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Mangrove Damage Evaluation using Two Species of *Acanthus* as a Biomonitoring Agent, Case Study: Segara Anakan Cilacap, Indonesia

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Abstract. Mangrove area continues to be decreased and lost in Indonesia due to human activities as well as natural disturbances. Segara Anakan is the largest mangrove ecosystem left in Java Island, where also in critical condition that mainly due to sedimentation and people use. This mangrove degradation can be evaluated by using mangrove understory as a bioindicator. *Acanthus* genera are one of mangrove vegetation that can overgrow after mangrove degraded and canopy been opened. There are two species, which are *Acanthus ilicifolius* and *Acanthus ebracteatus* in Segara Anakan mangrove ecosystems. The survey method with purposive sampling was used in this study in 2010 and 2018. Ecological data were analyzed using PRIMER-E, mapping, and spatial analysis using Surfer and ArcView 3.2. The study shows two species of *Acanthus* were distributed aggregate, especially in the damaged mangrove that found a low density of mangrove in the sapling and tree category. The density of *Acanthus* has increased during one decade as well as its distribution than one decade before. Therefore, *Acanthus* can be used for biomonitoring agent of mangrove damage because of its specific characteristics and distribution.

1. Introduction

Mangrove ecosystems provide various environmental resources and services that are used for humans and play a vital role in the environment. Goods and provisions of mangroves are well studied and explored, such as wood, fuel, fiber, food, medicine, coloring, and others. The ecological and environmental services of the mangrove ecosystem include the regulatory and supporting functions. Besides these two services, mangroves also provide social or human culture services [1]. One of the regulatory functions is the role of mangroves in sequestration and storage of carbon. The ecological functions are mangrove as a productive ecosystem that supports a nursery, spawning, and feeding ground for estuarine and marine biota, including biota with high economic value [2]. While social functions, mangroves can be used as a recreation site.

In recent years, the functions and ecosystem services of mangroves have reduced in line with the decline of mangrove areas. About 1.8 million hectares of mangroves in Indonesia had been damaged. Therefore, proper management urgently requires [3]. Mangrove is rapidly damaged due to the conversion function into other land uses. This leads to the emergence of several problems, including the decline in fisheries production, reduced biodiversity of mangrove ecosystems, loss of habitat and nursery areas, reduced mangrove and also aquatic productivity, soil acidification, pollution, and seawater intrusion [4, 5, 6]. Mangroves found on the southern coast of Java, such as Segara Anakan [7]. Habitats in the Segara Anakan ecosystem have undergone significant changes. It had decreased



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from 15827 ha to 9238 ha in 1987 to 2006 respectively. This change due to conversion mainly into rice fields and ponds. This condition leads to new social and economic problems for the surrounding community in the villages of Klaces, Ujungalang, Ujunggagak, and Penikel [8]. The area of the lagoon also has 50% reduced (from 2225 ha to 1002 ha in almost ten years), which is due to the high sedimentation process in the lagoon [9, 10].

Some mangrove species, including genus *Acanthus*, are often found in quite dominant numbers on the south coast of Java [6, 11, 12]. *Derris trifoliata* and *Acanthus ilicifolius* are mangrove understorey species that can be used as mangrove damage indicators [13]. *Acanthus* is a scrub that grows clustered and strung on the ground and can reach 2 m in height. *Acanthus* can spread vegetative, and had an air root growing on the lower surface of the horizontal stem. Flowers are pollinated assisted by birds and insects [14]. This causes that the growth rate is relatively fast compared to other vegetation.

This paper is expected to provide crucial necessary information about mangrove degradation at Segara Anakan Cilacap based on the density and distribution of *Acanthus*. Quick and simple data collection and analysis of *Acanthus* can be used in monitoring and utilization, including conservation efforts for the rehabilitation of mangrove ecosystems of the study area as well as in Indonesia.

2. Methods

The survey method was used in this study, the location and sampling station, as in Figure 1.

