Borneo Orangutan *Pongo pygmaeus pygmaeus* habitat sustainability and its challenges

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Abstracts. This study aims to evaluate the current condition of landscape sustainability and its challenges in Orangutan *Pongo pygmaeus pygmaeus* habitat in West Kalimantan, Indonesia. The results of such a study assist researchers, planners and policymakers to formulate direction of regional development policy with mainstream the concept of sustainability into development practice. For evaluating landscape sustainability, this study deployed assessment through sustainable landscape index that has six assessment indicators, which are expected to reflect economic, social and environmental sustainability. The indicators are land use benefit and regional economy as the representation of economic indicators, fairness of land utilization and poverty conditions as the representation of social indicators as well as environmental service protection and biodiversity conservation as the representation of environmental indicators. The study shows the sustainability in landscape level appears to be balanced among the six indicators of evaluation, but in further detail, it shows the unfair use of land utilization and gaps between sub-landscapes. There is high dominated land ownership by private groups in the landscape. The utilization gap is also found where in coastal and middle sub-landscapes are utilized more economic-oriented. Contrarily, the upstream is dominated by protection utilization. The paper recommends that government should be seriously considers the carrying capacity concept in land allocation and initiate payment for environmental services or other incentive mechanisms for upstream districts to conserve and protect the remaining forests.

Keywords: Land use, landscape sustainability, sustainable landscape index, West Kalimantan

1. Introduction

This paper is about the challenge to perform of wildlife endemic species landscape sustainability in Indonesia, particularly in West Kalimantan province. Orangutans are the iconic Indonesian species and the only great apes living in Asia. The species can be found only on Sumatra and Borneo islands, are protected by law and classified as Critically Endangered by the IUCN Red List of mammals and are listed on Appendix I of CITES [1]. As fruit eaters (frugivorous) and wide range territory, Orangutans play roles as an umbrella species in the tropical rainforest. The protection of this species create auto-
regeneration to protect the ecosystem [2], since the seeds come out along their feces can grow better than conventional planting by human [3].

The development of forest resources, which assists Indonesia to achieve economic development, has resulted in the loss and degradation of forests over the last 25 years, threatening the habitat of orangutans [4]. Forest conversion as orangutan’s habitat does not only have negative effects, as some changes are related to the positive increase of food and fiber yields for peoples’ health and wealth, job creations and economic growth [5-7]. This article asks: “How are the sustainability condition of the orangutan habitat landscape and sub-landscapes”. Moreover, it also aimed to formulate direction of regional development policy with mainstream the concept of sustainability into development in the landscape.

The principles of sustainable development imply that in developing land, ecological, social and economic functions are balanced in space and time to maintain their potential to deliver goods and services to future generations [8]. In the context of sustainable development, decisions on landscape change must take into account the three dimensions, i.e.: the eco-physical dimension, social dimension, and economic dimension, of the landscape concept, each of them representing a different way of looking at the function and pattern of landscapes [9]. Landscape approaches seek to provide tools and concepts for allocating and managing land to achieve social, economic, and environmental objectives in areas where agriculture, mining, and other productive land uses to compete with environmental and biodiversity goals [10]. In Indonesia, the strategic environmental assessment (SEA or Kajian Lingkungan Hidup Strategis/ KLHS) has applied to ensure sustainability conditions at the landscape level which mandated by Law Number 25 year 2004 on National Development Planning System.

2. Method

The case study was conducted in areas of orangutan subspecies Pongo pygmeus pygmeus’ habitat in West Kalimantan, Indonesia, lies between north of the Kapuas River up to Sarawak and the east bounded by Schwaner Mountains [11]. The total area of the habitat is approximately 61,674 square kilometers with lowland landscapes traversed by the flow path of large and small rivers. This location was chosen as case study for (i) the largest orangutan habitat converted to development purposes in Indonesia; (ii) as an important catchment area of Kapuas River system with approximately 3 million people depend their livelihood on this river system; (iii) as a part of Hearth of Borneo which identified as important forest area for the island. This habitat precisely traversed by the Equator with a tropical climate, high temperature and high humidity.

