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# The Impact and Mitigation of Forest Fire for Biodiversity in Indonesia

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**Abstract**

The purpose of this study was to assess and mitigate the impact of wildfires for biodiversity in Indonesia. Firstly researcher presented information about destruction of forests that spread throughout Indonesia. Forest degradation is caused by failure of government policies in addressing the implementation of concession to investors who were rife on 1967 and concerned this thing, the deforestation system of TPI changed into TPTI, HTI, Joint enterprise, HGU and APL which were caused to decline forest cover. Secondly researcher presented information about forest fires that trigger by the destruction of forests due to deforestation and forest degradation in some areas of concessions and other areas. The collected data has been indicated that forest fires have occurred since 1960 until 2015. These conditions clearly destroy the habitat of flora and fauna that exist in each forest ecosystems. The mitigation that needs to be done is for government to carry out rehabilitation, reforestation, restoration of forest lands where had been burned, so that biodiversity can be recovered, and conservation of germ plasma to be need in each forest ecosystem. The method used in this research was descriptive method by reviewing of regulations and legislation and approach to literature. The study was later described, narrated and in the interpretation and arranged in the form of papers. From these results it can be concluded that the fires is the classic phenomenon that occurs repeatedly and extends preceded by the destruction of forests due to wide spread deforestation and forest degradation in Indonesia.

*Keywords*: biodiversity; degradation and forest fires; impact; mitigation

## 1. Introduction

Indonesia is one of seven countries which has Mega Biodiversity in the world, and put on the second ranks after Brazil, and has the third largest area of tropical forest after Brazil and Zaire. Biodiversity of Indonesia is comprised of 10% of flowering plants, 12% of mammals, 10% reptilians and amphibians, 17% of birds and 25% of the fish in the world. Under these conditions natural resources of Indonesia are also located at intersection of two continents and two oceans that biogeographically is divided into two Indomalaya and Australia regions bounded by the Wallace line with world research center [1]. But the rate of deforestation reaches 1.5 million hectares over/year, so international communities to be worried this situation. In Indonesia forest area was originally about 144 million hectares, but today it decreased only about 130.68 million hectares.

Forest degradation from the result of deforestation and forest degradation with continue to run year after year is in line with the development of policy. And forest damages are getting worse due to forest fires. Usually forest damages trigger forest fires and the impact of forest fires clearly destroys the habitat of biodiversity. Forest fires become result of serious forest damages. And forest degradation will increase the occurrence of forest fires sensitively. That are already classic phenomenon. In the existence of vicious circle, these conditions indicate that forest fires can not be circumvented. Furthermore, forest degradation from forest fires cause decrease of biodiversity [2].

Forest fires have occurred since1960 and increased when the Law of Foreign Investment No.1 of 1967 [3], enacted and this Law supported by LawNo.5 of 1967 [4] on Basic Provisions of Forestry. At that time New Order of government was encouraged investors to invest at forest resources to exploit woods in order to improve of Indonesian economy slumped during the previous administration with old order of government. At that time the rate of conversion from forest to forest industry experienced three stages of development: in the first stage (1967-1979) focused was on log exports, in the second (1980-1990) focused on the development of the plywood industry and in third throughout the1990s focused more industry development activities pulp and paper [5].

The impact of deforestation was planned by government, namely transfered the functions of national forest into forest concessions exacerbated deforestation. To reduce forests damaged which were managed the concessionaire, the Director General of Forestry enacted Decree No. 35/Kpts/DD/I/1972 on the procedures for logging which used Selective Logging Guidelines for Indonesia (TPI). But until 1988 concessionaires were inconsistent to implement TPI. The failure of the implementation of Forest Concession (HPH) resulted in the destruction of forests in the concession area, and were getting serious concept of Selective Cutting Plants Indonesia (TPTI), Industrial Plantation Forest (HTI), Cultivation Right (HGU) that converted natural forests, damaged and became Crop Oil Palm and damaged to other forest conversion to other land use (APL), which caused decline in forest cover due to forest damage triggered by deforestation and forest degradation [6].

Other than forest damages occurs also degradation of forest, due to illegal logging, cleared away of forest which encroached own or controlled people. These conditions exacerbate deforestation with become critical land and the necessary handling of the government to carry out rehabilitation, reforestation and forest restoration in order to mitigate biodiversity which can immediately recover in addition to maintaining the stability of Greenhouse Gas Emissions (GRK) in the atmosphere.