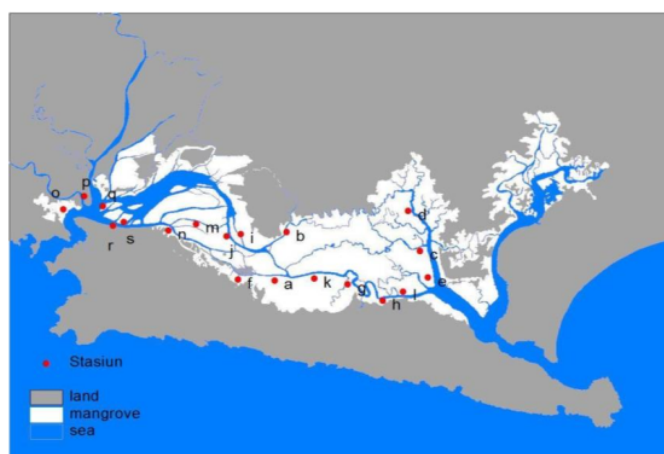


Figure 1. Research location

The plot sampling method was used for the structure and composition of mangrove vegetation [15]. Plot 10m × 10m for trees within diameter ≥ 10cm; plot 5m × 5m for sapling (1cm < diameter ≤ 10cm) and 1 × 1 m for seedling (high ≤ 1m or diameter = 1cm). Mangrove species identification based on mangrove book identification [15, 16, 17].

Environmental factors that measured in situ are air temperature, soil and water temperature, light intensity, soil pH, soil salinity. At the same time, ex-situ measurement includes total N and P, sediment structure (sand, clay, silt), water content, and organic content for each station. The distribution pattern was analyzed by variance S2 (Table 1). After the distribution pattern has been analyzed, then spatial analysis has done by using Surfer 8.0 dan ArcView 3.2 [18].

Table 1. Distribution pattern based on Spellerberg, 1991 [19]

Means versus variance (S^2)	Distribusi pattern
$S^2 = 0$	Uniform
$\bar{x} = S^2$	Random
$\bar{x} < S^2$	Aggregate

3. Results

The environmental conditions of Segara Anakan are varying in mangroves habitat (Table 2). Table shows that parameters such as soil temperature, soil pH, N, and P total are relatively the same for each location or observation station in the mangrove area. However, there are several other differences in parameter values such as sand, clay, mud, water content, soil salinity, and organic content in the soil for each station.

Table 2. The environmental data of Segara Anakan mangrove

Station	pH	WC (%)	OC (%)	Soil temp (°C)	N total (%)	P ₂ O ₅ total (%)	FeS ₂ (%)	sand (%)	silt (%)	Clay (%)	Salinity (ppt)
A	7.0	50.78	14.51	29.7	0.269	0.087	1.088	0.23	24.12	75.65	24.0
B	6.8	55.05	17.65	28.0	0.480	0.140	1.022	3.02	26.84	70.14	8.0
C	7.0	56.02	8.20	28.5	0.187	0.087	0.229	17.29	33.65	49.06	22.0
D	7.1	56.64	19.58	32.5	0.255	0.093	0.229	5.41	32.21	62.38	20.3
E	7.0	54.70	17.55	29.3	0.201	0.088	0.229	14.91	33.36	51.73	23.6
F	5.9	57.58	22.00	29.3	0.220	0.224	1.088	0.17	22.77	77.05	15.0
G	6.5	52.11	23.04	27.8	0.304	0.124	1.636	9.69	32.82	57.49	16.3
H	6.7	58.21	32.81	29.3	0.178	0.094	2.184	16.93	35.00	48.07	26.0
I	6.4	62.66	20.12	26.7	0.620	0.120	0.592	2.17	33.93	63.91	23.0
J	6.7	59.14	24.75	29.1	0.427	0.103	0.161	1.91	40.32	57.77	28.6
K	6.6	62.11	26.70	27.0	0.420	0.160	1.636	2.08	31.99	65.92	27.0
L	6.1	56.14	16.68	31.0	0.157	0.110	1.206	16.08	38.16	45.76	28.0
M	6.9	51.18	28.95	32.7	0.138	0.077	1.022	1.52	49.92	48.57	25.0
N	6.9	46.48	22.23	29.0	0.170	0.360	0.122	0.12	21.43	78.45	26.0
O	6.6	32.82	15.54	29.2	0.129	0.090	2.746	3.01	49.74	47.25	28.0
P	6.5	34.05	11.40	0.0	0.000	0.000	0.000	0.00	0.00	0.00	0.0
Q	6.9	47.35	11.50	31.1	2.520	1.019	1.435	2.08	41.47	56.45	25.0
R	6.8	45.08	12.97	0.0	0.000	0.000	0.000	0.00	0.00	0.00	0.0
S	7.0	61.38	17.74	27.5	0.220	0.220	0.123	0.59	40.82	58.58	29.0

