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Reducing Risks from Forest Fire and Disasters Through a Community Based Forest Fire Brigade (MPA), a Case Study in Danau Sentarum National Park

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Abstract

The TNBKDS is an exotic ecosystem and has designated as one of the world biospheres reserves. The Park is also inhabited by around 6,000 people. Ecotourism, biodiversity, and cultural value attracts many domestic and international tourists. However, the park has high-risk from forest fire and flooding. During 2014-2019, forest fire in the park is recorded at the average of 206.6 Ha. The lake has also experienced in regular flooding. Reducing these risks should involve community by strengthening their capacity to protect their home.

Consultations and SWOT analysis was used to map community capacity and to rank the threat. Opportunities on livelihood improvement is also identified to develop approach and strategy in reducing risks and improving their income. A GIS tool was used to monitor forest fire.

A total of 10 MPA were established in 10 villages, involving 300 peoples (300 households). From series of consultations, 100% agreed that community need to involve in combating forest fire and reducing the damage from flooding. FIP-1 provides forest fire equipment, as well as series of training on forest fire, forest monitoring using GPS, alternative income activities such as bee keeping, fish processing, and women empowerment. Establishment of MPA and implementation of forest patrol for the period of 2018-Jun 2021 has directly protected a forest area from forest fire of 11,265 ha and non-forest area of 82,481 ha.

Community participation is the key success of reducing risks from forest fire. Training program is also essential to support community capacity in reducing hotspots and to provide alternative income for their sustainable live within the national park.

Keywords: forest fire, community, West Kalimantan, climate change

Introduction, scope and main objectives

The Lake Sentarum National Park (Indonesian: Taman Nasional Danau Sentarum) is a national park protecting one of the world's most biodiverse lake systems (Jeanes and Meijaard 2009), located in the heart of Borneo Island, Kapuas Hulu Regency, West Kalimantan Province, Indonesia. It lies in the upper Kapuas River tectonic basin some 700 kilometers upstream from the delta. The basin is a vast floodplain, consisting of about 20 seasonal lakes, freshwater swamp forest and peat swamp forest. The National Park is located in the western part of this basin, where three-quarters of the seasonal lakes occur. Approximately half of the park consists of lakes, while the other half consists of freshwater swamp forest.

Danau Sentarum National Park has a rich fish fauna with around 240 recorded species, including the Asian arowana and clown loach botia (Kottelat and Widjanarti 2011). There have been 237 bird species recorded including the Storm's stork and great argus. Of the 143 mammal species 23 are endemic to Borneo including

the proboscis monkey. There is a relatively large population of the endangered orangutans present in the park. The lakes support a large traditional fishing industry. The western part of the upper Kapuas floodplain is inhabited by almost 20,000 people, 88% of which are Malay fishermen. About 3,000 people live in about 20 village enclaves within the Park.

Despite the great ecological value, the lake also in a risk for forest and land fire. Dennis et al. (2000) presented the study result that forest fire has been occurred since 1973. Research has found burn scar areas from the remotely sensed data from 1973, 1990, 1994, and 1997. The area has shown a significant increase on the size, from 5,483 ha in 1973 to 17,941 ha by mid of 1997.

The Forest Investment Program-1 (FIP-1), in cooperation between the Asian Development Bank and the Ministry of Environment and Forestry, Government of Indonesia, implemented a REDD+ pilot project in West Kalimantan province. One of the project targets is providing direct protection to 5,000 Ha of land and forest area and indirect protection to 91,000 Ha from forest fire, in which to achieve the outcome of reducing emission from deforestation and forest degradation.

Methodology/approach

Deforestation is defined as the conversion of natural forest cover into other land cover categories. This practical definition refers to Minister of Forestry Regulation No. 30/2009 which states that deforestation as a permanent change from forested areas to not forested due to human activities (Ministry of Forestry, 2012).

Deforestation and degradation within this period of monitoring were analyzed using the satellite imagery Landsat 8 with 15 m spatial resolution. The method to calculate GHG emissions from land cover and land use change utilizes activity data combined with emission and removal factors, based on the following: (i) Global Forest Observing Initiative (GFOI) Methods and Guidance Documentation (MGD) (GFOI, 2016); (ii) Calculation on Emission Reductions and Enhancement Methodological Book (MoEF, 2020); and (iii) Forest Reference Emission Level (MOEF, 2015).

