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Historical forest fire occurrence analysis in Jambi Province during the period of 2000 – 2015: its distribution & land cover trajectories

Lilik Budi Prasetyo[a,*], Arya H. Dharmawan[b], Fredian T. Nasdian[b], S. Ramdhoni[a]

[a] *Department of Forest Resources Conservation & Ecotourism-Faculty of Forestry, Bogor Agricultural University (IPB), Jl Meranti, Dramaga, Bogor 16680, Indonesia*

[b] *Department of Human Ecology, Faculty of Agriculture, Bogor Agricultural University (IPB), Jl Meranti, Dramaga, Bogor 16680, Indonesia*

Abstract

Forest and land fire in Indonesia have been given much attention since it creates environmental problems every year. Instead of its negative impacts, fire cannot be separated from agricultural system in the tropics. Moreover, under the regulation, the farmer is allowed to use fire for land preparation under 2 hectares. However, fire utilization is prohibited for land preparation in concessionaries. In facts, some companies are utilized fire for economics reason even though some of them are refused to admit. Therefore, it is interesting to know on what is really occur in the field related to the fire occurrence. Objectives of the research are to determine distribution of fire occurrence based on historical hot spot data during 15 years period (2001-2015), and analysis land cover as well as land use trajectories before and after fire occurrence in Jambi Province. Result showed, fire tend to occur in peat land every year, either during El Niño or La Niña period. Land covers before fire occurrence mostly were bush and disturbed secondary forest. It was also revealed that fire was also utilized by companies (oil palm and forest plantation). During period of analysis, on average, 20.67% was converted into forest plantation and 27.06% was converted into palm oil plantation, meanwhile the rest areas (52.27%) were community land area.

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Keywords: forest and land fire; Jambi; hotspot; land cover; trajectory

* Corresponding author. Tel: +62-812-133-5130.
E-mail address: lbprastdp@yahoo.com.

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1. Introduction

Forest and land fire has been given very much attention due to its great impact on the environment. Fire contributed to deforestation rate [1], habitat loss & species extinction [2] as well as greenhouse gases emission [3]. In 1997/1998, during the El Niño anomaly event there were 790 thousand hectares of forest disappear and release of about 0.81 – 2.57 Gton CO_2 e to the atmosphere [4] and its transboundary haze has created environment problems in neighboring countries [5]. Instead of its negative impacts, fire cannot be separated with the agricultural practices in the tropics. Shifting cultivators used to use fire as part of their cultivation technique. From the view point of farmers, burning will create space for crops planting, provide ash as a fertilizer, improve soil structure enabling faster sowing of seed, reduce weed competition, reduce occurrence of pest and disease [6]. However, recently fire also have been applied in large areas for land preparation of companies/concession, in order to minimize production cost [7]. During El Niño anomaly period, such kind activities might result in large uncontrolled forest and land fire, especially on dried peat soil. In the context of forest management, forest and land fire should be anticipated at the early stage. Regarding to REDD+ mechanism, forest and land fire is considered as risk and have to be taken into account seriously. To anticipate the fire occurrence, vulnerability forest and land fire mapping has been promoted based on weight & score of variables, such as physical factor, biomass, and disturbances (distance from human activities). Variables' weight and score to some extend are made based on theoretical knowledge and assumptions which are not based on fire occurrence in particular area and therefore resulted in inaccurate and mismatch with the fire occurrence in that area.

Global forest fire monitoring has been becoming very efficient by the availability of real time fire active data derived from Moderate Resolution Imaging Spectro-radiometer (MODIS) sensor on board of Terra-Aqua satellites [8]. The MODIS active fire has resolution of 1 x 1 km. It has been widely used for National official hotspot monitoring and information, such as Indonesia. It was also applied for Global burn scar estimation [9]. Objective of this research is to determine distribution of fire occurrence based on historical hot spot data during 15 years period (2001-2015), as such fire occurrence probability in particular area can be determined. The second objective is to analysis land cover and land use trajectories before and after fire occurrence. This will help to understand process and intention of drivers to use fire. Hopefully, the research result would be used to improve policy development to mitigate forest and land fire occurrence and determine priority areas. Jambi province was taken as a case due to its vulnerability to fire among other provinces in Sumatera Island.

2. Materials and Method

2.1. Study site

Study site is situated in Jambi Province (Fig. 1). The province consists of flat lowland area in the eastern and mountainous/hilly areas in the western part. The remaining forest in the area is in lowland area in the form of fresh water swamp and peat swamp forest, meanwhile the mountainous and hilly are upland forest. In the flat area, land cover was dominated by mixed between upland agriculture and bush. This is typical land cover of shifting cultivation, indicated by varies stages of secondary vegetation. As the main tree in shifting cultivation in Jambi is rubber (*Hevea brasiliensis*). Some researches called such kind of land cover as rubber jungle [10]. Other land cover on this flat area is oil palm plantation.

2.2. Historical data of forest and land fire

Hotspot data during the period of 2001 – 2015 of Jambi Province were downloaded from MODIS active fire data [8]. The hotspot data were selected by 80% confidence level of threshold value. The threshold value is higher compare to research result in Kalimantan, in which forest fire occurrence in the field were correlated with hotspot confidence level higher than 50% [11].