Mitigation of peatland fires and haze disaster through livelihood revitalization: a case study in Pelalawan Riau

Ernoiz Antriyanadarti, Joko Sutrisno, Endang Siti Rahayu, Nuning Setyowati, Istri Khomah, Eksa Rusdiyana
Faculty of Agriculture, Universitas Sebelas Maret, Jl. Ir. Sutami 36 A, Kentingan, Surakarta, Indonesia

Email : ernoiz_a@staff.uns.ac.id

Abstract. Mitigation of peatland fires and haze Disaster is done by restoration, namely rewetting, revegetation and revitalization of community livelihood. This study is conducted in Riau province which has the largest Peatland Hydrological Unit (PHU) area in Indonesia, with case studies in Pelalawan district. This study aims to develop the alternative livelihood to support peatland restoration through rewetting program by applying action research. We also examine the community participation of this livelihood revitalization program. The Merbau and Krumutan district are selected to represent of mainland malay and coastal malay community respectively. We stimulate the community to diversify economic activities by developing potential local processed food industry such as cassava, pineapple, and peatland fish. The results show that the participation of mainland Malay community is met at point 3.3, higher than that of coastal Malay community at 3.2. It is indicated that community participation and involvement of mainland Malay community in empowerment activities are highly rated and open for new activities (consultative), while in coastal Malay community is still growing. We need to encourage them toward consultative participation through modification of individualistic and instructive participation. It is highly possible that mitigation of peatland fires and haze disaster can be attempted through livelihood revitalization by strengthening empowerment, participation and market certainty.

1. Introduction
The agricultural sector still holds an important and strategic role in the national economy of Indonesia, with a contribution of 14.33% of GDP. In other words, the agricultural sector is still the main source of food for Indonesian people. Export performances of Indonesian agricultural commodities are dominated by plantation commodities, namely palm oil, cocoa, and coffee (see Figure 1). Indonesia is the largest producer palm oil in the world amount of 32 million tons production. The majority of Indonesia's palm oil production is exported to China, India, Malaysia, Singapore and the Netherlands (FAO of the UN, 2016). The dominance of this palm oil commodity has both positive and negative impacts. The positive impact is to boost economic growth and increase in income. The negative impact is resulting in deforestation and peatland fires due to the majority of oil palm grows on peatlands.

Peatland is a wetland ecosystem formed by the accumulation of organic material on the forest floor from the rubble of above vegetation for a long time (Najiyati, et al., 2005). The high profitability of the palm oil business resulted in exploited peatlands being planted with oil palm. Planting oil palm on peatlands causes drainage and fires which have led to massive increases in net emissions of greenhouse gases (GHG) from peatlands, which are now a significant contribution to global
anthropogenic emissions. In addition, peatland drainage leads to increased CO2 emissions in general and a rise of N2O release in nutrient rich peatlands. Because of the large emissions from degraded peatlands, rewetting and restoring them is one of the most cost-effective ways of avoiding anthropogenic greenhouse gas emissions (Parish, et. al., 2008). Furthermore, World Bank (2017) reported that estimated losses and damages from peatland fires and haze in Indonesia is amounted to USD 16,264 million.

![Figure 1. Export of Main Commodities (source: Food and Agriculture Organization of the United Nations, 2016)](image)

Peatland fires and haze disaster creates ecological problems that if not addressed will result in many victims and damage. Therefore, peatland restoration efforts are needed to restore the function of peatlands as a support for ecosystems, climate guards and livelihoods for surrounding communities. Mitigation of peatland fires and haze Disaster is done by restoration, namely rewetting, revegetation and revitalization of community livelihood. Since peatlands play a central role in the livelihoods of local communities, this study focus on revitalization of community livelihood. Peatland degradation has led to the loss of people's livelihoods and encourages communities to exploit peatlands by ignoring its threat.

Livelihood revitalization should be based on the potential and socio-economic conditions of the community. Then, community empowerment is carried out by implementing a community income-generating strategy. Thus, welfare will increase and reduce excessive peatland exploitation by the community. As Rahman and Begum (2010) stated that adoption of livelihood activities created self-employment opportunities of users for alternative means of earnings that reduced dependency on peatland to let the resources reestablish.

According to Ministry of Environment and Forestry (2016), Riau Province has largest peatland and forest fire, accounting to 1,928.26 ha. Therefore, this province is selected for our study area. The existing peatland ecosystem in Riau is a potential for fire. Peatlands are converted into plantation areas, with dry conditions. The nature of peatlands if burned is difficult to extinguish due to the depth of peat in the underground that can reach 10 meters. The structure of the peat ecosystem is actually understood by the Riau provincial government, but the fire is still repeated. Riau Province government capability is highly demanded in controlling forest and land fires (Meiwanda, 2016). The biophysical characteristics of peatlands change in horizon profile, thickness, decomposition rate, moisture content, ash content, pH, C-organic, and biomass due to land clearing activity. Groundwater management on peatlands prevents extreme changes in the biophysical characteristics of peatlands in oil palm
planted. It can prevent the occurrence of environmental degradation and able to maintain peatland productivity (Suwondo, et al., 2010). This study aims to develop the alternative livelihood to support peatland restoration through rewetting program by applying action research. We also examine the community participation of this livelihood revitalization program.

