

## **Analisis Kejadian Kebakaran Hutan di Kawasan Taman Nasional Berbak Sembilang Provinsi Jambi Selama Periode 2000-2018**

### ***Historical Forest Fire Occurrence Analysis in Berbak Sembilang National Park Jambi Province during Periode 2000-2018***

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**ABSTRAK** – Penelitian mengenai kebakaran hutan dan lahan telah banyak dilakukan rawa gambut dan rawa payau sangat rentan terhadap resiko kebakaran. Kebakaran berdampak besar yang sangat dirasakan oleh masyarakat di Pulau Sumatera akibat kebakaran di kawasan TNBS adalah kebakaran pada tahun 2015. Penelitian mengenai analisis sejarah kebakaran di TNBS belum pernah dilakukan sebelumnya dikarenakan TNBS merupakan gabungan dua kawasan taman nasional dari dua provinsi yakni Provinsi Jambi dan Sumatera Selatan pada tahun 2018. Penelitian ini dilaksanakan dengan menganalisis perubahan tutupan lahan yang terjadi pada tahun 2000-2018 di kawasan TNBS juga berdasarkan data hotspot yang telah dikumpulkan selama periode tersebut. Pengambilan data lapangan berupa kondisi bahan bakar setelah kejadian kebakaran juga dilakukan dalam melakukan analisis ini. Berdasarkan analisis yang telah dilakukan kebakaran berulang yang terus terjadi di kawasan TNBS terjadi setiap tahun serta mengakibatkan berkurangnya jumlah tutupan hutan primer di kawasan TNBS sehingga pada akhirnya penelitian ini menyarankan bahwa tindakan konservasi dan pemantauan menjadi sangat penting dilakukan secara serius di kawasan TNBS.

**Kata kunci:** mitigasi, hidrologi, DAS

**ABSTRACT** - Research on forest and land fires has been carried out however forest and land fires in Indonesia still occur every year. It has been a historical record that 1983 forest and land fires in West Kalimantan which burned an area of 3.6 million hectares seemed not to be a lesson in monitoring fire, especially in forest areas. Berbak Sembilang National Park (TNBS)- is a combination of two national park areas in 2018-consisting of ecosystems of peat swamps and freshwater swamps which are very vulnerable to fire risk. The major impact of the forest fire on the people in Sumatra province was the fire in 2015. Research on the historical history of fires in TNBS has never been done before because TNBS is a combination of two national park areas from two provinces Jambi and South Sumatra in 2018. This research was carried out by analyzing land cover changes that occurred in 2000-2018 in the TNBS area also based on hotspot data that had been collected during the period. Field data that collected in this research are fuel conditions after a fire occurrence. Based on the analysis of repeated fires that continue to occur in the TNBS area every year and reduction in the number of primary forest cover in the TNBS area, so that in the end this study suggested that conservation and monitoring actions are very important to be taken seriously in the TNBS.

**Keywords:** mitigation, hydrology, DAS

## **1. INTRODUCTION**

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 TerraAqua satellites (Earth Data, 2019). 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 and also applied for Global burn scar estimation. Objective of this research is to determine distribution of fire occurrence based on historical hotspot data during 18 years period (2000-2018) in Berbak Sembilang National Park (TNBS) as such fire occurrence probability in particular area can be determined.

Fire is a common occurrence on degraded tropical peatlands, (Graham, et al., 2014). Forest and land fire has given very much attention to its great impact on the environment. Fire contributed to deforestation rate (Siegert F and Hoffmann A A, 2000) habitat loss and species extinction as well as greenhouse gases emission (Prasetyo, L B et al., 2015). The threat to the loss of tropical forests is in line with the loss of biodiversity (Brooks et al., 2002; Dirzo and Raven, 2003; Gardner et al., 2009). In 1997/1998, during the El Niño anomaly event there were 790 thousand hectares of forest disappeared and released of about 0.81 - 2.57 Gton CO<sub>2</sub> e to the atmosphere Page S E et al., 2002) and its transboundary hazy has created environment problems in neighboring countries. TNBS consists of two habitat types – freshwater swamp forest and peat swamp forest – that extend over 200,000 hectares has been very vulnerable to fires. Hopefully, the research result would be used to improve policy development to mitigate forest and land fire occurrence.

