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Biodiversity Inventory and Conservation Opportunity of Suwi Wetlands, Muara Ancalong, East Kalimantan, Indonesia

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Abstract. Suwi wetlands lays in location permit of palm oil plantation, which has been cleared partially, but then abandoned because is not suitable for palm oil. Considering the biological richness and the usage, the wetlands is important to be conserved, the most possible is managed as an Essential Ecosystem. The main objective of this study was to conduct an inventory of species diversity of Suwi wetlands. Habitat condition and utilization was recorded as important supporting information. The fieldworks have been done from 2013 to 2016. Camera traps and mistnetts were used and randomly done several times in a place where animal were suspected presence. Direct observations were done in the morning and afternoon especially for bird and mammal inventory while dark night observations were done for the presence of crocodile. The result of fieldworks found 12 species of mammals, 63 species of birds, 9 species of reptiles and 38 species of fish, which 30 of the total 122 species are protected, based on Indonesian law as well as international rule. Proboscis monkey (*Nasalis larvatus*) is an endemic and one of conservation priority species of Indonesia. Meanwhile, Siamese crocodile (*Crocodylus siamensis*) is one of the most world's endangered crocodilians.

INTRODUCTION

Suwi wetlands ecosystem consists of lakes, riparian and fresh water swamp situated in Muara Ancalong sub district, East Kalimantan – Indonesia. Topographic map indicated that the surrounding Suwi lake area is a flood plain where water from rain and nearby river system are accumulated. Surrounding river system and rain influence the water level of the wetlands.

Understanding of wildlife diversity live in Suwi wetland is limited. Cox *et al* [1] mentioned in his report that Siamese Crocodile (*Crocodylus siamensis*) observed, was captured by local residents in Lake Suwi. Siamese Crocodile for the first time was described based on the species found in Siam (Thailand), hereafter was found and distributed in Indonesia, Malaysia (Sabah and Sarawak), Laos, Cambodia and Vietnam. In the distribution area, the species has locally extinct, that is why Siamese Crocodile is categorized as Critical Endangered by IUCN [2]. Indonesian Science Institute reported that Mesangat lake, nearby Suwi wetland, was the only natural habitat left for the Siamese Crocodile [3]. Based on the above information, the aim of this survey is to study about Siamese Crocodile's habitat and biodiversity potential as a basis for conservation opportunity assessment.

METHOD AND LOCATION

Location of the study is ±165 km North West of Samarinda and can be reach about 5-6 hours land travel by car. Suwi Lake located at latitude 0° 26' 27'' and longitude 116° 37' 50''. The wetland is bordered with Muara Kaman Sedulang Nature Reserve. Habitat survey and biodiversity inventory have been conducted over 2013-2016 to

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develop long-term information bank regarding presence, distribution (GPS point), abundance and conservation status of species, using simple method but accurate. The information builds the most important science element for conservation, since species management cannot be done without knowledge about species.

The study area can be reached by using boat with long tail engine (*ces*) and walking in dry area. Observation was done by exploring the survey areal, inventory all encountered wildlife. Besides attempting to encounter the wildlife, tracking of footprint, faces and feed remnant to know the present of terrestrial mammals. For avifauna, sound and nest can be a proof of presence.

Record of new species from regular observation during certain period of time, can be described a trend of species increasing. Unintended wildlife encounter, such as on the way for camera trapping location, as far as the species can be certainly identified or photographed also recorded. Common and uncommon species were determined by the presence in certain habitat. Camera trap were set up randomly to capture the elusive fauna. The areas which were not flooded at least for one month was one of criteria's for site selection of camera trap. Several camera trap set up in a tree to avoid the water level rise and to capture arboreal fauna. Footprints of crocodile or other target species were detected by using camera trap to get the evidence of the presence. Mist nett randomly was set up in dry area, instead of put in straight transect in the wetland. Dry land become wider in dry seasons that give bigger opportunity and easier to set up camera trap and mist nett, while in wet season with high water level, observation used boat, enabling to reach as wide as flooding area. Fish species inventory has been done to the fisherman's catch, the result has been matched with report of Aquatic Fauna Baseline Study at Danau Mesangat by Wowor *et al* [4]. Flora observation has been done together with ground check of habitat current condition of the wetland during the drought. The GPS point of observation sites were selected randomly every one km along the Suwi River. A 500 cm wooden beam set up in front of a fisherman raft for water level monitoring, and with the assistance of the fisherman the water level has been being recorded daily.