At the same time serious destruction of forests occurred by forest fires during 1997-1998 mainly on Borneo and Sumatra island, the condition is supported by Grahameet al. [7] stated that the land and forest fires as well as the accompanying smoke causes: (1) serious damage to the forest; (2) air pollution; (3) health and mortality; (4) economic loss; and (5) damage biodiversity habitats. The total area which had been burned was made by the Asian Development Bank (ADB) in 1999, and the area which was affected by fire from 1997 until 1998 reached 1.6 million hectares, Sumatra and Kalimantan island, 6.5 million hectares, 0.2 million hectares in Java and Papua 1 million ha.

From the background which described in above, authors wanted to assess and find out information about forest cover areas which have been damaged by forest fires before and after the enactment of logging concessions in 1960 through 2015. The specific object of this study was to examine the impact and mitigation of forest fires for biodiversity in Indonesia.

## 2. Material and Methods

This study was carried out used descriptive method with regulation and legislation approaches, as well as literatures that were analyzed and reported by Forest Watch in Indonesia. This analysis had been modified by Department of Forestry. Some of them objectively were approved this study. Results of this study later were described, narrated and interpreted and compiled in the form of papers.

## 3. Results and Discussion

### *3.1. Forest Damage*

The impact of deforestation which was planned by the government with conversion from national forest into forest concession had exacerbated deforestation. Number of concessionaires in 1978 reached at many as 383 concessions and increased sharply in 1987, which reached to 564, and covered total area of 55,468.35 million hectares of forest [8]. Deforestation area has increased from 600,000 hectares from 1980 to 1985, and to 900,000 hectares in 1989. Based on the analysis of forest cover between 2000 and 2009 released by FWI (2011) Indonesia had experienced deforestation around 15,158,926.59 hectares, with the rate of deforestation was 1,515,892.66 hectares every year (Table 1).

Table 1. Forest cover, deforestation areas and rate of deforestation per year

| Island | Land area (hectare) | Forest cover 2000 (hectare) | Forest cover 2009 (hectare) | Deforestation 2000-2009 (hectare) | Deforestation rate 2000-2009 (hectare) |
|---|---|---|---|---|---|
| Sumatera | 46,449,970.82 | 15,516,958.84 | 11,805,161.39 | 3,711,797.45 | 371,179.75 |
| Kalimantan | 53,262,378.46 | 32,856,107.16 | 27,350,243.23 | 5,505,863.93 | 550,586.39 |
| Sulawesi | 19,375,054.75 | 10,707,185.76 | 9,039,345.18 | 1,667,840.59 | 166,784.06 |
| Maluku | 7,972,596.62 | 5,015,206.85 | 3,757,115.13 | 1,258,091.72 | 125,809.17 |
| Papua | 42,877,146.20 | 34,767,891.15 | 34,138,992.70 | 628,898.44 | 62,889.84 |
| Jawa | 13,008,124.79 | 2,281,183.78 | 897,978.82 | 1,383,204.96 | 138,320.50 |
| Bali Nusa Tenggara | 7,365.736.32 | 2,184,833.28 | 1,181,603.75 | 1,003,229.49 | 100,322.95 |
| **Total** | **190,311,007.96** | **103,329,366.78** | **88,170,440.19** | **15,158,926.59** | **1,515,892.66** |

*Source: Forest Watch Indonesia (modified data) [9]*

Table 1 shows changes of forest cover areas due to deforestation. The deforestation spreads throughout major islands of Indonesia. So we know that initial total forest cover in 2009 decreased to 88,170,440.19 and in 2000 was 103,329,366.78. Also Table 2 shows that in 2009 forest cover area reached to 22.77 million hectares. The logging concessions area covered 20.42 million hectares. HTI concession area reached 1.57 million hectares. And HGU reached 0.77 million hectares. The logging concession area covered can be seen in Table 2.