This study observed sustainability in landscape and sub-landscape levels. We categorized sub-landscape level to coastal (i.e.: City of Pontianak, City of Singkawang, Mempawah, Sambas and Bengkayang), upstream (Kapuas Hulu), and middle sub landscape (i.e.: Landak, Sanggau, Sekadau and Sintang). For evaluating landscape sustainability, this study deployed assessment through sustainable landscape index that has six assessment indicators, which are expected to reflect economic, social and environmental sustainability. The indicators are land use benefit and regional economy as the representation of economic indicators, fairness of land utilization and poverty conditions as the representation of social indicators as well as environmental service protection and biodiversity conservation as the representation of environmental indicators. Land use vulnerability to orangutan sustainability (which assess the orangutan vulnerability value) was used for analyzing the biodiversity protection in this study. To assessed each indicator, we deployed: (i) regional economic indicator: regional economic growth less than 90 % of national economic growth rated by 1, regional economic growth 90–94 % of national economic growth rated by 2, regional economic growth more than 95 % of national economic growth rated by 3; (ii) land use benefit indicator: net present value (NPV)/year less than 4.99 million IDR/year rated by 1, NPV/year between 5-9.99 million IDR/year rated by 2, NPV/year more than 10 million IDR/year rated by 3; (iii) fairness of land utilization: land ownership dominated by corporations (> 50 %) rated by 1, land ownership dominated by corporation 30–49 % rated by 2, land ownership dominated by corporation less than 30 % rated by 3; (iv) poverty condition indicator: percentage of poor community less than 10 % rated by 1, percentage of poor community between
7.5–10 % rated by 2, percentage of poor community more than 7.5 % rated by 3; (v) environmental services protection indicator: forest area more than 35 % of area rated by 1, forest area between 35–45 % of area rated by 2, and forest area more than 45 % rated by 3; (vi) biodiversity protection indicator: orangutan vulnerability value less than 40 rated by 1, orangutan vulnerability value 41–60 rated by 2, and orangutan vulnerability value more than 60 rated by 3. In addition, for calculating the NPV/year, we used 7 % per year discount rate. The value of the six indicators in sustainable landscape index is presented in to radar graph. Meanwhile, a set of questionnaire was distributed to orangutan experts on vulnerability assessments of land use on orangutan conservation from March to April 2016. Ratings given by experts were including vulnerability to trigging forest fire, potential as a trigger of fragmented the existing habitat, availability of food and nest trees for orangutan, the potential location for poaching, the potential for use as a corridor or crossing, and the potential for increased human and orangutan conflict.

3. Results and discussion

3.1. Landscape and sub-landscape condition

The land use spatial distribution map in the observed landscape is presented in figure 1. Forests were the largest land use with 35 % of area, but most of the existing forest could not generate direct economic benefits. The forests were utilized as conservation area, protected forests and production forests with no active permit. The timber plantation covered 5 % of the landscape that was partly in the middle sub-landscape. Both natural forests and plantations were categorized as low economic gain. Others that also categorized as low economic gain were bushes and swamps (in total 6 % of the landscape). Palm oil plantations were highest economic benefits in the observed landscape and occupied 15 % of the landscape. In the future, it is estimated palm oil plantation will increase further, because lot of areas have been controlled by them and have not been developed yet. Some land use, such as: dry-land farming, rice fields, and settlements, were categorized as medium economic gain which occupied 39 % of the landscape. In sub-landscape level, we found the upstream were dominated by forests, bushes and swamps, which reach 84 %. Meanwhile, mixed garden dominate in the middle (46 %) and in coastal (43 %). Palm oil plantations reached 24 % in middle and 15 % in coastal sub-landscapes.

Economic growth condition during 2009–2012 in the observed landscape showed relatively in the same level of growth. Most districts experienced average economic growth of more than 5 %, although this average was still below the national average. The detailed data of economic growth can be seen in table 1. Only two districts with average growth rate below 5 %, namely: District of Pontianak (2.86 %) and District of Kapuas Hulu (4.58 %). In middle sub-landscape, the economic growth tended to be evenly distributed, while in the coastal sub-landscape there was a gap, mainly due to the low average economic growth in the District of Pontianak.

The land utilization ownership in the observed landscape dominated with corporation ownership (47 %), while public or state ownership only occupied 35 % and individual ownership occupied 18 %. The domination of corporation ownership was conquered by palm oil plantation companies. The spatial distribution of land ownership in the observed landscape can be seen in figure 2. If we observed at sub-landscape level in table 2, the gap at the sub-landscape level appeared more severe. In coastal and middle sub-landscapes, the corporation ownership reached 49 % in coastal and 64 % in middle. On the contrary, public/state ownership dominated upstream sub-landscape, reaching 72 %, where there were two national parks (Betung Kerihun National Park and Danau Sentarum National Park) and some protected forest areas. It seems the function of upstream sub-landscape was more for conservation purpose, since middle and downstream landscape were more for development purpose.