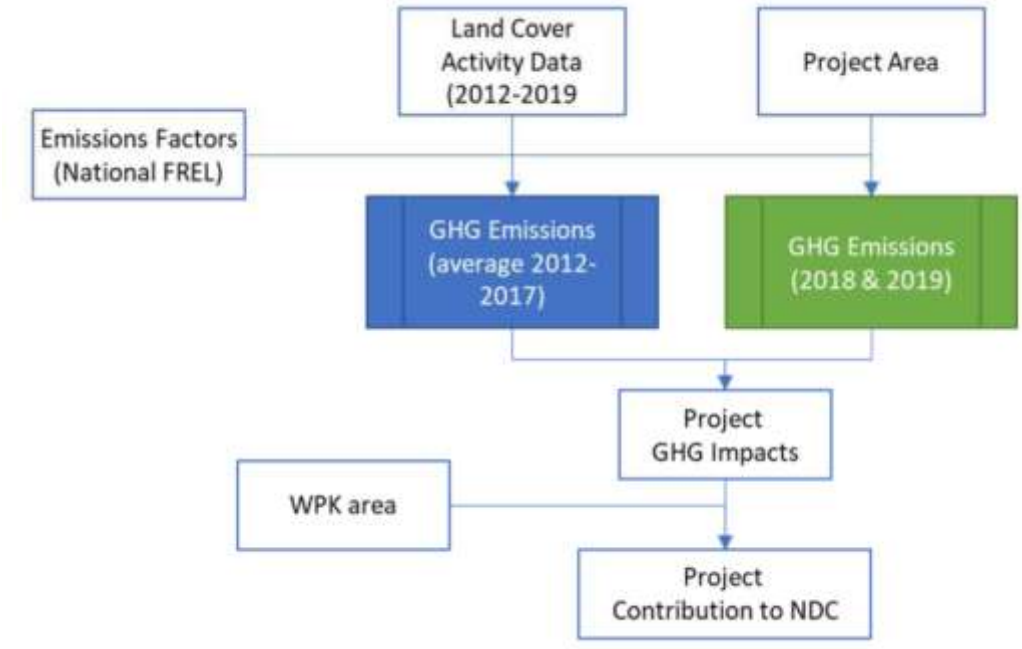

Fig. 1. Method for calculation of emission from deforestation and forest degradation (Note: WPK area is the REDD+ Accounting Area).

The direct impact from community FFM is calculated based on the forest cover in each village. It is assumed that through the efforts of the communities, the amount of fire will decrease, which will be presented in the activity data (burned area). The GHG emissions can be calculated using emissions factors in the National FREL (MOEF, 2015).

Results

Forest Fire Patrol

Community Forest Fire Brigade patrols (*Masyarakat Peduli Api* [MPA]) were conducted yielding direct observations in areas prone to forest fires and conducting fuel tests by means of litter squeeze and single leaf test. During the patrol, the group of MPA also conduct socialization on how to prevent the forest fire to the community in the local area. Table 1 summarizes the villages where FFM activities were conducted, which include four FIP-1 villages and eight additional villages.

The patrol location and time for the period of 2020 is presented in Table 1 below. The coverage of patrols was based on the assumption that the community member directly protects the forest and non-forest within 500 m to either side of the patrol track. The 500 m buffer was determined to be the effective patrolling distance due to the topography proximal to the villages surrounding the Danau Sentarum National Park. Because the topography is relatively flat, the patrol team can visually inspect a distance up to approximately 500 m.

Table 1: Summary of forest patrol by the Community Forest Fire Brigade, from the period of Jan 2019 to Jun 2021.

Monitoring Period	Direct Protection		Indirect Protection	
	Forest Area (Ha)	Non-Forest Area (Ha)	Forest Area (Ha)	Non-Forest Area (Ha)
Jan-Dec 2019	3,552	23,330	30,099	49,594
Jan-Jun 2020	3,155	21,904	30,367	51,052
Jul-Dec 2020	3,098	24,239	30,418	48,717
Jan-Jun 2021	1,460	13,008	32,056	59,947
Total	11,265	82,481	122,94	209,31
Grand Total	93,746		332,250	

Notes: * = each patrol was conducted by 3-4 groups at the same time. Source: REDD+ Data Series Monitoring Report, January-June 2021.

Hot-spot Monitoring

Hot spot monitoring was performed to provide an overview on the hot-spot in the villages. Data on the hotspot were collected from the SIPONGI website (information system for the forest fire management, operated by the Ministry of Environment and Forestry - http://sipongi.menlhk.go.id/home/main). The summary is presented in table below.

Table 2. Number and location for the hot-spot observed (2018-2021).

Village	2018	2019	2020	Jun 2021
Bungan Jaya	0	1	0	0
Datah Dian	5	3	1	0
Mensiau	0	0	0	0
Tanjung Lokang	3	0	4	0
Laut Tawang	4	7	0	0
Lubuk Pengail	0	0	0	0
Madang Permai	0	0	0	0
Nanga Leboyan	0	0	0	0
Pulau Majang	0	1	0	0
Sekulat	0	0	0	0
Sepandan	1	7	0	0
Vega	0	0	0	0
TOTAL	**13**	**19**	**5**	**0**

Source: REDD+ Data Series Monitoring Report, January-June 2021.

Emission Reduction

Total emission reduction in the targeted villages resulted from the forest fire management is presented in Table 3 below. It shows that the total emission reduction from the period of 2018-Jun 2021 is at 431,217 tCO2e. The baseline for the forest fire program was calculated at 91.668 tCO2e.

Table 3. Emission reduction calculation from the community based forest fire management (2018-2021).

