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Vegetation and Fauna Diversity of High Conservation Value (HCV) Swamp Areas in Oil Palm Plantation

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Abstract. The designation of an area as a "high conservation value" (HCV) is a form of concern for environmental management. The palm oil company is one of the business units that has responsibility for the existence of HCVs in its area. This study aims to characterize and analyze the components of vegetation and fauna in HCV in swamp areas in oil palm plantations. The research object is in the form of vegetation and wild animals found in HCV swamp areas. The equipment used is: a set of survey equipment, tally sheets, documentation equipment, equipment for data analysis. Vegetation data collection is done using line transect system. Data collected were the number of individuals and the number of species. Fauna data collection is done by exploring and adjusting to vegetation data plots. Data collected were the number of species found in each plot. Vegetation and fauna data were analyzed by using tabulation matrix. Specifically for vegetation species and aves, the data were analyzed using the Shannon-Wiener Diversity Index (H'). There are 8 types of vegetation in the HCV area. The most dominant species found at this location at all levels of growth (seedlings, saplings, poles and trees) is the *Melaleuca cajuputi* species. The dominant tree species was *Melaleuca cajuputi*. The important value index of *M.cajuputi* > 90%. The H' value for all vegetation levels are classified in the low category. The H' values of trees, poles, saplings and seedling are 0.84, 0.41, 0.49, 0.46, respectively. There are 16 species of undergrowth which are dominated by plants associated with water. There were 21 species of birds at the study site, 4 of which were protected by government regulation PP No.7 / 1999. There are 21 species of birds with a value of $H' = 2.5$. There are 8 species of mammals (including primates), 6 species of reptiles and 3 species of amphibians. The existence of HCV is very important in contributing to the diversity of homogeneous areas of oil palm plantations. Protecting HCV swamp areas in oil palm plantations are very important for the availability of a conducive animal habitat.

Key words: Conservation, Fauna, Palm, Swamp, Vegetation

1. Introduction



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The using of forest are for oil palm plantations has reduced biodiversity [1]. Converting forests to oil palm plantations reduces species richness by at least 60% [2]. The Indonesian Regulation No. 32/2009 on Environmental Protection and Management states that it is important to provide areas for the management of flora and fauna. All types of business unit that cover a relatively large area are required to carry out environmental management including components of flora and fauna.

To reduce the negative impact of oil palm plantations on biodiversity, the RSPO (Roundtable on Sustainable Palm Oil) promotes HCV in one of the requirements for certification of oil palm plantations to be sustainable. The existence of HCV will increase the number of protected areas that can facilitate biodiversity conservation activities. HCV is held with the intention of preserving the ecological and conservation values of an area [3].

The designation of some areas as "high conservation value areas" (HCV) is a form of concern for environmental management. The palm oil company is one of the business units that has responsibility for the existence of HCV in its area. The information related to flora and fauna characteristics is a direction for the management of the existence and survival of flora and fauna in and around the company's operational areas. This study aims to characterize and analyze the components of vegetation and fauna in HCV in swamp areas of oil palm plantations.

2. Methods

2.1. Object and tools

The objects of research are plants and wild animals that live in HCV areas of the oil palm plantations. The tools used consists of a set of survey equipment, tally sheets, documentation tools, computer hardware and software for data processing and analysis.

2.2. Location and Time of Research

The locations of research were three HCV areas in the operational sites of palm oil company. Administratively the research location is in the Margasari sub-district, Tapin District, South Kalimantan Indonesia. The observation points were made to be able to cover several types of vegetation cover, ranging from open land, shrubs, secondary forests which are HCV reserves. The time of the study was carried out for 3 months from data collection, data analysis and report writing.

2.3. Data Collection and Analysis

Vegetation data collection were carried out using a transect system, in which the transects were made in an arbitrarily adjusted exploration area of the observed vegetation and fauna conditions. The vegetation levels are tree, pole, sapling and seedling. Tree level is an individual tree with a diameter > 20 cm. Pole level is an individual tree with a diameter between 10-20 cm. Sapling level is an individual tree with a diameter less than 5 cm and height > 1.5 m. Seedling level is an individual tree that has a height < 1.5 m. The undergrowth are non-tree species found on the forest floor. Data collected were the number of individuals and the number of species.