Table 2. Area of forest cover in the concession on 2009 (hectare)

| Island | HPH | HTI | HGU | Total | Overlap between HPH, HTI, HGU | Other HPH, HTI and HGU | Total |
|---|---|---|---|---|---|---|---|
| Sumatera | 1,070,678.80 | 682,732.65 | 19,437.92 | 1,772,849.37 | 56,561.76 | 9,975,752.27 | 11,805,161.39 |
| Java | - | - | - | - | - | 897,978.82 | 897,978.82 |
| Bali Nusra | - | 2,108 | - | 2,108 | - | 1,179,495.53 | 1,181,603.75 |
| Kalimantan | **8,854,978.79** | **426,007.68** | **759,781.11** | **10,040,767.58** | 299,854.01 | 17,009,621.63 | 27,350,243.23 |
| Sulawesi | 1,077,089.06 | 35,792.89 | - | 1,112,881.95 | - | 7,929,463.23 | 9,039,345.18 |
| Maluku | 852,380.67 | 19,949.03 | - | 872,329.7 | 5,283.95 | 2,879,501.48 | 3,757,115.13 |
| Papua | **8,566,145.35** | **411,804.56** | - | **8,977,949.91** | - | 25,161,042.79 | 34,138,992.70 |
| **Total** | **20,421,270.66** | **1,578,395.03** | **779,219.03** | **22,778,886.51** | **361,699.72** | **65,029,855.76** | **88,170,440.19** |

Source: Forest Watch Indonesia (modified data) [9]

Also Table 2 shows that forest cover areas with overlap between HPH, HTI and concession area reached 361,699.72 hectares. Extensive forest of HPH, HTI and concession in Kalimantan, covered 10.04 million hectare, followed by Papua this Island covered 8.97 million hectares of HPH and HTI.

Forest cover concessions in peat lands in forest concessions (HPH), Industrial Plantation Forest (HTI) and Cultivation Right (HGU) in Indonesia, reached approximately 2.21 million hectares in 2009, comprising 1.41 million hectares in HPH, 0.46 million hectares are in plantations and 0.3 million hectares in concession and 0.029 million hectares located in the area overlapping between HPH, HTI and/or HGU (Table 3).

Table3. Area of peat land forest cover in the concessions, HTI and HGU 2009 (hectare)

| Island | HPH | HTI | HGU | Overlap between HPH, HTI, HGU | Other HPH, HTI and HGU | Total |
|---|---|---|---|---|---|---|
| Sumatera | 322,422.37 | 336,860.81 | 11,327.93 | 5,632.73 | 1,157,864,04 | 1,834,107.88 |
| Kalimantan | 192,515.10 | 70,985.81 | 291,120.93 | 23,966.48 | 2,206,833.40 | 2,785,421.72 |
| Papua | 897,212.75 | 58,671.10 | - | - | 5,200,359.34 | 6,156,243.19 |
| **Total** | **1,412,150.22** | **466,517.72** | **302,448.87** | **29,599.21** | **8,565,056.79** | **10,775,772.80** |

Source: Forest Watch Indonesia (modified data) [9]

The average rate of deforestation at period of 1985-2009 was 2.05 million hectares every year, but decreased in intervals of 10 years at period of 2000-2009, namely of 1.51 million hectares every year of areas, so total 45.27 million hectares of areas became deforestation (Table 4).

Table 4.The rate of deforestation in Indonesia Period 1985-2009

| Span | Year Interval | Deforestation | Total (Million hectares) |
|---|---|---|---|
| 1985-1997* | 12 | 1.80 | 21.60 |
| 1997-2000** | 3 | 2.84 | 8.52 |
| 2000-2009* | 10 | 1.51 | 15.15 |
| **Total** | | **$\overline{X}$ = 2.05** | **45.27** |

Source: *FWI/GFW [10] **Department of Forestry [11]

*3.2. Forest Fire*

Table 5. shows that total area of forecasts were exploited to category of forest land, these were covered with mountains, plains, forests and peat bogs, shrubs and grasses, HTI. Agriculture and plantations affected by fire is presented in the form spatial forecasts due to fires in 1997-1998.

Table 5. Estimated spatial due to fires1997-1998 (in hectares)

| Island | Mountain Forest[a] | Lowland Forest | Peat and Swamp forest | Dry bush and grass[b] | Industrial forest[d] | Agriculture[b] | Plantation[c] | Total |
|---|---|---|---|---|---|---|---|---|
| Kalimantan | - | 2.375,000 | 750,000 | 375,000 | 116,000 | 2,830,000 | 55,000 | 6,501,000[f] |
| Sumatera | - | 380,000 | 300,000 | 260,000 | 70,000 | 670,000 | 60,000 | 1,740,000[f] |
| Jawa | - | 25,000 | - | 25,000 | - | 50,000 | - | 100,000 |
| Sulawesi | - | 200,000 | - | - | - | 200,000 | 1000 | 401,000 |
| Papua | 100,000 | 300,000 | 400,000 | 100,000 | - | 100,000 | 3000 | 1,003,000 |
| **Total** | **100,000** | **3,280,000** | **1,450,000** | **760,000** | **186,000** | **3,850,000** | **119,000** | **9,745,000** |