Note: WC = water content, OC= organic content

Table 3. The density of mangrove understorey in Segara Anakan Cilacap

Station	<i>Acanthus ilicifolius</i>	<i>Acanthus ebracteatus</i>	<i>Derris trifoliata</i>	<i>Acrosticum</i> sp.
A	104.0	7.8	127.0	0
B	18.9	12.2	66.7	16.7
C	6.7	0	36.7	0
D	0	0	0	0
E	5.6	0	5.6	0
F	10.0	0	68.9	0
G	17.8	15.6	2.2	2.2
H	24.4	0	11.1	0
I	107.0	13.3	0	0
J	107.0	22.2	0	0
K	70.0	0	70.0	0
L	2.2	0	33.3	0
M	43.3	0	120.0	0
N	33.3	7.8	112.0	0
O	111.0	28.9	97.8	0
P	0	0	0	0
Q	46.7	10.0	27.8	5.6
R	20.0	0	34.4	0
S	86.7	15.6	6.7	0

4. Discussion

Differences in parameter values such as sand, clay, mud, water content, soil salinity, and organic content in the soil for each station are due to differences from external factors and existing anthropology, for example, in the western and central regions (stations P and R) where freshwater supplies are obtained from several existing rivers such as Citanduy, Cikonde, and Cibeureum. Thus, it causes relatively large salinity fluctuations of 0-26 ppt compared to 12-30 ppt in the eastern region [20]. This is because the two main rivers in the east part (Donan and Sapuregel) are only canals that have a few freshwater supplies. All measurement results indicate that environmental factors are suitable for biota life. The most differences between the western, central, and eastern regions are the composition of the substrate. As shown in Table 2, in the east of the area, the substrate is composed mainly of sand with a content of more than 15%. In opposite, a substrate is dominated by clay that occurs in the western and central regions, the clay which originates from alluvial deposits from several surrounding rivers.

The Segara Anakan ecosystem in the eastern area is under considerable pressure from human activities and industries (Pertamina and Holcim). While in the western and central areas, more is affected by sedimentation and people activities such as land conversion. Sedimentation became one of the primary management concerns in the river basin, particularly regarding the impacts on the low land activities, including the Segara Anakan. It has been attributed to deforestation and poor agricultural management practices in the upland areas of the Citanduy river basin, as well as to the volcanic eruption of Mount Galunggung in 1982, which is located in the river basin [21].

The results of the study show that the genus *Acanthus* grows in central and western regions of Segara Anakan. This is because the location has a relatively low salinity compared to the eastern region. *Acanthus* grows optimally at low salinity [22] with open canopy because the mangroves have been cut down [2]. It is also corroborated by figure 3, which shows a low density of mangrove sapling and tree category. In contrast to the eastern part of Segara Anakan, where is mangrove sampling and tree category was denser, and also salinity is high, the genus *Acanthus* can not grow optimally. Therefore, *Acanthus* can grow optimally at the degraded mangrove area.

