Business models on peatlands to prevent land and forest fires

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Abstract. Peatlands nowadays, most of it has been degraded due to land and forest fires. The Indonesian government through The Peatland Restoration Agency has attempted to carry out peat restoration through three pillars. Revitalization is one of the restoration pillars besides rewetting and replanting, it seeks to improve the community livelihoods. The objectives of this study are to identify business models that have developed in the community and to analyze the mechanisms that occur in those business models in preventing forest and land fires. The research was conducted at the Peat Hydrological Unit of Mendahara-Batanghari, Jambi Province. In-depth interviews were conducted with respondents who were obtained by the purposive sampling method. Data and information then were analyzed descriptively qualitatively. Based on the field research this study found that the business models which can prevent forest and land fires are the rice field and horticulture business model, areca nut cultivation and utilization, liberica coffee agroforestry, pineapple cultivation, honey/beekeeping, jelutong agroforestry, ecotourism, and carbon trading. This study concludes that these business models have similar characteristics in preventing forest and land fires, namely land use adjusting the peat depth zoning with native peat species, non-timber forest products, and agroforestry patterns; intensive land management; utilization of biomass so that it does not become fuel during the dry season; maintaining peatlands in humid conditions through water management, and maintaining forest cover.

1. Introduction

Peatlands are an essential resource [1] because they have a role in storing carbon, water management, endemic and unique sources of biodiversity, and a source of community livelihoods [2]. Indonesia is a tropical country that has large peat reserves [1]. The area of peatland in Indonesia reaches 13.34 million hectares [3]. Currently, the condition of peatlands in Indonesia has experienced a lot of degradation. According to [4], peatlands in Indonesia are in a degraded state covering an area of 6.66 million hectares. Peatland degradations are caused by, among others, land fires, errors in water management, and mining activities [5]. In 2015, fires broke out in Indonesia burned about 2.6 million forests and land, which is about 33 percent of this area is a peatland. These fires are estimated to produce 800 mega to 1.6 Giga metric tons of carbon dioxide equivalent [6]. These fires caused degraded peatlands area increased significantly.

The Government of Indonesia, through the Peat Restoration Agency (BRG), is undertaking peatland restoration efforts to improve the degraded peatland ecosystem. There are 3 (three) pillars in restoration, rewetting, replanting, and revitalization [6]. Rewetting peatlands is carried out so that the peatlands return to ideal moisture [7]. Revegetation is an action to restore land cover through replanting activities.
with native plants (endemic) and adaptive plants on open peatlands, enrichment planting in degraded peat forest areas, and improving and applying techniques seed-dispersing agents, dispersal techniques) to encourage the regeneration of peat vegetation [8]. Revitalization is carried out to empower the local community’s economy [7]. In the restoration process, the three pillars are carried out in an integrated process [9]. The implementations of peat restoration were carried out in landscape unit called the Peat Hydrological Unit (PHU), which includes protection and cultivation functions [9]. The PHU took place various activities, both aimed at protecting and utilizing peatlands.

According to their depth the typologies of peatlands are grouped as follows: shallow peat (50 - 100 cm), medium peat (100 - 200 cm), deep peat (200 - 300 cm), and very deep peat (> 300 cm) [10]. Based on Government Regulation of the Republic of Indonesia Number 57 Year 2016 concerning Amendments to Government Regulation Number 71 of 2014 concerning Protection and Management of Peat Ecosystems. Peat ecosystem functions include for protection function at peat depth > 3 meter and for cultivation function in the peat < 3 meters. Peatlands developments in Indonesia are carried out by dividing the area into two, namely conservation areas which focused on rehabilitation and saving peatlands, and cultivation areas which are used for agricultural utilization and revitalization [11].

Peatlands have been widely used for settlement, infrastructure, plantations, and agriculture [12]. Plantation and agricultural cultivation activities are the main businesses of the community on peatlands [5]. Some peatlands for agriculture and plantations which were cleared in the 1970-1990s, are deep and very deep peatlands (400-700 cm thick) [13]. Cultivation activities are usually carried out by draining peatlands [14]. The leading cause of forest and land fires is the mismanagement of peatlands that have been trained to become flammable materials [15]. In addition, there are positive local customs and wisdoms that have long developed in the community in utilizing peatlands. These things foster community knowledge to manage and place business activities on peatlands. As a result, several business models based on land use, commodities, ecosystems, and environmental services have been developed. Some of them were identified as preventing peatland damage, preventing fires, and becoming a source of livelihood for the community.