## **2. MATERIAL AND METHOD**

### **2.1. Study site**

Study site is situated in TNBS located in Jambi and Sumatera Selatan Provinces and extends over an area of approximately 200,000 hectares (Fig. 1). TNBS forms part of the vast alluvial coastal plain of eastern Sumatra, that is assumed to have formed about 5,000 years BP. Evidence indicates that sea levels have dropped about two metres during the past 5,000 years, with sediments – mainly supplied by the Batanghari River – accumulating along the accreting coastline. On the highly weathered sediments, peat has formed, with an average age of about 4,500 years, and in some areas with a depth of more than 20 metres (Scholtz, 1983). Berbak is very flat, and at no point is the elevation more than about 15 metres.

### **2.2. Historical data of forest and land fire**

Hotspot data during the period of 2000 – 2018 of Berbak National Park were downloaded from MODIS active fire data. 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% (Thoha A S et al., 2014).

### **2.3. Distribution of hotspot**

Hotspot distribution were analyzed by using Getis-Ord-Gi\* statistic, a spatial analysis tool in ArcGIS software (Formula 1, 2, and 3). Since the input data was point feature (hotspot data), the tools will do clustering of hotspot points based on the number of hotspot occurrence points per grid (fishnet) that derived automatically during processing. Then the tools determine statistically significant spatial clusters of high values (called as hot spots), low values (called as cold spots) and not significance area. Further the hotspot and cold spot area was classified into 90%, 95% and 99% probability occurrence.

### **2.4. Land cover & land cover identification**

Land cover identification were performed based on visual classification of Sentinel 2 taken in 2018. Classification technique was relied on key identification of object such as on color, tone, size, shape, texture, pattern, site and association. Land use and land cover before fire occurrence were determined based on Sentinel 2 data approximately a year before fire occurrence (hotspot acquisition), meanwhile land use and

land cover after occurrence were determined based on Landsat taken 3 years after fire occurrence. This period of time is determined for the sake of clarity to identify land-use type.

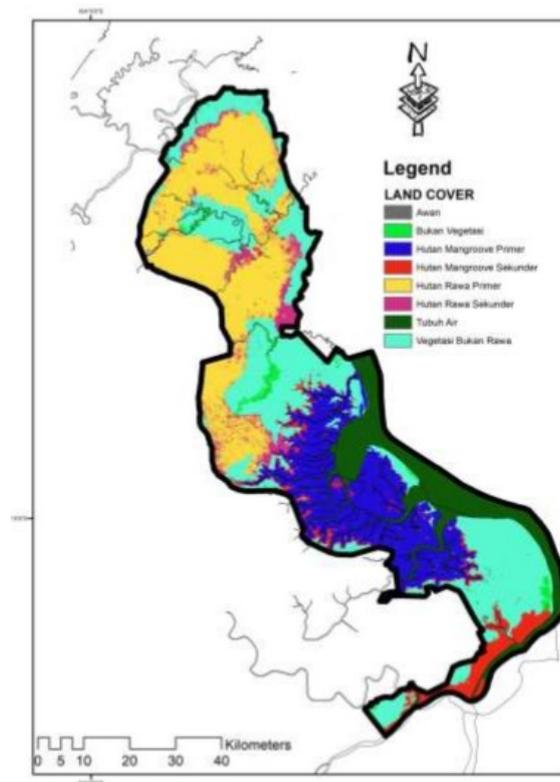


Figure 1. Berbak Sembilang National Park

The Getis-Ord local statistic is given as:

$$G_i^* = \frac{\sum_{j=1}^n w_{i,j} x_j - \bar{X} \sum_{j=1}^n w_{i,j}}{S \sqrt{\frac{n \sum_{j=1}^n w_{i,j}^2 - \left( \sum_{j=1}^n w_{i,j} \right)^2}{n-1}}} \quad (1)$$

where  $x_j$  is the attribute value for feature  $j$ ,  $w_{i,j}$  is the spatial weight between feature  $i$  and  $j$ ,  $n$  is equal to the total number of features and:

$$\bar{X} = \frac{\sum_{j=1}^n x_j}{n} \quad (2)$$

$$S = \sqrt{\frac{\sum_{j=1}^n x_j^2}{n} - (\bar{X})^2} \quad (3)$$

The  $G_i^*$  statistic is a z-score so no further calculations are required.