2. Experimental Methods
This study is conducted in Riau province which has the largest Peatland Hydrological Unit (PHU) area in Indonesia, with case studies in Pelalawan district. Pelalawan is one of the districts in Kampar Peninsula Riau with high utilization of land resources for agriculture, plantation, and timber plantation (HTI), thus, it is vulnerable to forest fire and haze disaster in the dry season (Sayendri, 2016).

This research activity is an action research conducted in the Krumutan sub-district as a representation of coastal Malay community and Bunut sub-district as representation of mainland Malay community. This study involves all elements of community to actively participate in the livelihood revitalization by using Participatory Rural Appraisal (PRA) method. PRA is a method that community as subjects, planners, implementers, as well as assessors in the empowerment program. Activity carried out after getting information about the problem, needs and potential in the village. Participation means community is involved in a bottom-up approach that require capability of good communication and transferred technology in any situation (Cavestro, 2003). Participation in this study refers to three definitions. First, participation is defined as a community movement to involve in the decision-making process, execute and enjoy the benefit of activities as well as evaluate it (Uphoff, 1988). Second, participation is considered as a process whereby various actors can influence and divide authority in determining development initiatives, as well as the allocation of various resources that have an effect on their lives (World Bank, 2004). Third, participation is interpreted as a process of growing awareness of interconnection among different stakeholders in the community, between social groups and communities with policy makers and other service agencies. Participation can be interpreted as "the act of taking part or sharing in something". Two words close to the concept of "participation" are "engagement" and "involvement" (Syahyuti, 2005). By using participation spectrum analysis, the three definitions are considered to assess participation of the community in the mitigation of peatland fires and haze disaster mitigation through livelihood revitalization.

3. Result and Discussion
3.1. Livelihood in Pelalawan and Community Empowerment
The agriculture sector is the major source of occupation for Pelalawan people (55.32%) which is dominated by palm oil and rubber commodity (Pelalawan in Figure, 2017). Other main commodities are fish (freshwater and peatland river) and swallow. There are two groups of Pelalawan people, namely mainland Malay and coastal Malay communities. Both communities are depending on oil palm and rubber plantation which is that commodity causing degraded peatland. Mizuno (2013) emphasizes that although people have inherited good use practices that intensively relied on peatland, large-scale timber plantations, logging, deforestation and oil palm cultivation, have changed them and made them vulnerable to fire. As a result, land has suffered severe degradation, and finally become barren or abandoned. Therefore, we conducted the community empowerment focusing on 4 activities, namely assisting farmer group to manage peatland, strengthening village institution, diversification of economic activities, and strengthening participation of the community. However, during the empowerment process, economic goals and environmental goals may conflict with achieving equity goals (Beukering, et.al., 2008).

In Bunut sub-district which is the area of mainland Malay people, we assisted the farmer empowerment through planting more suitable commodities that support rewetting of peatland such as pineapple, cassava, coconut and sago. In order to support the post-harvest of pilot commodities, we trained the community to produce spicy (in Sumatra called ‘balado’) cassava chips and processed...
pineapple (Figure 2 and Figure 3). Balado cassava chips become the choice of products introduced by the research team due to the community have not produced balado cassava chips, whereas it is a typical Riau cassava chips that have added value and high selling value. After the training, people that dominated by women can diversify their economic activities.

![Figure 2. Diversification of economic activities through processing of spicy cassava chips](image)

![Figure 3. Diversification of economic activities through processing of pineapple](image)

![Figure 4. Diversification of economic activities through processing of tuakang fish](image)

While in the Krumutan sub-district -where coastal Malay people live in-, community empowerment focus on peatland river fish commodity, water hyacinth and institutional fisherman group. One of the economic diversification based on tuakang fish which is the famous peat river fish. Diversification of processed tuakang fish is done by providing training on the production of tuakang fish stick and crackers. Training participants are members of fishermen and science technology groups who are generally housewives.

Water hyacinth is one of the plants that become obstacles for fishermen when looking for fish in the peat river. Especially during the rainy season, water hyacinth grows more and more to cover the river body. Fishermen have to get rid of water hyacinths that block the way the boat in the river. Therefore, this study conducted the action research how to overcome the amount of waste water hyacinth by transferring knowledge the potential of water hyacinth and how to make various handicrafts that have value of sale and high added value. The community got new knowledge and solution to solve the water hyacinth waste through the utilization of water hyacinth into handicraft. Some people already have the skills in weaving.