Source: Grahame, A. et al [7]

*Note:*

a) Estimates of aerial surveys help members, the United Nations Disaster Assistance Disaster Assessement Commission Report, Field visit, Papua, 3 to 8 October 1997 (NSWRFS 1997).

b) Estimates of the total area of which is exploited in land cover categories such as lowland forest, shrubs and grasses, and agriculture, based on estimates Liew et al. (1998) and Burnt Scar Maps or Map burnt from the Center for Remote Sensing and Processing 1999; puau zoning on other islands based on land cover data from the National Forest Inventory (NFI) or the National Forest Inventory of Indonesia (1996), National Development Planning Agency (1993, 62-9), and ADB (1999).

c) Papua and other islands based on an estimate of 20% peat and peat distribution in the Biodiversity Action Plan [12].

d) Estimates based Soedarmo (1998), and the estimated loss of plantation given by the Department of Agriculture of East Kalimantan Province (1998), 13,769 hectares in 1997 and 101,922 hectares in 1998.

e) Soedarmo estimates that 112,000 hectares burned in 1997 and the Government of Indonesia, the Ministry of Environment and the United Nations Development Program (1998) estimates that 119,070.32 ha burnt [13].

f) Liew et al. (1998) estimates that 3.06 million hectares in Kalimantan (similar estimate for 1998 to 1.5 million ha in Sumatra [14]. Makarim et al. [15] reported that the EU forecasts for may Sumatra 2,798,000 ha, including 700,000 ha of forest .

Apparently the disastrous of forest fires and smoke have occurred since 1960-1990 period; 1990-2000; and period of 2000-2013 as shown in Table 6. These occurred repeatedly and widespread was conducted in old times, but number

of fires increased in four decades. Recapitulation of mapping which was done by every province of Indonesian Government Site Environment in 2010-2015 also shows below.

Table 6. Forest fire and disaster smoke ever since

| 1960-1990 | 1990-2000 | 2000-2013 |
|---|---|---|
| **Sumatera**<br>Riau, South Sumatera | **Sumatera**<br>South Sumatera, Bengkulu, Jambi | **Sumatera**<br>Riau, South Sumatera, Jambi |
| **Kalimantan**<br>East Kalimantan, Balikpapan, Banjarmasin, Banjar | **Kalimatan**<br>East Kalimantan, Palangkaraya, Pontianak | **Kalimantan**<br>Central Kalimantan, West Kalimantan, South Kalimantan |
| ***West Java***<br>Majalengka, Purwakarta, Sumedang, Kuningan | ***West Jawa***<br>Mountainside of Ciremai, Cigurai | |
| **Central Jawa**<br>Grobongan | **Central Java**<br>mountain side cleft of Lawu, Merbabu, Welirang | **Central Jawa**<br>protected forest mountain of Welirang, Merbabu |

Source : Anonymous [16]

Compared with 2010, the burned area have increased times as happened in Jambi, in 2010 only area of 2.5 hectares burned, but in 2014 increased to 3,470 hectares. In Central Kalimantan burned area since January to 10 September reached 940.9 hectares. In 2014, fires occured 4.022 hectares. The recapitulation of forest fires and smoke have occured from 2014-2015 are shown presented in Table 7.

Table 7. Forest fire and disaster smoke ever since

| 2014 – 2015 |
|---|
| • Fires 1,827 hectares of forest and peat land in Riau<br>• About 30 percent of the forest and conservation areas covering 10.5 million hectares or damaged due to various factors, like encroachment, illegal logging and forest fires<br>• Each year an average of 100,000 hectares conducted restoration<br>• BNPB perform artificial rain at a cost of 200 billion rupiahs to cope with drought. To cope with forest fires, the cost of prepared 385 billion Rupiah. Burning by plantation companies and residents to open up new land for plantations and agriculture<br>• *Climate phenomenon El Nino until November feared to increase the incidence of forest fires in Indonesia* |

Source: Anonymous [16]

The data about area of fires which have been collected in the form of extensive recapitulation of forest fires in every province at 2010-2015 are shown presented in Table 8 below.

