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Identification of The Potential of Mangrove At Pantai Sari, Pakis, Banyuwangi, Java Province

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Abstract: Banyuwangi is an area that has the longest coastline in East Java, with a length of 175.8 km. One of the coastal potentials is the mangrove ecosystem. Pantai Sari is one of the locations that has the potentials to be developed in Banyuwangi regency. This beach is a forest area in the city of Banyuwangi. In general, they have natural characteristics, many pine trees have been planted since 2015. The purpose of this study was to obtain data on the diversity of mangroves in river and coastal areas at Pantai Sari. The method used is descriptive quantitative, with data collection using nested plot method with a distance of 20 m between plots. The results showed that there are seven species mangroves found in the river, namely *Avicennia officinalis*, *Rhizophora apiculata*, *Sonneratia caseolaris*, *Lannea coramandelica*, *Erythrina costaricensis*, and *Thespesia populnea*. The highest number of individuals was *Rhizophora apiculata* with number 1,291 individuals, and the lowest number was *Erythrina costaricensis* and *Thespesia populnea*. On the other hand, there were five species mangroves in the coastal area, namely *Casuarina cunninghamiana*, *Casuarina equisetifolia*, *Lannea coramandelica*, *Terminalia catappa*, and *Thespesia populnea*. The highest number of individuals was Australian pine (*Casuarina equisetifolia*) with number 122 individuals, and the lowest number was Portia tree (*Thespesia populnea*) with number one individual.
Keywords: mangrove, ecotourism, identification, coastal, Pantai Sari

1. Introduction

Banyuwangi is an area that has the longest coastline in East Java. The length of the coastline reaches 175.8 km. The area around the coastline stretching from north to south is a producing area for various marine biota [1]. There are nine-sub districts, one sub-district facing the Indonesian Ocean, seven sub-districts facing the Bali Strait, and one sub-districts facing the Java Sea [2]. One of the coastal potentials that can be utilized as having various functions is the mangrove ecosystem.

Mangrove ecosystems are a unique and distinctive form of ecosystem, generally found in tidal areas in coastal areas [3], beaches, and small islands [4]. This ecosystem is unique because it grows in areas that have relatively high salinity and volatile water conditions, namely inundation at high tide and no inundation at low tide [5]. Mangrove ecosystems have various functions, ranging from ecological, physical and socio-economic functions. One of the ecological functions of the mangrove ecosystem is that it acts as a carbon sink and can store large amounts of carbon in vegetation [6], biomass, and other organic matter [7]. In addition, mangroves also function to withstand coastal abrasion [2], as well as a place for biota to find food [5][2], spawning ground [6], and nursery ground for some marine biota [8]. Seeing the large number of biota or animals contained in this mangrove ecosystem, it can also be used as natural tourism resource, namely the development of ecotourism.

Mangrove based tourism activity is generally found in an area where the local community, who are actively involved in preserving mangrove [9]. Conservation of natural mangrove forest resources is very important in development and natural tourism management [3].

Pantai Sari is an area located in an urban forest area, which is bordered by Pantai Cemara in the south [10]. Ecotourism at Pantai Cemara has been very

developed. Ecotourism development at Pantai Cemara is carried out based on the potential of natural resources available, there were turtle conservation and mangrove ecosystem tourism [11]. Seeing this development, it is necessary to conduct a study to determine the potential of natural resources, mangroves at Pantai Sari as an initial step towards developing the mangrove ecosystem as an ecotourism area. The purpose of this study was to identify the types of mangroves in the river and coastal areas of Pantai Sari, Pakis, Banyuwangi, East Java.

2. Material and Methods

2.1. Materials

The materials used during the study were raffia, plastic rubber bands, and label paper. The tools used during the study include Garmin's Global Positioning System (GPS), camera, stationery, identification books, buoys, roll meters, slap ropes, and metlines.

