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## Importance of Community Preparedness to Wildfire in Indonesia

**Saut Sagala**

*Institute of Technology Bandung,  
Indonesia*

**Efraim Sitinjak**

*Resilience Development Initiative,  
Bandung, Indonesia*

**Dodon Yamin**

*Resilience Development Initiative,  
Bandung, Indonesia*

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**Saut Sagala<sup>1</sup>, Efraim Sitinjak<sup>2</sup>, and Dodon Yamin<sup>2</sup>**

*<sup>1</sup>School of Architecture and Policy Development, Institute of Technology Bandung, Indonesia*

*<sup>2</sup>Resilience Development Initiative, Bandung, Indonesia*

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### **Contact:**

**Alamat:** Jalan Imperial II No. 52, Bandung 40135  
Jawa Barat – INDONESIA  
**Telepon:** +62 22 2536574  
**Email:** rdi@rdi.or.id  
**Website:** www.rdi.or.id

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# Importance of Community Preparedness to Wildfire in Indonesia

Saut Sagala<sup>1</sup>, Efraim Sitinjak<sup>2</sup> and Dodon Yamin<sup>2</sup>

<sup>1</sup>*School of Architecture and Policy Development,  
Institute of Technology Bandung, Indonesia*

<sup>2</sup>*Resilience Development Initiative,  
Bandung, Indonesia*

## Abstract

*Wildfire causes a lot of impacts to Indonesian forest areas. The impact includes loss of biodiversity, destroyed agriculture areas and loss of properties. Communities living near to forest areas are also at risk to wildfire impacts. This paper explores current practices of community preparedness to wildfire in Indonesia, particularly in East Kalimantan and South Sumatra. The majority of wildfire occurrences in Indonesia in fact are induced by anthropogenic activities. Therefore, raising community preparedness will help not only to increase community resilience but their better management to mitigate fire occurrences. This paper argues that collaboration between stakeholders (community, private companies and government) will be beneficial to increase not only community preparedness but also to reduce fire incidents.*

**Keywords:** Community; Indonesia; preparedness; wildfire

## 1. Introduction

As a country located along the equator and in the tropical region, Indonesia has the third largest tropical forest in the world, after Brazil and Zaire (Makarim, et al, 1998). These forest areas are mostly located in Sumatra, Kalimantan and Papua Islands. In these forest areas, many indigenous people live near the forest. According to National Village Potential Data 2006 (BPS) and Forest Area Map of 15 province, there are 1,305 villages (4,08%) of the total 31,957 villages in Indonesia that are in forest area while 7,943 villages (24,86%) are located near forest area. These villages are mostly dependent to agriculture sector (Forest Department, 2008). These high interactions between people and forest create causal-relationship impacts between forest and people. Unfortunately, the anthropogenic activities in Indonesia result in more negative impact rather than the desirable opposite.

The major anthropogenic impact in Indonesia is forest conversion. While forests continue to dominate the landscape in Indonesia, other land use types are expanding, including bush and scrub lands, grasslands, areas of shifting cultivation, areas under permanent agriculture and settlements (Makarim et al, 1998). However, the recent and most challenging problems are the persistent and recurring incidents of wildfires. When a wildfire occurs near a village, it causes people at risk to economic and health problems. Indonesia's forests are a major component of the national economy, providing significant wood product exports, employment, domestic usage and non-timber resources.

Back in 1983, Lennertz and Pance (1983) noted about 3.5 million of Indonesian forest were heavily destroyed due to a long dry season in 1982. This was also followed by the fire incidents in 1983. Destroyed forest covers around 800,000 ha of primary forest, 1,400,000 ha forest area which is cut for logging. 750,000 ha of secondary forest, agriculture field, and settlement, and 550,000 ha of wetlands and forest wetlands. Figure 1 shows the distribution of wildfire hazards in Indonesia which are dominated by two large islands of Sumatra & Kalimantan (BNPB 2009).

