A short note on Siak River, Sumatra, Indonesia

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Abstract. The Siak River is recorded as the deepest rivers in Indonesia and used as main transportation route since long time ago for big ship. Due to high human activities, most of the natural resources are disturbed; however there is limited studies related to impact of disturbance on natural resources. This study aimed to record the natural resources of the Siak River both vegetation and fisheries as well as to assess the environmental stress due to human activities around the areas. About 26 species of dominant vegetation was recorded which exotic and invasive plant species had invaded the catchment areas of the Siak River. Fish population and fishermen income were recorded decreasing due to increasing the environmental disturbances. Due to land conversion, sedimentations were occurred. Then environmental pressures on the Siak River were intense by the rapid development of industries and the pollutants are causing risk for humans, biodiversity and environment. Therefore, a good catchment area management need to be implemented to restore the natural resources of the Siak River ecosystem.

1. Introduction
Undoubtedly rivers are an important source for human life and play a significant role in maintaining of biodiversity, economic, cultural, transportation, and tourisms. According to Naditia [1], Indonesia has 5,590 main rivers and 65,017 creeks. One of Indonesia’s main rivers is Siak River which is draining the Riau Province. Recent province is part of the central of east coast of Sumatra. This river is one of the deepest rivers in Indonesia with 20 – 30 m in depth [2]. With depths ranging from 20 to 30 m, Siak River is considered one of the deepest rivers in Sumatra.

Siak River is a black water river that originated at the encounter of Sungai Tapung Kanan (or Tapung Kanan River) and Sungai Tapung Kiri (or Tapung Kiri River) tributaries. It traverses through lowlands and releases into the Strait of Malacca [3, 4], with 100-150 m in width [5] and drains an area of 11.500 km² [6]. Tapung Kanan River and Mandau River, the major creeks of the Siak, initiate in the peat swamps and enter the Siak serially at river km 155 and 245 [3, 4]. Siak basin is largely peat swamp landscapes (Figure 1).

Siak River has long history as heart of people’s lives before the colonial era both transportation route for big ship as well as source of life, such as fisheries resources. Siak Sri Indrapura was capital of the Sultanate of Siak Indrapura as a big Malay kingdom at 17th century. Due to high human activities, most of the natural resources are disturbed. However, there are limited studies related to impact of disturbance on natural resources. This research aimed to record the natural resources of the
Siak River both vegetation and fisheries as well as to assess the environmental stress due to human activities around the areas.

2. Material and method

![Figure 1](image-url)

**Figure 1.** Map showing the Siak River in central of east coast of Sumatra, zones overlaid by peat soils (dark gray coloured) with research site is marked by red box (a) and the elevation map of the Siak basin area (b). (Source: [3] and [4])

Field survey was carried out from 13 to 18 November 2013 along the Siak River from Pekanbaru City to Siak Sri Indrapura which is about 70 km in length and located at the middle section of the Siak
River (Figure 1). This research data would be important as basis for historical study related to natural resources and its environment condition and management in the future.

A rapid assessment method was used to record the dominant vegetation along the river bank. The fisheries resources were recorded based interview of local fishermen and review of some sources both published and unpublished articles/reports. Subsequently, the literature review was done to assess the environmental stress of the Siak River.

3. Result and discussion

3.1. Vegetation type and richness

Based on a rapid assessment, the oilpalm and rubber plantations, tropical lowland forests and bushes are common land use in the Siak catchment area. Some of natural plant species are common found along river bank from Pekanbaru to Siak Sri Indrapura which is about 70 km in length and located at the middle section of the Siak River (Table 1). The large populations Barringtonia spicata (Figure 2) are dominant found the river bank. Sonneratia caseolaris (Figure 2), a true mangrove vegetation is recorded more than 100 km from the coast, the altitude is between 4 to 10 m above sea level (asl). It should be noted that invasive floating plants, such as Eichhornia crassipes and Ipomoea aquatic are recorded following down from the interior location. The other exotic and invasive plant is Mimosa pigra, a semi aquatic plant. The exotic and invasive plant was being reported to invade the disturbance of peat swamp ecosystem at Singkil Swamp Nature Reserve at west coast of Aceh [7].