2.2. Methods

2.2.1. Data collection and preparation

Data collection on mangroves in the Pantai Sari area is to determine the location of the flora sampling with the plot method and transect assistance along the coast and river. The method used is a nested plot. The use of this plot aims to collect data on all the constituent members of vegetation in the form of trees, poles, stakes, seedlings and herb for floor covering. The maximum distance between plots is 20 m. The nested sampling can be seen in Figure 1.

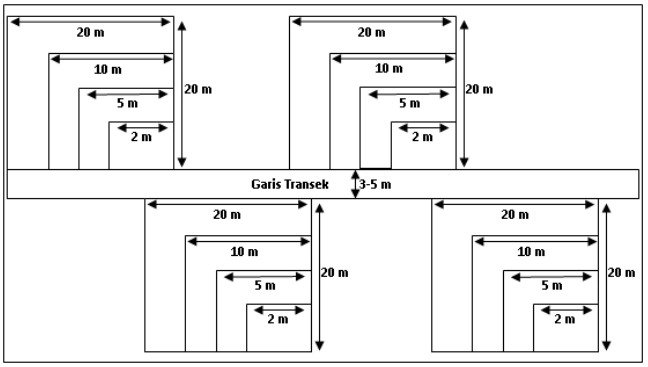

Figure 1. The nested sampling design

Explanation:

Plot of 20x20 m: stand with a trunk diameter of ≥ 20 cm (tree)

Plot of 10x10 m: stand with a trunk diameter (≥ 7-19 cm) (pole)

Plot of 5x5 m : stand with a trunk diameter (< 7 cm and height ≥ 1.5 m) (stake)

Plot of 2x2 m : upright saplings, shrubs and floor vegetation < 1.5 m high (seedling)

2.3. Map of Study Area

The map of study area can be seen in Figure 2. Sampling was carried out in river areas and coastal areas.

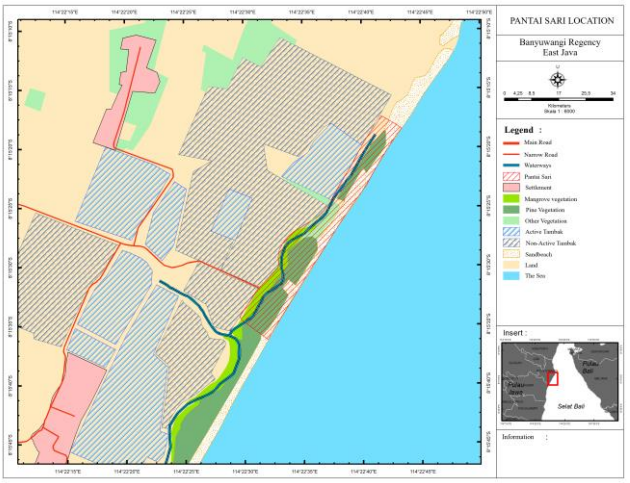

Figure 2. Map of study area

2.4 Data Analysis

a. Density (K)

Species density is the number of individual species in a unit area expressed in the following formula [12]:

$$K = \frac{\text{Total individu}}{\text{sampling plot area}}$$

b. Relative density (KR)

$$KR = \frac{\text{K n species}}{\text{K all species}} \text{ x } 100\%$$

c. Frequency (F)

$$F = \frac{\text{The number of sampling plots found of a species}}{\text{Total sampling plot area}}$$

d. Relative Frequency (FR)

$$FR = \frac{\text{F n species}}{\text{F all species}} \text{ x } 100\%$$

e. Dominance (D)

$$D = \frac{\text{The base area of a species}}{\text{Sampling plot area}}$$

f. Relative Dominance (DR)

$$D = \frac{\text{D of a species}}{\text{D all species}} \text{ x } 100\%$$

g. Importance Value Index (INP)

$$INP = KR + FR + DR$$

3. Results and Discussion

The result of the research conducted identification of mangrove species in river and coastal areas. Species mangroves in the river area can be seen in the Table 1.

