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Socioeconomic factors of smallholder farmers' behavior in biomass burning around palm oil plantation in Indonesia

Maswadi ^{1,4}, Arifudin ², Nurmelati Septiana ³ and Maulidi ¹

¹ Universitas Tanjungpura, Universitas Riau², dan Universitas Lambung Mangkurat³

⁴ Email Corresponding : maswadi@faperta.untan.ac.id

Abstract. Indonesian peatland fires has been revealed as the cause of haze disaster in Indonesia, while oil palm plantation's concession owned both by companies and smallholder farmers are accused as the main cause of this problem, especially in practice of land clearing. It is very important to conduct research on socioeconomic factors of farmers' behavior in burning the peatland, while peatland one of the megabiomass storage in nature. The research was conducted in Kalimantan barat, where in province has been choosen two villages as the sample. Observation, interview with quuestionare, and focus group discussion were used in collecting data. In term of analysing the data, regression analysis (ordinary least square) was performed using SPSS Program. The result show that: (1). The socio economics factor that are affecting the burning behavior, were extension's activities, degree of knowledge, consideration to burn, degree of participation on organisation and degree of cosmopolite. On the other hand, degree of burning frequent, was affected by land productivity, extension activities, and degree of participation in organisation, and finally the size of land' burning is affected by, the kind of burning's activities, the mutual aid (social capital), consideration of land burning, degree of awarness, and degree participation on organization.

1. Introduction

The community is one of the most important elements in the implementation of fire prevention efforts. Society is all unity of human life that interact according to custom system which is bound by a sense of common identity. The concept of society according to Hughes et al. (2002) referred by Main (2010) [15], society refers to a group of people living within the same territory and sharing a particular culture. The culture makes people have the same values and norms and usually have a common language.

Based on the Regulation of the State Minister for the Environment, Land is a terrain of terrestrial ecosystems used for business or field activities or gardens for the community, whereas according to West Kalimantan Regulation [10], land is an area outside the forest area, Vegetation (alang-alang, bush, cultivated and other crops) or non-vegetation intended for development in agriculture, plantation, forestry, transmigration, mining and others. Based on some of these definitions, the definition of land in this study is the area outside the forest area used for the cultivation activities in the form of peat soil.

The results of a study conducted by [9] suggest the reasons for the danger of fire in peatlands because if fires occur below the surface, there is no tool capable of extinguishing them. Very perfect peat land hold fire, fire can be extinguished only with the rain that fell with a swift. If rain falls relatively small (not to inundate peatland), peat fires will cause greater smoke, other than that rapid fire creeps on the inside of dry peatlands, which often leads to new fire spots in some places.



Because of the incident, many human activities are disturbed [2]. Fires cause huge losses and problems in various aspects, ranging from health, social and economic aspects. Disadvantages in the health aspects of the smoke caused can interfere with breathing and cause various diseases. Losses on social aspects affect the political relations between neighboring countries, because the smoke that spreads beyond the borders of the country is considered environmental pollution that can disturb visibility. Losses on the economic aspects that can be estimated only include losses in timber value, but many other non-timber losses cannot be accurately estimated, such as germplasm, ecotourism, water resources and water regulator, erosion control and soil conservation and nutrient cycles . Forest and land fires also have negative impacts on the vegetation, wildlife, soil, water and air that can be felt by the community not only in the fire location, but also into the area even to neighboring countries.

Due to the magnitude of losses caused by frequent fires, it is necessary to make efforts to prevent fire. Fire prevention is better as the first action than doing much more difficult and costly blackouts and rehabilitation. Precautions in the management of forest and land fires have the objective of preventing fires, minimizing fires, minimizing the impact of fires and maintaining and preserving forest resources from the dangers of land fires [1]. This study aims to determine the factors that influence the behavior of burning the peat land, especially around community-based oil palm plantation areas.

2. Methods

2.1. Research Design

This study uses an explanatory study is research method to retrieve data from the sample and questionnaire as a data collection tool. Once the data is obtained, the results are explained in the explanatory, and the data were analyzed to test the hypothesis proposed at the beginning if study [4].

2.2. Location and Time of Study

Determination of research area is based on criteria that have a close relationship with the issues raised in the study. These criteria include the West Kalimantan province which has the location of the second most frequent fires in Indonesia after Riau Province. Bengkayang Regency is a fire-prone district located around the area of oil palm plantations.