### 3. RESULT AND DISCUSSION

#### 3.1. Distribution of hotspot

Between 2000-2018 periods, there were 32,501 hotspot occurrences in TNBS. Among them 1,214 occurrences were selected, in which is having probability 80% of confidence level. Fire has been utilized in

land clearing in Jambi and community around TNBS and therefore, it is not surprising every year during 2000 – 2018, fire occurrence could be detected. Hotspot occurred either during drought condition of El Niño in the year of 2004, 2006, 2009 and 2015 or wet condition of La Niña in the year of 2001, 2007, 2008, 2011, and 2012. Based on historical hotspot occurrence (**Figure 2**), it seems that there was no relationship between climate anomalies with the number of hotspot after 2012. In 2011 and 2012 huge number of hotspot was detected even though the period was during wet condition of La Niña. This condition has made difficulties to predict forest fire based climatic factor as suggested by Spessa et al., 2015 and Wooster et al., 2012. Peat land area is only about 12 % of Jambi Provinces, however of about 79 % points hotspot were situated in peat area, especially at surrounding TNBS. Base on Gi\* spatial statistic, this area have occurrence confidence level more than 90%, and defined as hotspot area, meanwhile most of mineral soil area were not significance (**Figure 3**). This fact is surprising since under normal condition, peat land is inundated and therefore is hardly burned. Only under condition of drained peat easily burned. Large number of hotspot occurrence on peat even in La Niña season indicated that the peat ecosystem has already disturbed and drained.

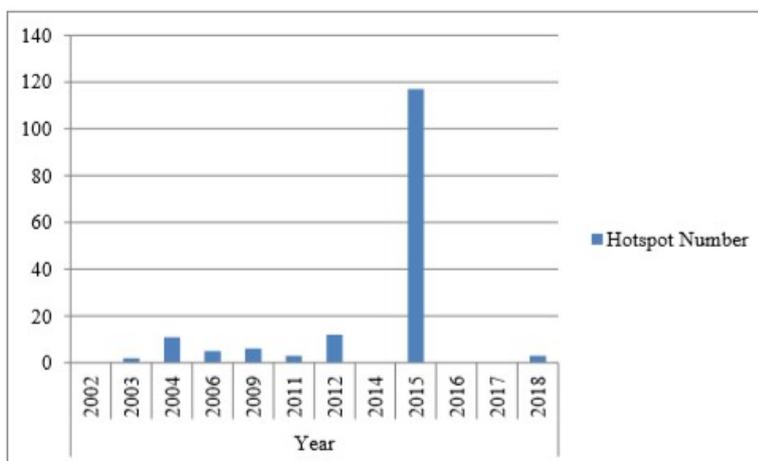


Figure 2. Hotspot number during 2002-2018

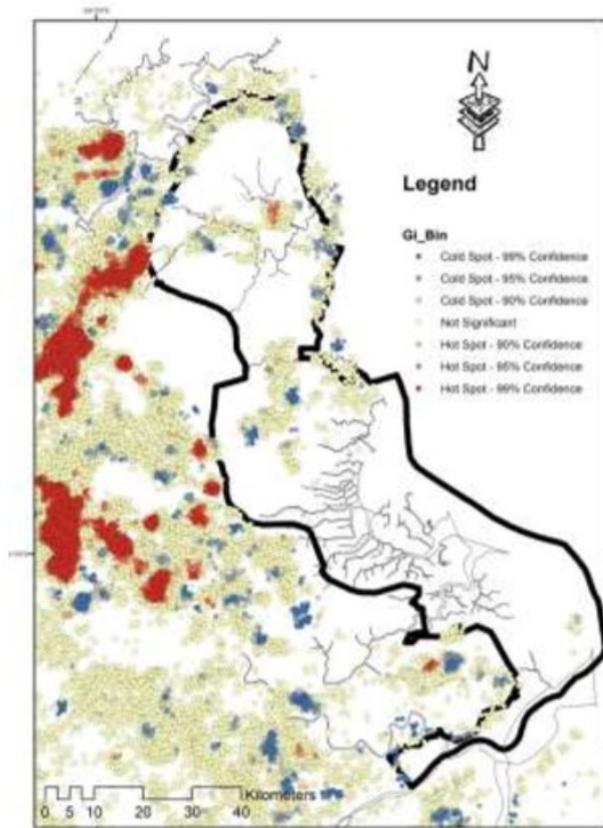


Figure 3. Hotspot occurrence distribution during 2000 – 2018

#### 4. CONCLUSION

Between 2000-2018 periods, there were 32,501 hotspot occurrences in TNBS, in which 1,214 occurrences having probability 80% of confidence level. Fire tends to occur in peat land every year, either during El Niño or La Niña period.

#### 5. ACKNOWLEDGEMENTS

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