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Short Communication

# Riparian Plants Vegetation Diversity Salah Nama Island in Banyuasin, South Sumatra

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## Abstract

Riparian plants play an important role in maintaining the balance of an aquatic ecosystem. The missing plant components from a water can cause sedimentation and change the microhabitat in these waters. The purpose of the study is to determine the diversity of riparian aquatic plants on the island of Salah Nama Banyuasin.The research was conducted in August 2016, November 2016, and January 2017 at Salah Nama Island Mariana Ilir Banyuasin 1, South Sumatra. Sampling was done by using the purposive sampling method. Determination of the sampling location used GPS (Global Positioning System). Observation stations consisted of 5 sampling locations. The method of taking water plants was done in exploratory way. Data collection on riparian plants used the quadratic transect method measuring 1 m x 1 m. Samples of riparian plants were taken then wrapped with newspaper or paper and put into large plastic, labeled then taken to the testing laboratory Institute Inland fisheries and extension, Palembang. The results showed that there were 21 types of riparian aquatic plants in 16 families. The highest composition is in the Lythraceae family, namely *Sonneratia acida*. The diversity index of aquatic plants ranges from 1 <H'<3 in the stable condition category. Based on the results of the study, the riparian plant species that dominated the most were *Sonneratia* sp.The conclusion that can be drawn is that the diversity of riparian plants on the island of Salah Nama is in the medium category, the dominant riparian plants are *Sonneratia* sp.

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## 1. Introduction

South Sumatra has several districts, one of which is Banyuasin. Banyuasin has an island surrounded by the waters of the Musi River. The island is known as Salah Nama Island or called Banjar Island. Salah Nama Island has its uniqueness: among others, its area is a flooded swamp area influenced by tides. Most of the people work as fishermen, but some also farm or cultivate crops. Salah Nama Island has a unique topography where in addition to the main job as a fisherman, in the dry season this island will become land so that some people cultivate crops by planting rice and annual crops, but during the rainy season the Musi River will be submerged in water. Apart from being a residential area, the island is also an area for boat traffic on the Musi River; in fact, there are many large ships docking on the edge of the island, causing damage to many riparian plants around Salah Nama Island.

Based on research on riparian areas, it was found that the riparian zone is located on the border between the terrestrial ecosystem zone and the aquatic ecosystem in rivers, lakes, and swamps (Sakio, 2008). Naiman *et al.* (2005); SEPA (2009) reported that the riparian zone is a semi terrestrial transitional area that is regularly influenced by freshwater which generally extends from the edge of water body to edge of highlands. According to Salemi *et al.* (2012) in Paramitha and Kurniawan (2017) that riparian plants are composed of forest trees, but also include other types of plants such as shrubs. Riparian vegetation is a plant community that exists on the banks of rivers and inundated swamps and is an integral part of the river ecosystem (Mligo, 2017; Dosskey, *et al.*, 2010). Riparian plants serveto withstand the forces of currents into the river and absorb the particles carried in it from mainland. According to Suhendang (2002), one of the types of ecosystems that are expected to have high diversity is ecosystems located in riparian areas (areas on the outskirts of swamps, lakes, water sources, and rivers). Research Corbacho *et al.* (2003) and Bassem (2020) about riparian habitats contain a diverse collection of valuable species and are regarded as biodiversity corridors. This is also supported by Tuheteru and Mahfudz (2012) that riparian areas are seasonal swamp vegetation, alluvial soils, and located along large rivers. Various roles of riparian areas have been described as erosion/sediment filters, maintaining water quality and a place to live for terrestrial animals (Konsorsium Revised HCV Toolkit Indonesia, 2008; Siahaan, 2014; Agustina and Arisoesilaningsih, 2013; Heartsill-Scalley and Aide, 2003; Junardi *et al.*, 2018; MacKinnon, 1986; Jäkäläniemi *et al.*, 2004; Mulyadi, 2001; Bates, 1961; Waryono, 2002; WSROC, 2004; Mitsch and Gosselink, 1993). Widiyanto, *et al.* (2018), Anggana, *et al.* (2018), and Karno *et al.* (2018) mentioned that some use riparian areas as plantation or cultivation land. This is because this land has a high fertility rate, sufficient water availability, and massive inorganic-organic material. If this land is degraded, it will disturb the river ecosystem and subsequently causes changes in the macro ecosystem and riparian vegetation to disappear (Maryono *et al.*, 2005; Kocher and Harris, 2007; Ainy and Wardhana, 2018; Naiman *et al.*, 2005). The function of riparian vegetation in maintaining biodiversity in the riparian zone, prevents riparian degradation caused by human activities which has an impact on reducing species diversity (Hughes, 1984; Vallari *et al.*, 2009) and influencing the composition and structure of plant communities. This is supported by the research of Jackrel and Wootton (2015), that the biodiversity of river banks will affect aquatic ecosystems.