After the empowerment activities and assistance, they have new productive economic activities. The dependency to the oil palm and rubber can be reduced. In addition, during the period post program of livelihood revitalization, it has been no fires and haze disaster in the study area. The community empowerment should be followed by market demand of diversification product. The certainty of
market becomes the guarantee for community to revitalize livelihood. The high economic interest of palm oil and rubber companies is the main constraint for sustainability of diversified economic activities.

3.2. Participation Analysis

3.2.1. Mainland Malay Community. Good participation from the community becomes the main capital of sustainability of peatland community empowerment to revitalize livelihood. Community participation is met at point 3.3. It is indicated that community participation and involvement in empowerment activities are highly rated and open for new activities (consultative).

3.2.2. Coastal Malay Community. Community participation meets at point 3.2, it means the level of participation and community involvement in activities is growing. In addition, we need to encourage them toward consultative participation through modification of individualistic and instructive participation.

4. Conclusion

It is highly possible that mitigation of peatland fires and haze disaster through livelihood alternatives by strengthening empowerment, participation and market certainty. Thus, social and economic conditions of peatland community can be developed further without peatland exploitation.

5. References

[1] A reference BPS (Central Bureau of Statistics). 2017. Pelalawan in Figure 2017. Pelalawan.
[2] Beukering, P.V., Schaafsma, M., Davies, O., Oskolokaite, I. 2008. The economic value of peatland resources within the Central Kalimantan Peatland Project in Indonesia: Perceptions of local communities. Report E-08/05. Wetlands International and the University Palangkaraya
[3] Food and Agriculture Organization of the United Nations. 2016. http://faostat3.fao.org/download/FB/FBS/E, 2016/ 02/24.
[4] Naijyati, S., Agus A., dan I Nyoman N. S. 2005. Pemberdayaan Masyarakat di Lahan Gambut (Community Empowerment in Peatland). Programme dan Wildlife Habitat Canada. Bogor.
[5] Meiwanda, G. 2016. Kapabilitas Pemerintah Daerah Provinsi Riau: Hambatan dan Tantangan Pengendalian Kebakaran Hutan dan Lahan (Capability of Riau Government: Constraint and Challenge of Forest and Land Fires Prevention). Jurnal Ilmu Sosial dan Ilmu Politik, March 2016, Vol.19(3): 251-263.
[6] Ministry of Environment and Forestry. 2016. http://sipongi.menlhk.go.id. 2016/12/21
[7] Suwondo., Supiandi S., Sumardjo., dan Bambang P. 2010. Analisis Lingkungan Biofisik Lahan Gambut pada Perkebunan Kelapa Sawit (Analysis of Peatland Biophysical Environment on Oil Palm Plantation). Jurnal Hidrolitan, 2010, Vol. 1(2): 20-28.
[8] Mizuno, K. 2013. Toward forest-based management of the peat lands in Riau, Indonesia. The Newsletter. Winter 2013(66): 34.
[9] Parish, F., Sirin, A., Charman, D., Joosten, H., Minayeva, T., Silvius, M. and Stringer, L. (Eds.) 2008. Assessment on Peatlands, Biodiversity and Climate Change: Main Report. Global Environment Centre, Kuala Lumpur and Wetlands International, Wageningen.
[10] Rahman, MM. and Begum, A. 2010. The Strategy of Empowering Poor for Wetland Resources Conservation in Bangladesh. J Hum Ecol, 2010, 31(2): 87-92.
[11] Sayendri, D. 2016. Partisipasi Masyarakat Peduli Api dalam Penanggulangan Kebakaran Hutan dan Lahan (Studi Kasus di Kecamatan Bunut Kabupaten 133 Pelalawan Tahun 2010-2013 (Participation of Community Care Fire on Forest and Land Fires Prevention: A Case Study in Bunut Sub-district Year 2010-2013). Jom FISIP. Februari 2016, Vol. 3 (3).
[12] Syahyuti. 2005. Pembangunan Pertanian dengan Pendekatan Komunitas: Kasus Rancangan
Program Primatani (Agricultural Development through Community Approach: Case Primatani Program Plan). *Forum Penelitian Agro Ekonomi*, Vol 23(2): 102-115.

[13] Uphoff, N., 1988. “Menyesuaikan Proyek pada Manusia” dalam Mengutamakan Manusia di dalam Pembangunan (Project Adaptation of Human to Put Priority on Development), ed, Michael M. Cernea. Publikasi Bank Dunia. Jakarta: UI

[14] World Bank. 2004. *Strategic Framework for Assistance to Africa*. TheWorld Bank. Washington.

[15] World Bank. 2017. World Bank Report. http://documents.worldbank.org/curated/en/380421495161199210/pdf/SG-PRW-PID-CP-P162960-05-18-2017-1495161187260.pdf. [Accessed 2018/5/30].