Fauna data collection were done by exploring and adjusting to vegetation data plots. Data on fauna collected were the number of species found in each transect plot. Data on birds collected were the number of individuals and number of species. Fauna identification guidelines used some reference [4, 5, 6]. Data of vegetation and fauna were also collected by literature review and interviews with key informants.

2.4. Data Analysis

Vegetation and fauna data analysis were performed by using tabulation matrix of species. Specifically for bird species, the data was also analyzed for the Species Diversity Index. Species diversity was calculated using the Shannon-Wiener Diversity Index [7]. The Shannon-Wiener Diversity Index is calculated by the formula

$$H = - \sum P_i \ln P_i$$

with:
 H = Shannon diversity index
 P_i = Proportion of species i to total number of species

3. Result and Discussion

3.1. Vegetation Characteristic

There are 2 land systems in the study area, namely the formation of Kahayan system (91.47%), and the Tanjung system (8.53%). The research location is included in the lowland category referred to included in the lowlands of the Amandit Sub-watershed and Barito Hilir Sub-watershed. The research location is an area of tidal swamp ecosystem which is strongly influenced by tidal rivers. Tidal swamp water level between the rainy season and the dry season is significantly different. HCV areas are patches of secondary swamp forest stands. The composition of species vegetation are listed in Table 1.

Vegetation Species	tree	pole	sapling	seedling
<i>Floucarataria rukam</i>			√	
<i>Gluta renghas</i>	√			
<i>Lagerstromia speciosa</i>	√	√	√	
<i>Melaleuca cajuputi</i>	√	√	√	√
<i>Syzygium sp.</i>				√
<i>Syzygium sp.</i>			√	
<i>Terminalia cattapa</i>	√	√		√
<i>Vitex pubescen</i>	√	√	√	√

There are 8 species of vegetation in the HCV area. The most dominant species found in this location at all levels of growth both in the level of seedlings, saplings, poles and trees is *Melaleuca cajuputi*. The dominating of *M.cajuputi* species is > 90%. Other species are not found at all levels of vegetation. Uneven distribution of species at each level of vegetation is a problem in tree regeneration, hence the survival and existence of species are threatened. The vegetation level diversity index values of the HCV area are shown in Figure 1.

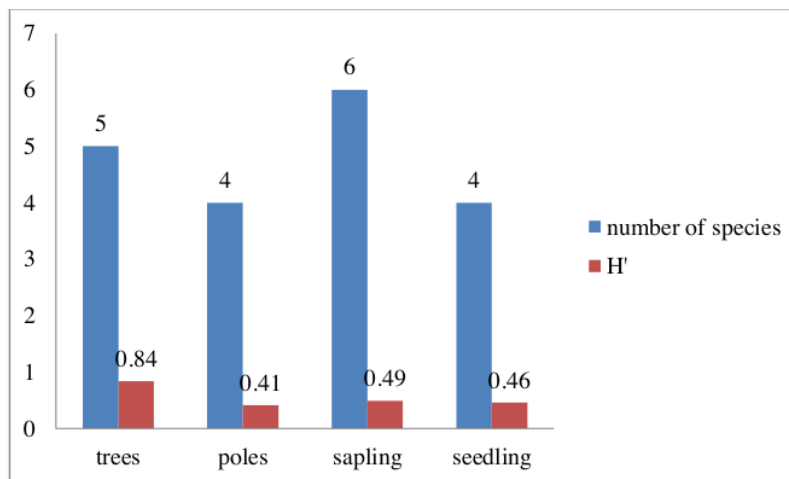


Figure 1: Number of species and diversity index of vegetation.