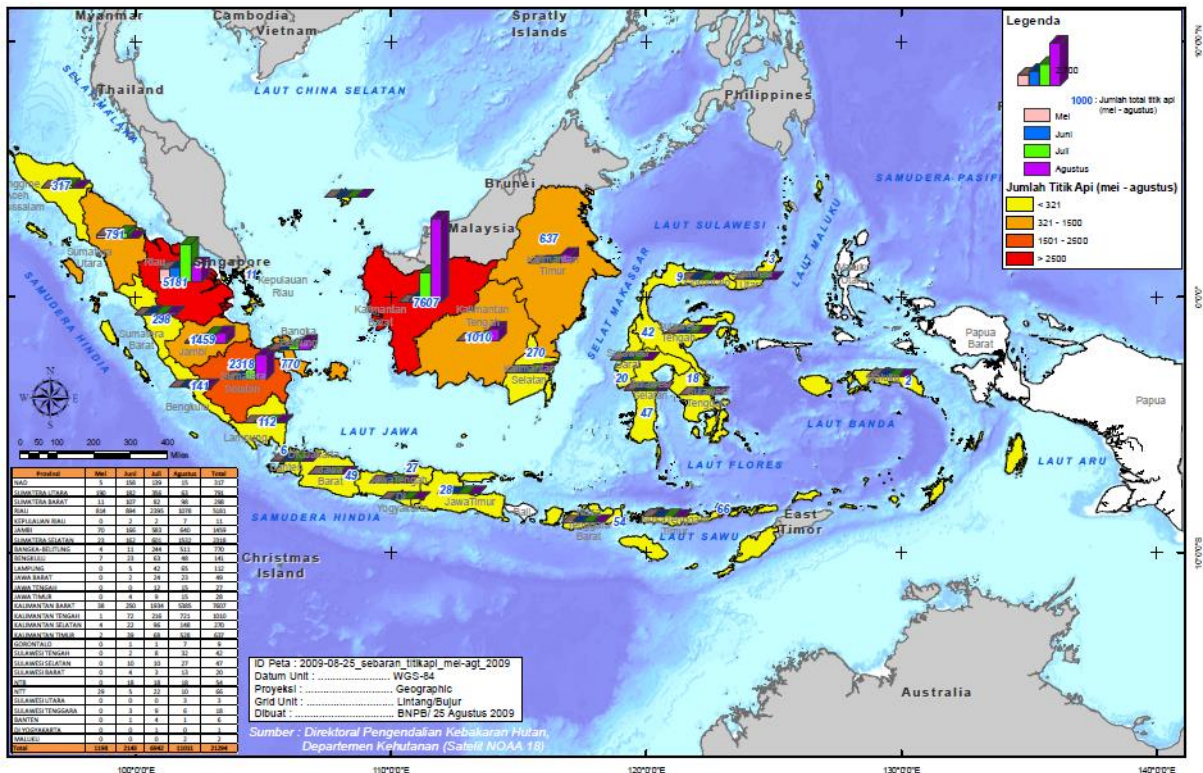


Figure 1 Wildfire Hazards in Indonesia

Source: BNPB, 2009

According to the data between 1997-2013 (BNPB, 2013), wildfire susceptibility areas in Indonesia can be divided as follows: very high (Central Kalimantan, West Kalimantan, Riau, Riau Islands, South Sumatra), high (East Kalimantan, Jambi, North Sumatra, South Kalimantan), medium (Lampung, West Sumatra, East Jawa, Nangroe Aceh Darussalam, West Java, Central Java, Special Region Yogyakarta, West Nusa Tenggara. East Nusa Tenggara, South Sulawesi) and low (Bengkulu, West Papua, Papua, Moluccas, DKI Jakarta, Central Sulawesi, North Sulawesi, South West Sulawesi, Bali). This research draws upon two cases taken from South Sumatra and East Kalimantan which are categorized in ‘very high’ and ‘high’ category of wildfire susceptibility. More detailed explanation of communities in these provinces are also assessed. Upon explanation of wildfire background in Indonesia, this article further explores the theory of interdependency between people (community) and forest. This will start by explanation of factors causing wildfire and wildfire management based on progress in literature. This paper later identifies community’s view and perception over forest and wildfires.

## 2. Wildfire and Wildfire Management in Indonesia

Wildfires are a serious and growing hazard over much of the Indonesia, posing a considerable threat to life and property – particularly when they are located near built up areas, such as settlements and agriculture fields. The secondary hazard, such as smoke, can cause health problems and environmental degradation. Wildfires also constitute a natural process, and attempts at suppression in the past are now recognized to have created a larger fire hazard as living and dead vegetation accumulates in areas where fire has occurred.

Wildfire is a naturally re-occurring phenomenon which significantly affects many of the world's ecosystems, including forests. The way fire plays in the ecosystem, its causes, and the time between one outbreak and the next are quite varied (Schindler, 2000). Wildfire is an all-embracing term for bush-fire, wildfire, or indeed any fire that start and spreads in a non-urban (commonly wilderness) environment. Often such fires grow into conflagrations and spread to urban areas with pushing consequences. Natural resources are damaged, human settlements are destroyed, and the areas devastated by the fire are made more vulnerable to the subsequent affects of torrential rainfall, including flooding and landslides (Kovach and McGuire, 2003). Wildfires play a natural and useful

role in the life-cycle of a forest and its ecosystem. But fire can also have a devastating long-term effect on ecosystems that are not adapted to such patterns of burning. Frequent and large-scale fires, mainly caused by increased human activity, affect many forests and peatlands around the world. Therefore, tropical rainforests are at particular risk (CIFOR, 2012).

Many reports have studied the impacts of vegetation fires in East Kalimantan and other Indonesian provinces (Goldammer et al., 1996; Hinrichs, 2000; Mayer, 1989; Schindele et al., 1989; Bappenas, 1999; Barber and Schweithelm, 2000; Schweithelm, 1999; State Ministry for Environment of the Republic of Indonesia and UNDP, 1998). The majority of wildfires in this country is caused by human activities usually associated with land-use practices and conversion (Goldammer, et al, 2011). These land-use activities are mostly due to large-scale land clearing conversion from forest to palm oil and rubber plantation.

While most of wildfires in Indonesia are anthropogenic, glowing coal layers near the surface are also a potential wildfire source in Kalimantan. Personal observations and interviews with villagers suggest that human-caused fires sweeping through the area often ignite such coal seams. Once lighted, these seams increase future fire risks by smoldering for a long time in an already degraded environment. In many cases, fires were used to clear land for large-scale oil palm plantations (Barber and Schweithelm, 2000).

According to General Directorate of PHPA (1994), in Indonesia there are three types of wildfire. *First*, Ground fire. This usually happens at low land peat clay areas or at land where some minerals such as coal is found. This type of wildfire is not easily detected. *The second* one is surface fire. This is where the fire occurs at the surface of the ground. Fire burns bushes, serasah, and small trees. This type of fire does not burn the tree canopies since the trees are rare or from the kind that is difficult to get burnt. *The third* one is crown fire. This type of fire occurs at tree canopies. Fire starts from the ground which finally continues to burn the tree branches and tree canopies. This type of fire is difficult to manage especially when a strong wind occurs.

On the other hand, the tool that is applied for wildfire management that is mainly the mapping of wildfires hotspot. Looking at the major distribution of hotspots can help to suspect the wildfire occurrences. Hotspot detection can be accurate and rapid information to increase the awareness and alert to mitigate and manage wildfire (Saharjo, 2004). The number of hotspots varies every month according to the weather and climate (monthly rainfall pattern and maximum temperature), wind direction and speed and types of vegetation that are burned. The drier the area, the higher number of hotspot potential (Solichin, 2004) occurs in dry season. However, solely depend on the wildfires hotspots for wildfires management is obviously not sufficient for wildfires suppression in Indonesia.