This study aimed to determine the diversity of riparian vegetation in Salah Nama Island. This research is very useful as information data for the community and stakeholders in protecting the riparian ecosystem around the waters of the Musi River, especially those on Salah Nama Island. The important role of riverside plants as a biotic component is to conserve fish resources in the waters.

## 2. Materials and Methods

### *2.1 Data Collection*

The research was conducted at Salah Nama Island in August, November 2016 and January 2017. The data were collected at observation stations. The sampling point was based on the purposive sampling method (Table 1 and Figure 1). Station 1 represented a residential area, station 2 represented a flooded swamp area, station 3 represented an area full of riparian water plants, station 4 represented ship traffic areas, and station 5 represented areas of erosion that occur in rivers due to reduced riparian water plants.

The method used in this vegetation collection is the transect method. This was done by taking a 1 m2 transect line which was divided into three square plots or 3 replications with a distance of 1 meter. The name of the species and the number of individuals was recorded for each plot of 1 m2. The plot / transect method describes the riparian vegetation at each station. Plant samples from each station are taken and packaged and then taken to the laboratory for further identification. This method is useful for describing the riparian vegetation at each station.

**Table 1**. Position of transect station on Salah Nama Island

| No | Name station | GPS |
|---|---|---|
| 1 | St.1 | S 02$^0$57$^0$28,1$^0$<br>E 104$^0$52$^0$36,1$^0$ |
| 2 | St.2 | S 02$^0$57’25,5$^0$<br>E 104$^0$52’20.4” |
| 3 | St.3 | S 02$^0$57’09.3”<br>E 104$^0$52’48.2” |
| 4 | St.4 | S 02$^0$57’08.2”<br>E 104$^0$52’20.5” |
| 5 | St.5 | S 02$^0$57’26.6’<br>E 104$^0$51’59.2” |

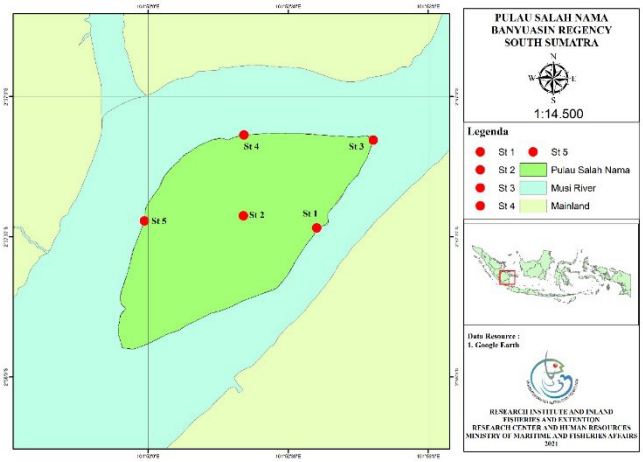


**Figure 1.** Salah Nama Island which is the location of the research

*2.2 Data Analysis*

The identification results refer to the taxonomic identification book based on Steenis (1981), Tjitrosoepomo (1985), Gosselink *et al.* (1980), Huffman and Forsythe (1981), Mitsch and Gosselink (1993), and Naiman *et al.* (2005). The calculation was calculated based on the formula referring to Begon *et al.* (1990). The analysis is interpreted in the form of tables and graphs.

