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Local Wisdom as a peatland management strategy of land fire mitigation in Meranti regency, Indonesia

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ABSTRACT

Damage to peatlands in Riau Province was one of the main cause of great fires in 2014–2015. Top-down peatland management without involving the local community was considered as one of the factors exacerbating the fires. This research aims to explain how local wisdom and land management patterns that changed from state management to community-based management with Social Forestry scheme applies as an effort to reduce peatland fires in Tebing Tinggi Timur District, Meranti Regency. This study used qualitative method. The data were collected by interview and field observation. The results of the study show that the local wisdom of the community in managing peatlands by building *tebat* (canal blockings) is able to keep wet the peat throughout the year so that the land is protected from threats of fire. The choice of plants (sago, rubber and areca nut) that has been carried out for generations has proven to be able to preserve the land and support the community's economy. Social Forestry (Village Forest) scheme becomes the community basis to legally manage and utilize the peatland/forest and provide protection for the community's rights to access and utilize the land. The results also show that the community's ability to adapt to nature and fires makes the community able to live in harmony with disaster.

Key words *: Local wisdom, Forest fire, Peatland, Tebat/Canal blocking.*

Introduction

The islands of Sumatera, Kalimantan and Papua are the three provinces with the largest peatlands in Indonesia, around 13 million ha, with thicknesses between 1–10 m and average thickness of 3 m, which are categorized as very deep peats (Miettinen and Soo, 2010; Barchia, 2012; Wahyunto *et al.*, 2003). Other than containing high carbon (Agus *et al.*, 2010), peatlands are able to maintain biodiversity and endangered animals (Aswandi *et al.*, 2015; Dariah and Maswar, 2016) as well as to store water reserves up to 13 times the weight of the peat (Sabiham and Maswar, 2016). In this condition, peat functions as hydrological control, carbon sequester and biodiversity maintainer (Sabiham and Sukarman, 2012; Sondang, 2015; Aswandi, 2015).

In Indonesia, peatlands develop to become one of the objects to fulfill economic interests (Saito *et al.*, 2016), where palm plantations are created to produce oil and acacia trees (*acacia denticulosa*) are planted to produce pulp. This policy allows plantation expansion which is often carried out through destructive processes without regard to ecosystem sustainability (Silvius and Diemont, 2007; Saswattecha, 2015; Basyuni *et al.*, 2015; Rachmanadi *et al.*, 2017; Astiani, 2017) that impacts on biodiversity loss and land degradation (Ahmed, Yahia, Okkacha, 2020; Dhanasekar and Muthukumar, 2020). Land clearing conducted by

peat burning can be fatal to the sustainability of peat as ecosystem controller (Irma, *et al.*,, 2018) that impacts on carbon emission increase, including economic and environmental losses (Silvius and Diemont, 2007; Saharjo and Wasis, 2019). Perpetual carbon emission will result in earth temperature increase which triggers fires (Field and Shen, 2008; Miettinen *et al.*, 2012; Irma *et al.*, 2018) as well as biomass loss, extinction of plants and endangered animals also decreased surface water (Jauhiainen *et al.*, 2005). Therefore, peatland protection needs to be done, among others, through selection of suitable plants (Surahman, Soni, Shivakotl, 2017) and moratorium on the issuance of management permits on peatlands, especially the granting of concessions for Cultivation Rights and Industrial Forest (Utami *et al.*, 2017).

Riau Province has 3,867,413 ha of peatlands and within Meranti Regency has around 680,414 ha (Safrizal, 2016). Among this area, some locations show serious damage (Rizal *et al.*, 2016), one of which is in Tebing Tinggi Timur District. Lack of control over plantation expansion and forest use often allows violations on the management and use of peatlands (Ishak *et al.*, 2017). Land clearing through the process of burning peat to create Industrial Forest and large-scale plantations is sometimes done because the cost is cheaper and the ash produced can help fertilize the soil (Soewandita, 2018; Akinola and Adegoke, 2018; Nugraha, 2019). Nevertheless, this process results in the destruction of ecosystems and land as what happened in 2014–2015 which consumed more than half of peatlands in Meranti. On the other hand, the top-down state policy (Nurhidayah and Riyanti, 2017) is instructionally applied in disaster response basis without concern about the roots of the local community, their local wisdom and culture. Such model is not quite effective to be an applied policy.