All findings were put in the map. The data were proceed through GIS program to produce map of detail distribution, territory size and their habitat. Conservation status of each species, determined based on red list of International Union for Conservation of Nature and Natural Resources (IUCN), Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) and Indonesian regulation Number 7 Year 1999. All data put in spread sheet Data Base. The spread sheet provides simple information to determined priority species to protect or important species to take conservation action.

RESULT AND DISCUSSION

Biodiversity

The result of fieldworks found 12 species of mammals, 63 species of birds, 9 species of reptiles and 38 species of fish, which 30 of the total 112 species are protected, based on Indonesian law as well as international rule (**FIGURE 1**). 35 floras identified based on limited flowering specimens.

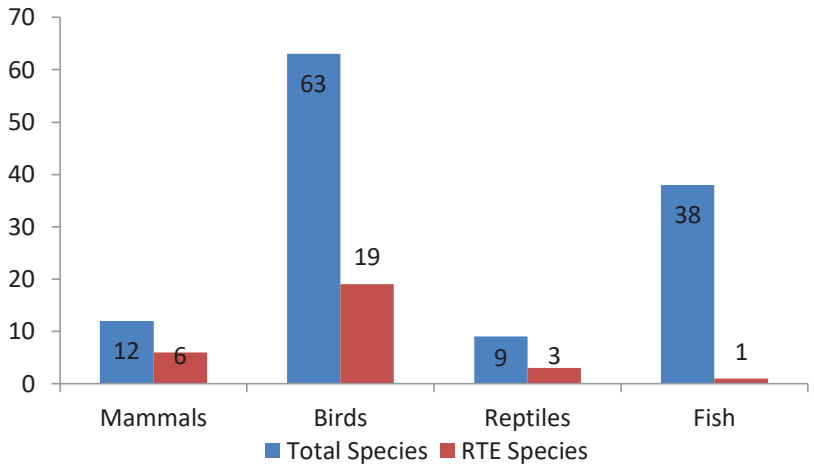

FIGURE 1. Vertebrata diversity

Mammals

Based on Camera Trapping and direct observation, 12 species (9 family) of mammal were recorded, 6 of them are protected, endemic or threatened. Camera traps were set up in 13 locations alternately in main habitat (swamp forest and riparian forest), along the waterway or locations where there were indicated presence of Siamese crocodile or other animals.