2.3 Population and Sample

Populations in this research are farmer owner and peat land farmer whose land has been burnt and its land is in the surrounding land which had burned around palm oil plantation. The sampling technique was done by using census method or total sampling. Therefore, this study includes population studies or census studies, in line with those expressed by [3] hich refers [6] that the appropriate sample size for census studies is 100-200. Based on the informants (in this case the village head of each research village), the number of farmers who owned and cultivated the land that had burned and been around the land had been burned is as follows:

Tabel 1. Number of Population and Sample

District	Village	Number of Population/unit	Number of Sample
Sui raya Kepulauan	Sui Raya	60	60
Sui Raya Kepulauan	Sui Keran	60	60
Total		120	120

The total sample in this research is 120 respondent of farmer owner and cultivator of land that has been burnt and farmer owner and cultivator of land which is around the land had burned and land around palm oil plantation area.

3. Data Analysis

This study used multiple regressions with OLS (ordinary least square) method with prediction of factors influencing burning behavior seen from three aspects, that is the opportunity of burning behavior of the land (Y_1), the frequency of burning the land (Y_2) and the area of burned land (Y_3). Therefore, the model for the analysis of factors affecting burn behavior consists of three models. The model used is as follows [8]:

$$\begin{aligned}
 Y_{1n} &= \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} \\
 &\quad + \beta_{12} X_{12} + \beta_{13} X_{13} + \beta_{14} X_{14} + \beta_{15} X_{15} + \varepsilon \\
 Y_{2n} &= \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \\
 &\quad \beta_{14} X_{14} + \beta_{15} X_{15} + \varepsilon \\
 Y_{3n} &= \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \\
 &\quad \beta_{14} X_{14} + \beta_{15} X_{15} + \varepsilon
 \end{aligned}$$

4. Results and Discussions

4.1. Analysis of Burning Behavior of West Kalimantan Province

Analysis on the behavior of burning land in West Kalimantan Province shows there are several variables that influence the burning behavior significantly, as follows:

Table 2. Result of Behavioral Burning Analysis in West Kalimantan Province

Variabel		Y1 (Land Burning Behavior)			Y2 (Burning Frequency)		Y3 (Burning Area)	
		Coef.	Sig.	Exp(B)	Coef.	Sig.	Coef.	Sig.
X1	Area of farmland	.104	.009	1.110	.002	.975	-.171	.010
X2	Age of respondent	.000	.476	1.000	.006	.920	.010	.861
X3	Income	-.055	.110	.946	.080	.214	.029	.554
X4	Land productivity	.195	.000	1.216	-.018	.768	-.131	.019
X5	Extension activities	.120	.000	1.128	.073	.202	-.057	.282
X6	Number of plant species	-.160	.091	.853	-.020	.735	.008	.889
X7	Number of land plots	.002	.256	.998	.042	.441	-.079	.122
X8	Type of activity to burn	-.007	.464	.993	.072	.243	.127	.028
X9	Number of types of gotong royong	.000	.856	1.000	-.069	.210	-.030	.559
X10	Level of education	.017	.396	1.018	-.089	.119	.069	.192
X11	Knowledge level	.104	.009	1.009	.005	.928	.068	.199
X12	Rating burns	.031	.961	1.031	.060	.380	.116	.071
X13	Level of concern for the burning of land	.256	.649	1.291	-.210	.044	-.121	.014
X14	Activity of organization	.002	.907	1.002	.166	.003	.104	.043
X15	Cosmopolitan level	-.002	.000	.998	.142	.031	-.079	.122
Constant		-13.572	.002	.000		.357		.054
R²		.716			.437		.575	
N		120			120		120	

Source: Primary data analysis results (2017)

Remark: * = Significant at 95% confidence level

The results of the analysis show that there are several factors influencing the burning behavior of the land, namely:

Table 3. Significant Variables that Affect Behavior of Land Burning

Independent Variable	Y1	Y2	Y3
Farmland Area (X1)	Landowners tend not to burn land		Land owners who are still burning tend to burn land with a large area
Land Productivity (X4)	Respondents with low productivity levels, land burning behavior tend to be high		Respondents with low productivity levels tend to burn large areas of land
Extension Activity (X5)	Respondents with high level of education tend not to burn land		
Type of activity to burn (X8)			Respondents with type of activity burning a lot, tend to burn land with large area
Level of Knowledge (X11)	Respondents with a high level of knowledge tend not to burn land		
Rating burns (X12)			Respondents with good burn ratings tend to burn with a smaller area
Level of concern for the burning of land (X13)		Respondents' level of concern for high land burning tends to rarely burn	Respondents' level of awareness of high land burning, tend to burn with a smaller area
Activity of organization (X14)		Respondents with high organizational activity, tend to rarely burn land	Respondents with high organizational activeness, tend to burn land with small area
Cosmopolitan level (X15)	Respondents with high cosmopolitan levels, tended not to burn land	Respondents with high cosmopolitan rates tend to rarely burn	