This condition triggered the local community (Meranti) to collaboratively organize themselves with their local wisdom in a particular cultural system (Pesurnay, 2018). The community built *tebat* (canal blockings) to rewet the peat and the result is more effective to reduce the risk of land fires. *Tebat* is considered a local genius method owned by the community as an innovative "technology" based on their local wisdom that becomes community's capital in managing peatlands while protecting the land from threats of fire.

Based on the explanation of the problem above, a top-down forest fire prevention policy has proven to be ineffective at the community level. The state should collaborate with the community by looking at their potentials and strategies. Peatland, ecological, economic and social community issues must be resolved in an integrative and collaborative way by providing opportunities for the community to work with their methods and strategies. For this reason, this study aims to explain two things: 1) how the community with their local wisdom made strategies to save peatlands from threats of fire; and 2) how the community's capability with government support was successfully able to be a prototype in managing peatlands amid the threats of land and forest fire.

Methods

This research was conducted in Tebing Tinggi Timur District, Meranti Regency. The study was conducted specifically at locations that experienced fires in Tebing Tinggi Timur District with the recipients of Social Forestry (Village Forest) as the study object. The chosen method of the study is qualitative-descriptive (Creswell, 2010). Data were obtained by interview and field study, as well as desk study to collect data related to peatland management and land fires. Deep interviews were done with key informants covering members of the community and local community leaders, heads of villages, Fire-Care Community (Masyarakat Peduli Api), State-owned Enterprises (BUMDES), Forest Management Unit (Kesatuan Pengelolaan Hutan), the Head of Land Office and Village Forest Manager. The qualitative data were presented descriptively (Raco, 2010) related to how the community local wisdom manages and preserves peatlands in order to minimize land fires.

Results and Discussion

Peatland and Forest Fires in Tebing Tinggi Timur

Fire is the biggest threat in forest and land management in Indonesia (Ekayani *et al.*, 2015) and the 2014 - 2015 fires were the biggest in Riau Province. Several studies stated that fires mostly occur by intentional factors, only a small part that is due to natural factors (BNPB, 2014). The study of other researchers and investigators lead to similar results that fires mostly occur due to land clearing process

carried out by companies or planters in clearing land.

Geographically, Riau Province is an area with the largest peatlands. This condition is beneficial for peat is a water controller, but improper handling and utilization can lead to a threat (Dharmawan *et al.*, 2016). Since the peatland utilization in Riau Province was improper (Wahyunto, Nugroho, Agus, 2016), deforestation (Nugraha *et al.*, 2019) and peatland degradation caused high distribution of hot spots (Jikalahari, 2017). The level of disaster hazard, particularly in Riau, can be seen in Figure 1.

According to Figure 1, most of Riau Province area is prone to forest and land fires with following details: 1) very vulnerable area covering 2.109.212 ha; 2) vulnerable area 5.088.928 ha; 3) less vulnerable area 1.778.721 ha; and 5) not vulnerable area 51.767 ha (Utami *et al.*, 2017).

Fires in 2014 - 2015 were an extraordinary event. Several sources mentioned that peatland and forest fires in Riau, other than triggered by El-Nino (Rampangilei, 2016), and were also caused by a large-scale expansion (Cultivation Rights) of palm plantation. Palm oil plantation is a profitable cultivation (Dhiaulhaq *et al.*, 2014), but this commodity has adverse impacts on the environment (Obidzinski *et al.*, 2012), among others are temperature increase and drainage of peatlands. Other than Cultivation Rights, Industrial Forest concession on peatlands in Meranti (Salim *et al.*, 2018) massively impacts on environment damage such as release of carbon contained in peatlands and damage of forest ecosystems as water reserves and oxygen supplier. At last, it leads to fires.

Peatland ecosystem damage in the end of 2008 began to occur in Tebing Tinggi Timur District, Meranti. This was started with the coming of a company, PT Lestari Unggul Makmur (LUM), who had an Industrial Forest concession permit covering 10,390 ha. PT LUM was among the companies affiliating with a pulp company, Asia Pacific Resources International Holding Ltd (APRIL). The concession area included 7 villages in Tebing Tinggi Timur District: Sungai Tohor, Sungai Tohor Barat, Sungai Nipah Sendanu, Sendanu Dapur Ikhsan, Tanjung Sari, Lukun and Kepau Baru. At the end of 2008, PT LUM began to operate by constructing a canal in the forest with a width and depth of approximately 4–6 meters and a length of 25 km. This canal was used by PT LUM to transport logistics, acacia seeds and people to carry out land clearing. This canal was supposed to function to reduce the spread of fire.

