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Potential Analysis Of Peatland Fire In Ogan Komering Ilir District

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Abstract— Based on data from CIFOR (Center for International Forestry Research), there are 3 million hectares of wetlands in South Sumatra, with an area of 1.73 million hectares of peatland. Around 796,000 hectares of peatland are located in the district of Ogan Komering Ilir. Almost every year peatland fires occur in this area. Therefore, it is necessaryto mitigate the disaster of peatland fires by analyzing the potential level of vulnerability to peatland fires in Ogan Komering Ilir Regency. There are five sub-districts that are sampled in this study, namely Kayuagung, Tulung Selapan, Pedamaran Timur, Pangkalan Lampan, and Pedamaran District. The parameters reviewed were based on the type ofland cover, the maturity level of the peatlands, and the water level of the peat soil. In addition, the potential for peatland fires is seen from the intensity of rainfall. Because the potential for peatland fires is higher if they occur during the dry season where rainfall intensity is low or during dry months. The results showed the potential for peatland fires based on the characteristics of peatlands in Ogan Komering Ilir Regency has a moderate to high level. While the analysis is based on the intensity of rainfall, the potential for peatland fires from July to November which is a dry month with rainfall intensity < 100mm. .

Keywords— peatland; fires; rainfall; Groundwater Level

I. INTRODUCTION

According to CIFOR (Centre for International Forestry Research) data, South Sumatra has wetlands covering 3 million hectares and peatlands covering 1.73 million hectares. The Ogan Komering Ilir Regency area contains around 796,000 hectares ofpeatlands, and peatland fires occur there virtually yearly.[2]

In 2017, there were 9,286 hectares of forest and land fires in South Sumatra Province, distributed among 11 (eleven) regencies/cities. Ogan Komering Ilir Regency had the most fires, totaling 2,614 hectares, or 28.15 percent of the burned land area.[5].

Fires that occur on peatlands are very difficult to extinguish because fires can spread to the inner layers of peat soil and spread to other areas. Due to the abundance of organic matter in peat soil, the deep layers of burned peat soil will become hotspots.

As a result, actions are required to prevent peatland fires. In South Sumatra Province, one of these initiatives entails mapping the potential for peatland fires in regions with the greatest peatlands. Peat soil physically has the ability to dry out and then never return. Peat that has dried and has a moisture percentage of less than 100% cannot absorb water when wet. Dry peat can catch fire and is readily washed away by water.[1].

Dry peat has the same properties as firewood. However, burning peat produces more heat energy than wood. If the fire spreadsbelow the peat surface it can cause wider peat fires and fires will be difficult to extinguish.

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Fires that occur on peatlands are initiated by the ignition of fires on the ground surface, either intentionally or unintentionally to clear land. Fires can occur in company concession areas, community lands, forest areas/National Parks, and land conflict areas.

Peat fires are influenced by several factors, both peat character and weather. Peat characteristic factors include: peat water content, water level, peat decomposition rate, and peatland cover. Meanwhile, the weather factor, based on the intensity of rainfall, is divided into wet months, humid months, and dry months. Wet month if the rainfall >200mm, Moist month if the rainfall is 100 - 200mm, and Dry month if the rainfall <100mm.

Peatlands have a high organic content so they can be used as fuel in the event of a fire. The level of fuel availability in peatlands is influenced by the moisture conditions of the peat soil. Meanwhile, the condition of peat soil moisture is influenced bythe groundwater level.

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The peat's high water content has an impact on how quickly it burns. Whereas the rate of burning is inversely correlated with the amount of water in the peat. The ripeness of the peat also influences how easily peatlands burn. Peats that are fibric and hemic in composition burn more readily than sapric peat.[9].

The kind of land cover has an impact on the risk of forest and peatland fires. With a burned area of 80,708.99 ha (0.53% of theentire study area), areas with bush land cover have the highest risk of forest and land fires (very high risk). Because shrubs have a finer structure than other combustible materials, they are more flammable.[13].