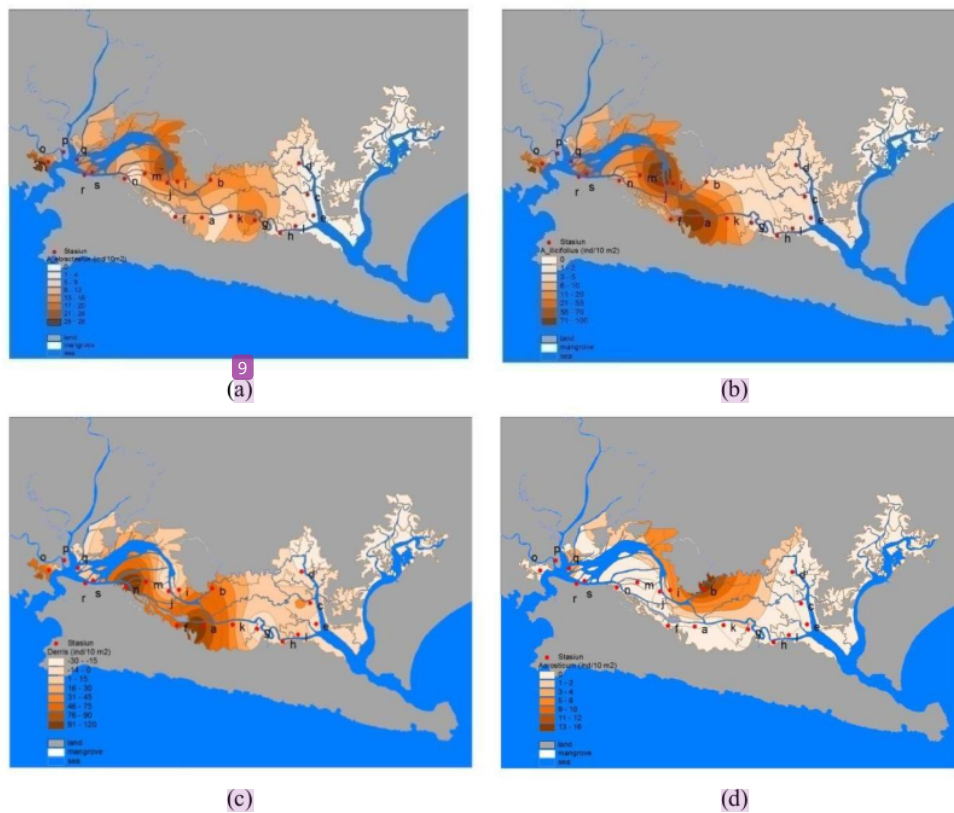


Figure 2. Spatial distribution of mangrove understory (a) *Acanthus ebracteatus*, (b) *Acanthus ilicifolius*, (c) *Acrosticum speciosum*, (d) *Derris trifoliata* at Segara Anakan Cilacap.

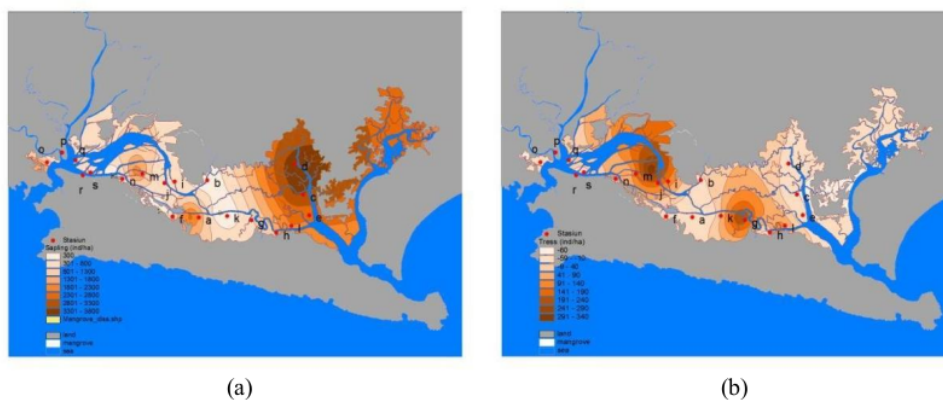


Figure 3. Spatial distribution of mangrove sapling category (a) and tree category (b).

Mangrove conversion has lead to several problems besides reducing fishery yields. It has lead to a reduction of biodiversity, loss of habitats and nursery areas, an increase in coastal erosion, loss in productivity, soil acidification, pollution, and alteration of water drainage patterns [4]. The loss of biodiversity in mangrove-converted areas of the SAL has been reported since the 1980s [9]. Overall, it appears that the continuous changes in the mangrove ecosystem, its resources, and its biodiversity have significantly been affected.

5. Conclusion

This study can be concluded that both *Acanthus ilicifolius* and *Acanthus ebracteatus* were aggregates distribution. It grows very dense in the damaged mangrove area, and there found a low density of mangrove in the sapling and tree category. The density of *Acanthus* has increased during one decade as well as its distribution than one decade before. Therefore, *Acanthus* can be used for biomonitoring agents of mangrove damage because of its specific characteristics and distribution.

