

IDENTIFICATION OF LAKE SENTARUM'S POTENTIAL ECOSYSTEM SERVICES, SOCIAL AND INSTITUTIONAL PROFILES TO SUPPORT ECOTOURISM DEVELOPMENT (A REVIEW PAPER)

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ABSTRACT

A memorandum of understanding of ecotourism development in Kapuas Hulu District has been signed by several institutions. Among some covered ecosystems, Lake Sentarum as a very unique ecosystem is the prime destination included in the tourism plan. This paper is aimed to review and identify the lake's potential ecosystem services (i.e. biodiversity, water supply) as well as social and institutional profiles of the surrounding areas which are the main elements of the tourism plan. Moreover, a useful information that can be easily read by the decision makers about the strengths, weaknesses, opportunities, and threats is also presented in the paper. The information was obtained by reviewing all possibly accessed papers and then they were analyzed by using a strength, weakness, opportunity and threat (SWOT) analysis. The results of the analysis show that the biodiversity and unique ecohydrological process are the main strength of the area. At the same time, limited access and infrastructure is identified as the main weakness. The main identified opportunity is the fast growth of ecotourism in global scale. Whilst the identified main treats are both deforestation and land use changing. Eventually, it is concluded that even though Lake Sentarum is significantly potential for ecotourism development, structural and institutional improvement is imperative to be conducted to support the tourism plan.

Keywords: Lake Sentarum, ecotourism, ecosystem services

INTRODUCTION

The World Wide Fund (WWF) and Kapuas Hulu District Office of Tourism and Culture Ministry, Danau Sentarum National Park (Taman Nasional Danau Sentarum/ TNDS), Kapuas Hulu Forest Management Agency (Kesatuan Pengelolaan Hutan (KPH) Model Kapuas Hulu), and Melemba Village Government have signed the memorandum of understanding of ecotourism development in Kapuas Hulu District. The ecotourism plan is aimed to support both ecological and economical benefits. In the future, the development of ecotourism may include Lake Sentarum as the main tourist attractor. Lake Sentarum, located in Central Kalimantan Indonesia, is a unique floodplain system impressively connected with its surrounding ecosystem such as peat forests, peat swamps, and riparian forests and many other ecosystems. Moreover, cultural richness and social structure in the area are fascinating to be explored and they provide valuable contribution for the development of the area. There have been tons of researches conducting in this area. The reasearches were mostly done by national and international NGO (i.e. CIFOR), Universities (i.e IPB), and govermental research Institute (i.e Research Centre for Limnology LIPI). In order to provide an elaborate paper and a guideline paper for the decission makers in considering the best policies to manage the area, this paper is written. It is hoped that this paper can provide a simple summary and a guideline to address such needs.

The main chapters of the paper will be divided into two main parts. The first part is the summary of all possibly accessed literature comprising biological resources, non-biological resources (i.e.water and carbon stock capacity), economic values, social profiles, institutional profiles, and resource use patterns. Whilst, the second part will be the SWOT analysis identifying the useful and informative information generated from the review materials and its discussion.

METHODS

The review is accomplished by reviewing all possibly accessed literatures such as the publications from CIFOR, LIPI, as well as related online publications. Thereafter, SWOT analysis is performed to achieve the objectives.

RESULTS AND DISCUSSIONS

REVIEW

The Lake's main potential resources are its astonishing biodiversities and hydrological patterns. This chapter will briefly describe those characteristics as well as explore the economic values, social profiles, institutional profiles, and resource use patterns that can be summarized from various literature.

Biological Resources

Fin-Fish

Several researchers have identified the biological resources of Lake Sentarum and its surrounding ecosystems. One of the most distinctive researches was a fishery survey conducted by Dudley (2000). The author wrote about the fishery productivity based on 1992 to 1995 data, and he concluded that the lake can support up to 97.5-162.5 kg of fish catch per ha per year. Meanwhile, Kottelat *et al.* (2005) identified that there were 303 fish species captured in the lake area and Kapuas River area in 1991. This number increasing quite significantly become 315 species in the survey conducted in 1995 by Kottelat *et al.* (1995). Jeanes (2000) stated that there were about 10 main fish species in the lake which are *Balantiocheilos melanopterus*, *Scleropages formosus*, *Kalimantania* cf. *lawak*, *Osteochilus pentalineatus*, *Parachela cyanea*, *Puntius* aff. *binotatus* 2, *Puntius* cf. *lineatus*, *Rasbora* aff. *sumatrana*, *Mystus*, *Silurichthys* cf. *hasseltii*.