The purpose of this research is to identify business models that developed on peatlands by the community, which are alleged to prevent forest and land fires and at the same time could improve the economic condition of the community. The best practices of these business models are expected to be lesson learnt to revitalization efforts in other peat land areas.

2. Methodology

2.1. Time and location of research
This study was conducted on 20-23 October 2020. The research location is in the Mendahara-Batanghari Peat Hydrological Unit, Tanjung Jabung Timur Regency, Jambi Province.
2.2. Data Collection Methods
The types of data used are primary and secondary data mostly in the form of qualitative data. This study conducted in-depth interviews with two people as representatives from each type of business, so there are 18 respondent of business actors from nine business models. As well as added respondents from KHG Manager from FMU Unit XIV Tanjung Jabung Timur. The forms of business are an individual business, Forest Farmers Group, and Forest Women Farmers Group. Determination of respondents purposively based on the role and type of business related to resource management in peat. Meanwhile, secondary data were obtained from books, reports, internet sites, and data and information from affiliated institutions. Data collection methods used were in-depth interviews, field observations, and exploration of secondary data.

2.3. Data analysis method
The business models identified are based on people's preferences. Based on the results of interviews and literature studies, a qualitative descriptive analysis was carried out to describe the mechanisms that run on these business models to prevent forest and land fires, and at the same time to improve community welfare.

3. Result and discussion
3.1. Rice paddy and horticulture cultivation business model
Lowland rice cultivation and horticulture business models are well developed on peatlands. Specifically the land availability for rice cultivation business models are very limited compared to the whole area of peatland. The small amount of lands means that only tiny part of the community lands are cultivated for lowland rice. Lowland rice cultivation is only carried out on thin peat, which is usually close to rivers. Lowland rice cultivation activities produce rice which has a vital role in maintaining food security and independence.

Lowland rice cultivation activities are carried out alternately with horticultural crops. In the rainy season the farmers will cultivate rice plants, while in the dry season they will cultivate horticulture. The types of horticulture are spinach, kale, corn, soybeans, eggplant, chilies, long beans, and mustard greens.
The activities of drying and burning of land are not required in lowland rice cultivation and horticulture. In addition, the remain decomposed leaves and stumps from rice cultivation can be used as input for horticultural cultivation so that it does not need to be burned. As we know, fires are usually caused by land preparation activities by burning on drained peatlands. Regarding forest and land fires, [16] stated that forest and peatland fires in South Sumatra often originate from burning activity in the land preparation process for rice cultivation on peatlands. [17] stated that the primary source of fire came from shifting cultivation carried out by the communities. The burning activity can spread to other areas if there are no management and supervision of the landowners. The rice and horticultural cultivation activities are carried out throughout the year so that there is no time lag for the land to be empty without management from the landowner. Based on research conducted by [18], one of the triggering factors for peat fires in Musi Banyuasin Regency is abandoned open access area. Thus, developing a business model for lowland rice farming and horticulture can prevent forest and land fires.

3.2. Areca nut cultivation business model

Areca nut is one of the primary plantation commodities for farmers in Jambi Province, apart from coconut and rubber [19]. The areca-producing centers areas are in Tanjung Jabung Barat and Tanjung Jabung Timur Regencies. The areas of areca nut in Jambi Province reached 19,968 ha. It covered about 9,882 ha in Tanjung Jabung Barat and about 8,894 ha in Tanjung Jabung Timur [20]. Initially, the areca nut trees were used to be a land divider or intercropping plant which were cultivated between oil palms. However, nowadays, people are starting to grow areca nuts in monoculture pattern. Some farmers have begun replacing unproductive oil palm trees with areca nut trees.

Areca nut cultivation requires the construction of primary and secondary trenches. The secondary canals are equipped with watergates to regulate the water discharge in the channels so that the surrounding peatland conditions are constantly moist. Humid conditions are needed so that areca plants can grow well. Thus, areca nut cultivation can keep the peatlands moist. Besides that, farmers usually plant vegetables such as corn, cassava, chilies, and other vegetable crops among areca plants. The areca nut harvest period is every 20 days. But farmers will visit their gardens more often because they have to maintain the vegetables among the areca plants, which have shorter harvest period. The frequent visits of farmers to the farm will intensify the maintenance of lands. So, when there is a threat of fire it will be quicker to be identified and controlled. Therefore the effort to keep peatlands in moist conditions and intensive management will protect peatlands from fires.