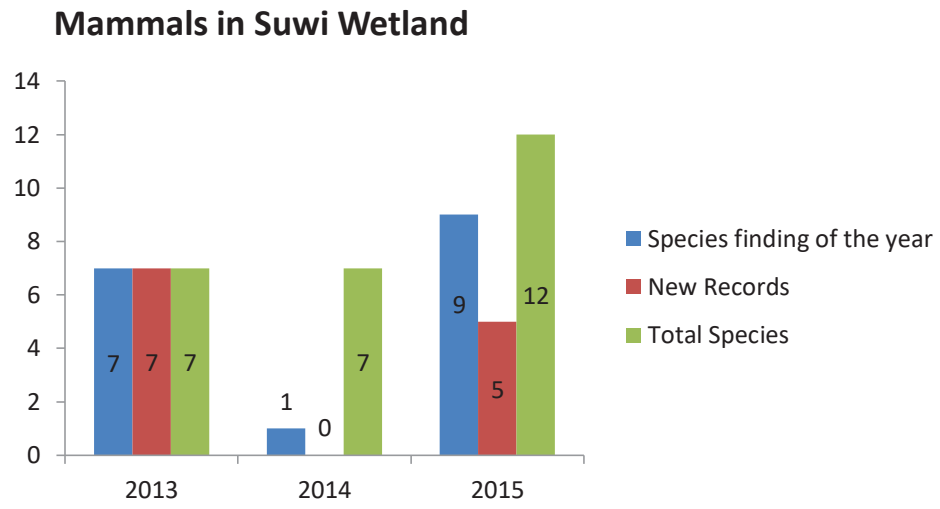

FIGURE 2. Annual finding of mammal 2013 to 2015

The most captured in the picture are: Long-tailed macaque (*Macaca fascicularis,* 678 pictures), Bearded pig, (*Sus barbatus*, 103 pictures) and Proboscis monkey (*Nasalis larvatus,* 93 pictures). Other mammals species are: Sambar deer (*Cervus unicolor*), Flat-headed cat (*Prionailurus planiceps*), Greater mouse deer (*Tragulus napu*), Otters (*Lutra sp*), Black-capped fruit bat (*Chironax melanocephalus*), Silvered leaf monkey (*Presbytis cristata*), Plantain squirrel (*Callosciurus notatus*), Black-eared squirrel (*Nannosciurus melanotis*) and rat (*Rattus sp*).

Proboscis monkey (*Nasalis larvatus*) is the unique and endemic species of Borneo Island (Kalimantan, Sabah, Sarawak and Brunei). This species almost always photograph in riverine forest during boat survey. In Suwi River,

this species frequently appeared in relative dense forest with medium high canopy, in riparian secondary and old forest. They were rare recorded on the forest floor; especially younger individuals spend much of their time in canopy. However adult Proboscis Monkey was captured by camera trap several times in forest floor during the dry season. Long tail macaque (*Macaca fascicularis*) the most common along Suwi River, only once found in the edge of Suwi Lake. Silvered Langur (*Presbytis cristata*) only once found were feeding on fruit tree close to Suwi Lake.

A felis, the Endangered Flat Headed Cat (*Prionailurus planiceps*) were captured by camera trap at night in 2013. Images of Flat Headed Cat were restricted to wet area in the edge of wetlands or swamp forests. Flat Headed Cat eats frogs, shrimp and fish [7].

Bearded pig *(Sus barbatus)* was detected from a lot of foot print during on the way for setting up camera trap or habitat ground check. On camera trap this species always captured at dark time (18:00 – 05.00) only in dry forest on river edge. This is very different records from other research in Sungai Belayan (Kutai Kertanegara district), this species were photographed both day and night (24 hours) and in all forest types, as well as in the planted blocks [8].

Birds

A group of 63 bird species from 34 families was recorded during 2013 – 2016, 20 species are protected, include a vulnerable Lesser Adjutant (*Leptoptilos javanicus*). Storm's Stork (*Ciconia stormi*), a rare species was found by Rea conservation team in estuary of Suwi River in 2010. Wading Birds encompass 31% of the total species, such as herons and egrets which are used to live in association with wetlands. The others were species which only feeding or nesting around the wetlands. This indicated that Suwi wetlands is important and has conservation value for birds in the wider landscape.