Non-Fin Fish

Tortoises and softshelled turtles are other biological resources that have been researched and exploited by the locals. Walter (2001) identified that at least three soft shell turtles living in the lake area; which are *Amyda cartilaginea*, *Dogania supлана*, and *Orlitia borneensis*. The author also mentioned that there were about 11 tortoises and turtles living in the lake area and none of them is native in Kalimantan. They are Asian brown tortoise, Black marsh turtle, Asian box turtle, Asian leaf/stream turtle, Spiny turtle, Ricefield/snail eating turtle, Malaysian giant turtle, Keeled box turtle, Asian softshelled turtle, Malayan softshelled turtle, dan Asian giant softshelled turtle (Walter, 2000). On the other hand, other biotas such as crabs, shrimps, and Gastropods are relatively barely observed by the researchers. Only few studies can be found about the biotas. One of the study was done by Giesen (1987) cited in Jeanes (2000). The study mentioned about several gastropod species that can be found; which are *Pilla ampucea*, *Ctenodesma* sp., *Schepmania* sp., and 2 species of *Bellamyia*. In addition, the study also described about 2 unidentified crab species. A study about the occurrence of a native prawn species (*Macrobrachium sintangense*) in the Lake was conducted by Said *et al.* (2014). They also concluded that in the study year, there were no any introduced prawn and shrimp species found in the Lake. Phytoplankton, as the primary producer in the lake area, also has been observed. Sulawesty (2013) identified that Chlorophytes (38 species) in particular desmid group (i.e. *Staurastrum*) were mostly found in the Lake compared to other groups. On the contrary, the least abundant group was Pyrrophytes (1 species). It was stated by the author that the observation results are coherent with the lake's physical condition which is acidic.

Terrestrial Flora and Fauna

Giesen (2000) conducted a survey that recorded 504 plant species. Several described main plant groups are adalah *Dipterocarpaceae* (40 species), *Euphorbiceae* (10 species), *Rubiaceae* (35 species), *Myrtaceae* (26 species), *Fabaceae* (21 species), and so on. In particular the author also lined up 13 wild orchid species from the area. These orchids have been managed as sustainable local economy in the area (Prasetyo, *et al.*, 2010). Whilst, Jeanes (2000) identified 293 bird species and 143 mammal species in the area. Moreover, the author also stated about 24 reptile species listed from the area.

Non-biological Resources

Water is the main non-biological resource supplied by the lake. The lake ecosystem absorbs 25% Kapuas River's water in rainy season while in the dry season this lake flows 50% of its water to the river (Yuliani *et al.*, 2007). Giesen *et al.* (2000) stated that the lake hydrological system is a function of rainfall rate which is about 3,900 mm/year in the lake area. At the same manner, the lake ecosystem is an enormous carbon sink. If the peat swamp conversion is minimized, the lake ecosystem (especially peat swamp forest area) can absorb 2,879 tonnes of carbon/ha or similar to 10,000 tonnes of CO₂/ha (Anshari, 2010).

Social Profiles

Social Groups

There are to prime user groups around Lake Sentarum National Park. The first group is Moslem Malay who mainly works as fishers. This group shares about 93% of total population

in the area (Indriatmoko, 2010 cited in Wadley, dkk., 2010). The second group, Christian Iban, engage as terrace farmers and hunters (Colfer, *et al.*, 1999). The livelihood discrepancy further endorses different life styles between the groups. The main difference is seasonal migration done by Malay group due to the fish harvesting season. Meanwhile, Iban group experiences daily migration due to their farming and hunting activities.

Economic Values

Roslinda (2013) conducted a research on several economic values of the lake ecosystem. The result of the study is summarized in **Table 1**. The researcher calculated that total value generated by the lake ecosystem was 139.1 billion IDR with 2010 currency. Whilst, total cost spent by the government to manage the lake ecosystem was 6.7 billion IDR in 2010 currency. Specifically, Aglionby (1999) cited in Dudley (2000) stated that capture fishery sector shared 1.5 Million USD and the aquaculture sector provided 0.7 million USD.