The gap of poverty was shown among the sub-landscapes, although the percentage of poor people was only 7.99 % of population at the landscape level. The complete data on poverty in the observed landscape can be seen in table 1. The poverty in upstream sub-landscape was most for conservation purpose, since middle and downstream landscape were more for development purpose.

The gap of poverty was shown among the sub-landscapes, although the percentage of poor people was only 7.99 % of population at the landscape level. The complete data on poverty in the observed landscape can be seen in table 1. The poverty in upstream sub-landscape was worst. District of Sambas was the only districts in coastal sub-landscape with the higher percentage of poor people (9.58 %)
compare to the national poverty reduction target (7.5%). The other two districts with higher percentage of poor people compare to the national target were District of Landak (13.77 %) in the middle and District of Kapuas Hulu (10.47 %) in the upstream sub-landscape.

The environmental services protection was affected by the forest cover condition. In the observed landscape, the remaining forest cover still reaches more than 40 % of the area. However, if we observed further at the sub-landscape level, it appeared most existing forest covers were located and dominated in the upstream sub-landscapes (reaching 78 % of total sub-landscape area). While, in coastal and middle sub-landscapes, the existing forest covers were less than 25 % of the total area (24 % in middle sub-landscape and 21 % in coastal sub-landscape). The remaining forest distribution in the observed landscape can be seen in figure 3.

Based on the analysis at the landscape level, it showed 35 % of the areas have high vulnerability to orangutan sustainability, 3 % medium, 36 % low to medium and 26 % were low. If we observed further

![Figure 1. Land use spatial distribution map in the observed landscape.](image)

| Category     | District          | Economic Growth (%) | Poverty Condition (%) |
|--------------|-------------------|---------------------|-----------------------|
|              |                   | 2009  | 2010  | 2011  | 2012  | Ave. | Index | 2009  | 2010  | 2011  | 2012  | Ave. | Index |
| Coastal      | Sanbas            | 5.43  | 5.88  | 5.75  | 5.88  | 5.74  | 3     | 9.96  | 10.08 | 9.38  | 8.88  | 9.38  | 2     |
|              | Bengkayang        | 4.50  | 4.63  | 5.65  | 5.74  | 5.13  | 1     | 7.82  | 7.82  | 7.25  | 6.74  | 7.41  | 3     |
|              | Pontianak         | 1.40  | 2.10  | 4.78  | 3.17  | 2.86  | 1     | 5.46  | 6.41  | 5.97  | 5.64  | 5.87  | 3     |
|              | Pontianak City    | 4.93  | 5.39  | 5.88  | 6.07  | 5.57  | 2     | 6.38  | 6.62  | 6.15  | 5.77  | 6.23  | 3     |
|              | City of Singkawang| 4.88  | 5.54  | 6.46  | 6.16  | 5.76  | 3     | 6.2   | 6.12  | 5.69  | 5.32  | 5.83  | 3     |
| Middle       | Landak            | 4.67  | 5.01  | 6.99  | 6.01  | 5.67  | 3     | 15.48 | 14.06 | 13.13 | 12.41 | 13.77 | 1     |
|              | Sanggau           | 5.59  | 4.15  | 4.61  | 5.92  | 5.07  | 1     | 4.62  | 5.02  | 4.67  | 4.4  | 4.68  | 3     |
|              | Sintang           | 5.38  | 5.21  | 5.49  | 5.78  | 5.47  | 2     | 11.55 | 9.76  | 9.07  | 8.55  | 9.73  | 2     |
|              | Sekadau           | 5.35  | 4.54  | 6.05  | 5.95  | 5.47  | 2     | 6.42  | 6.77  | 6.3   | 5.93  | 6.36  | 3     |
| Upstream     | Kapuas Hulu       | 3.70  | 4.44  | 4.56  | 5.60  | 4.58  | 1     | 9.93  | 11.39 | 10.61 | 9.95  | 10.47 | 1     |
| National     | Landscape         | 4.50  | 6.10  | 6.40  | 6.20  | 5.80  | 2     | 2     | 2     | 2     | 2     | 2     | 2     |

Table 1. Districts economic growth and poverty condition in observed landscape.
Figure 2. Land ownership spatial distribution map in the observed landscape.