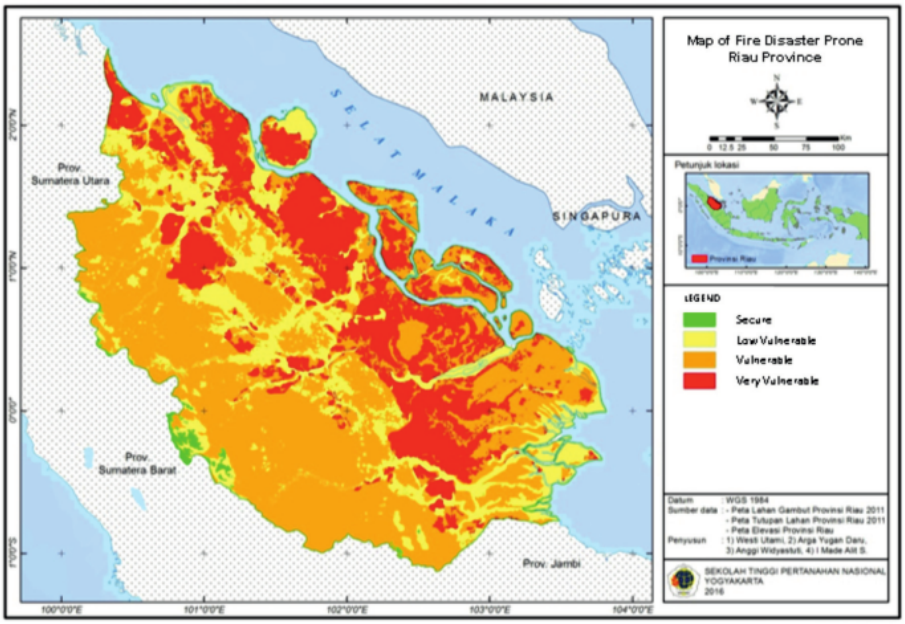

Fig. 1. Map of Riau Province Forest and Land Fire Disasters based on Land Cover Map, Hot Spot Distribution Map, Elevation Map and Peatland Map.

(*Source:* Data Analysis, Utami *et al.*, 2017)

However, when the fire broke out, the flames blazed and snatched over the canal.

The data on the field in 2014–2015 show that fires was unable to counter by the canal (Figure 2). Instead, this canal could cause decreased surface water in peatlands, or in other words, the canal destroys water stability. Flames could move from one branch to another by the gusts of wind. The high intensity, long-lasting fire was able to burn the entire fields and plants. In peatlands, the fire did not burn plants on the surface of the ground only, but also the dry peat below. The canal absorbed the water of the peat and make it dry (Rampangilei, 2016). This was the condition that happened during the fires in 2014–2015. The community and firefighters had difficulty in putting out the fire because extinguishing fire from the surface could not reach the hot spots below.

Fig. 2. Canal constructed by PT LUM in Tebing Tinggi Timur, Meranti for peatland clearing process. (*Source:* Eyes on the Forest, 2010).

The Role of Local Wisdom in Peatland Management in Meranti

Local community in Meranti Islands has been living around the peatland/forest area even before the Indonesian declaration of independence (Roza, 2013). The long process allows the community live in harmony with nature so that they can adapt to their environment. Good habits that have been discovered and passed down for generations in managing and understanding peatlands make them experts in sustainable land management. Peatland is a land that has special characteristics and each peat has certain local characteristics, so they must be treated differently. In this context, peatland management must at least pay attention to conditions of thickness, physical/chemical/biological content, hydrotopography, soil characteristics/depth of pyrite, type of sediment under the peat and ecosystem so that it can be cultivated for agricultural land (Sudrajat and Subekti, 2019).

The native inhabitants who firstly cultivated the peat were the tribes of Banjar in South Kalimantan, Dayak in Central Kalimantan, Malay and Chinese, migrants of Bugis and Banjar who lived in Sumatera: Riau, Jambi and Lampung (Umar, Noor, Noorginayuwati, 2016). Most of the farmers managing peatlands by planting sago (*metroxylon spp.*) in Tebing Tinggi Timur were Bugis migrants who originated from Pelelawan Regency. These communities with their hereditary land management systems began to feel disturbed by the existence of peatland development programs by the government in 1969 (Prayoga, 2016). The presence of technology and innovation which only prioritized economic aspects and the top-down policy (Putra *et al.*, 2019) implemented by the government without considering the environment often shifted local wisdom implemented by the community. This condition made the communities, at first, rejected peatland clearing in Kalimantan and Sumatera for they were worried that the patterns of peatland management technology applied by the government would cause ecosystem destruction. Rejection occurred since the new methods were made without adjustment to social, economic and cultural conditions as well as community participation (Sunaryo and Joshi, 2003).