Table 1. Economic Values of Lake Sentarum National Park (Roslinda, 2013) (all values are stated in 2010 IDR/ year)

NO.	Economic Value Elements	Components	Value	Economic Value per ha IDR/ year	%
1	Direct values	• Capture Fishery	15,505,805,000	117,468.22	2.79
		• Honey Production	729,630,000	5,527.5	0.07
		• Ruber	2,218,796,000	16,809.06	0.15
		• Paddyfield	81,200,000	615.15	0.03
		• Firewood	3,329,492	25.22	0.00
		• Tourism	14,426,000	109.29	0.00
2	Indirect Values	• Domestic Use	964,476,000	7,306.64	0.08
		• Transportation	28,736,100,000	217,697.73	5.72
		• Fishery Use	4,587,500,000	34,753.79	0.98
		• Carbon Stock	431,636,400,000	3,269,972.73	75.19
3	Option Values	• Option	86,205,000,000	653,068.18	14.99
Total			570,703,707,492	4,323,353.51	100.00

It can be summarized from the Table that indirect values in particular carbon stock dominated the calculated value. This matter gets high interest from the international world since the Lake is a great carbon absorber in term of the concern for climate change. However, the discrepancy among direct and indirect values may threaten the conservation effort applied in the lake ecosystem. It may lead to the occurrence of land conversion into something providing instant access to economic impact. This matter is also shown by the relatively high calculated option value. Thus, various optional plans such as ecotourism and alternative livelihood provision have to be planned ahead to improve the direct values of the lake ecosystem. Therefore, local people will receive the benefits of the lake occurrence to limit such threads.

Institutional Profiles

Lake Sentarum Natural Resources Conservation Board (Balai Konservasi Sumber Daya Alam/BKSDA) is the main institution involving in the management of the lake area. Other participating institutional are international and local NGOs, national agencies, and local governmental relationships are and their roles are illustrated in **Figure 1**. It can be assumed from the Figure that there are two main groups who actively engage in the management process. BKSDA as the main decision maker and the prime manager also act as the coordinator among the institutions. BKSDA is the permission letter issuer agency is the legal representative of The Republic of Indonesia Government. Meanwhile, NGOs such as CIFOR and Yayasan Riak Bumi participate in various conservation activities such as alternative livelihood, conservation planning, and local coordination and cooperation. Both institutions (BKSDA and NGOs) actively provide fund for many activities conducted in the lake.

At the same manner, local people as the main stakeholders who use and manage the resources holds the central role in the management process. Iban group, although only a minority group, employs shifting cultivation, thus they relatively create significant land use changing. Moreover, they also hunt their prey in the lake catchment area; therefore, their activities give direct impacts to the lake ecosystem. The central role of Iban group was studied by Wadley (2002). Whilst, Malay activities are considered not significantly impact to the

changing of lake ecosystem since they mostly engage on fishery activities and they migrate along with harvesting season. Nevertheless, their roles in the management should not be neglected since they are the dominant population.

Local government shares the responsibility by both technical and non-technical efforts as well as coordinating roles in managing the lake ecosystem. At the same time, the government also shares their roles to the impacting activities as they hold the authority to issue permit for many activities such as palm oil plantation. Roslinda (2013) found similar finding after conducting a stakeholder analysis. The author revealed that BKSDA is the main stakeholder by empowering both high interest and influence. On the other hand, local communities are categorized as the parties with high interest but low influences since they do not have access to decision making process. Whilst, international organization; for instances, CIFOR and CANOPY share low interest and influence. At the same time, local government represented by Local Planning Agency (BAPPEDA) showed high influence and low interest. Thus, both BKSDA and BAPPEDA should be the prime leader for good management movement. Moreover, local community roles should be empowered and invited to participate more in the management process since they have high interest to the resources and they acquire great knowledge about the resources.

