcoal-making materials, and for fuel. This wood can also be used to produce high-quality paper because it can generate a high heat energy which is equal to 5,017 cal/gw.

2. *Rhizophora mucronata* Lmk.

Rhizophora mucronata Lmk. is also known as *Soki*. The height of the tree can reach 30 meters and the diameter can grow until 5-7 meters. It has wider leaves and longer propagules compared to other species of mangrove. Data displayed in Table 1 suggests that the majority of people living near the forest usually use its wood for fuel. The wood can produce heat or high calories [10].

3. *Bruguiera gymnorrhiza* (L.)

Bruguiera gymnorrhiza (L.) or *Dao* (local name) can reach 15-30 meters in size. This mangrove species often dominates the old mangrove forests, marking the final stage of litoral zone development and the transition to drier land zones [7]. The wood is used by local people

to make house walls and fence posts due to its firm property when planted in the ground or mud. [5] classifies B. gymnorrhiza (L.) into the heavy, hard, and strong category of wood. This wood is more durable when used under a roof.

4. *Xylocarpus granatum* Koen.

Xylocarpus granatum Koen. or Fruit usually has a height of about 5 meters. This type of mangrove often dominates mangrove forests in the back area or drier land zones [7]. Local people use its wood to build the walls and floors of a boat. The wood will be processed into boards and the boards will be arranged into a boat body. This finding is in line with the results of the [5] study which found that wood from the Xylocarpus tree was widely used as firewood and the body of the boat because it can produce a heat of 3.899 Cal/I. This type of wood can also be used to build houses and as the handle of a *keris* (traditional Indonesian dagger).

The description above shows that human activities (anthropogenic factors) has a great contribution on the destruction of mangrove forests in Wangeotak. Local people or fishermen families living in the area continue using the mangrove wood to meet their basic needs on a daily basis. [4] argues that human desire to fulfill their needs can inhibit the development of mangroves and damage the habitat of their species. In addition, damage can also occur due to the increased demand for timber production, leading to the excessive exploitation of mangrove forests.

Environmental damage, including mangrove forests destruction and a reduction in the number of certain species, which affects the structure of the mangroves, are clearly related to human activities (anthropogenic factors). Traditional fishermen play a major role in damaging the sea ecosystem [8]. Even though the fishermen are aware of the consequences, they cannot stop themselves from over-exploiting the mangroves due to economic pressure. Other influential factors that might have an impact on the balance of coastal ecosystems include mangrove forests logging, coastal sand mining, and fishing using explosives [2].

IV. CONCLUSIONS

Based on the results of the study and the discussion, it can be concluded that:

1. Human activities (anthropogenic factors) mainly contribute to the damage of mangroves in Wangeotak Malifut of North Halmahera;

2. Local people who live in Wangeotak exploit the mangrove forests to fulfill their basic needs and for commercial purposes.

3. Mangroves detriment can also affect the structure of mangrove communities in Wangeotak Malifut of North Halmahera in general.

V. REFERENCES

[1] Arisandi, P. *Mangrove Jawa Timur, Hutan Pantai yang Terlupakan*.Ecological Observation and Wetlands conservation (ECOTON). Gresik. 2001

[2] Bengen , D.G. *Sinopsis Ekosistem dan Sumber dya Alam Pesisir dan Laut serta Prinsip Pengelolaanya*. Bogor: Pusat Kajian Sumber daya Pesisir dan Lautan IPB. 2004

[3] Bengen, D. G. *Teknis Pengambilan Contoh dan Analisis data Biofisik Sumber daya Pesisir.* Sinopsis. Pusat Kajian Sumber Daya Pesisir dan Lautan, Institut Pertanian Bogor. 2000

[4] Dahuri R. *Penglolaan Sumber Daya Wilayah Pesisir dan Lautan secara terpadu*. PT. Pradnya Paramita. Jakarta. 2001

[5] FAO. *Mangrove Forest Management Guidelines Fao Forestry Papaer 117*. (online) (http://archive.Org/stream/mangroveforestma034845mbp/mang,diakses,1 Mei 2019. 1994.

[6] Kementrian Kehutanan. *Rencana Kehutanan Tingkat Nasional RKTN Tahun 2011-2030*. Lampiran Dari Peraturan Menteri Kehutanan Republik Indonesia Nomor P.49/2011. Jakarta. Diakses, 2 Mei 2019. 2001

[7] Noor, R.Y; M. Khazali; I.N.N, Suryapura. *Panduan Pengenalan Mangrove di Indonesia*. Wetsland International, Indonesia Programme. Bogor. 2006

[8] Tampubolon, M. *Pendidikan Pola Pemberdayaan Masyarakat dan Pemberdayaan Partisipasi Masyarakat Dalam Pembangunan Sesuai Tuntutan Otonomi Daerah* (online) http://www.depdiknas.go.id/jurnal/32/pendidikan diakses 2 Mei 2019.2002

[9] Tolangara A.R., & Sundari. *Ekologi Mangrove Maluku Utara jilid 2 (kerusakan mangrove)*. Ternate: LepKhair. 2012

[10] Tolangara, A.R., &A.D. Corebima. *Species Composition and Utilization Patterns of Mangrove in the District of Jailolo West Halmahera Province of North Mollucas*. Indonesia. Enviromental Science and Indian Journal. Volume 9 Issue 10. ISSN 0974-7451**.** pp359-364. 2014

[11] Tolangara, A.R., Hasan T., &A.D. Corebima. *Comparing Several Mangrove Seedlings.* Donnish Journals. Volume 2 (1). ISSN 2014-1162.pp.008-011. February 2015. 2015

[12] Waryono, T. *Restorasi Ekologi Hutan Mangrove*. (Studi Kasus DKI Jakarta). Seminar Nasional Mangrove "Konservasi Rehabilitasi Mangrove Sebagai Pemulihan Ekosistem Hutan Mangrove DKI Jakarta" Jakarta. 2002