The number of species found in each growth rate is relatively low, with seedling and poles with the smallest number, and sapling with the highest number of species. The highest diversity index value is at the tree level. Although the number of species and diversity of HCV vegetation is relatively low, the existence of these vegetation types gives a little additional value to the diversity of tree species. The existence of HCV has significance for animal habitat both for birds, mammals, and primates. The stand in the HCV acts as a place to find food and as a place for other animal activities. Large canopy trees with high crowns are shelters or nesting birds and nesting birds such as *Harliastur indus* (Figure 2).



Figure 2: *Melaleuca cajuputi* stands in HCV area as habitat of birds.

The areas in and around open oil palm plantations are overgrown by aquatic plants and grasses. Several species were found, as shown in Table 2.

Number	Species List	Number	Species List
1	<i>Imperata cylindrica</i>	10	<i>Melastoma affine</i>
2	<i>Crinum asiaticum</i>	11	<i>Colocasia esculenta</i>
3	<i>Leersia hexandra</i>	12	<i>Stenochlaena palustris</i>
4	<i>Cyperus sp.</i>	13	<i>Mimmosa pudica</i>
5	<i>Nerremia sp.</i>	14	<i>Heleocharis dulcis</i>
6	<i>Eichornia crassipes</i>	15	<i>Seleria sp.</i>
7	<i>Saccarum spontaneum</i>	16	<i>Nymphaea alba</i>
8	<i>Ipomea aquatica</i>	17	<i>Nymphaea rubra</i>
9	<i>Eleocharis dulcis</i>		

Table 2: List of plant species in and around of open area of oil palm plantation.

The undergrowth is found in the HCV area and in the palm oil plantation area. This undergrowth is important as an animal habitat that occupies shrubs as a place to live. Figure 3 describes several undergrowth such as *Melastoma affine*, *Stenochlaena palustris* and *Eleocharis dulcis* which were found in an open area.



Figure 3: The undergrowth founded around oil palm plantation area.

Some areas with pure stands of *M.cajuputi* are allowed to develop naturally. This galam stand area can be reserved as a HCV area for the company. Although the diversity of pure galam stands vegetation are relatively low, galam stands can be a conservation area especially for waterbirds.



Figure 4: Stand of *Melaleuca cajuputi* in area of oil palm plantation.

The low diversity of galam stands as areas that can be reserved as HCV can be improved by enrichment planting. The gardens area around the river and rivarian forest are the another source of biodiversity.

3.2. Fauna Characteristic

Some birds species found in the HCV area are listed in Table 3. There were 21 species of birds at the study site, 4 of which were protected by government regulation PP No.7 /1999. Based on the table, several protected bird species found in the study area were *Alcedo mininting*, *Pelargopsis capensis*, *Haliastur indus* and *Haliastur leucogaster*.

The species of water birds and shrubs are species of birds that have a large population. The types of birds as a whole give an overview of the habitats occupied, both in the form of natural vegetation and shrubs found in water/rivers/swamps and yard, open land and oil palm plantations. Based on the diversity index value ($H' = 2.82$), bird species diversity is in the medium category.

The bird species found in the location of oil palm plantations are mainly from seed eaters, fish eaters, animals and insect eaters. Some species of birds that are found as insectivorous include *Centropus bengalensis*, *Pycnonotus cafer*, *Hirundo tahitica*, *Caprimulgus afinis*, *Lanius sach* and *Ficedula dumetoria*. Oil palm plantations are indeed an ideal and conducive habitat for insectivorous birds. Seed-eating birds include *Passer montanus*, *Neiglyptes triptis*, *Gerygone sulphurca*, *Nectarinia jugularis* and *Pycnonotus goiavier*. Based on the results of several references and the results of field observations, oil palm plantations are generally dominated by insectivorous birds. and a few seed eaters that generally live in scrubs and community garden.