Source: Primary Data Analysis Result (2017)

Factors that influence the behavioral opportunities of burning land are the area of farming land, land productivity, extension activities, level of knowledge, and cosmopolitan level. Thus, to reduce the chances of burning behavior can be done through the approach of the five variables. Village peat land fire prevention activities around the palm oil company is a social engineering in the direction of social change by paying attention to local wisdom (Indigenous knowledge). Local wisdom can be interpreted as local knowledge of the community in addressing the existing environmental conditions so as to be in harmony with nature. Physical changes of peat that have wet nature, causing some local wisdom are no longer suitable to be practiced, for example clearing land by burning. The habit of burning land is a local wisdom for people who used to do shifting cultivation, but now this practice is very dangerous to do, because changes in drained peat conditions and extreme weather changes cause vulnerable peat

land to occur small fires can spread into large fires. Nevertheless, many communities still have local wisdom relevant to practice, such as customary rules, such as forbidden forests, which prohibit the conversion of forest functions into non-forest areas. Another example is the local wisdom of the people who plant sago plants that are very compatible with the nature of peat in Sungai Tohor Village, Meranti Regency, Kepulauan Riau, [14]. Local community wisdom in every village that is relevant and in harmony with nature is very well explored and developed in the activities of fire prevention of land.

Several studies on local wisdom have been conducted by several researchers, in various types of society in Indonesia, such as the wisdom of the Osing community, Banyuwangi, East Java. Their local wisdom can be seen from their knowledge, values, morals and ethics, and the norms applied in the form of suggestions, rules and sanctions, and words of wisdom as a guideline for them to behave and act in safeguarding, preserving and preserving the eyes Water, especially in keeping a constant stream of water discharge, they protect the trees and plants around. In maintaining this local culture, the older generation pass on values, morals, ethics, and norms including Islamic norms as guidance on how to behave and act in the tradition and instinct to respect the environment for their families, neighbors, relatives and children -grandchildren [12]. Other local wisdom is in Sundanese society, where research conducted by [7] shows that directly or indirectly nature is actually "the earth of residence as well as the life of the living" for the Sundanese. Local wisdom is on its development to be 'custom and culture. Sundanese people who are still bound by *tatali paranti karuhun*) have a role in maintaining the sustainability and balance of nature. The Sea Tribe Society, Condong Indragiri Hilir Riau, also has local wisdom in preserving nature [17]. While local community wisdom research on peat swamp land has not been done yet, but there are some studies that indicate that there is local wisdom possessed by society such as research conducted by [16], who found that in cultivating, Dayaks have a particular way of managing agriculture and production technology, especially manifested in the local concept of *malacak*, *manatak* and *maimbul*, which is a manifest in hoeing, *bantangan* and agricultural cycles. Thus, basically local people in each region have their own local wisdom, in accordance with natural conditions and their history travel to adapt to nature. Utilization and excavation of local wisdom will be faster with a social engineering that encourages social change towards a better, environmentally friendly and sustainable.

The burning behavior of land viewed from burning frequency is also influenced by several factors, ie income and activeness of organization, while the area of burned land is affected by the area of farming land, the productivity of the land, the type of burning activity, the burning assessment, the level of awareness of the burning of the land and the activity of the organization. The main factors causing fires in sub optimal areas including on peat lands are burning behavior when clearing land, throwing cigarette butts indiscriminately, and land conflicts. The village community's control over the learner behavior is still low [5]. Therefore, it needs strengthening to reduce the human factor as the cause of fire or fire source through the assistance of fire prone villages. Company firefighting teams and community counseling concerning fires that have only been busy extinguishing fires during the dry season and are often overwhelmed, especially if the fires occur in peat areas, can be optimized by strengthening their capacity. In addition, the application of fire control regulations and sanctions to reduce the human factor as a source of fire is in dire need of strict supervision in the field (village) in order to sustain the impact. [5] indicated that weak land governance, highly dependent land-based economic activities, and poor community institutions have contributed to the lack of social control over land fires.

5. Conclusions

The burning behavior of community land around the oil palm plantation is influenced by the area of farming land, income, land productivity, extension activity, burnt activity type, level of knowledge, burning assessment, the level of awareness of the burning of land, the activity of organizing and the cosmopolitan level. Sustainability in reducing burning behavior is social dimension

(cosmopolitan level), economic dimension (farmer exchange rate) and ecology dimension (fertilizer use).

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