References

- [1] Clough B. 2013 *Continuing the Journey Amongst Mangroves ISME Mangrove Educational Book Series No. 1, 1st ed Okinawa - Yokohama* (The International Society for Mangrove Ecosystems (ISME) and the International Tropical Timber Organization (ITTO))
- [2] Ardli E. R., E. Yani and A. Widyastuti 2015 Kajian Perubahan Bioekologi pada Restorasi Ekosistem Mangrove di Segara Anakan Cilacap *Biosfera* **32** 19-28
- [3] Kuswandono A. 2019 *The Acceleration of Mangrove Ecosystem Recovery* (Purwokerto)
- [4] Ardli E. R. and M. Wolff 2009 Land Use and Land Cover Change Affecting Habitat Distribution in the Segara Anakan Lagoon, Java, Indonesia, *Regional Environmental Change* **9** 235–243
- [5] Ardli E. R., A. Widyastuti and E. Yani 2012 *Kajian Bioekologi Mangrove pada Area Restorasi di Segara Anakan Cilacap* (Purwokerto)
- [6] Koswara S. D., E. R. Ardli and E. Yani 2017 The Monitoring of Mangrove Vegetation Community Structure in Segara Anakan Cilacap for the Period of 2009 and 2015 *Scripta Biologica* **4** 113-118
- [7] Amaliyah S., S. Hariyanto and H. Pumobasuki 2018 Growth Responses of *Rhizophora apiculata* Blume in Different Soil and Sediment Conditions *AACL Bioflux* **11** 379-386
- [8] Hinrich S., I. Nordhaus and S. J. Geist, 2009 Status, Diversity and Distribution Patterns of Mangrove Vegetation in the Segara Anakan Lagoon, Java, Indonesia *Regional Environmental Change*, **9** 275-289
- [9] Yuwono E., T. Jennerjahn, I. Nordhaus, E. R. Ardli, M. H. Sastranegara and R. Pribadi 2007 Ecological Status of Segara Anakan, Java, Indonesia, a Mangrove-fringed Lagoon Affected by Human Activities *Asian Journal of Water, Environment and Pollution* **4** 29-3
- [10] Holtermann P., H. Burchard and T. Jennerjahn 2009 Hydrodynamics of the Segara Anakan lagoon *Regional Environmental Change* **9** 245-258
- [11] Nordhaus I., M. Toben and A. Fauziyah 2019 Impact of Deforestation on Mangrove Tree Diversity, Biomass and Community Dynamics in the Segara Anakan Lagoon, Java, Indonesia: A Ten-year Perspective *Estuarine, Coastal and Shelf Science* **227**
- [12] Rahman, F. Yulianda, I. Rusmana and Y. Wardiatno 2019 Production Ratio of Seedlings and Density Status of Mangrove Ecosystem in Coastal Areas of Indonesia *Advances in Environmental Biology* **13** 13-21,.
- [13] Ardli E. R., E. Yani and A. Widyastuti 2011 *Density and Spatial Distribution of *Derris trifoliata* Lour and *Acanthus ilicifolius* as a Biomonitoring Agent of Mangrove Damages at the Segara Anakan Lagoon (Cilacap, Indonesia)* (Chiba)
- [14] Noor Y. R., M. Khazali and I. N. Suryadiputra 1999 *Panduan Pengenalan Mangrove di*

Indonesia (Bogor: PHKA/WI-IP)

- [15] Tomlinson P. 1994 *The Botany of Mangrove* (New-York: Cambridge University Press)
- [16] Kitamura S., C. Anwar, A. Chaniago and S. Baba 1997 *Handbook of Mangrove in Indonesia: Bali & Lombok* (Denpasar: International Society for Mangrove Ecosystem)
- [17] Giesen W., S. Wullffraat, M. Zieren and L. Scholten 2006 *Mangrove Guide Book for Southeast Asia* (Bangkok: FAO and Wetlands International)
- [18] Ardli E. R. and M. Wolff 2008 Quantifying habitat and resource use changes in the Segara Anakan Lagoon (Cilacap, Indonesia) over the past 25 years (1978-2004) *Asian Journal of Water, Environment and Pollution* **5** 59-67
- [19] Spellerberg I. F., 2009 *Monitoring Ecological Change* (Cambridge: Cambridge University Press)
- [20] T. Jennerjahn, P. Holtermann, I. Pohlenga and B. Nasir 2007 Environmental Conditions in the SegaraAnakan Lagoon, Java, Indonesia *Synopsis of Ecological and Socio-Economic Aspects of Tropical Coastal Eco* ed E. Yuwono, T. Jennerjahn, M. H. Sastranegara and P. Sukardi (Purwokerto: Research Institute, Jenderal Soedirman University)
- [21] Ardli E. R. and M. Wolff 2008 Quantifying Habitat and Resource Use Changes in the Segara Anakan Lagoon (Cilacap, Indonesia) over the past 25 years (1978-2004) *Asian Journal of Water, Environment and Pollution* **5** 59-67
- [22] Ball M. C., 1998 Mangrove Species Richness in Relation to Salinity and Waterlogging: A Case Study Along the Adelaide River Floodplain, Northern Australia *Global Ecology and Biogeography Letters* **7** 73-82

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