Nama Latin	H'	Conservation Status
<i>Dendrocygna javanica</i>	0,15	Not protected
<i>Pelargopsis capensis</i>	0,05	protected: PP 7/1999
<i>Alcedo mininting</i>	0,08	protected: PP 7/1999
<i>Gallinula chloropas</i>	0,11	Not protected
<i>Centropus bengalensis</i>	0,13	Not protected
<i>Ardeola speciosa</i>	0,20	Not protected
<i>Lanius shach</i>	0,11	Not protected
<i>Nectarinia jugularis</i>	0,11	Not protected
<i>Gerygone sulphurca</i>	0,08	Not protected
<i>Streptopelia chinensis</i>	0,20	Not protected
<i>Harliantus indus</i>	0,05	protected: PP 7/1999
<i>Haliartus leucogaster</i>	0,13	protected: PP 7/1999
<i>Pycnonotus goiavier</i>	0,20	Not protected
<i>Ixobrychus cinnamomeus</i>	0,13	Not protected
<i>Pycnonotus aurigaster</i>	0,23	Not protected
<i>Coturnik chinensis</i>	0,08	Not protected
<i>Lonchura mallaca</i>	0,11	Not protected
<i>Lonchura fuscans</i>	0,19	Not protected
<i>Treron olax</i>	0,08	Not protected
<i>Lonchura fuscans</i>	0,11	Not protected
<i>Phalacrocorax sp</i>	0,11	Not protected

Tabel 3. Bird species found around HCV area.

Fish-eating birds and other animals found at the study site include *Dendrocygna arcuata*, *Alcedo mininting*, *Harliantus indus*, *Haliartus leucogaster*, *Ixobrychus cinnamomeus*, *Ardeola speciosa*, *Phalacrocorax sp*. They live in areas of river borders, water places and open spaces in wetlands. The abundance of fish and prey animals are conducive habitat for these species of birds.

The species of mammals recorded at the time of field observations can be seen in Table 4. The species of mammals protected in the study area, namely *Nasalis larvatus* and *Lutra sp*. *N.larvatus* is an endemic primate found in Kalimantan. These species of mammals are very rarely found in the area of oil palm plantations, but more often found in the secondary/remnant forests in wetlands swamp. The population of these animals in the area of observation can not be determined yet, but it is suspected based on the results of interviews with residents of the relatively low. Overall the number of individuals from these mammals is relatively low.

Name	Conservation Status
<i>Sus barbatus</i>	Not protected
<i>Lutra sp.</i>	Protected: PP 7/1999
<i>Nasalis larvatus</i>	Protected: PP 7/1999
<i>Suku Pteropodidae</i>	Not protected
<i>Paradoxorus sp</i>	Not protected
<i>Rattus spp.</i>	Not protected
<i>Sundasciurus sp</i>	Not protected
<i>Macaca fascicularis</i>	Not protected

Table 4. List of mamals that founded in HCV and remnant forest.

The species of mammals included in the list of protected animals are animals that are relatively more sensitive to disturbance affecting their habitat and community. Hence the mammal population that can be found are very small. Based on the results obtained in Table 4 above, the number of mammals found was 8 species. Based on the number of species found diversity is relatively low. Otters (*Lutra sp.*) is mammal that is protected according to laws and regulations. It included in the red list of IUCN Appendix II categories.

The species of reptiles that are often found are *Varanus salvator*, *Bronchocela jubata*, *Bungarus fascies*, and *Eutropis multifasciata*. The species of reptiles are found in HVC described in Table 5.

Reptilia species	Conservation status
<i>Varanus salvator</i>	Protected PP 7/1999
<i>Eutropis multifasciata</i> .	Not protected
<i>Bronchocela jubata</i>	Not protected
<i>Phyton sp</i>	Not protected
<i>Bungarus fascies</i>	Not protected
<i>Acrochordus javanicus</i>	Not protected

Table 5. List of Reptilia species.

Based on table 5, *Varanus salvator* is classified as animals protected by law. The existence of reptiles as predators is very dependent on the life and population of animals underneath. Habitat damage that can reduce the population of prey animals will affect the existing reptile population. Management plans for the existence of terrestrial fauna must also consider the habitat and feed of these animals. The amphibians were found directly and interviewed in the form of brown frogs (*Rana erythrae*), green frogs (*Rana limnocharis*), and turtles (*Orilitia borneensis*) through interviews. There is one type of animal amphibia turtle (*Orilitia borneensis*) which is protected according to PP 7/1999.