3.3. Business model of making plates from betel nut midrib

A business model utilizing by-products is starting to develop; one of them is a business model that uses betel nut midrib. Betel nut midribs are usually just thrown away but are now used as an innovative product in form of plates. This innovation was initiated by the Faculty of Agricultural Technology, Jambi University with the Rumah Jambe-e production. This invention was to assemble a betel nut midrib pressed by machine into a plate that could be used as a container for foods or fruits. Unlike the press machine originating from India, which required a large power, this press machines from Rumah Jambe-e are made with natural gas which are easy to be used by people in a home industrial scale. However, this business model is still running on a home industry scale by operating five hotpress machines with a production capacity of 5,000 pcs/month/machine.

Appropriate technology and the potential for abundant raw materials in the location areas are good opportunities for increasing the added value of betel nut midrib and as an alternative of income livelihood. In addition, the use of dry betel nut midrib can also reduce the organic fuels that can trigger forest and land fires. As stated by [16], abundant biomass in the dry season can trigger forest fires.

3.4. The agroforestry business model of liberika coffee

Liberika coffee has begun to be developed by many people in Tanjung Jabung Barat and Tanjung Jabung Timur, Jambi Province due to its high potential economic values. Unlike Arabica and Robusta coffee, Liberika coffee can grow well on peatlands. Agronomically, Liberika coffee has some advantages such
as it can grow well on marginal lands especially on peatlands and it is resistant to leaf rust disease and coffee fruit borer attacks (BPTP, 2014). There are only a limited high economic species that can grow well on peatlands [21]. So, Liberika coffee can be used as an alternative commodity to increase people’s income. Liberika coffee trees are usually cultivated with other plants that serve as the shade.

Liberika coffee trees are grown together with areca nut as the shade [22] or agroforestry with coconut trees [23]. With several canopy strata in the agroforestry cropping pattern, the land unit will function as a good receiver, storage, distributor, and release agent for water irrigation [24]. Thus the agroforestry pattern in this Liberika coffee cultivation can conserve water by controlling water flows during the rainy season and maintaining the condition of peatlands to be moist during the dry season. Furthermore, the moist condition of peatlands during the dry season can prevent fires.

3.5. Pineapple cultivation business model

Peat pineapple or pineapple tangkit (Ananas comosus (L) merr) is a type of pineapple that can adapt well and thrive in burned peatlands. Pineapple is an adaptive plant in acid swamps (pH 2-3), poor drainage, and thick peat [25]. Pineapple has excellent economic values because the pineapple business covers activities from upstream to downstream. Pineapple can be consumed without being processed first. The processed products are also varied, such as pineapple lunkhead, pineapple jam, pineapple chips, pineapple syrup, etc. There are also many side products and services from pineapple cultivation, such as pineapple fiber, bromeline for medicine, and ecotourism.

The pineapple cultivation process starts from land preparation. After the land conditions become clean, then soil compaction is carried out. Compaction made the soil pores become tiny so that it can reduce evaporation. The trenching activities are carried out around the planting area with a width of 2 meters and a depth of 2 meters and are not connected to other trenches. In the planting area, a canal is also made with a width of 50 cm and a depth of 50 cm. Soils which are always maintained in moist conditions as well as the trenches are always filled with water can prevent forest fires.

Pineapple harvests are carried out a year after planting. While waiting for the harvest time, the farmers maintain intensively the pineapple farm. After the first harvest, pineapple fruits can be harvested every week for a year ahead. Maintenance activities are also carried out so that pineapples can produce fruits optimally. Intensive care, monitoring, and utilization throughout the year on land for pineapple cultivation will prevent fires.

3.6. Honey beekeeping business model

The species is Apis mellifera L. This species is not a native Indonesian honey bees but originates from Europe, first imported to Indonesia in 1972 by Boyscouts from Australia [26]. This introduction aims to increase domestic honey production in Indonesia because this honey bees have a much higher productivity level than local Apis cerana F [27]. Community groups carry out honey beekeps around the Wira Karya Sakti Industrial Plantation Forest areas.