Tabel 1. Species mangroves in the river area Pantai Sari

No	Species Name	∑ Ind.	KR (%)	FR (%)	DR (%)	INP	H'
1	Indian Mangrove (*Avicennia officinalis*)	34	2.34	19.10	25.97	47.41	0.09
2	Mangrove(*Rhizophora apiculata*)	1,291	88.85	31.46	3.64	123.95	0.11
3	Firefly mangrove (*Sonneratia caseolaris*)	45	3.10	20.22	37.08	60.40	0.11
4	Large trees	5	0.34	4.49	4.62	9.46	0.02
5	Indian ash tree (*Lannea coromandelica*)	70	4.82	16.85	21.94	43.62	0.15
6	Coral tree (*Erythrina costaricensis*)	4	0.28	4.49	4.40	9.17	0.02
7	Portia tree (*Thespesia populnea*)	4	0.28	3.37	2.34	5.99	0.02
	Total	1,453	100,00	100.00	100.00	300.00	0.50

Information:

Ind.: Individual; KR: Relative Density; FR: Relative Frequency; DR: Relative Dominance; INP: Importance Value Index INP= KR+FR+DR; H': Diversity

Based on Table 1, it is known that there are seven types of mangroves in the river area. The true mangrove species identified were Indian mangrove (*Avicennia officinalis*), Mangrove (*Rhizophora apiculata*), and Firefly mangrove (*Sonneratia caseolaris*). Mangrove associations are large trees, Indian ash tree (*Lannea coromandelica*), Coral tree (*Erythrina costaricensis*), and Portia tree (*Thespesia populnea*). The highest number of individuals, Mangrove reach 1,291 individuals, while the lowest number was in Coral trees and Portia tree respectively four individuals. The number of individual mangroves is classified as a moderate mangrove community structure, referring to the Keputusan Menteri Negara Lingkungan Hidup No. 201 2004. Quality standard criteria for mangrove density, high density ≥ 1,500 ind/ha, moderate ≥ 1,000-1,500 ind/ha, and rarely < 1,000 ind/ha [13]. The high density of mangrove species shows the number of tree stands within area [12]. The relative density (KR) value shows the percentage ratio of the density of a species to the total density. The highest value was in Mangrove, which was 88.85% and the lowest was for Coral tree and Portia tree respectively 0.28%. The relative frequency value (FR) shows the percentage ratio of the frequency of a species to the overall frequency. The highest FR value was Mangrove which 31.46%, and the lowest was Portia tree which 3.37%. The relative dominance value (DR) shows the percentage of dominance of a species with total dominance. The highest DR value for Firefly mangrove was 37.08 % and the lowest was Portia tree which 2.34%. the highest INP value was in Mangrove, 123.95% and the lowest was Portia tree at 5.99%. The total value of the Importance Value Index (INP) shows a value 300%. The highest diversity value (H') was in Indian ash tree, which was 0.15 and the lowest was for Portia tree and Coral tree which were 0.02 respectively. In the previous research also in the same area in Pantai Cemara, it was found mangrove species: Mangrove (*Rhizophora mucronata*), Apple mangrove (*Sonneratia alba)* and Api-Api (*Avicennia alba*) [10]. Previous research on the coastal area of Banyuwangi, in Coastal Bengkak Wongsorejo, dominated *Avicennia* sp. and *Rhizophora* sp [14].

Species mangroves in the coastal area can be seen in the Table 2.