The population of insects found in several research locations through direct observation of visualization are quite varied. Some of them are butterflies and ordo of Lepidoptera, subordo of Caelifera, ordo of Ordonata), ordo of Araneae, Apis cenara, subordo of Cyclorrapha, subordo of Nematocera, ordo of Coleoptera. This insect population dominates the area of oil palm plantations and must be controlled so as not to become a population of pests that explode both for oil palm plants and other cultivation plants around the plantation location. Maintaining the diversity of birds and the diversity of flora/vegetation, especially natural or artificial protected areas, is one of the control mechanisms to keep insect populations from becoming pests that will interfere with plantation activities. The combination of terrestrial surveys and interview techniques records more animals than using a trapping camera [9].

In relation to the importance of environmental management in and around plantation areas, some suggestions for environmental management especially flora and fauna of oil palm plantations are listed in Table 6.

Developing of HCV areas is an indication of the oof palm oil plantation companies that is relatively concerned about the existence of natural flora and fauna. However, socialization is still needed relating to the existence of flora and fauna within the plantation area. Making name plate of HCV, warning signs for hunting prohibited animals, discussion forums with the community need to be made. Establishment of the remaining natural M.cajuputi stands as HCV areas can only be done as part of the conservation of wetlands.

Implementation of the surjan system in the planting areas can maintain the stabilization of the swamp water level. Its impact on performing habitat for water birds and water mammals. Aquatic plants that are in a pool outside the mound of oil palm that is allowed to grow are a habitat for water birds and other fauna.

Planning activities	Component Activity	Location
Socialization	Hunting prohibited signs, prohibited cutting down trees	In area of palm oil plantation and HCV
	Socialization to community about flora and fauna	Village around the plantation area
Enrichment Planting outside of HCV	Planting wood trees and muti purpose trees species	Left and right of the main road or branch an open area bordering the river
		The area around the employee housing and office
HCV	Expansion of natural HCV	<i>M.cajuputi</i> remnant stands in area of palm oil plantation
	Enrichment planting in HCV or new area of conservation land	Open areas or remnant stands that allow planting of various types of plants

Tabel 6. Planing activities in management of flora and fauna.

HCV is at the center of the habitat of many animal species and populations. Various fauna groups use the HCV area as a place to find food. Maintaining and developing HCV is one of the important efforts towards fauna conservation. The existence of the HCV area provides considerable benefits as a habitat for flora and fauna that develop within the palm oil plantation area.

The tendency of existence of HCV is that the HCV areas are too small and are predicted to be less able to accommodate a variety of animals that live in and around the plantation area. Responding to the relatively small area of the existing HCVs requires the company to find new areas as HCV. The remnant forest of *M.cajuputi* pure stand can function as a water bird conservation area. Plant enrichment program must be done with various species of plants that can adapt to the swamp environment. Some empty areas such as the left and right of the road or others can be arranged as artificial habitat to increase the diversity of flora and fauna. Plant enrichment activities become very important to increase the distribution of conservation areas in oil palm plantations.

4. Conclusion

Environmental changes have occurred since the operation of oil palm plantations in swampy areas. Changes in vegetation conditions also have an impact on changes in fauna contained in the region. Changes in habitat environment will change the diversity of species both flora and fauna. The diversity of natural vegetation of trees and regeneration is still relatively low both in oil palm plantations or HCV areas. Phenomena of low diversity value are also found in mammals, insects, primates, reptiles and amphibians. Only the diversity of bird species is in the medium category. HCV areas and some plantations that are not yet planted are still conducive to water birds and fauna that occupy shrubs or shrubs.

The extent of HCV area found is relatively small and less able to accommodate a variety of animals that live in and around the plantation area. HCV development can be done by expanding HCV areas, plant enrichment. Some plantation areas that are covered with pure *M.cajuputi* stands can be confirmed as HCV areas.

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