Before palm plantation program, people in Riau had managed peatlands for cultivations of rubber (*Hevea brasiliensi*), sago (*metroxylon spp.*), areca nut (*areca catechu L.*) and alternative plants. When migration from many regions widespread in Riau and the government expanded its program to create large-scale palm plantation (McCarthy, 2010, 822) and Industrial Forest-acacia-for pulp supply, some of the local people were marginalized and eventually ruled out, so they migrated to Meranti border area.

Local people have ability to manage and understand the suitable plants to cultivate. They are well-versed with planting patterns, peat characteristics, also the management procedures for protecting peat so as to be able to provide economic value. All this time, with their knowledge, the local people successfully applied cropping patterns to minimize land ecological damage. *Tebat* method as a form of their local wisdom becomes a technology that is able

to reduce the risk of fires.

Since 1967 up until 2015, the government policy in forest management had been oriented to corporation demands through concession of Forest Management Rights and Industrial Forest. This was marked by the presence of national and multinational companies that expanded massively without paying attention to the local natural conditions and leaving aside the local communities or indigenous peoples. The granting of large-scale concessions in the forms of Cultivation Rights, Land Management Rights, Forest Concessions and Industrial Plantation impacts on the loss of local community rights in accessing peatlands or forests that they had limitedly managed before as an economic practice with local wisdom basis (Herb, 1999). In fact, large-scale concessions triggered tenurial conflicts between local communities and corporations (Herawati, *et al.*, 2019). Tenurial conflicts had been long going on in Tebing Tinggi Timur District since the land that before had been managed by the local community as their source of livelihood to cultivate sago, rubber, areca nut and other plantations was turned over to PT LUM for acacia cultivation.

Such condition led to conflict expansion for large-scale concession was a top-down policy that did not involve the community. This experience also took place in Tebing Tinggi Island, where Rangsang Island and Padang Island were turned over to a corporation. Undeniably, there had been protests in all those areas since the construction of canals expanded causing ecological damage including forest fires was getting more massive. Yet, only the people of Tebing Tinggi Timur District succeeded in retaking over the land from the operating corporation (Salim, 2017).

The government intended that peatland clearing program could carry out without conflicts and ecological damage as well as also improve the economy of the community. The key is local wisdom empowerment and optimization, by supporting it with facility for its management. Besides, poverty alleviation concentrated in rural areas, and especially poverty in communities living around forests, is necessary to be resolved so that tenure conflicts can be reduced. This is substantially in line with agrarian reform agenda through Social Forestry scheme as one of the solutions to answer poverty problems, tenurial conflicts (Choenkwan and Fisher, 2018; Salim and Utami, 2019) and threats of fire. Such policy is now implemented in Tebing Timur District, Meranti. Village Forest management by the local community of the land that was previously managed by PT LUM with Social Forestry scheme becomes one concrete solution where the government gives a legal access for the community to manage and utilize it.

The given Social Forestry scheme basically means returning and protecting community's rights to manage peat forest for the sake of sustainability and welfare. Forest management paradigm from state-based management to local-based management needs a support by agrarian reform strategic program (Siscawati *et al.*, 2017) since deforestation and poverty rate of the community around the forest area are considerably high (Salim and Utami, 2019). Legally granting access to the village forest to the community enables them to be more responsible so that the forest with peat they manage can improve the economy of the surrounding community and maintain its sustainability.

The local wisdom of Meranti community in managing peatlands is a strength and basic capital for peatland clearing to be utilized by the community without ignoring environmental aspect. The combination of Village Forest and local wisdom becomes a method of peatland management. Without access to village forest, the local community will be forever accused as thieves and threatened with illegal forest use and management; without local wisdom, there will easily be degradation in the utilization of peatland/forest (Mutia *et al.*, 2019, 1077-1083). This experiment is important to see further whether it will be sustainable for the state as well as the community in empowering scheme (Perkins, 2010; Arizqi and Fachrunnisa, 2017). The fully involved community to sustainably access, utilize and preserve the forest or peatland is successful in Tebing Tinggi Timur District.