| No | Species                      | Local Name | Remark                  |
|----|------------------------------|------------|-------------------------|
| 1  | Acacia mangium              | Akasia     | Planted, exotic         |
| 2  | Acanthus ilicifolius        | Asam payau | Mangrove herb           |
| 3  | Acrosticum aureum           | Piai       | Mangrove fern           |
| 4  | Bambusa vulgaris            | Bambu kuning |                    |
| 5  | Barringtonia spicata        | Putat      | Peat swamp tree         |
| 6  | Cerbera manghas             | Bintaro    |                         |
| 7  | Cyperus rotundus            | Rumput teki |                    |
| 8  | Eichhornia crassipes        | Sawit      | Floating plant, invasive, exotic |
| 9  | Elaeis guineensis           | Jawi-jawi  | Planted, exotic         |
| 10 | Eucalyptus spp.             |            | Planted, exotic         |
| 11 | Ficus sp.                   |            |                         |
| 12 | Garcinia sp.                |            |                         |
| 13 | Gluta renghas               |            |                         |
| 14 | Hevea brasiiliensis         | Karet      | Planted                 |
| 15 | Hibiscus tiliaceus          | Waru       |                         |
| 16 | Hymenachne acutigluma       | Rumput kumpai |                |
| 17 | Imperata cylindrica         | Alang-alang |                    |
| 18 | Ipomoea aquatic             | Kangkung   | Floating plant, invasive |
| 19 | Koompassia malaccensis      | Kempas     | Peat swamp tree         |
| 20 | Mangifera caesia            | Binjai     |                         |
| 21 | Melastoma candidum          | Kenduduh   |                         |
| 22 | Metroxylon sagu             | Rumbia     |                         |
| 23 | Mimosa pigra                |            | Exotic and invasive     |
| 24 | Pandanus sp.                | Pandan     |                         |
| 25 | Pogonatherum sp.            | Bambu kasap |                    |
| 26 | Sonneratia caseolaris       | Berembang  | True mangrove           |
Oil palm, *Eucalypt* and *Acacia* plantations have transformed peat swamps and lowland forests in the Siak catchment area. Drainage of peat swamp in land preparation for oil palm plantation has resulted in decreasing the water levels, increase the peat decomposition, and increase the potential in peat land fire. *Eucalypt* and *Acacia* plantations are used for pulp and paper industries. Most of factories are located in Perawang adjacent to the Siak river bank (Figure 3). The three exotic species were planted and cultured mostly by big company due to high commercial values of their products.

![Figure 2](image1.jpg)  
**Figure 2.** The zonation of *Barringtonia spicata* at river bank (left) and the zonation of *Sonneratia caseolaris* (true mangrove) is found at the Siak river bank which located is more than 100 km from the coast and elevation is about 8 m als. The floating plants of *Eichhornia crassipes* are snagged in the pencil roots of *Sonneratia caseolaris* (right)

![Figure 3](image2.jpg)  
**Figure 3.** Pulp and paper industries are located at Pelalawan, around the Siak river bank

### 3.2. Fisheries resources

Inland fishery is one of important sources of livelihood among local people along the Siak River. Due to increasing the environmental disturbances, the local people indicated that fish populations and other fishery products are decreasing both in catch and aquaculture projects at the Siak River. Consequently, the income of fishermen has been also decreased. In the year 2011, an average of monthly income for fisherman was IDR 2,535,412 (~ US$ 253.5) [1].

There are limited studies on fisheries resources and to certain extent the limnology study in Siak River. Pulungan [8] studied the diversity of fishes at Sungai Ukai, a creek of the Siak River. It recorded 12 families of fishes that consist of 35 species (Table 2). Because of the study only covers a small part of the Siak River, the fish list is incomplete and further studies are required.
3.3. Environment stress
Sedimentation has been occurred in the Siak River, resulting in a shallow the river. Amri [5] reported that sedimentation varied from 0.25 to 4.65 m per year with an average 2.4 m per year. The sedimentation materials flow from the river bank erosion and sites also from the impacted of conversion of forested land to non-forested land, such as plantations and develop areas. Indonesia Ministry of Environment [9] stated that the rate of the Siak river bank erosion is about 2 cm per year. Environmental pressures on the Siak River were intense by the rapid development of industries. For example in 2005, there are 47 big factories dominated by wood industries and large-scale petroleum mining in the Siak catchment areas [10].