SWOT ANALYSIS FOR ECOTOURISM DEVELOPMENT

To elevate local economic impact as well as to support conservation program in the lake's ecosystem, The World Wide Fund (WWF) and Kapuas Hulu District Office of Tourism and Culture Ministry, Danau Sentarum National Park (Taman Nasional Danau Sentarum/ TNDS), Kapuas Hulu Forest Management Agency (Kesatuan Pengelolaan Hutan (KPH) Model Kapuas Hulu), and Melemba Village Government have developed an initial process for ecotourism at Melemba Village. The tourism has to be supported by various aspects; for examples: infrastructure development and local people empowerment. In this paper, a SWOT analysis is proposed for the improvement of the ecotourism plan. The analysis is presented in **Table 2**. Overall, the main strength for ecotourism development is the lake's wonderful biodiversity. Whilst, the main identified weakness is limited accessibility and infrastructure. This statement is supported by a tourism expedition conducted by Kompas held in 2013. The journalist member of the expedition wrote that it was relatively expensive, difficult, and dangerous to access the lake area (Kompas, 2013).

Table 2. SWOT analysis to support ecotourism development in Lake Sentarum

	Helpful for development	for ecotourism	Harmful for ecotourism development
	STRENGTHS		WEAKNESSES
Internal factors	<ul style="list-style-type: none"> • Amazing biodiversity • Endemic species • Abundant water resources • Unique hydrological processes • Huge amount of carbon sequestration 		<ul style="list-style-type: none"> • Very limited infrastructure and transportation/ Low Accessibility • Differences among dry and wet season hydrological processes is a threat for water transportation continuation • Acidic peat water limits tourism activities • Limitation of local people involvement by the planning agency • Very few bridging research and or discussion
	OPPORTUNITIES		THREATS
External factors	<ul style="list-style-type: none"> • Emerging ecotourism trend in the world • Various research availability • Low identified direct economic values from other activities 		<ul style="list-style-type: none"> • Deforestation • Land use changing

- Supports from Governmental Boards and private invitation
 - Support from both international and local NGOs
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The success of ecotourism development cannot be separated with the increase of global ecotourism demands. Ecotourism is becoming a worldwide new trend; thus, it should be optimized by promoting Lake Sentarum as a unique ecotourism experience. In order to promote Lake Sentarum's ecotourism globally, the available support from both governmental and international institutions is an opportunity that should be captured by the tourism developer. At the same manner, it is also presented that low identified direct economic value is the opportunity that should be seen since ecotourism

On the other hand, the development of ecotourism is mostly threatened by alteration of land use surrounding the lake area. There are plenty popular articles (i.e. Kompas, 2015 and Republika, 2011) citing that opening of palm oil plantation in the lake's catchment area created disturbances on the ecosystem. Although some popular media have explored the danger of palm oil plantation to Lake Sentarum's ecosystem, there is no scientific publication has been found to describe detail impacts of palm oil plantation to Lake Sentarum's ecosystem. Unfortunately, this lack of scientific research creates an opportunity for the local government to state that there is no interrelationship between palm oil plantation with reduction of fish capture (Antaraneews.com, no date available). Therefore, it is necessary to be aware that expansion of palm oil plantation may be continuing. The threats of palm oil plantation to the ecosystem in other areas actually have been well documented. One of the most recent studies focusing on the impacts of alteration of secondary peat swamp forest into a mature palm oil plantation was conducted by Tonks *et al.* (2017) in Malaysia. The study found that the conversion forfeited C storage and water holding capacity of the swamp. Other studies such as Saswattecha *et al.* (2015) and Silalertruksa (2016) highlight some concerns related to green house, water footprint, and acidification as the impacts that should be aware to be generated by the expansion of the plantation. Thus, the impacts of palm oil expansion to the water holding capacity and C storage may pose great threats to the development of ecotourism since the lake main strengths include aquatic biodiversity and carbon stocks.

CONCLUSIONS

To succeed the ecotourism plan that have been signed, the moment of global ecotourism booming should not be missed by the manager. Thus, some major threats should be resolved before they devastate the occurring plan since the identified threat can disrupt the main strengths such as water capacity and carbon sequestration which eventually impact the marvelous lake diversity. The identified threats are land conversion and deforestation. In line with the plan development, a massive progress of infrastructure development as well as increment of local people involvement is a top priority work that should be finished promptly. All in all, should all aspects are synergies a well-developed and sustainable ecotourism may be performed and in the end local people welfare may also be improved.

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