## **2.1. Wildfire in Indonesia**

As can be seen in table 1, the wildfires in Indonesia the earlier year (1982 onwards) was mainly caused by long dry season and climate change phenomenon, such as El-Nino. In the later period (2013 onwards) the wildfires were caused mainly by anthropogenic activists such as palm oil plantation.

As research on underlying causes of fire in Indonesia has indicated (Applegate et al., 2001), perverse policy and institutional incentives (e.g. inappropriate land-use allocation, lack of tenure security) and external forces (e.g. demographic changes) have influenced the communities' use of their knowledge of fire behavior in sustaining their livelihoods. Large areas of land and forest in Indonesia burned in 1982 and 1983. In Kalimantan alone, the fires burned from 2.4 to 3.6 million ha of forest. Land and wildfires also burned in Indonesia during extended dry periods in 1987 (49,323 ha), 1991 (118,881 ha) and 1994 (161,798 ha). The fire areas in 1987, 1991 and 1994 were larger than during years with normal rainfall, but not nearly as large as the area burned during the extended drought from June of 1982 to April 1983 in East Kalimantan. World Resources Institute (2013) noted a large number of fire incidents are initiated at timber plantation and oil palm, accounting about 47% of the total incidents. Large numbers of timber and oil palm plantations indeed are found in Kalimantan and Sumatra, where the large number of fire hotspots occurred.



The historical data from 2001 until 2012 shows that in Sumatra there were 20,000 hotspot warnings every year (with the accuracy of 30 percent). The large scale wildfires are induced by the extended dry period that occurred in 1987, 1991, 1994 and 1997 (Environmental Ministry and UNDP, 1998).

**Table 1 Large Wildfire Incidents in Indonesia**

Year	Location	Causes	Coverage area	Losses
1982/1983	East Kalimantan	Long dry season	Destroying 3.2 juta ha	IDR 6 trillion
1987	West Region of Sumatra, Kalimantan until Timor East Area.		In 1987, recorded 66.000 Ha burn, in reality, it could have been more than that.	
1991	West Region of Sumatra, Kalimantan until Timor East Area.		500.000 Ha with some reports of local smog (smoke & fog)	
1994/1995	Sumatra & Kalimantan	Long dry season	more than 5 million Ha in 1994	Smog reaches up to Malaysia and Singapura
1997/1998	Almost in all area of Sumatra and Kalimantan	El nino and heat wave	1.3 million ha	USD 1.62 – 2.7 billion Some airports, sea ports, and road transportation were affected and closed. Pollution cost reached up to USD 674 – 799 million and related carbon emission of USD 2.8 billion.
2013	Riau, Kalimantan	Businessman, Plantation	38.000-40.000 hectare (ha)	

Source: \*(FWI, 2001), (Bowen *et al.* 2001), (Tacconi 2003), (Boer 2002).

In general, the impact of wildfire causes major health problems to the people. When the wind was very strong, the smog also reached Malaysia and Singapore. In June 2013, wildfire incidents have increased which are accompanied by increasing proportion of fires warning in the concession area (WRI, 2013). Wind patterns direct some smog towards Singapore and Malaysia (The Economist, 2013a). The influence of these fires in neighboring Singapore and Malaysia is no less dramatic: in the day Friday, June 21, Pollution Standards Index (PSI), which is used to measure air pollution in Singapore rose sharply to a record number of 400, much higher than 100 which is the maximum acceptable air quality as healthy (The Economist, 2013b). High numbers of hotspots and is still a very serious issue, often also associated with land clearance for key commodities such as palm oil, wood and paper industries. These activities have damaged the natural forest, contributing to the high air pollution, impact on climate change and also give a very adverse impact on public health in the region (WRI, 2013).

## 2.2. Wildfire Community Management

The term community-based is much more than community labour in fighting fires. It is also important to recognize that community involvement covers a wide spectrum of situations, from potentially forced participation in an activity (coercion) to free and willing participation in actions developed by the actors themselves (empowerment). Traditional or local knowledge alone is insufficient to ensure sound, effective fire management. Institutional structures - both within and beyond the community - and the capacity to apply the knowledge are needed. While pertinent, timely and appropriate knowledge about fires is useful, it will be of little use without the community institution to organize and direct the application of the knowledge.

To provide guidance and direction in wildfire control activities, the Minister of Forestry has established the regulation of the Minister of Forestry Number: P. 12/Menhut-II/2009 On Wildfire Control. In addition, the involvement of the institution and the public can be expected to occur and control all activities. Analysis of interests, influence and role of the parties can map the position of institutions in wildfire control activities of both government and non-government, both at central and



regional levels as well as institutional follow-up program that will be done to manage the institutional role.

For community based fire management to be effective, three fundamental components need to be understood (Makarabhirom et al, 2002): first, ecology and wildfire behaviour, particularly wildfire regimes; second, the community, particularly its needs and the behaviour of its members; and third, the relationships between fire and the community. Integrated wildfire management is a community based fire management that offers a support programme to address several issues including modules for institutional development, fire management training, equipment use and maintenance (Abberger, 2002). The development of fire (management) crews – or volunteer village fire brigades – is a decisive step towards institutionalising village fire management. The major task of such crews is to prevent and suppress wildfires in the village and to promote safe burning practices in slash-and-burn agriculture in co-ordination and co-operation with the village and district authorities.