Based on the hotspot density level, bushland cover is the area with the most dense hotspots at 0.507 per km2. The lowest hotspot density level is in unvegetated areas (open land) at 0.188 per km2. Based on the function of the area, the plantation and cultivation development areas have the highest number of hotspots. Meanwhile, the research forest area has the fewest hotspots. Areas that function as industrial plantation forest areas have the highest hotspot density, and are followed by thick peat conservation areas. Based on the type of land system, there are three land systems that are vulnerable to fire hazards, namely the deeper peat swamp land system (8,188.44 ha or 0.54%). shallow peat (1,958.96 ha or 0.01%) and shallower peat (1,175.37 ha or 0.01%). The three land systems above are classified as peat soil types which consist of wood residue, litter and twigs that have notbeen completely decomposed. The deeper the peat layer, the more wood remains, so the deeper the peat layer the higher the risk of fire[13.]

The severity of autumn can affect the water status of peatlands. Peat groundwater status varies and is closely related to degradation. Where the water surface remains underground from December to May. During the period from June to October the water surface depth ranges from 12 cm to 50 cm and the critical water level is 40 cm.[10].

II. METHODOLOGY

The research location is in 5 sub-districts in Ogan Komering Ilir District, namely: Kayuagung District, Tulung Selapan District, and Pedamaran Timur District, Pangkalan Lampan District and Pedamaran District. In each sub-district there are 2 locations of sampling points in different places. Research time September 2021. The data taken in this study are based on the characteristics of the peat soil and the intensity of rainfall.

Based on the characteristics of peatlands there are three parameters that are reviewed:

a. Land cover

b. Peat maturity level

c. ground water level

Rainfall intensity data is used to determine the climate based on Oldeman's criteria. The criteria in this climate classification are based on the calculation of the Wet Month, Moist Month, and Dry Month with the limitation of taking into account the chance of rain, effective rain and crop water needs. Wet Month, is a month with an average rainfall of

more than 200 mm. The Moist Month, is a month with an average rainfall of 100 to 200 mm, and the Dry Month, is a month with an average rainfall of less than 100 mm.

Land cover data was obtained through field observations. Peat maturity level data were obtained through fiber content testingin the soil mechanics laboratory or direct observation in the field. Peat water level data was obtained through direct measurements in the field. Rainfall intensity data were obtained from the Badan Meteorologi Klimatologi dan Geofisika. Kenten, Palembang

Analysis based on peat characteristic factors which include: land cover analysis, water level, and peat maturity level was carried out to determine the level of potential fire hazard of peatlands. To analyze the potential for peatland fires, it is done by assigning a score to each parameter. Scoring is given on a scale of 1 to 3. where the highest scale indicates a high potential for peat fires.

Differences in land cover will cause differences in the extent of fires. Where peatlands with bushland cover are very prone to peatland fires (36,8%) compared to swamp forests (27,7%), industrial plantation forests (9,2%), oil palm plantations (6,9%) and coconut plantations. (5%)[11].

Table 1. Scoring of land cover and land use types against potential peat fires

land cover and land use types	Score
Primary/secondary forest	1
Industrial forest/ plantation	2
Weed bush	3

The maturity level of peatlands at the time of hotspot occurrence at the research location at a depth of 0-100 cm is the hemic type. Peatlands that have a hemic maturity level are quite vulnerable to peatland fires, because hemic peat does not have a large water holding capacity, so the land quickly becomes dry. In addition, hemic peat has finer plant fibers, so if it is ignited, it will spread to the side more quickly[7].

The water content of peat in natural conditions is determined by the level of maturity of the peat. In peat that has a very crude maturity level (fibric), most of the water is in the macro pores so that the water will quickly disappear if it is drained. Whereas in more mature peat, water is stored in micro and meso pores. The force of gravity is not sufficient to drain the water stored in the micro or meso pores, so the water will be more retained[3].

Based on the results of the research above, the highest scoring for the potential for peat fires is for the maturity level of Hemik peat, then fibric, and the smallest is Saprik.

Table 2. Scoring of Peatland Maturity Level Against Peat Fire Potential

Peatland Maturity Level	Skor
Sapric	1
Fibric	2
Hemic	3

The critical point for the depth of the peat soil water table ranges from 27 to 74 cm. The water table depth of peatlands should be maintained below the critical point, otherwise the potential for peatland fires will increase[8].

Table 3. Scoring of Peat Groundwater Level Against Peat Fire Potential

Peat Groundwater Level	Score
< 27 cm	1
27 - 74 cm	2
> 74 cm	3

From the three parameters above, an overall analysis was made at each sample point. Furthermore, the three parameters are then added together, to get the results of scoring the potential level of peat fires.