Data from vegetation analysis were calculated based on the equation English *et al.* (1994) in Parmadi *et al*., (2016):

*Type Density*

Density (Di) is the number of stands of species I in a unit area. The density of a riparian plant using the formula:

$$Di = Ni/A$$

Description:
Di = density to-i (ind / m)
Ni = Total number of individuals of type - i (ind)
A = Total sampling area ($m^2$)

*Relative Density*

Relative Density (RDi) is the ratio between the numbers of stands for type i (Ni) and the total stands of all species (∑n):

$$RDi = (NI/(\sum n))x100\%$$

Description:
RDi = Relative Density (%)
Ni = Number of individuals of type i (ind)
∑n = Total of all individuals (ind)

*Specific frequencies and relative frequencies*

Frequency (Fi) is the probability of finding a type in all sample plots which are made:

$$Fi=PI/(\sum pi)$$

Description:
Fi = Frequency type of the -i
pi = The number of sample plots created
∑pi = The total number of sample plots created

*Relative Frequency*

Relative Frequency (RFi) is the ratio between the specific (Fi) and total frequencies frequency of all types (∑F):

$$RFi = (Fi/(\sum F))x\ 100\ \%$$

Description:
RFi = Relative Frequency (%)
Fi = Frequency of the ith type (ind)
∑F = Total frequency of all types (ind)

The Shannon-Wiener equation as follow by Ifo *et al.* (2016)

$$H^{\wedge}{}' = -\sum_{ni=1}^{i=1} pi\ lnpi$$

Description;
H^'= Shannon – Wiener Species Diversity Index
pi = Proportion to density to–I (ni/N)
ni = density of the species
N = total number of all species

According to Mokoginta (2016), the Shannon-Wiener Index Classification, there are three categories of species diversity, namely:

a) Value H ‘Index > 3 is high diversity, number of individuals which are high in each species, and high stability

b) Value H ‘Index 1-3 is moderate diversity, total individuals in each species being, and moderate stability

c) Value H ‘Index <1 is low diversity, number individuals low on each species and low stability

## 3. Results and Discussion

### *3.1 Results*

#### *3.1.1 Types of riparian vegetation*

Research on riparian plants along the island of Salah Nama Sungai Musi, South Sumatra from August 2016, November 2016, and January 2017 found 21 types of riparian aquatic plants included in 16 riparian aquatic plant families (Table 2 and Table 3).

**Table 2.** Vegetation of riparian water plants on Salah Nama Island in 2016-2017

| No | Family | Species | Local Name |
|---|---|---|---|
| 1 | Acanthaceae | *Acanthus ilicifolius* | Jeruju |
| 2 | Butomaceae | *Limnocharis flava* | Kegenjeran |
| 3 | Convolvulaceae | *Ipomoea fistulosa* | Kangkungan |
| 4 | Cyperaceae | *Cyperus malaccensis* Lamk | Menerung |
| 5 | Dipterocarpaceae | *Shorea balangeran* | Kawi |
| 6 | Lecythidaceae | *Barringtonia acutangula* | Putak |
| 7 | Lythraceae | *Sonneratia acida* | Pedado |
| 8 | Mantaceae | *Donax canaeformis* | Bemban |
| 9 | Mimosaceae | *Mimosa pigra* | Kayu Duri |
| 10 | Onagraceae | *Ludwigia adscendens* | Sabut lintah |
| 11 | | *Sacciolepis indica* | Sabur lintah |
| 12 | Poaceae | *Echinochloa stagnina* | Kumpai Bulu |
| 13 | | *Leersia hexandra* | Bento |
| 14 | | *Echinochloa crusgalli* | Kumpai tembago |
| 15 | Polygonaceae | *Polygonum barbatum* | Sebakat |
| 16 | Pontederiaceae | *Eichhornia crassipes* | Eceng gondok |
| 17 | | *Monocharia hastata* | Keladi air |
| 18 | Pteridaceae | *Acrostichum aureum* L | Pakis udang |
| 19 | Typhaceae | *Typha angustifolia* | Perumpung |
| 20 | | *Equisetum* spp. | Purun |
| 21 | Vitaceae | *Cayratia trifolia* | Galing |