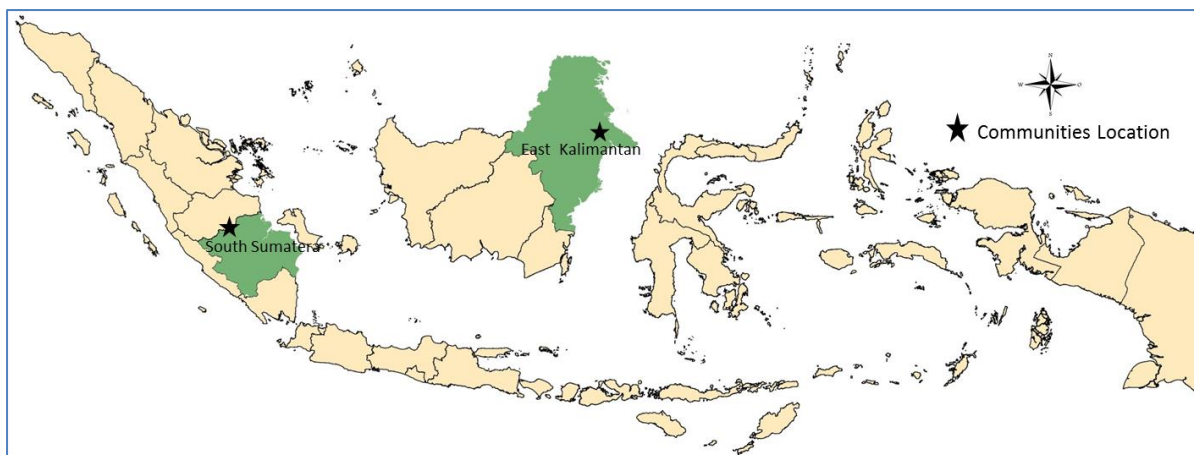
Paton (2005) emphasized the need for risk communication which should be based on the principle of community involvement and encourage discussion of the issues hazard established in the community forums (eg, religious groups, social groups) in a way that empowers community members to identify the implications of the danger to their activities and facilitate their ability to deal with issues (Paton, 2006; Paton & Bishop, 1996). When the emergency agency community members about the dangers involved, the level of trust, satisfaction with communication, risk acceptance, willingness to take responsibility for their own safety, and collective commitment to face the consequences of danger will increase.

It is clear that participation is important but not sufficient to provide a context for evaluating the information. Community members also need to direct their efforts participatory manner that facilitates their ability to identify what they need to know. Hazard education programs rarely require active and sustained community participation as a component in programs intended to encourage preparing (Paton, 2006). Paton et al (2005) demonstrated that whether or not people prepared was a function of how people interpreted their relationship with the hazardous aspects of their environment. The fact that participation is important but not sufficient to provide a context for evaluating information was evident. Community members also need to direct their participatory endeavors in ways that facilitate their ability to identify what they need to know (Paton, 2006).

Perception of environmental risk can be influenced by others' views. Similarly, mitigation decisions are also affected by how the large community sees the risks (Earle, 2004; Jakes et al., 2003; Lion et al., 2004; Poortinga & Pidgeon, 2004). Participation may trigger sharing new information from interaction with peers. This is by co-learning of new skills by involvement in substantial discussions, developing social capital through frequent contacts, and a sense of collective action to improve collective quality of life (Dalton et al., 2007; Earle, 2004).

### **3. Research Methodology**

This paper is based on the review of studies of the wildfire events across Indonesia. Further analysis is carried out at two provinces in Indonesia, South Sumatra & East Kalimantan where, many wildfire events have occurred in the past. Documents for each of the cases were obtained from government officials, donor agencies, and previous research studies. In addition to the documents as the main information sources, the authors have had the opportunity to conduct observation and interviews several government staffs. The data are also enriched by empirical data from previous studies in South Sumatra and East Kalimantan. In South Sumatra (Ajeng, 2011), the research focuses at communities nearby and around rainforest area, Muba District at the border between Jambi and South Sumatra Provinces, while in East Kalimantan, the research obtained data from Lesan River Conservation Area, Berau District (Bunna, 2010).



**Figure 2 Study Location**

**Table 2 Respondent Characteristics at Musi Banyuasin District, South Sumatra**

Characteristics	Description	
<b>Education Level</b>	No education	47
	Primary School	27
	Junior High School	14
	Senior High School	19
	University	3
<b>Occupation</b>	Farmer	64
	Plantation Labor	24
	Housewife	3
	Small entrepreneur	7
<b>Income</b>	< IDR 50,000	8
	IDR 50,000-Rp. 500,000	29
	IDR 500,001-Rp.1000,000	60
	>Rp. 1,000,000	13
<b>Length Stay</b>	0-20 year	52
	21- 40 year	44
	>40 year	17

Source: Ajeng, 2011

**Table 3 Community Characteristics at Berau District**

Community Characteristics	Description
Gender	56,8% male; 43,2 % female
Occupation	47,6% farmer; 14,92% housewife; 37,48% others (local entrepreneur, teacher, etc)
Education	3,7% no education; 52,8% primary school; 19,4% junior high school; 15,2% senior high school; dan 9% university
Age composition	20,7% (15 - 24 year); 30,1% (25 - 34 year); 27,2% (35 - 44 year); 22% (>45 year)

Source: Bunna, 2010

The analytical method in this research is mixed qualitative and quantitative, carried out through the discussion of the main issues and problems experienced in the cases, supported by some field as well as secondary data, followed by synthesizing the lessons learned, in line with the theoretical framework discussed in the Section 2. However, the depth of discussions in each case study varies due to limited information available in some issues in the case studies.

Interviews were conducted to several respondents including WWF, Walhi, instructors at Ministry of Forestry, staffs at Ministry of Forestry Bangka Belitung, National Park at Bukit Barisan in Jambi, Researcher at Center for Research and Development on Forest Fire, Department of Forestry, South Sumatra, - Forest Resource Production Sumsel, Staff of Ministry of Forestry.

#### 4. Community Preparedness to Wildfire in South Sumatra and East Kalimantan

##### 4.1. Wildfire in South Sumatra

South Sumatra Province has a total area of 8,7 million ha, while the area of forest land area is about 4,4 million ha (Ministry of Forestry, 2009). The forest composition can be seen in table 11 below. Forest in South Sumatra is an important part of the community. Community perception to forest function can be categorized into forest as source of livelihoods (28%) and as a place to live (28%). Forest is the source of livelihoods because it provides a variety of community needs such as firewood, building materials for house construction. On the other hand for agriculturist community, forest is the source of water that maintains the balance of nature.