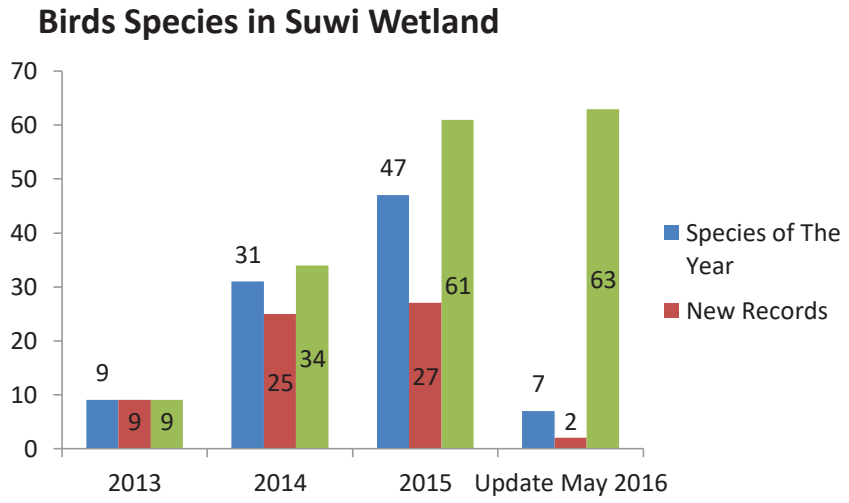

FIGURE 3.Annual finding of bird 2013 to 2016

Herpetofauna

Herpetofauna surveys have not specifically done yet, since this requires additional time and resources. Yet findings were obtained through observation the following:

- Siamese crocodile (*Crocodylus siamensis*)
- Gold-ringed cat snake (*Boiga dendrophila*)
- Painted bronze-Back Snake *(Dendrelaphis pictus)*
- Puff-faced Water Snake (*Homalopsis buccata*)
- Reticulated python (*Python reticulatus*)
- East Indian Brown Mabuya *(Eutropis multifassciata)*
- Water Monitor (*Varanus salvator*)
- Malaysian giant turtle (*Orlitia borneensis*)
- Asiatic softshell turtle(*Amyda cartilaginea*)

According to Simpson at al [2], Siamese crocodile (*Crocodylus siamensis*) is one of the most world's endangered crocodilians andwas virtually extinct in the wild. In Indonesia, Siamese crocodile distribute in Kalimantan Island. Further study discovered wild population in Vietnam, Cambodia, Laos, and Mesangat Lake of Indonesia. Because of distinct population reduction, Siamese crocodile was protected by Indonesian Government under Regulation No. 7 Year 1999 about Preservation of plants and animals. The appropriate time for crocodilesurvey is the dark moon with water level 200-400 cm while Suwi lake can be reach only when water level about 500 cm. The result of crocodile surveys in Suwi wetlands are resume in **TABLE 1**.

TABLE 1.Location and finding of crocodile surveys

Location	Remark
Suwi River estuary	adult individual *C. siamensis* on shore of the river
Serapung Lake	Juvenile *C. siamensis* release
Serapung River	3 finding: 2 eye sighting, feces
Mentelang River	5 finding: 2 sub adult *C. siamensis*, footprints in the ground, 2 eye sighting
Loah Bekara	Night surveys no crocodile finding
Putih River (tributary of Suwi river)	Night survey no crocodile finding
Kenohan Kayu	night survey no crocodile finding
Ketiau Lake & River	night survey no crocodile finding
Loah Ranam Hitam	night survey no crocodile finding
Suwi River	Night surveys no crocodile finding, Fisherman information, *Siamese crocodile* often seen
Loah Telihan	Visit in dry season, Fisherman information presence of *C. siamensis*, not confirm yet
Suwi Lake	Visit in dry season ,Fisherman information presence of *C. siamensis*, not confirm yet
Plangka lake	Visit in dry season, Fisherman information presence of *C. siamensis*, not confirm yet
Loah Putih Kenohan	Visit in dry season, Fisherman information presence of *T. schlegelii*, not confirm yet

We continued to compensate and release of Asiatic soft shell turtle (*Amyda cartilaginea*) and Malaysian giant turtle (*Orlitia borneensis*) in cooperation with "Suwi Indah", a fisherman group. Yet it is still difficult to get data on capture and local trading. So far only three individual of Asiatic soft shell turtle were reported to us for hook removal, measure and released and only one individual of Malaysian giant turtle reported to us, measured and released.

Fish

Fish inventory was done based on fisherman catch with local fish name, (22 species). Nugroho *et al*.study has identified 29 species [5]; from both studies have been listed 38 species. *Notopterus notopterus* is the only protected species, the population has been depleted because of intensive use. *Chana micropeltes* is the exotic predator species, can grow up to 8 kgs, fortunately it has market value, however has to be controlled to restrict the biological effect to other species.