Table 4. Scoring of Peat Fire Potential Level

Peat Fire Potential Level	Skor
Low	1-3
Medium	4-6
High	7-9

III. Result And Discussion

A. Peatland Fire Potential of Ogan Komering Ilir Regency Based on peat characteristic factors

The results of the analysis of the potential for peatland fires carried out at each soil sampling point are as follows:

a) Sample point 1 KA 1

The research location is in Kotarayo Village, Kayuagung District, Ogan Komering Ilir Regency. Geographically it is located at coordinates - 3024'49,692'S 104051'4,764'E 1150SE.

Based on the land cover analysis, the peat in Kotaraya Urban Village is in the form of shrubs that cover almost the entire peat area, with a few chili plants planted in the part adjacent to the road. Based on the land cover, the peat soil at the sample point of KA 1 has a score of 3. Based on peat maturity level analysis, including safric (ripe) peat. Based on this analysis, the score of peat soil at the sample point of KA 1 is 1.Based on the analysis of the groundwater level, including those with a groundwater level of about 10 cm-20 cm. So based on the analysis of the groundwater level, it has a score of 1.

Based on the scoring of these three parameters, at the sample point locations, KA 1 has a total score of 5. This value belongs to the category of medium peat fire potential.

b) Sample point 2 KA 2

The second research was conducted in Kedaton Village, Kayuagung District which is located at coordinates - 30235239205 10405232,6820E 206 SW. Based on land cover analysis, it has a score of 3. The land cover at the research location is in the form of grasslands / shrubs. Based on the analysis of the maturity level of peat, including Hemik peat, with a score of 3. Based on the water level, it has a depth of about 21 cm, with a score of 1. Based on the three analyses, sample point2 has a total score of 7, with a high level of potential for peatland fires.

c) Sample point 3 PT 1

Subsequent research is located at the location of SP 1, East Pedamaran District. Geographically, it is located at coordinates

-3033'10,878"S and 10502'30,546"E, 34060N.The results of the analysis based on land cover have a value of 2 because it is oilpalm plantation land. While the results of the analysis are based on the maturity level of peat including safric

peat, so the valueis 1. Based on the analysis of water level, the water level is between 8 cm to 20 cm, has a score of 1. The total value of the three parameters observed at the site is 4 and includes a moderate level of fire potential.

d) Sample point 4 PT 2

The location of sample point 4 is in Sumber Hidup Village, Pedamaran Timur District, with coordinates of - 3033'10,81706"S and 10502'27,61166"E, 2300SW. Based on land cover, it is peatland which is mostly overgrown with grass and partly overgrown with gelam trees. The water level varies, there are some areas that are inundated with water and the land area has a water level of about 23 cm. Based on the maturity of the peat type, including hermic peat. The results of the analysisbased on land cover, get a score of 3. while based on water level, it has a score of 1, and based on peat maturity it has a scoreof 3. The total score of the three analyzes is 7 and based on the potential for peatland fires, it is high.

e) Sample point 5 TS 1

The 5th research location is located in Tulung Selapan Timur Village, Tulung Selapan District with coordinates - 301516,050S 105019'21,1380E 3410N. The results of the analysis based on land cover have a value of 3, because the research location has a land cover of shrubs. Based on observations including hemic peat, so that the results of the analysis based on thematurity of the peat have a value of 3. Based on the analysis of the depth of the water table, it has a value of 2 because the water level depth is between 31cm-40 cm. The total value of the three parameters observed is 8 and has a high potential for peat fires.

f) Sample point 6 TS 2

The location of sample point 6 is located in Tulung Selapan Ilir Village, Tulung Selapan District, with coordinates of - 3.251728”S and 1050298535”E. Based on the results of the land cover analysis, it has a value of 3 because the land cover is in the form of grass plants and a few gelam trees. The results of the analysis based on the maturity of peat, including safric peat (ripe), so the value is 1. Meanwhile, based on the analysis of water level, it has a value of 1 because some of the peatlands are inundated with water. On dry soil, water level <27 cm. The total value from the analysis of the three parameters observed is 4, so sample point 6 has a moderate peat fire potential.

g) Sample point 7 PL 1

Point 7 is located in Deling village, Pangkalan Lampan sub-district, with coordinates -3.2229480S and 105, 0759170E. Based on land cover analysis, sample point 7 gets a score of 3 because it is a bush area. Analysis of peat maturity shows thatsample point 7 is Hemic peat, with a score of 3. Meanwhile, based on water level, most of the peat area is covered by water,with an average water level of <27 cm in dry areas. Based on the analysis of the water level has a score of 1. The total scorebased on the three analyzes for the sample point 7 PL 1 is 7 and has a high potential for peat fires.