**Table 4 Opinion on Forest Function for the Community**

Forest Function	Percentage (%)
Place of living	28
Natural Resource (Vegetables, Fruits and Animals)	10
Livelihood Sources	28
Plantation (Palm Oil and Rubber)	19
Natural Balance	15

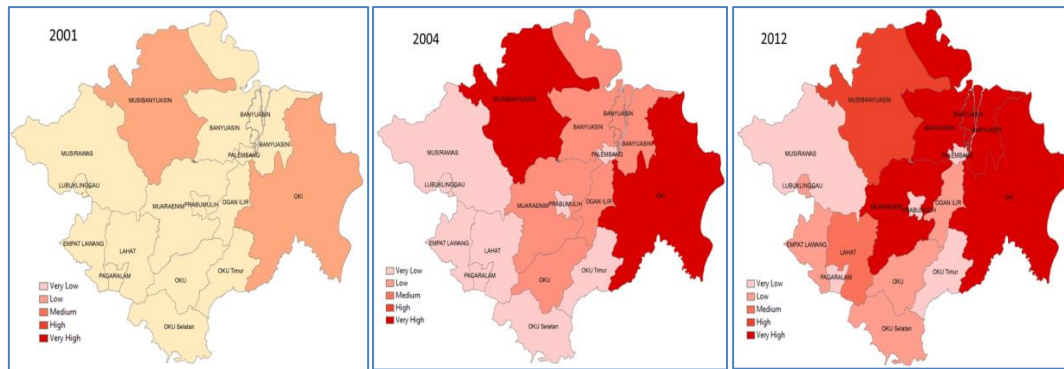
Source : Ajeng, 2011

**Table 5 Type of forest in South Sumatra**

Forest composition	Percentage %
Protected forest	17.22
Conservation forest	16.17
Permanent production forest	51.92
Convertible production forest	9.77
Limited production forest	4.92

However, forest area is steadily declining with high rates of deforestation. Average annual deforestation rate of the period 1985-1998 is approximately 192,824 ha / year (McCarty, 2000). High deforestation is driven by several community activities and policies issued by the government. One cause of deforestation is high transmigration program, granting mining license, plantations and community behavior.

On the other hand, wildfires afflicted up to 34% of the total forest area. According to Ramon and Wall (1998) the extent of land and wildfires in 1997/1998 were covered about 34,229 ha of forest and about 19,318 ha non forest area while it is based on predictions of forest area FFPCP 697.500 ha and non-forest area covering 1,508,900 ha. Figure 4 shows the distribution of wildfires hotspots in South Sumatra in 2001, 2004 and 2012.



**Figure 3 The increasing of Hot Spots in South Sumatra in 2001, 2004 dan 2012**

Source: Lapan, 2014

Previous researches showed that the cause of land and wildfires in South Sumatra is due to large logging and forest businesses run by several large companies (Bowen et al. 2000, Solichin, 2004; Wardani, 2004). These also include the land use conversion by some oil palm and coal mining companies. The absence of land use policy on land clearing by burning causes these activities still take place.

Other than by private companies, land clearing by burning was done especially by people who are on the east coast of South Sumatra (Fakhri, 2007). Burning forests by the public is generally carried out by low-income communities. They do not have much choices to clear the land, and thus they use fire which is cheap, easy and fast in order to maintain their survivability. Then the cleared land is used for plantation, rice field, and fish farming (Septicorini, 2006).

In addition, natural factors, such as climate and type of soil, also attribute to the occurrences of wildfires in South Sumatra. This can be seen in figure 4, where the hotspots were found mainly in OKI and Banyuasin district, which have the largest peatland areas in South Sumatra. In total peat wetland covers about 30% of the area of South Sumatra Province. Moreover, the geographical position of South Sumatra in tropical zones make the climate equal between wet and dry seasons. The dry season spans from July to October (3-5 months each year) annually. Thus, the interaction between the behavior of people who use the land by burning, the more extreme climatic conditions and soil conditions caused the fire.

**Table 6 Wildfire Occurrences in South Sumatra**

Location	Year	Forest Condition	Owner	Causes
Desa Mangunjaya, Sekayu-MUBA	1982, 1997	Bushes	Transmigrants (500KK/1000ha)	Land Clearing
OKI	1987, 1991, 1994 dan 1997	Bushes	HPH, Community	Sonor, Fish hunting
Hutan Wisata Punt Kayu-Kota Palembang	1997	Forest	Dephut	
Bayung Lincir (MUBA)	1997	Bushes and Industrial Plantation Forest	HPHTI (300ha)	
Kec. Tanjung Batu OI	1996 dan 1996	Rubber Plantation	Community	Land Clearing
Kec. Tanjung Batu OI	Setiap Tahun	Sugar Cane Plantation	PTPN VII Cinta Manis	Land Clearing
Kec. Mesuji-OKI	1997	Palm Oil Plantation	PT Selapan Jaya	Conflict between communities and plantation company
Kec. Lahat-Lahat	1997	Rubber and Coffee Plantation	Community	
Musi Rawas	1997-1998	Forest	Inhutani	Road Clearing

Source: Baharuddin. 2001; Setijono, Djoko. 2001; CIFOR, 2001



**Figure 4 Wildfire Induced by People’s Activities to Open Agriculture Areas in South Sumatra**

Source: observation in 2013 by one of the authors

#### 4.2. Community Preparedness to Wildfire in South Sumatra

The community is the key to the survival of forests through integrating indigenous knowledge, conservation values and sustainable livelihoods. Managing the forest with the full involvement of community members is more effective for managing fire if it is an entrenched social responsibility in the first place (Chamarik and Santasombut, 1994; Wasee, 1996; Sukwong, 1998; Ganz et al., 2001). Manifest traditional knowledge of fire management: Backfires are also used to stop approaching fires. Villagers are aware of the potential fire damages and have controlled the spread of fire to minimise destruction of community assets.