Tabel 2. Species mangroves in the coastal area of Pantai Sari

No.	Species Name	∑ Ind.	KR (%)	FR (%)	DR (%)	INP	H'
1	Australian beefwood (*Casuarina cunninghamiana*)	46	25.84	31.25	16.29	73.39	0.35
2	Australian pine (*Casuarina equisetifolia*)	122	68.54	59.38	44.01	171.93	0.26
3	Indian ash tree (*Lannea coromandelica*)	2	1.12	3.13	37.63	41.88	0.05
4	Indian almond (*Terminalia catappa*)	7	3.93	4.69	1.08	9.70	0.13
5	Portia tree (*Thespesia populnea*)	1	0.56	1.56	0.98	3.11	0.03
	Total	178	100.00	100.00	100.00	300.00	0.82

Based on Table 2., it is known that there are five species of mangroves in the coastal area. All species mangrove classified as mangrove associations. The

species identified were Australian beefwood (*Casuarina cunninghamiana)*, Australian pine (*Casuarina equisetifolia)*, Indian ash tree (*Lannea coromandelica*), Indian almond (*Terminalia catappa*), and Portia tree (*Thespesia populnea*). The highest number of individuals was Australian pine, 122 individuals, while the lowest number of individuals was Portia tree one individual. The relative density (KR) value shows the percentage ratio of the density of a species to the total density. The highest value was Australian pine, which was 68.54%, and the lowest was Portia tree 0.56%. The relative frequency value (FR) shows the percentage ratio of the frequency of a species to the overall frequency. The highest FR value was in Australian pine which was 59.38%, and the lowest was in Portia tree which was 1.56%. The relative dominance value (DR) shows the percentage of dominance of a species with total dominance. The highest DR value for Australian pine was 44.01% % and the lowest was Portia tree which 0.98%. the highest INP value was in Australian pine, 171.93% and the lowest was Portia tree at 3.11%. The total value of the Importance Value Index (INP) shows a value 300%. Criteria important value index of herb species 201-300% belong in high [11]. The highest diversity value (H') was in Australian beefwood, which was 0.35 and the lowest was for Portia tree which was 0.03. In the coastal areas dominated by mangrove association. Previous research on the coastal area of Banyuwangi, in Coastal Bengkak Wongsorejo, dominated *Avicennia* sp. and *Rhizophora* sp [14].

Table 3. Bush species in coastal area Pantai Sari

No.	Species Name	∑ Ind.	KR	FR	INP
1	Giant Milkweed (*Calotropis gigantea*)	42	1	16	18
2	Yellow dots (*Sphagneticola trilobata*)	665	20	34	55
3	Siam weed (*Chromolaena odorata*)	161	5	11	16
4	Mangrove holly (*Acanthus ilicifolius*)	2,375	73	36	109
5	Screw pine (*Pandanus tectorius*)	3	0	3	3
	Jumlah	3,246	100	100	200

Information:

Ind.: Individual; KR: Relative Density; FR: Relative Frequency; DR: Relative Dominance; INP: Importance Value Index INP= KR+FR;

Based on Table 3 above, it is known that there are five species of bush in the coastal area. All species mangrove classified as mangrove associations. The species identified were Giant Milkweed (*Calotropis gigantea*), Yellow dot (*Sphagneticola trilobata*), Siam weed (*Chromolaena odorata*), Mangrove holly (*Acanthus ilicifolius*), and Screw pine (*Pandanus tectorius*). The highest number of individuals was Mangrove holly, 2,375 individuals, while the lowest number of individuals was Screw pine three individual. The relative density (KR) value shows the percentage ratio of the density of a species to the total density. The highest value was Mangrove holly, which was 73%, and the lowest was Screw pine 0%. The relative frequency value (FR) shows the percentage ratio of the frequency of a species to the overall frequency. The highest FR value was in Mangrove holly which was 36%, and the lowest was in Screw pine which was 3%. The highest INP value was in Mangrove holly, 109% and the lowest was Screw pine at 3%. The total value of the Importance Value Index (INP) shows a value 200%. Criteria important value index of herb species 101-200% belong in medium [11]. There has been no previous research on Pantai Sari, but there was research in Pantai Cemara, which in one location of city forest. There was same species of mangrove association, this species Holy mangrove (*Acanthus ilicfolius*). The other species found Seaside clerodendron (*Clerodendron inerme*, Gaertn), Serunai laut (*Cydaisy serrenai*), gelang laut (*Sesuvium portulacastrum*), and Pandan hutan (*Pandanus odoratissima*) [15]. This pandanus plant is used as a marker for the landing of turtles to lay eggs. Previous research in the Bengkak, showed Widuri (*Calontropis gigantea*), Dadap laut (*Clerodendrum inerme*), and Waru laut (*Hibiscus tiliaceus*) [14].