Baseline (tCO2e)	Monitoring Period	Performance (tCO2e)	Emission Reduction (tCO2e)
91,668	Jan-Jun 2018	53,126	38,542
91,668	Jul-Dec 2018	27,185	64,483
91,668	Jan-Jun 2019	21,272	70,396
91,668	Jul-Dec 2019	21,619	70,048
91,668	Jan-Jun 2020	43,276	48,392
91,668	Jul-Dec 2020	22,851	68,816
91,668	Jan-Jun 2021	21,127	70,540
TOTAL		**210,456**	**431,217**

Source: REDD+ Data Series Monitoring Report, January-June 2021.

SWOT Analysis

Although the trend of forest fire has reduced from 2018 to 2021, it is important to analyze the driver for forest fire in the village level. A SWOT analysis was conducted through a focus group discussion was conducted, and is summarized below.

Table 4. SWOT analysis for the forest fire management in the National Park of Danau Sentarum.

STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
Early warning system from the SIPONGI has provide adequate information on the hotspot	Sustainability of program (reduced when donor project has completed)	Trend on low level of forest fire will provide potential benefit from reduced emission.	Natural disasters (forest fire during dry season)
Support from donor and NGOs on program to reducing forest fire	Limited capacity after project is completed and community	The national park also provide support to the community group in the form of conservation partnership agreement, in which provide long term access to forest resources (for non-timber forest product and ecosystem services).	Human activities that expose forest area into forest fire risk, e.g., drying fish using fire an from cigarette butts.

Discussion

Community Based Forest Fire Brigade (MPA)

The results presented in Table 1-3 has shown positive impacts in reducing forest fire within the national park. There were no hot-spots identified during the period of January-June 2021. While natural factors may contribute to this achievement (weather has been mostly wet during the period of 2020-2021), the Project (including all relevant stakeholders, e.g., government, village communities) has provided a good commitment to the successful implementation of the project. The total project investment for the national park to reduce deforestation and forest degradation within the national park including for the forest fire management is a total of USD 2.69 million. In addition, the project has implemented a comprehensive training for local community related to forest fire management, sustainable forest management, livelihood improvement and community organizational development. Total investment for this capacity building program is USD 38,150 in

Kapuas Hulu District, West Kalimantan. Wahyu et al. (2020) stated that the community-based forest management has proven to contribute in improving forest conditions, optimizing village land use utilization, and reduce the rate of deforestation, and at the same time, improving community livelihood condition.

Fadlillah et al. (2017) on her research in Mount Ciremai National Park, has found that establishment of community forest fire brigade (MPA – *Masyarakat Peduli Api*), has established a positive perception from community to participate in the forest fire management program. Although this good perception has not positively link to participation, community in general aware on the need of their involvement in forest fighting activities.

Reducing Emission from Forest Fire Protection Program

The FIP-1 project is implemented at the local area and only targeting 10 villages. In a larger scale, to be able to continue achieving success of the program, an intervention at the policy level, i.e., stronger law, a comprehensive and integrated legal framework instead of a fragmented system. In addition, consistent law enforcement, land tenure, poverty reduction and promoting alternative economic activity are also important drivers which need to be addressed (Nurhidayah and Lipman 2017). The FIP-1 project, as an integrated project design, has also implemented other supporting project components, including:

1. Development of alternative livelihood improvement consists of bee-keeping program, fish culture and processing, handicraft, and home garden;
2. Development and operation of Grievance Redress Mechanism including Land Tenure Conflict management. A procedure has been completed, operationalized and monitored; and
3. Development of Benefit Sharing Mechanism guidelines for REDD+. Although this guideline has not yet operationalized as it requires all enabling condition for REDD+ implementation in a jurisdictional approach.

Development of Sustainable Forest Monitoring Program

Freitas et al. (2017) described in the article that one approach to address fire risk on forest area should consider a simultaneous observation on the climatic conditions through different times of the year (more or less favorable to forest fire damage) and structural conditions addressed to land uses, aspect, slope, roads and demographic density. This method allows the team to calculate fire susceptibility, vulnerability and fire damage, according to several climatic scenarios. It also allowed the incorporation of different paths regarding different fire risk conditions and the minimization of risk due to fire damage through different management responses.

Learning from the experience and considering local condition, and to ensure the sustainability of the forest fire management program within the National Park of Danau Sentarum, the following principles are to be considered in the development of the management and monitoring program:

1. Availability of continuous funding to support the forest fire management at the national park. National budget should be allocated to maintain forest fire patrol involving local community. Potential collaboration with other potential donors should also be identified;
2. Continuing support to local community through livelihood improvement program. The Conservation Partnership Agreement should be optimized by relevant business development on non-timber forest product and environmental services;
3. Continuous program related to increasing community awareness in reducing forest fire; and
4. Support and supervision from the provincial government and central government. Regulation enforcement at the village level by the national park resort is also part of the provincial government support to this program.

Conclusions

The FIP-1, in cooperation between the Asian Development Bank and the Ministry of Environment and Forestry, Government of Indonesia, has able to achieve and exceed the target of direct protection to a 5,000 Ha of land and forest area and indirect protection to 91,000 Ha from forest fire. From this achievement, the FIP-1 project has contribute to emission reduction of 431,127 tons CO2e. This is approximately 35% of the total achievement on emission reduction in the first semester of 2021 (1.24 million tons CO2e).

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