*“Economic conditions and the knowledge of the society is the reason why people clearing land by burning forests. Land clearing costs by burning very inexpensive, does not require a lot of power and it’s speed has become people’s main reasons”*

(Staff, Center for Forest Natural Resource Conservation, South Sumatra, 2013)”

Meanwhile, based on related research (Ajeng, 2011; Setijono, 2001) it was found that most people use fire for economic reasons (29%), such and it’s practicality to do (21%). Another reason is that forest clearing using this way will be more effective and faster (36%). Some other respondents have perception that wildfires can make the soil becomes more fertile (13%).

**Table 7 Reasons for Land Clearing with Fire**

Reasons	Percentage (%)
Soil becomes more fertile	13
Cheaper / Economical	29
Practicality	21
Effective and Faster	36

Source : Ajeng, 2011; Setijono, 2001

Study of risk perception and preparedness seeks for correlation or causal relationship between characteristics of respondents with risk perception. The perception in this case is the public perception on forest functions, perception on threat of wildfires and perception of the threat of wildfire and public perception of the role of the community in reduction in the risk of wildfires (Yuwono, 2006). To see these relationships, correlation analyses are carried out between the characteristics of respondents to the public perception of the forest, the impact of wildfires and the importance of the community role in wildfire management.

**Table 8 Correlation between Respondent Characteristics and Forest Function, Threats to the Forest, Community Preparedness**

	Perception of Forest Function	Perception of Forest Threat	Community Preparedness
<b>Education Level</b>	0.87*	0.86*	0.89*
<b>Income</b>	0.86*	-0.26	-0.09
<b>Length Stay</b>	0.75*	0.45**	1.00

\*Significant at 0,01

\*\* Significant at 0,05

Forest functions in the study area range from the residence, source of income / livelihood and as a natural resource (vegetables, fruits and other daily needs ). Correlation between level of education and the amount of forest function showed a strong positive correlation ( $r = 0.87$ ). This shows that the higher a person's education, they become increasingly aware of the important role of forests to people's lives. The correlation between income and forest function showed a positive correlation ( $r = 0.86$ ) shows the higher income people, the more important forest function for them. A strong positive relationship between the public perception of old people living in the study area ( $r = 0.75$ ) make them recognizes the important functions of forests for the benefit of their lives. Meanwhile, education and income levels showed a positive impact on the public perception associated with forest.

Perception of the threat of wildfires is related with community preparedness. Wildfire threat can be manifested by damages to harvest, farmland, damages to houses and properties, health problems, injuries and deaths. Correlation between education level and risk perception showed a strong positive correlation ( $r = 0.86$ ). This shows the higher one's education, they are increasingly recognizing that wildfires are a serious threats. Meanwhile, correlation between income and risk perception showed a weak negative correlation ( $r = -0.26$ ). The correlation between the threat of fire to the length of stay showed positive relationship ( $r = 0.45$ ). This shows the people who have long lived in the study tended to perceive the location of wildfires as a serious threat to them. Threats to wildfires are influenced by public education, especially related to the understanding of the threat of wildfires and the length of the community living in a region will affect public perception of the threat of wildfires. Besides the general low-income people of their livelihood depends on the wildfires are likely to assume a serious threat because it can lead to loss of their job as a lumberjack.

Public perception of the importance of the role of the community to reduce the risk of catastrophic wildfires will form a community preparedness. Perceptions of the role of communities in disaster risk reduction fires a very strong positive correlation to the level of education ( $r = 0.89$ ) and long-lived people ( $r = 0.99$ ). Respondents who have a higher education level will understand how important the role of the community to reduce the risk of wildfires. The duration of the study communities residing in the location and form a community experience provides an understanding of the importance of their role in disaster risk reduction wildfires. The level of income of the people do not have a significant influence on the perception of the role of society.

Based on research conducted in the area OKI South Sumatra by Soewarso (2003), people who depend on forests will be more motivated to do fire prevention and preparedness. Another motivation is also due to they want to keep their plantations from fire. Therefore, in such a society, there is unwritten rule that is related to compensation for any wildfire activity. Community perception to the forest also shapes the behavior of people during the dry season. For example, in the dry season people do not conduct activities that uses fire nearby the forest. Some preventive measures are conducted such as by building canals around their garden and keep their gardens in the dry season (Giesen, 1991; Brady, 1997; Anderson, 1999).

As an illustration, people who worked as a lumberjack or farmer use fire for their common activities, such as cooking, smoking, etc (Soewarso, 2003). These activities could also trigger the cause of wildfires for some periods of time. In general, community perception on forest conservation is still low (Kasih, 2012). In addition to that, the role of institution related with conservation is also still low.

Institutional formal and non-formal is needed to regulate a variety of community conservation action. The majority of people agree that the institution should encompass cultural institution, family and external institution including donors (Love, 2012). Village communities around forest areas generally have a passion to obtain information specifically related to the use of forest resources that do not damage the environment. However, the limitations of socio-economic information has become a source of problem.

There is a positive correlation between cultural values and local wisdom to the perception of the importance of community preparedness measures ( $r = 0.88$ ). This relationship shows that the society that has local knowledge about the forest tends to realize the importance of conservation measures. It is also demonstrated that a positive correlation exist between cultural values or local knowledge of the communities with the conservation measures undertaken by the community ( $r = 0.94$ ). Society that values local knowledge tend to build conservation measures such as building canals, making village rules relating to regulation of forest use and conservation of some of the people doing the replanting areas that have been burned / new garden. There was also a positive correlation between public perception of the importance of conservation measures with the preparedness undertaken by the community ( $r = 0.69$ ).