Table 4. Herb species in coastal area Pantai Sari

No.	Species Name	∑ Ind.	KR (100%)	FR (100%)	INP (200%)
1	Nutgrass (*Cyperus rotundus*)	594	60	14	75
2	Ravanna's Moustache (*Spinifex littoreus*)	201	20	35	55
3	Beach morning glory (*Ipomoea pescaprae*)	15	2	14	16
4	Stinking passion flower (*Passiflora foetida*)	16	2	17	19
5	Coatbuttons (*Tridax procumbens*)	111	11	8	19
6	Madagascar periwinkle (*Catharanthus roseus*)	48	5	11	16
		985	100	100	200

Information:

Ind.: Individual; KR: Relative Density; FR: Relative Frequency; DR: Relative Dominance; INP: Importance Value Index INP= KR+FR;

Based on Table 4, it is known that there are six herb species in the coastal area. All species mangrove classified as mangrove associations. The species identified were Nutgrass (*Cyperus rotundus*), Ravanna's Moustache (*Spinifex littoreus*), Beach morning glory (*Ipomoea pescaprae*), Stinking passion flower (*Passiflora foetida*), Coatbuttons (*Tridax procumbens*), and Madagascar periwinkle (*Catharanthus roseus*). The highest number of individuals was Nutgrass, 594 individuals, while the lowest number of individuals was Beach morning glory 15 individual. The relative density (KR) value shows the percentage ratio of the density of a species to the total density. The highest value was Nutgrass, which was 60%, and the lowest was Beach morning glory and Stinking passion flower respectively 2%. The relative frequency value (FR) shows the percentage ratio of the frequency of a species to the overall frequency. The highest FR value was in Ravanna's Moustache which was 35%, and the lowest was in Coatbuttons which was 8%. The highest INP value was in Nutgrass, 75% and the lowest was Beach morning glory and Madagascar periwinkle at 16%. The total value of the Importance Value Index (INP) shows a value 200%. Criteria important value index of herb species 101-200% belong in medium [11]. There has been no previous research on Pantai Sari, but there was research in Pantai Cemara, which in one location of city forest. Pantai Cemara in south, and Pantai Sari in north. But the species look different, some species of mangrove association found are Sesepi (*Sesuvium portulacastrum*), Serunai laut (*Cydaisy serrenai*), and Ambung (*Derris trifoliate* Lour) [11]. Some species of mangrove association in Bengkak Coastal Tapak kuda (*Ipomea pes-caprae*) and Keceprek (*Passiflora foetida*) [14].

4. Conclusion

Based on the result of research potential mangroves at Pantai Sari, some conclusions can be obtained are: There are seven mangrove species found in the river area and five mangrove species in the coastal area. There are also five bush and six herb species in the coastal area.

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References

[1] K. BPS Banyuwangi, *Kabupaten Banyuwangi Dalam Angka 2020*, vol., no. Banyuwangi, 2020.

[2] E. W. Setyaningrum, M. Yuniartik, A. T. K. Dewi, and M. P. Nugrahaini, *Pengelolaan Pesisir dalam Persepektif Ekologi Perairan: Studi Kasus Kawasan Pesisir Banyuwangi*. Malang: PT. Cita Intrans Selaras, 2019.