The honey beekeeping activity is a program of the Peat Restoration Agency (BRG) to empower farmer groups around forest areas. the honey beekeeping provided alternative livelihoods for people without cutting trees in the forests or burning the peatlands. the honey beekeeping required foods derived from plant or tree flowers. The flowers of the acacia trees can be used as food for bees. However, the fire will destroy the acacia plant and its flowers. Fires also affect the migration of honey bees [28] and cause bees to leave the bee hives. Thus, farmers must protect the environment around their cultivation from fires to maintain food supplies and the presence of honey bees.

3.7. Jelutong agroforestry development business model

The swamp jelutong (Dyera polyphylla Miq.) is a native species of peatland forest. It can be an alternative for people besides oil palm [29]. This type of tree can be used for wood and sap. The woods are used as raw material for making pencils, carving, plywood, partition boards, ceilings, and clogs (a type of sandal made of wood). The sap can be used as raw material for chewing gum, paint, electric cable insulators, and export commodities.
Before, jelutong sap could be used as raw material for chewing gum, the demand for jelutong sap in 2014 are still good. But after that, the economic values of jelutong sap are no longer exists because the emergence of synthetic materials which can substitute its function. Therefore, jelutong cultivation is carried out in an agroforestry pattern with high economic value commodities under its shade to increase economic value, such as pepper, pepper, rattan, rhizome, etc.

As one of the native species of peatland, the cultivation of swamp jelutong does not require environmental engineering in the form of land draining. The agroforestry pattern encourages the community to carry out an intensive land management. Therefore, jelutong cultivation using agroforestry can improve environmental conditions and the economic conditions of the community. The integrated management system can prevent forest and peatland fires. Agroforestry jelutong business model is suitable for peat with a peatland depth of >3 meters.

3.8. Ecotourism business model based on peat ecosystem conservation
The business model for utilizing environmental services in the peat ecosystem has begun to develop by taking advantage of protected peat forests, which still have a good ecosystems. In 2017 Pematang Rahim Village obtained a Social Forestry permit with a Village Forest scheme covering 1,185 ha. The permit grants are expected to strengthen the community groups in protecting peat areas from fires and peatland damage. Besides that, it is also to support government programs to reduce greenhouse gas emissions and provide positive benefits for the community. Furthermore, village forest management is planned to be directed towards the ecotourism development. The peculiarities from the village forest in peatland areas can be appointed as ecotourism landmarks. This ecotourism business model will rely on preserving the ecosystem to support this business. Realizing the sustainability of the ecosystem as much as possible will protect the area from the threat of fire. Therefore, the ecotourism business model will be in line with fire control program.

3.9. Carbon trading business model
The carbon trading business model for the REDD scheme was started in 2013 by the community accompanied by the Indonesian Conservation Community Warsi. The Bujang Raba community applies the Village Forest and Community-based Forest Management scheme to have a prominent role in mitigation by maintaining forest cover and preventing logging from storing carbon in the form of carbon stock and preventing it from releasing into the air. This activity is a form of community role in mitigating and adapting to climate change. This is motivated by the threat of land conversion and deforestation into Industrial Plantation Forests and oil palm plantations against the impact of the ecological disaster that will be caused. Communities with awareness want area management that prioritizes sustainability and sustainable values. The carbon trading business model is one of the reward schemes to increase and maintain carbon stocks in stands and land management units. Fire is one of the events that can cause the release of carbon stocks. Thus, the carbon trading business goes hand in hand with preventing forest and land fires.

4. Conclusion
This study concluded that the business models that develops in the community which can prevent forest and land fires have particular characteristics such as (1) land preparation mechanisms without drying and burning, (2) land protecting to prevent abandoned open access areas, (3) agroforestry patterns that can intensify land management and add economic values, (4) Utilization of biomass which was previously an organic fuel for fires, (5) maintaining soil moisture through compaction for soil pore reduction and water management, (6) planting native species combined with economic value commodities with agroforestry patterns, (7) utilizing of the uniqueness of ecosystems, and (8) increasing public awareness of the environment through preventing the release of carbon stocks. These characteristics and the best practices of business models in peatland areas in PHU Mendahara-Batanghari can be lesson learnt and good examples to develop business models and to implement revitalization efforts in other peatland areas in Indonesia.
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