Community generally has its own preparedness, rules and procedures for disaster risk reduction and conservation of wildfires. One is the compensation rules in the sub-district of Tulung Selapan, OKI District. Another example is that the wildfire activity should only be done on land that is rightfully their own. If they enter into other people's property then they will be given penalty (Suyanto, 2002). Some areas are even referred to as sacred in the District and the District Pedamaran Kayuagung in OKI 's often a myth associated with the presence of nature named Liud River. Forests of this region tend to be maintained due to fear of exploitation or encroachment.

### **4.3. Wildfire in East Kalimantan**

The spread of wildfire hotspots in Kalimantan can be seen in Figure 6. The areas with highest hotspot occurrences are Kutai Kartanegara, Kabupaten Kutai Timur District, Balikpapan, Bontang, and Samarinda City. The following vulnerable areas are Pasir and Nunukan District.

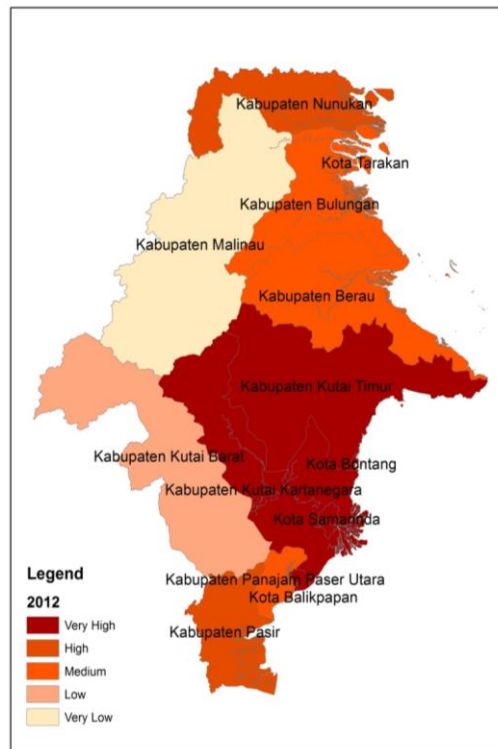
From 1990 to 2010, almost all oil palm plantations are converted from forest land use. Currently, palm oil plantations now have an area of 31,640 square kilometers which is an increase of 300% since 2000. 47% of the development of oil palm plantations from 1990 to 2010 in Borneo expense of intact forests. Twenty-two percent comes from secondary forest and 21 percent is derived from a mixture of forest and farm land. The rest was only 10 percent of palm oil plantations on non-forest area (Kimberly et al, 2002).

Lesan River protected area located in the district of Berau district of East Kalimantan Kelai has an area of 12,192 ha. The area is divided into four administrative regions, namely Lesan Dayak village, Muara Lesan, Sidobangen, and Merapun. Lesan River Protected Area has a northern border with Sidobangen, east by Lesan Dayak and Muara Lesan; southern borders with Merapun village and adjoining west with HPH PT. Mardhika Insan Mulia and PT. Karya Lestari.

Natural resource is still the main source of people's livelihood along the river Lesan. The decreasing function of natural resources (NR) primary forest and the river will result in loss of livelihoods. Communities in four villages around particular exploit natural resources in the region to get a variety of purposes such as honey, *gaharu*, rattan, *resin*, genius leaves (palm), fish and animal. Local people, especially from the Dayak Dayak Lesan Gaai in future still expect to get access to the use of timber and non-timber resources contained in this Lesan River Protected areas for the purposes of the village needs (subsistence) as for building materials, boat (*katinting*), consumption and others. The land use change is also triggered by regulation of Governor of East Kalimantan No. 521/9038/EK on 10 November 2005.

The villages near Lesan River Conservation area is Dayak Village and transmigration villages They compose of indigenous Dayak Lebo (village Merapun), Gaai Dayak (Dayak village Lesan), tribal Berau / Benuag (Kampung Muara Lesan), and transmigration Sidobangen village which has a population of 14 ethnic groups in Indonesia (Bina Organization 2006).





**Figure 5 Wildfire Hazards in East Kalimantan**  
Source: LAPAN, 2012

#### 4.4. Community Preparedness to Fire in Berau District, East Kalimantan

In Kalimantan, indigenous communities have initiated fire management efforts in response to the perceived causes of many fires that adversely affected their community life and agro-ecosystems during the late 1990s. In West Kalimantan, most initiatives have focused on emergency fire suppression, rather than tackling the underlying causes of fires. Community-based fire management is defined as the conscious use of fire to meet a specific objective. The results of community fire management may not always be positive, which depends on whose perspective is adopted to judge the outcomes.

Another threat to the preservation of the region is illegal logging. In 1999, illegal logging actually is still limited. The potential of large wood were a lot the relatively easy accessibility makes the region vulnerable to the illegal logging activities. The area is also suffers from the occurrence of wildfires. The increasing illegal logging activity has increased the wildfire events and land use conversion. As shown in the following table Community living in Lesan River protected forest area said that the wildfire as one of the causes of forest destruction (Bunna, 2010).

**Table 9 Reasons of Destroyed Forest**

No	Reasons of Destroyed Forest	Score	Percentage(%)
1	Expansion of Palm Oil Plantation	71	27.5
2	Timber Cutting by Company	113	43.8
3	Illegal logging	100	38.8
4	Excessive Land clearing	94	36.5
5	Forest Fire	29	11.2
6	Illegal non timber harvesting	15	5.8
7	Wild animal hunting	3	1.2
8	Do not know	24	9.3
9	Low awareness	3	1.2

Source: Bunna, 2010

Communities know their lives are very dependent to the forest. Community also realized that the direct benefits of the forest will be obtained when conservation is preserved. While the community support the conservation of forest resources and the establishment of protected areas in the river Lesan, they do not know the benefits of protected areas for them. Public perception of the protected areas is still limited by the presence of protected areas means they are prevented utilize forest products again. The public does not know about the role of the protected area in the river Lesan.