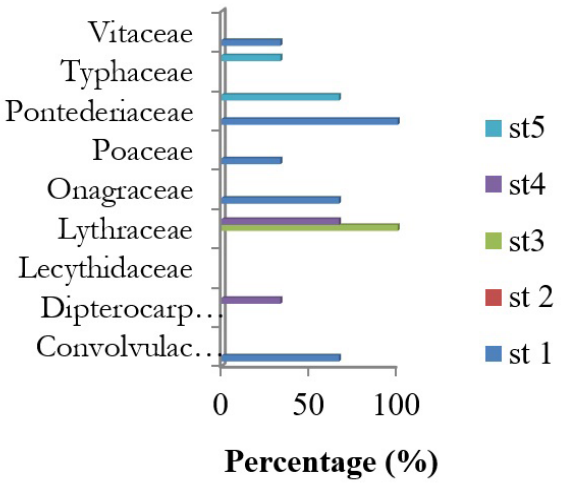


**Figure 2.** Percentage of riparian water crop cover on August 2016

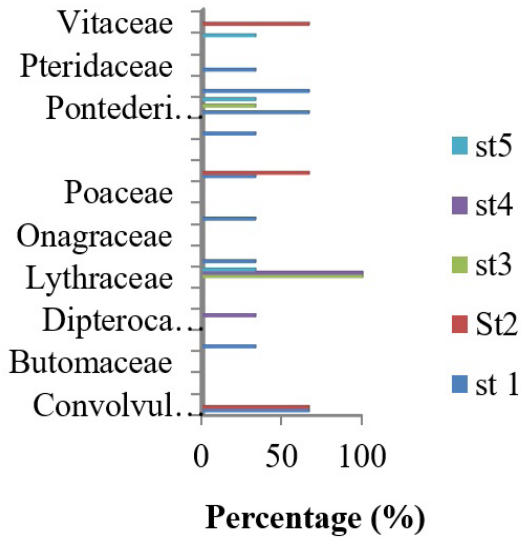


**Figure 3.** Percentage of riparian water crop cover on November 2016

**Table 3.** Morphology of riparian water plants on Salah Nama Island

| | | | |
|---|---|---|---|
|  |  |  |  |
| *Monocharia hastata* | *Ludwigia adscendens* | *Acanthus ilicifolius* | *Ipomoea fistulosa* |
|  |  |  |  |
| *Eichhornia crassipes* | *Acrostichum aureum* L | *Echinochloa crusgalli* | *Cayratia trifolia* |
|  |  |  |  |
| *Barringtonia acutangula* | *Mimosa pigra* | *Typha angustifolia* | *Sonneratia acida* |
|  |  |  |  |
| *Donax canaeformis* | *Limnocharis flava* | *Polygonum barbatum* | *Sacciolepis indica* |
|  |  |  |  |
| *Equisetum* spp. | *Sacciolepis interrupt* | *Leersia hexandra* | *Echinochloa stagnina* |

 