Flora

Plant communities are spread in riparian forest, swamp forest, swamp brushwood, floating in open lake, the edge of the lake (ecotone area) as well as in meadow or regrowth area after burned. Swamp forest characterized by the presence of *Malotus sumatranus, Baringtonia acutangula, Gardenia tubifera, Tabernaemontana macrocarpa*,

while riparian forest characterized by presence of *Lagerstroemia speciosa, Dillenia excelsa, Lepisanthe salata*, and *Ficus microcarpa* with hanging aerial roots. Swamp brushwood dominated by *Mimosa pigra*, this exotic spiny shrub tolerates to waterlogged and smother a wide area, especially in repeated burned area. Its occupancy inhibits forest regrowth, however in certain area such in Mentelang River, Ketiau River, Serapong and Loa Bekara, the forest regenerate after burned. Floating herb consist of *Hypolytrum nemorum, Scleria terristris, Cyperus compressus, Hanguana malayana, Leersia hexandra, Eichornia crassipes, Ludwigia adscendens* and *Salvinia molesta* which form unstable floating vegetation "kumpai" [6]. So far known that Siamese Crocodile nesting in those "*kumpai*". While in the edge of the lake, fern and sedge which common are *Stenochlaena palustris, Cyclosorus interruptus, Scleria sumatrana*. Higher areas which are frequently burned have been growth by *Imperata cylindrica*, with *Eupatorium odoratum* and *Trema orientalis*.

Habitat disturbance

Suwi wetlands lays in location permit of palm oil plantation, which has been cleared partially, but then certain areas abandoned. Sink oil palm tree in wet season also documented by the team during field survey. Based on water level daily record, fluctuation was approximately 500 cm with the lowest water level was 20 cm mostly in October 2014 and highest water level was 520 cm during the end of December 2014- early January 2015, this indicate that the area are not suitable for oil palm. The companies had been drained the wetland, as a result the wetland experience severe water receding during the drought. The fresh water swamp of Suwi is under great environmental stress and has been degraded to a great extent during the last few years. Local fisherman have lost their livelihoods because the wetland dried out and scarcity of fish, even Suwi lake still keep water, but no access to reach the area.

Conservation Opportunity

Suwi wetland undoubtedly is important habitat for protected species, especially for critically endangered *Crocodylus siamensis,* protected endemic mammal of Borneo, *Nasalis larvatus* and many protected birds. The wetland located above Sendawar ground basin and proven to be a wide floodplain during the wet season, that is important for water absorption. Considering that the wetland also be a fishing ground for the fisherman, the damage of Suwi wetland have to be recover and should be managed sustainably.

According to Government Regulation No 28/2011 about Nature Reserve and Nature Conservation Area article 24 1) that protection of Nature Reserve and Nature Conservation Area, include protection of essential ecosystem. Essential Ecosystem is an ecosystem outside Nature Reserve and Nature Conservation Area which is important for biodiversity conservation. Government Regulation no 27/1991 about swamp, article 6 (2) swamp is protected and preserve, enhanced its function and benefits. East Kutai Regulation No 6/2005 about plantation permit article 27 (1.c) from every net area of location permit, every plantation compulsory set aside 10 % of area for conservation.

Based on biodiversity values found and above regulations the wetlands is feasible to be proposed as an Essential Ecosystem to be managed sustainably by considering economic, social and environment aspect, by stakeholder from government, private, community, university and NGO. Management of wetlands Essential Ecosystem have to be designed to accommodate use and protection in a balanced. Use, preserve and research as main component of conservation are significant to be done in Suwi wetland. Collaborative management to gather the commitment and accommodate interest of stakeholders is a right choice regarding the current land status.

CONCLUSION

In Suwi Wetlands, 12 species of mammals, 63 species of birds, 9 species of reptiles were found and 38 species of fish, which 30 of the total 112 species were also protected, based on Indonesian law as well as international rule, and 35 of plant species. According to biodiversity richness, unsuitable land for oil palm and ecological services, Suwi wetland is worthy to be conserved. Regarding the regulation and current land status, the wetland has possibility to nominate as an Essential Ecosystem.

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