Lesan River Protected Area is managed by a collaborative approach involving government representatives at the district, sub-district and village. Only 30.10% (115 respondents) who know the whereabouts of the management board of 52.09% (199 respondents) who do not know or undecided (17.28%) did ever hear or know the whereabouts of the manager. Of the 115 people who know about the governing body, according to those who should be involved in the community around the area manager is (23.3%), not just figures village officials. The duties of the governing body according to the knowledge society is to regulate forest management Lesan River (12.04%), set monitoring / security Lesan River forest (7.59%), and some who do not know the functions and duties of the governing body (6.28%), limiting areas exploit people (2.36%) and other responses (2.9%).

#### **4.5 Community Participation in Wildfire Management**

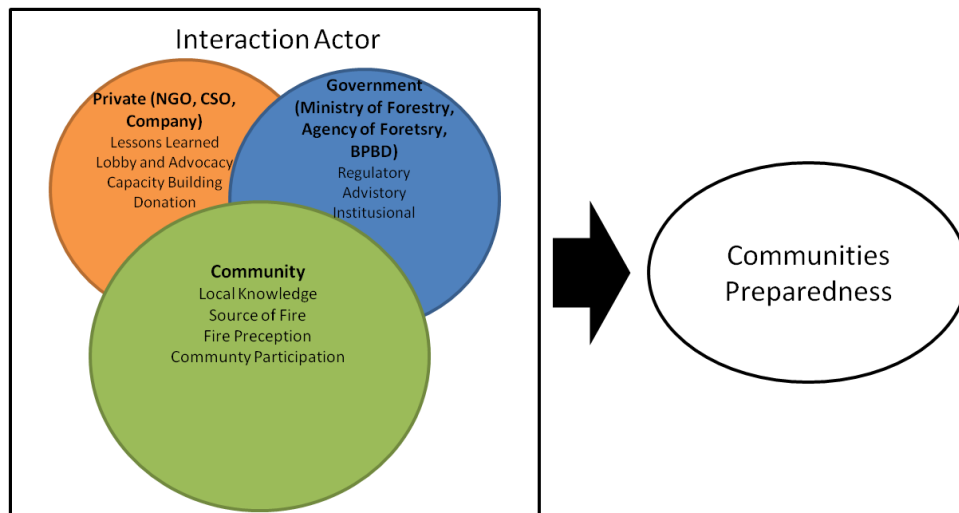
As the previous section suggests, community is at the center of wildfire management. The reason is that most of the fires are caused and related with human activities. Therefore, the community has an important role in the suppression and prevention efforts because of their adjacent location to the forest and their knowledge and understanding of the forest condition. Thus, this will make easier in term of mobilization of resources. This way puts the government as a facilitator and motivator.

This is in line with the concept proposed by Indonesian Ministry of Forestry. That is, the concept of Conservation Village Model (*Model Desa Konservasi*). The conservation village model provides opportunities for communities living near protected areas. This model also provides an opportunity for the public to gain secure access to land use so as to ensure their long-term commitment to support forest conservation. The use of access models may vary from one region to another region depending on the agreement between the community and the authorities. The idea of Conservation Village Model requires the existence of buffer villages around the area of forest conservation.

The scope of a conservation village encompasses community development, spatial planning / rural-based conservation and conservation-based economic development. Most of the stages in the development of the conservation village model using PRA approach. The conservation village model becomes a sort of role model for community involvement in forest processing. This village model is no more as the government attempts to anticipate the destruction of forests around the existing population of protected forest areas.

Apart from government support, private sector, such as plantation companies also need to be involved to strengthen the community preparedness. As noted, private companies account for many land use changes from forest to plantation areas. They also increase the susceptibility to wildfire. Collaboration from private companies will be important to strengthen wildfire preparedness. For example, BKSDA of South Sumatra established *Mangala Agni* which is a community-based unit of wildfirfighters. The concept is by empowering communities surrounding the forest. This is also through collaboration with local government and private companies around the forest.

As suggested by the following figure, community preparedness will need support from other actors. Community is indeed the frontliner for the community preparedness. However, limitation in term of resources, knowledge and access can be eliminated with proper collaboration with other actors, such as private companies and local government.



**Figure 6 Interaction between community with other stakeholders**

## 5. Conclusion

Forest in Indonesia has significant values to local community as live supporting factor. Forest provides the community with livelihood and natural resources. However, the rate of deforestation is increasingly alarming. In South Sumatra region, the occurrence of wildfire increase annually. This is attributed to several factors: type of land (combustible peat), community and industrial activities (land burning) and dry climate. Although the community already possesses some degree of preparedness and perception, as well as rules and procedures regarding prevention of wildfire, the occurrences of wildfires are not suppressed. This implies that there is a need for government intervention by providing law or policies that regulate land use and land clearing.

In East Kalimantan, wildfire is ranked as number three as factors that contribute to forest destruction. While the number one factor is forest conversion into palm oil plantation by companies. However, these companies show no preparedness towards wildfires occurrences.

Thus, in general wildfire in Indonesia is mostly anthropogenic (Mayer, 1989). The anthropogenic activities that induce wildfires are mainly conducted by two stakeholders, which are local community and private companies. Other than inducing the wildfires, they could mitigate and prevent the wildfires. This implies that the stakeholders, especially local community and private companies could play two contradictory roles, either causing or preventing the wildfires, depending on the characteristic of the stakeholders. Thus, the task of the government is to make sure these stakeholders possessing the good characteristics that would help preventing the wildfires instead of creating it. This implies that the lack of government interference to the stakeholders could worsen the incidents of wildfires.

In contrast the active interference of the government could help reduce the occurrences of wildfires. This can be reached by fostering collaboration between the stakeholders: community, private companies and government. Other benefit that can be obtained from active interference of the government is increasing the community preparedness toward the wildfire. This would benefit the community by lowering the destruction and casualties caused by wildfire.

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**Office:** Jalan Imperial II No. 52 Bandung, West Java, Indonesia 40135  
**Phone:** +622 225 36574 | **Email:** rdi@rdi.or.id | **Website:** www.rdi.or.id