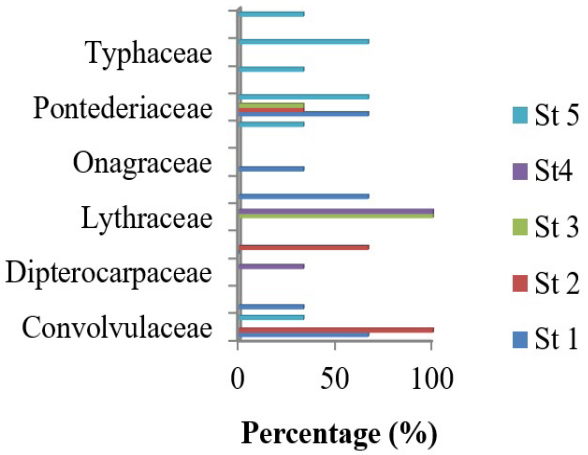


**Figure 4.** Percentage of riparian water crop cover on January 2017

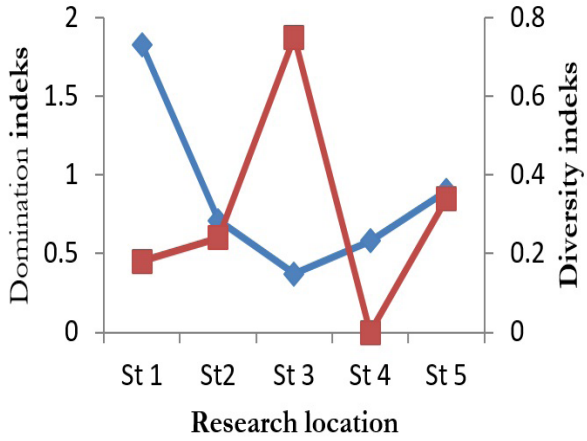


**Figure 5.** Diversity index values and domination

### *3.1.2 Riparian plant cover composition*

The results of the composition of riparian plant cover on Salah Nama Island from August 2016, November 2016, and January 2017 were varied (Figure 2, Figure 3, and Figure 4). The diversity index Salah Nama island was 0-2 and the dominance index ranged from 0-1 (Figure 5).

## *3.2 Discussion*

### *3.2.1 Types of riparian vegetation*

Research on riparian aquatic plants was conducted in August 2016, November 2016, and January 2017 where species and families were found respectively, 10 species in 9 families, 19 species in 15 families, and 17 species in 12 families. The total number of species recorded at Salah Nama Island were 21 types of riparian aquatic plants in 16 families.

Based on observations and calculations, the riparian plant coverage in August, November 2016 and January 2017, the highest riparian water plant coverage, namely the coverage with a value of C ≤ 75%, was found in the Lythraceae family at station 3 type *Sonneratia acida*. This difference is possible with the difference in taking each month. August is part of the dry season, so the water tends to recede and the water plants found will be different from the November and January seasons. Thus, each station will have different aquatic plants according to the plant's habitat, distribution, and lifestyle. But in general the riparian aquatic plant with the highest coverage was Pedado (*Sonneratia acida*). Riparian vegetation coverage is specific, influenced by altitude and rock type (Waryono, 2002). According KepMen LH No.200 (2004) in Riswandi *et al*. (2016), when viewed from the percent of seagrass cover seen from the type of substrate, the research area is classified as class 5. KepMen no. 200 (2004) suggests that class 5 is 1/2 full area closure (50-100%). Furthermore, Brower and Van Ende (1990) explained that there are 7 families; Lythraceae, Pontederiaceae, Poaceae, Mimosaceae, Vitaceae, Lecythidaceae, and Convolvulaceae which are categorized as class 5, cover almost half of the waters, about 75% (KepMen LH no.200, 2004). Eight other families, including Butomaceae, Cyperaceae, Dipterocarpaceae, Mantaceae, Onagraceae, Polygonaceae, Typhaceae, and Vitaceae are categorized as class 4 with total area cover of ¼ to ½ or 25% - 50% of the area.

Marson (2006), Wiriadinata and Setyowati (2008) stated that water hyacinth (*Eichhornia crassipes*) is used as a plant that is tolerant to pollution, current circulation, and able to withstand large amounts of mud. Burnawi and Subroto (2011) stated that the Awang Shelf fishery area of the Barito river, South Kalimantan, has a lot of aquatic plants, including bento (*Leersia hexandra)*, kumpai Bulu (*Paspalum* sp), ilung (*Eichornia crassipes*), and kale (*Ipomoea aquatica).* on Research by Gosari and Haris (2012) on the types of plants found, Salah Nama Island has seven types of aquatic plants. The plants found on Salah Nama Island are categorized as good because their percent cover is 50-75% (*Sonneratia acida, Ipomoea fistulosa, Barringtonia acutangula, Eichhornia crassipes, Monocharia hastata, Cayratia trifolia,* and *Mimosa pigra*) and are quite good with an average percentage of 25 -50% (*Shorea bal Pangeran, Ludwigia adscendens, Sacciolepis indica, Typha angustifolia, Equisetum* sp, *Acanthus ilicifolius, Limnocharis flava, Cyperus malaccensis, Donax canaeformis, Polygonum barbatum,* and *Acrostichum aureum*). The highest percentage is Sonneratia acida at

station 3. This station is surrounded by the lower reaches of the Musi river basin and the substrate is rather deep and sandy.