The submission of Village Forest to the community in Tebing Tinggi Timur District, Meranti, which took place since 2016 with the establishment of decree of Ministry of Environment and Forestry No. 6716-6722/MENLHK-PSKL/PSL.0/12/2016, has given new spirit for the local community. Sago cultivation that they had started before is increasingly being expanded so that the crop yield is also expected to increase. The conditions of the peat and sago are both far better than before. The canal blocking method or *tebat* the community built made the sago farming flourish, because this method succeeds in maintaining soil humidity. This condition

is able to support the food security of the local community who has been dependent for decades on sago and other forest products.

Peatland Fire Management Based on Local Wisdom

Disaster risk reduction is the responsibility of all parties, including the government, private sectors as well as all levels of society. The paradigm in disaster management that previously only focused on rehabilitation and reconstruction that has changed to be comprehensive risk reduction paradigm by prioritizing prevention is expected to be able to reduce disaster risk level. In concept, disaster risk reduction can be done by reducing the vulnerability level (social, economy, physic and environment) and increasing community's building capacity (Smith, 2007). In the context of fires, risk reduction can be done by reducing factors that can trigger a fire, restoring peatland function, managing fire with community livelihood basis, choosing proper soil to use/plants to cultivate, preparing community's capacity in facing fires and improving firefighting facility.

The fires occurred in 2014–2015 shows that the local community's care and capacity in facing fire was remarkable, where they relentlessly tried hand in hand to stop the fire days and nights. In some interviews, they admitted that their motto "Never Go Home before It Goes Out" strengthens their spirit to stay close to the source of fires to put them out until they truly stopped. The difficulty they experienced in 2014–2015 was that the fires had spread, the temperature was extremely high, the wind blew strongly and the flames crept into the inside of the peat. The very dry peat, decreased water surface and limited facility made it difficult for the community to stop the fire; their effort mainly focused on stopping the fire so as not to spread to the wider area. The scheme was done through a mechanism of firefighting from various directions and later assuring that all the hot spots had died out. After the fire, the community made various efforts to reduce the risk of fire by maximizing *tebat* in many locations to keep moist the land.

Tebat: Community's Local Wisdom in Disaster Mitigation

Forest and peatland fires become a lesson and evaluation against ecosystem change in Tebing Tinggi Timur District. The community realized that if they keep the peat forest well, there will be no fire and other disasters. Since the fire, the community made a fire-care group containing every element of their people as a manifestation of their awareness on environmental conservation. After the fire, the local community leaders, together with NGOs, took a lesson and evaluated the factors causing the fire and concluded: 1) the canal constructed by PT LUM made the peatland dry and flammable; and 2) Industrial Forest plan proposed by PT LUM to plant acacia was not recommended since peatland is not suitable for monocultural plants; acacia will also make the peatland dry and potentially damage sago plantation that has been cultivated by Tebing Tinggi Timur people for decades. This evaluation led to a collective action of the community to hand in hand preserve and manage peatlands with the local knowledge they had. The management system and types of plants that, so far, the community believes will preserve the land are eco-friendly and has proven to minimize the threats of fire. The local community defines local wisdom as a form of cultural identity with its own orientation, perception, life system, even also life style (Pesurnay, 2018, 6) to be continuously on going so as to form a belief.

Fig. 3. Continuing the construction of *tebat* as a legacy to maintain peatland humidity (Picture source: Riauonline.co.id)

The local community tries to overcome the peatland damage by continuing the construction of *tebat* (canal blocking), where the canals are blocked so that the water does not flow to the river or sea. The construction of the blocks in many locations (around 25 locations) in one village (Sungai Tohor) makes the peat in this area stays humid. This canal blocking functions to reserve the water and makes the water able to flow and soak into the peat to make it humid. By maintaining humidity, peatlands become less flammable (Salim *et al.*, 2018).

The construction of *tebat* in this district was initi-

ated by Abdul Manan, a farmer in Sungai Tohor Village, Meranti, by utilizing unused natural woods or sago barks. This initiation succeeded, proven by the surface water that used to fall far below the surface was then filled almost flat with the ground. With the availability of abundant canal water, the peatland became wet throughout the year. This condition also benefited the community because the sago they cultivated could flourish. The construction of *tebat* was later conducted concurrently in Sungai Tohor Village, followed by many other surrounding villages, which were Nipah Sentanu, Sendanu Darul Ihsan, Tanjungsari, Lukun and almost all other villages in Tebing Tinggi Timur District. Moreover, what had been done by Abdul Manan was later replicated in several areas with peatlands in Sumatera, although it may not exactly result in the same outcomes as what occurred in Tebing Tinggi Timur, because it depends on the land conditions (Jenito 2015).