h) Sample point 8 PL 2

The location of sample point 8 is located in Pangkalan Lampan Village, Pangkalan Lampan District, with coordinates - 3.2182370S and 105.0828480E. The peatlands at that location are dominated by purun plants (Eleocharis dulcis), so the resultsof the land cover analysis have a score of 3. based on the maturity of peat including hemic peat, so it has a score of 3. while based on the analysis of water level it has a score of 1 because most of the peatlands inundated by water. The total score for sample point 8 is 7 and belongs to the category of a high level of potential for peatland fires.

i) Sample point 9 PD 1

The research location at point 9 is in Cinta Jaya Village, Pedamaran District, with coordinates 3028'47,168"S and 104051'5,997"E. Based on the land cover analysis, it got a score of 3, because it was a grassy meadow, mostly purun (Eleocharis dulcis) and a few Gelam (Maleleuca sp) plants. Most of the peat swamp at research point 9 is inundated by water. In the land area, the water level is between 10cm-20cm, so based on the analysis of the water level, it has a score of 1. Analysis based on peat maturity gets a score of 3, because it belongs to the Hemik peat type. Based on the

three analyzes above, the results of the study at the sample points of 9 1 indicate a high potential for peatland fires.

j) Sample point 10 PD 2

The 10th sample study was in the village of Menang Raya, Pedamaran District, with coordinates of 3029'38,927"S and 104049'17.05"E. At sample point 10, based on land cover analysis, it is an area covered by purun plants and a small number ofgelam trees, so it has a score of 3. The groundwater level is about 18cm-20cm in dry areas and most of the peatlands are flooded by water. So based on the analysis of the water level, it gets a score of 1. Based on the maturity of peat is hemic peat, it has a score of 3. Based on the three analyzes above, the results of the research at sample points 10 indicate a high potential for peatland fires.

Table 5. Recapitulation of the Potential Level of Peatland Fire Hazards in Ogan Komering Ilir Regency.

N0	Sample point	Village	Scoring for land cover	Scoring for Peat maturity level	Scoring for ground water level	Total value	Fire Potential Level
1	KA 1	Kotarayo	3	1	1	5	medium
2	KA 2	Kedaton	3	3	1	7	high
3	PT 1	SP 1	2	1	1	4	medium
4	PT 2	Sumber Hidup	3	2	1	6	high
5	TS 1	Tulung Selapan Ilir	3	3	2	8	high
6	TS 2	Tulung Selapan Ulu	3	1	1	4	medium
7	PL 1	Deling	3	3	1	7	high
8	PL 2	Pangkalan Lampam	3	3	1	7	high
9	PD 1	Cinta Jaya	3	3	1	7	high
10	PD 2	Menang Raya	3	3	1	7	high

Based on the table of the Recapitulation of Potential Levels of Fire Hazards for Peatlands, Ogan Komering Ilir Regency, it shows a moderate to high level. Therefore, efforts and cooperation of stakeholders are needed to prevent the occurrence of peatland fires in Ogan Komering Ilir Regency.

B. Peatland Fire Potential of Ogan Komering Ilir Regency Based on Rainfall

Based on rainfall data from 2018 to 2019, the dry months in 2018, occurred from July to September. In 2019, the dry month starts from July to November. Whereas in 2020 only two months experienced dry months, namely July and August. The potential for peatland fires is higher if they occur during the dry season where rainfall intensity is low or during dry months. Therefore, in the dry months, around July to November, high attention and vigilance are needed in an effort to prevent forest fires on peatlands.

Tabel 6. Rainfall (mm) in year, Ogan Komering Ilir District

Month	Amount of Rainfall (mm) in Year		
	2018	2019	2020
January	228.80	109.10	114.30
February	263.50	307.40	298.50
March	452.80	484.60	367.90
April	324.60	349.50	396.50
May	137.40	166.90	265.30
June	172.70	119.80	133.00
July	43.30	96.00	74.90
August	95.30	0.50	48.60
September	77.90	14.90	116.00
October	214.80	75.90	251.80
November	310.10	67.70	333.60
December	211.50	242.20	228.20

Source : Badan Meteorologi Klimatologi and Geofisika Kenten Palembang.

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