[3] A. A. Fisu, A. Ahmad, A. Hidayat, and L. U. Marzaman, "Potential of Mangrove Ecosystem as a Tourism Object Development in Kaledupa Island," *Edutourism J. Tour. Res.*, vol. 02, no. 01, pp. 11–17, 2020.

[4] D. J. Prihadi, I. R. Riyantini, and M. R. Ismail, "Pengelolaan Kondisi Ekosistem Mangrove dan

Daya Dukung Lingkungan Kawasan Wisata Bahari Mangrove Di Karangsong Indramayu," *J. Kelaut. Nas.*, vol. 1, no. 1, 2018, doi: 10.15578/jkn.v1i1.6748.

[5] D. Sulastini, "Seri Buku Informasi dan Potensi Mangrove Taman Nasional Alas Purwo," *Balai Taman Nas. Alas Purwo. Bayuwangi*, 2011.

[6] D. Murdiyarso *et al.*, "The potential of Indonesian mangrove forests for global climate change mitigation," *Nat. Clim. Chang. Clim. Chang.*, vol. 5, no., pp. 1089–1092, 2015.

[7] S. T. Cahyaningrum, A. Hartoko, and Suryanti, "Biomassa Karbon Mangrove pada Kawasan Mangrove Pulau Kemujan Taman Nasional Karimunjawa," *Diponergoro J. Maquares Manag. Aquat. Resour.*, vol. 3, pp. 34–42, 2014.

[8] H. Latuconsina, *Ekologi Perairan Tropis: Prinsip Dasar Pengelolaan Sumber Daya Hayati Perairan*, Kedua. Yogyakarta: Gadjah Mada University Press, 2018.

[9] L. Hakim, D. Siswanto, and N. Makagoshi, "Mangrove Conservation in East Java: The Ecotourism Development Perspectives," *J. Trop. Life Sci.*, vol. 7, no. 3, pp. 277–285, 2017, doi: 10.11594/jtls.07.03.14.

[10] A. T. K. Dewi and M. Yuniartik, "Potensi Pantai Cemara, Kabupaten Banyuwangi, Jawa Timur Sebagai Kawasan Ekowisata," *JFMR-Journal Fish. Mar. Res.*, vol. 3, no. 3, pp. 351–358, 2019, doi: 10.21776/ub.jfmr.2019.003.03.10.

[11] E. W. Setyaningrum, Z. Erwanto, K. P. Prapti, M. Yuniartik, and A. T. K. Dewi, "Ecotourism Development And Its Effect On Alternative Livelihoods In The Cemara Beach of Banyuwangi District," vol. 1, no. 2, pp. 18–25, 2019.

[12] L. Usman, Syamsuddin, and S. N. Hamzah, "Analisis vegetasi mangrove di Pulau Dudepo Kecamatan Anggrek, Kabupaten Gorontalo Utara," *J. Ilm. Perikan. dan Kelaut.*, vol. 1, no. 1, pp. 11–17, 2013, [Online]. Available: http://ejurnal.ung.ac.id/index.php/nike/article/view/1211.

[13] Kementerian Lingkungan Hidup, *Keputusan Menteri Negara Lingkungan Hidup Nomor: 201 Tahun 2004 tentang Kriteria Baku dan Pedoman Penentuan Kerusakan Mangrove*. Indonesia, 2004.

[14] Y. R. Buwono, "Keanekaragaman Jenis Mangrove di Pesisir Desa Bengkak Kabupaten Banyuwangi," *J. Aquac. Sci.*, vol. 4, no. 2, pp. 73–82, 2019.

[15] E. W. Setyaningrum, A. T. K. Dewi, K. P. Prapti, Z. Erwanto, and H. D. Susanti, "Area development based on conservation and ecotourism on the Cemara Beach (Pine Trees Beach), Pakis, Banyuwangi, East Java Province, Indonesia," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 236, no. 1, 2019, doi: 10.1088/1755-1315/236/1/012132.