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Regeneration Options for Peat Forest

Case Study in Merang Kepayang, South Sumatra, Indonesia

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by

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Summary

As part of the peatlands ecosystems, Tropical Peat Swamp Forest (TPSF) covers 30 to 40 million ha worldwide, where Southeast Asia contains about 70% of the total area of this forests. From that amount, Indonesia is considered as one of the tropical countries which have the largest peat swamp forest areas. Peat swamp forests in Indonesia are particularly extensive in parts of Sumatra, Kalimantan and Papua. TPSF forms one of the most efficient carbon-sequestering ecosystems and important carbon stores, which contribute in regulating the global climate.

Today, all over the world TPSFs are degrading. In Indonesia, it is predicted that up to 70% of the TPSF has been significantly affected by logging, deforestation, drainage, fires and environmentally damaging agricultural practices. Furthermore, the remaining natural TPSFs are under severe threat of conversion and degradation. This not only causes a reduction in biodiversity and direct benefit for people, but it creates also a potential to generate further problems, due to the important ecological roles of the TPSFs. The protection and wise use of TPSFs would have to be a global priority.

This study mainly focuses on the understanding of the nature of peat formation, what are the main threats to peatland forests (including human negative practices and natural processes on the peatland forests) and how are their impacts on the peat formation. The research took the study case in Merang Kepayang Peat Swamp Forest (MKPSF) area, which is considered as the last remaining natural peat swamp forest in South Sumatra, located within the river systems of Merang and Kepayang (01°45’ – 02°03’ South and 103°51’ – 104°17’ East). Administratively, this area belongs to the Bayung Lencir Sub-district of Musi Banyuasin (MUBA) Regency, South Sumatra Province, Indonesia.

MKPSF is identified as one large system of peat swamp forest in the northwest of South Sumatra Province, adjacent to the border of the Jambi Province. It still consists of a large area of mixed natural primary and disturbed secondary peat swamp forest. The peat swamp forest in MKPSF is considered as an extension of the large system of peat swamp forest laying from Berbak National Park in Jambi Province to the Sembilang National Park in South Sumatra. This system has also been identified as an important buffer zone for both national parks, while the existence of peat swamp forest in this area is the main fresh water resource of rivers that flow through the parks.

The root problem in the MKPSF area started with the disturbing events to the natural state of the former MKPSF: the logging activities, both legal and illegal, which triggered the high speed of the deforestation rate in this area. Due to the legal status of the area as a production forest, since 1970 there were some timber companies operating within this area. Logging activities created disturbance to the natural ecosystem, caused problems for local settlers whose life depends heavily on the natural forest resources production and services. At the end of the concession rights in 2000, when the enterprises stopped their activities, there were some groups of people, which are outsiders, coming to the area for taking benefit of the remaining forests. They do logging illegally.

Both legal and illegal loggers constructed and used canals for years as media in transporting the logs from the peat forest to the river system. According to one of the important ecological functions of the peat ecosystem as fresh water resource and reservoir (catchment), these canals drain the peat swamp forest ecosystem quickly in wet periods or in the raining season. This causes a higher rate of natural surface run off

(higher discharge) in the surface water flow mechanism of intact peat swamp forest. In dry periods or the dry season, the existence of the drainage flow through the canals lowers the groundwater table in the peat layer. As consequences, it causes an oxidation process of fossil peat, releases of carbon to the atmosphere, generates the compaction process and contributes to the process of peat soil subsidence.

Field observations and study of literature show that there are interrelationships among those processes mentioned above. Due to the physical properties of peat, over draining makes the peat shrinks and causes changes in the peat physical formation. This degrading process creates changes in the peat thickness and in the long term it also changes the peat distribution.

The thesis provides information related to the location of the study site. Other severe impact is that over drained peat will loss its structure and permeability. Once it is drained, its ability in holding the water will subsequently decrease. As a result, this condition makes the remaining peat layer surface dry and prone to peatland forest fire, especially during the dry period.

Based on historical facts, MKPSF has experienced repeated fire events. The most severe impacts were when the prolonged dry periods occurred at the extreme event of El Nino in 1997. There are many studies and reports related to this disaster and how terrible its impacts were. Furthermore, this area also experienced repeated fires in 2002 and 2006. These disasters do need serious attention, because of the huge effects and damages generated by them. Unfortunately, this trans-national problem tends to be not so easy to be solved, due to the characteristics of the fire propagation in the subsurface peat layer. During past decades, this problem became a global issue, which can be repeated at any time in the future.