Table 8. Summary of forest fire size (hectares) per province in Indonesia year 2010-2015

| No. | Province | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|
| 1 | Aceh | 5.00 | - | 13.00 | - | 155.66 | - |
| 2 | Bali | 10.10 | - | 250.00 | 60.50 | 30.00 | - |
| 3 | Bangka Belitung | - | - | - | - | - | - |
| 4 | Banten | - | - | - | - | 2.00 | - |
| 5 | Bengkulu | - | 0.50 | - | - | 5.25 | - |
| 6 | DKI Jakarta | - | - | - | - | - | - |
| 7 | Gorontalo | - | - | - | - | - | - |
| 8 | Jambi | 2.50 | 89.00 | 11.25 | 199.10 | 3,470.61 | 2,21700 |
| 9 | West Java | - | 1,278.55 | 1,945.50 | 252.80 | 552.69 | 1,029.70 |
| 10 | Central Java | - | 712.24 | 454.00 | 31.20 | 159.76 | 424.73 |
| 11 | East Java | 204.90 | 48.35 | 2,960.05 | 1,352.14 | 4,975.32 | 553.30 |
| 12 | West Kalimantan | - | - | 577.40 | 22.70 | 3,556.10 | 995.32 |
| 13 | South Kalimantan | - | - | 60.50 | 417.50 | 341,00 | 185.70 |
| 14 | Central Kalimantan | - | 22.00 | 55.15 | 3.10 | 4,022.85 | 1,220.40 |
| 15 | East Kalimantan | - | 148.80 | 51.50 | - | 325.19 | 109.00 |
| 16 | North Kalimantan | - | - | - | - | - | - |
| 17 | Kepulauan Riau | - | - | - | - | - | - |
| 18 | Lampung | 106.00 | 31.00 | - | - | 22.80 | 10.00 |
| 19 | Maluku | - | - | - | - | 179.83 | - |
| 20 | North Maluku | 10.00 | - | - | - | 6.50 | - |

| No. | Province | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|
| 21 | West Nusa Tenggara | 2.00 | - | - | 12.00 | 3,977.55 | - |
| 22 | East Nusa Tenggara | 95.00 | - | 553.20 | 649.90 | 980.87 | 3.05 |
| 23 | Papua | 39.00 | - | - | - | 300.00 | 177.40 |
| 24 | West Papua | 1.12 | - | - | - | - | - |
| 25 | Riau | 26.00 | 74.50 | 1,060.00 | 1,077.50 | 6,301.10 | 2.643.00 |
| 26 | West Sulawesi | - | - | - | - | - | - |
| 27 | South Sulawesi | 28.00 | 34.75 | 45.30 | 40..50 | 483,10 | 751.05 |
| 28 | Central Sulawesi | - | - | 30.83 | 1.00 | 70,73 | - |
| 29 | South East Sulawesi | 16.00 | 85.90 | 346.10 | 13.00 | 2.410,86 | 284.31 |
| 30 | North Sulawesi | - | - | 1.80 | 0.25 | 236,06 | - |
| 31 | West Sumatera | 56.00 | - | 3.50 | - | 120,50 | 0.25 |
| 32 | South Sumatera | - | 84.50 | - | 484.15 | 8.504,86 | 476.57 |
| 33 | North Sumatera | 80.00 | 5.00 | 1,181.00 | 295.40 | 3.219,90 | 146.00 |
| 34 | Yogyakarta | 2,818.50 | - | 6.45 | 6.00 | 0,27 | - |

Source : Anonymous [17]

The impact of deforestation which was planned by the government with transference of function from national forest to logging concession of other foreign capital companies exacerbate deforestation and increase forest fires (Table 1 to 7). The observation for the forest fire occasions by Kompas newspaper reinforces result of author's research. It is to say that the forest fire occasions due to massive easily destruct forests on lands, for example the conversion from peat forest to concessionaires and the conversion process of peat forest by drying method which build excessive canals occur uncontrolled fires (Tables 3, 5 and 7).

This condition occurs due to failure of the concession aires in implementation of the procedures for logging with contained in Decree Letter Director General of Forestry No. 35/Kpts/DD/I /1972 [18], and this letter caused to decline forest cover due to damages and occasions of forest fires by deforestation and forest degradation in HPH concessions throughout Indonesia.