Table 2. Land ownership in sub-landscape level in observed landscape.

| Land Ownership         | Coastal | Middle | Upstream |
|------------------------|---------|--------|----------|
| Individual ownership   | 19 %    | 24 %   | 7 %      |
| Corporation ownership  | 49 %    | 64 %   | 21 %     |
| Public/ state ownership| 31 %    | 12 %   | 72 %     |

Figure 3. Remaining forest distribution map in the observed landscape.
at the sub-landscape level, there were gaps among the upstream, middle and coastal sub-landscape, where the coastal and middle were dominated by medium to high and high vulnerability conditions, while upstream were dominated by low vulnerability. The distribution of vulnerability conditions to orangutan sustainability in the observed landscape can be seen in figure 4.

The landscape sustainability is presented in a radar graph, which placed the value of the six indicators on each axis, as shown in figure 5 and figure 6. In landscape level, the sustainability is seen balance among the six indicators, except the fairness of land utilization. The fairness of land utilization is out of sustainability range due to domination ownership by corporations. In the coastal sub-landscape, the poverty condition shows very good where the poor is less than sustainable development goals target. Meanwhile, some districts have higher economic growth compare to the national growth and the region economic condition became better, although the land use benefit is not good. This situation caused of the economy drives by the urban and coastal resource sectors, and not just relies on the land based sector. The fairness of land utilization and environmental services protection conditions in this sub-landscape
are poor, since the remaining forest is limited and corporation land ownership is highly dominant. The landscape sustainability in middle sub-landscape looks quite similar with coastal landscape. The different is only on land use benefit situation which higher than coastal sub-landscape, because this sub-landscape is the main area of palm oil plantation. The sustainability of the upstream sub-landscape is different with the other sub-landscapes in the downstream. The fairness of land utilization is quite good, since most of the area is national parks and protected forest which manage for the public interest. The huge remaining forests left indicate biodiversity protection and environmental services are good. The land use benefit is quite good, but the poverty and regional economy conditions in this sub-sub-landscape are quite poor. Poverty and economic gap are feared to become trigger for the remaining forest extraction.

3.2. Input for realizing landscape sustainability

Based on landscape and sub-landscape condition, we found the better sustainability conditions at the landscape level will not be guarantee of similar condition at the sub-landscape level, and vice versa. The implementation of the strategic environmental assessment (SEA or KLHS) is expected to be effective instrument in realizing spatial sustainable development [12], but based on this research finding, KLHS could not ensure the sustainability. We propose additional instruments, such as the landscape sustainability index utilized in this study, as a complement to the KLHS implementation which mandated by Law Number 25 year 2004 on National Development Planning System as well as recommended by several studies [13-15].

The imbalanced ownership of spatial utilization and sub-landscape utilization gaps were two major findings found in the observed landscape that needs to be taken into account of the future landscape management. The imbalanced ownership of spatial use is characterized by high dominating of land ownership by private sectors. The control gaps of natural resource have led various violent conflicts in the world. The resulting conflicts often lead to chaotic and wasteful deployment of human capacities and the depletion of the very natural resources on which livelihoods, economies, and societies are based. They may also lead to bloodshed [16-18].

The gap between the upstream sub-landscape with the middle and coastal sub-landscape should be taken seriously by government. The coastal and middle sub-landscapes were utilized more economic oriented. Contrarily, the upstream was dominated by protection utilization. The desire of upstream district government to regional expansion will be a challenge to sustainability, because the upstream government has limited development areas and will drive demand to change forest areas into development areas. To anticipate this situation, government should be seriously consider the carrying capacity concept in land allocation and initiate payment for environmental services or other incentive mechanisms for upstream districts to conserve and protect the remaining forests.

The current condition of the observed landscape demonstrated the difficulty of realizing the development of a green economy that stimulates the improvement of human life and social equality. The stimulation is expected to reduce environmental degradation and ecological scarcity, which ordered by the United Nations Conference on Sustainable Development (2013). We suggested the future development strategy should enhance the economic productivity of the existing land without degrading its natural capital. Increased productivity in dominating lands is expected to suppress palm oil expansion and increase the drivers of sustainable land management [19].

4. Conclusion

The study shows several outcomes: (i) Better sustainability conditions at the landscape level will not be guarantee of similar condition at the sub-landscape level, and vice versa; (ii) The imbalanced ownership of spatial use and sub-landscape utilization gaps were two major findings found in the observed landscape that needs to be taken into account of the future landscape management; (iii) The gap between the upstream sub-landscape with the middle and coastal sub-landscape should be taken seriously by government. The coastal and middle sub-landscapes were utilized more economic oriented. Contrarily,
the upstream was dominated by protection utilization; (iv) The current condition of the observe landscape demonstrated the difficulty of realizing the development of a green economy that stimulates the improvement of human life and social equality.

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