Considering hydrology as amongst the most important factors in the formation and functioning of the peat swamp forest ecosystems, this research introduces and analysis the *blocking of canals* concept as part of the technical solution to conserve and regenerate the nature of the hydrological system within this degraded peat swamp forest ecosystem. This method is based on a technical analysis of the water balance at the field level in the sampling area of the study site, and also on the groundwater flow characteristics of peat soils. This research technically assesses this hydrological approach using the BALANCE computer program, DUFLOW hydrological modelling, and MODFLOW simulation system for groundwater flow analysis.

The result of analysis shows that by using DUFLOW hydrological modelling, blocking canal concept has been proven to be effective in raising the level of the water layer in the sampling canal. From 3 scenarios prepared to be run with the DUFLOW program, the scenario no.3 of regeneration option using blocking canal method could raising the level of water in the sample canal up to 20 cm from the soil surface, without causing flood. In this simulation time is set to be in the dry season that is the period when the risk of fire occurrence is relatively high. In order to fulfil 1 section of the canal, the flow in the canal needs 3 days starting from the condition when the canal is already blocked.

Further computation by using MODFLOW simulation system for groundwater flow analysis gives the significant results regarding the relationship between the raising of the water level in the canal to the raising of the groundwater head level in the surrounding peat soils layers. The computational results of the model demonstrate that there is an

agreement between those 2 variables. In other word, the raising of the water layer in the canal will cause the raising also to the groundwater head level in the peat soil layer. This means that the proposed blocking canal method is hydraulically applicable in the context of our scenario and it is therefore it could be applied in our effort to raising the level of the groundwater layer in the surrounding peat soil in the study area, especially during the dry period, so that we will have the peat soil layers in the study area is in the wet condition, meaning that we can minimise the risk of the peat forest fire.

Additionally, in the simulation of the velocity the MODFLOW also informs about the role of the recharge to the system. It is demonstrated through the maps consisting of the groundwater contour head levels that when the recharge is there (input to the data), the velocity of the water flow from the peat layers into the canal. However, in the condition when there is no recharge, the flow will be reverse from the canal to the peat soil layer.

However, due to the complexity of the real root of problems in this area, the research also describes and elaborates other key steps and practices that need to be taken as part of the supporting system in determining the success of regenerating Merang Kepayang Peat Swamp Forest ecosystem. This approach includes biological aspects, socio-economic aspects, and also an analysis of the policy outputs that need to be taken into account. They are all interconnected and need to be integrated in order to achieve the main objectives of the study successfully. Moreover, the key factor is not only the integration, but the solution also needs to be based on the involvement of the local people.

To make sure that the solution will be sustainable in the long term, there needs to be a proportion for local communities to perform as one of the key stakeholders. Unfortunately, based on the facts, the study found that one of the main problems in the study area is the problem of economy: local people are very poor. They only have very limited access to education and health services. Furthermore, they almost have nothing as economic resource, unless the existence of the natural resource as the environment where they live.

In order to address this real problem, in this study I also initiated some schemes as part of the solution, which are generated from the same approach. It is realised that the blocking of canals can give some positive implications to the ecosystem, from where the local people can take benefits. They can use the blocked canals for fisheries. A good and protected peat swamp forest ecosystem will also give them opportunities to do farming with some tree species. It is also possible to do some agriculture practice on the thin peat soil, with certain species of plants and using some technical support and water management. Additionally, with some skills and methods, they can take benefit of the existence of natural peat forest by producing some non-timber peat forest products (such as honey, handicrafts, traditional foods, etc.).

The main objective of those schemes is to provide some environmentally sound livelihoods for the local people, so that they can make money without having to harm the environment. This plan may need long time run and also needs some support to achieve success in the implementation. However, at least this study brings the idea how to overcome the real problems in the local context in relation to their importance of existence at the global level. By implementing such an integrated management planning, it is hoped that the study will contribute in the effort to answer the real concern of the problems with the implementation of what it is called as “think globally, do locally”.