After the 2014–2015 fires, Tebing Tinggi Timur people also initiated to manage many kinds of land potentials to save the environment. The fires made the forest barren so that the community worked together to plant perennial seeds to reforest the burnt area. The community also tried to preserve the mangrove forests in the area again. Many ways done by the local community in preventing land and peat forest was appreciated by the president Joko Widodo who made time to visit these remote islands as a form of commitment to hand over the peatland management to them (Tata, 2016).

The community's awareness on the importance of peatlands became a belief passed down for generations. Their realization to keep the peatlands in humid condition is a stepping stone for them whose lives depended on agricultural sector by cultivating sago plants. Suitability of soil use in peatland area as well as preserving peat makes the ecology remains sustainable. Sago is one among other plants that has proven to be very suitably cultivated in peatland area and makes Tebing Tinggi Timur the largest sago producer in Riau. Peat characteristics as ecological controller and water stabilizer also support the fertility of sago. Several things related to the resilience and efforts of the community in peatland and forest fire management are described in the following diagram.

Local wisdom and disaster risk reduction system starting from pre-disaster–disaster–post disaster

Fig. 4. Local Wisdom of the Community in Comprehensive Risk Reduction of Forest and Land Fires (Pre-disaster–Disaster–Rehabilitatin and Reconstruction)

constructed by Tebing Tinggi Timur District people is more effective and efficient in reducing forest and land fires. This is proven as the level of occurrence and damage of disaster can be suppressed. The fire in Tebing Tinggi Timur, particularly, has never occurred in a large-scale from 2015 to 2019.

The bottom-up disaster risk reduction scheme in Tebing Tinggi Timur District initiated and conducted by the community is more effective, efficient and implementable. The advantages of this system are that the local community can be intensively involved and that the implementing program can be carried out sustainably. This study shows that local wisdom in peatland management can be built by several factors as follows.

Environment

The quite unique environment condition in Tebing Tinggi Timur District with very thick peat requires the local community to adapt in order to survive. Their continuous adaptation finally shapes the community to utilize peatland wisely, one of which is by choosing sago, rubber and areca nut to be cultivated and made to be their main commodity. Sago as the source of livelihood of most of the people has proven to successfully preserve their environment.

Leadership

Leadership becomes an essential part in an organization or institution both formal and informal ones. A leader in community organization (community leader) plays important role on the policy, program planning, program implementation and community movement. Sungai Tohor and several other villages in Tebing Tinggi Timur Districts have leaders who are honest, patient and persistent in moving their peoples and cooperating with outside parties. Other than heads of villages, Tebing Tinggi Timur District also has community figure who is eagerly fights for environmental issues, one of which is Abdul Manan. The existence of heads of villages and Abdul Manan who are responsible and assertive in environmental management makes their peoples aware of the importance of preserving their environment and maintaining the sustainability of peatland/forest.

People's awareness of threats of fire, that once occurred, results in new knowledge, skills and local wisdom for them so that they can adapt. Their adaptation and preparedness patterns should be encouraged and assisted by supporting facilities so that the environment and nature can be spared from fires. The concept of living harmony with disaster enables all levels of the community to the lowest to be aware of threats of disaster. Tebing Tinggi Timur District shows that their forest activity and management can be carried out without any impacts on ecological damage and forest function disruption.

Conclusion

Government policy intending to be more oriented to peatland/forest scheme, that has changed from state management system to community-based management system, needs support. This policy, surely, can provide legal access to communities to manage and utilize peatland/peat forest in order to improve the economy of people living on peatland and peat forest. Legal access with Village Forest scheme given to the community over agricultural source has proven to be able to improve their economy and prevent fires. This scheme can protect Indonesian people's rights who live in agricultural society. Moreover, peatland management system through local knowledge and wisdom becomes an essential capital to avoid peatland degradation. By utilizing local wisdom as a method through *tebat* construction, proper selection of plants and involvement of all elements of the community is undoubtedly more effective and implementable to keep the peatland wet and spared from fires. This method is a model which, of course, needs support from the government so that the food security, welfare and sustainability of peat forest/peat land can be maintained.

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