Table 2. The checklist of fish species in the Siak River

| No. | Family             | No. | Species                  | Local Name       | S1 | S2 |
|-----|--------------------|-----|--------------------------|------------------|----|----|
| 1.  | Anabantidae        | 1.  | *Anabas testudineus*     |                  |    |    |
| 2.  | Aplocheilidae      | 2.  | *Aplocheilos panchax*    |                  |    |    |
| 3.  | Bagridae           | 3.  | *Mnigriceps*             |                  |    |    |
|     |                    | 4.  | *Molyroides*             |                  |    |    |
|     |                    | 5.  | *Mystus nemurus*         | Ikan baung       |    |    |
| 4.  | Belontidae         | 6.  | *Trichogaster leeri*     |                  |    |    |
|     |                    | 7.  | *Trichogaster trichopterus* |                  |    |    |
|     |                    | 8.  | *Trichopterus vittata*   |                  |    |    |
| 5.  | Channidae          | 9.  | *Channa striatus*        | Ikan gabus       |    |    |
| 6.  | Cichlidae          | 10. | *Oreochromis niloticus*  |                  |    |    |
|     |                    | 11. | *Clarias batrachus*      |                  |    |    |
| 7.  | Cyprinidae         | 12. | *Cyclocheilichthys apogon* |               |    |    |
|     |                    | 13. | *Hampala macrolepidota*  |                  |    |    |
|     |                    | 14. | *Lobocheilos schwanefeldi* |                |    |    |
|     |                    | 15. | *Luciosoma trinema*      |                  |    |    |
|     |                    | 16. | *Osteochilus hasselti*   | Ikan baung       |    |    |
|     |                    | 17. | *Osteochilus melanopleura* |             |    |    |
|     |                    | 18. | *Osteochilus spilurus*   |                  |    |    |
|     |                    | 19. | *Osteochilus Waandersi*  |                  |    |    |
|     |                    | 20. | *Oxygaster anomarula*    |                  |    |    |
|     |                    | 21. | *Parachela hypophthalmus* |               |    |    |
|     |                    | 22. | *Puntioplites bulu*      |                  |    |    |
|     |                    | 23. | *Puntius binotatus*      |                  |    |    |
|     |                    | 24. | *Rasbora borneesis*      | ikan pantau      |    |    |
|     |                    | 25. | *Rasbora caudimaculata*  |                  |    |    |
|     |                    | 26. | *Rasbora duronensis*     |                  |    |    |
| 8.  | Eleotritidae       | 27. | *Oxyeleotris marmorata*  | ikan betutu      |    |    |
| 9.  | Hemirampidae       | 28. | *Dermogenys sumatrana*   |                  |    |    |
| 10. | Palaemonidae       | 29. | *Macrobrachium rosenbergii* |         |    |    |
| 11. | Pangasidae         | 30. | *Pangasius polyuranodon* | Ikan juara       |    |    |
| 12. | Pristolepidae      | 31. | *Pritolepis grooti*      |                  |    |    |
| 13. | Siluridae          | 32. | *Ceratoglanis scleronema* |              |    |    |
|     |                    | 33. | *Kryptopterus apogon*    | Ikan selais      |    |    |
|     |                    | 34. | *Ompok hypophthalmus*    |                  |    |    |
|     |                    | 35. | *Wallago leerie*         | Ikan tapah       |    |    |

Unprocessed sewerage of an approximated 2 million residents has been discharged to the Siak River. Furthermore, an amount of sawmills and latex drying mills which release sawdust and
biological- and grain affluent waters are drained to the river. In Perawang, paper and pulp industries are releasing major counts of unprocessed production waters. In the region of the creeks Tapung Kiri and Tapung Kanan, oilpalm plantations are the highly plenteous shape of land use [5]. The pollutants are also from shipping activities (Figure 4). Large ships visit in the docks along the Siak River are as much as 10,450 vessels in 2004 [10]. The pollutants are causing risk for humans, biodiversity and environment of the Siak River. Therefore, the appropriate best managements are needed to improve the Siak condition.

Figure 4. Shipping activities in the Siak River are very busy both to transport goods and peoples

4. Conclusions and recommendations
Disturbance of natural resources at the Siak River catchment areas causes loss of many natural vegetation and invaded by exotic and invasive species as well as decreasing fish population and fishermen income. Conversion of forested land to non-forested land caused high sedimentation and decreasing water quality of the Siak River. On the other hand, environmental pressures on the Siak River were also intense by the rapid development of industries. Finally, the pollutants are causing risk for humans, biodiversity and environment of the ecosystem. Therefore, the appropriate management needs to be implemented to restore the natural resources of the Siak River ecosystem.

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