Bengen (2001) stated that the distribution and zoning of mangrove forests depend on various environmental factors. Areas containing salinity or near the sea with a slightly sandy substrate, this zone contains *Sonneratia* spp, this area has a muddy substrate and is rich in organic matter. This plant is one of the mangrove species which predominantly grows in mud which is rich in organic matter and has breath roots (Bengen, 2002). Kusmana *et al*., (2000) stated that *Sonneratia* is one of the mangroves plant community that forms in tidal areas. The low percentage of cover in several types of aquatic plants is related to the suitability of the substrate, competition in obtaining nutrients, and the physicochemical environmental factors of the water. The existence of aquatic plants indirectly affects the growth and production of animals, because plants are the basis of the food chain in water and able to increase the concentration of dissolved oxygen in water (Puspitaningrum *et al*., 2012).

The value of the diversity index for riparian aquatic plants in Salah Nama Island is 0-2 and the dominance index ranges from 0-1 (Figure 5). Fachrull (2007) means that the diversity index is 1 <H '<3, it is said that the condition of the biota is stable or there is still no threat from other species. Plants that are able to withstand rising water conditions are floating water plants found in any season and plants that are not susceptible to rising or receding water conditions will die by themselves. Based on the types of plants found and their diversity index value, the waters of Salah Nama Island are still in good condition as their habitat. This is supported by the number of aquatic plants in the area, diverse and well maintained. However, if there is damage, it is suspected that the cause of the damage is caused by human behavior who does not pay attention to the balance of the surrounding natural environment (Sutiyanti *et al*., 2019; Ilhami *et al*., 2018)

According to Arsyad (1989), erosion is the event of moving or transporting soil or parts of land from one place to another by natural media. Damage due to water erosion is the erosion of the soil layer caused by moving water activities. The flowing river water will have a current, causing the process of transporting the material. The material can float or be at the bottom of the river.

The riparian water plant that dominates in Salah Nama Island is Pedado (*Sonneratia* sp.). At Station 1 *Mimosa pigra*, Station 2, *Barringtonia acutangula* was found on the edge of the swamp, Station 3 and Station 4 were dominated by *Sonneratia* sp. which is a ship traffic area, meanwhile station Station 5 *Sonneratia* sp. decreased due to damage by human negligence, such as the automatic mooring of barges. Tomlinson (1986) reported *Sonneratia* sp. is included in the major mangrove group (true mangrove flora), which is flora that shows loyalty to mangrove habitat, able to form pure stands, dominantly characterizes community structures, morphologically has special adaptive forms to the mangrove environment, and has a physiological mechanism for controlling salt. The species that are often encountered are *Sonneratia alba* and *Sonneratia caseolaris* and generally these trees reach 15 m in height at the tip of the leaf slightly curved downward (Bengen, 2002). The ecological function of mangrove / mangrove resources in the form of *Sonneratia* serves as stability of the coastline / waters, holding sediment, protecting habitat and diversity, productivity of biomass, sources of germplasm, recreation or tourism, fishing and other products (Bann, 1998).

## 4. Conclusion

The conclusion that can be drawn is that the diversity of riparian plants on the island of Salah Nama is in the medium category, the dominant riparian plants are *Sonneratia* sp.

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## Authors' Contributions

All authors have contributed to the final manuscript. The contribution of each author as follows, Mirna D; collect data, compile manuscripts and design drawings, compile main conceptual ideas, and revise articles. Etty R and Agnes S. P; provided guidance, suggestions and input for the improvement of this article.

## Conflict of Interest

The authors state that this research was conducted in the absence of a commercial relationship which could be interpreted as a potential conflict of interest.

## Funding Information

This research is personal data because it is part of a student thesis.

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