Illegal logging which becomes one cause of deforestations and forest fires already quite clearly and unambiguously stated, in Law No. 41 of 1999 [19] on Forestry in Article 50 paragraph (2); Article 50 paragraph (3) letter a-f; Law No.5 of 1990 on Conservation of Natural Resources and Ecosystems Article 21 paragraph (1); Government Ordinance No. 45 of 2004 on the Protection of Forests in Article 12 paragraph (1) and (2) [20]; and Presidential Decree No.4 of 2005 and the Minister of the Interior Instruction No.3 of 2005 [21] on Eradication of Illegal Logging in the forest area and the circulation in the entire territory of Indonesia [10].

Forest fires have been stipulated same regulation recurred and increased since 1960-2015, were caused by the destruction or cleared away of forests and greedy of humans on hungry land, forest encroachment and irresponsible illegal logging. Since 1960 the government should have strong program strategy/firm that must be implemented, every year anticipated and evaluated economical demand of State and should be preventable and addressed. Table 8 shows that almost provinces have experienced forest fires except province of Bangka Belitung, Jakarta, Gorontalo, North Kalimantan, Riau and West Sulawesi. It can be concluded that from 34 provinces in Indonesia, only 6 (six) provinces didn't experienced catastrophic wildfires. Otherwise number of provinces always experience forest fires since 2010-2015, especially 6 (six) provinces a large Jambi, East Java, Riau, South Sulawesi, Southeast Sulawesi and North Sumatra, 2011-2015. Three (3) provinces, namely West Java, Central Java and Central Kalimantan do not experience forest fires on. Furthermore, another province experienced forest fires in certain years. And once forest fires had been focused on Sumatra and Kalimantan, but now spread to Eastern Indonesia, namely Maluku and Papua, the large number of fires spread throughout Indonesia over 3000 points [22]. It can be concluded that Indonesian archipelago tend to occurs forest fires in dry season, especially during El Nino year which occurs near, equator this phenomena stimulates rapidly forest fires when human occurs are not responsible utilize forest island mainly damage forest, conditions such as HPH, HTI, HGU, APL.

These conditions are also feared in News Paper of Kompas (2015). In this news item Ministry of Environment and Forests said that10 investigate companies were suspected to involve in burning of forest. And companies were suspected forest fires in Riau, and 2 another companies were suspected in Jambi. Otherwise 3 companies had same conduct in central Kalimantan. But these all companies originally engaged in the plantations and forest plantation business. Environmental groups criticized pulp, paper and palm oil companies do not attempt anything to prevent forest fires, only to do the deforestation on massive [23].

The head Investigational Department of Criminal Police Commissioner General Anang Iskandar said on Tuesday, 20 November 2015 Police have decided seven companies of foreign capital owners as suspicious in alleged burning forests and land in large number of regions in Indonesia. And the police also handled with 256 case reports from that resulted in 49,326 hectares of forest land burned overall. The number of suspicious individuals reached 226 people, while 17 corporates were suspected. The total of 83 individual suspects have been detained, and five corporations were suspected too [24].

In 2015 it should not be repeated recent experience and increased spread throughout Indonesia so it is very necessary to revitalize and to counter measure SPD (Early Warning System) in synergy with relevant agencies, especially BMKG (Agency for Meteorology and Geophysics) and BPBN (Agency for Disaster Management state) in central and BPBDs (Regional Disaster Management Agency) in religion. At that time it is high priority that must be drawn firmly into RTRWP (Spatial Plan Province) in each province to reduce risk of catastrophic fires by building broader capacity of fire management, by developing coordination of fire preventive rationalization between national, provincialand local; and by strengthening local capacity to develop local fire preventive plans in order to facilitate ownership of the forest area.

It is very important to equip and strengthen the legislations on rights of authority and obligations for the concessionaires including plantation, concession and APL, and each concession holder and/or foreign capital companies as owners must be responsible for forest fires in concession area of its forest concession and/or another foreign capital owners in order to maintain their forest respectively. For assertive government in these cases, the Ministry of Environment and Forestry and the National Police should be appreciated which concessionaires or anyone deliberately set fire to the forest. If there is no intensive control of government, forest fires will continue and happen every year, especially in dry season. Do not expect that the impact of forest fires and smoke haze will disappear during rainy season. Apparently government and concessionaires have same perception that government has always neglected and allowed to drag on the incidence of forest fires and smoke haze, whereas the impact of forest fires is very large, not only material losses and incalculable value damages to the environment, especially decline biological diversity, not including the cost of restoring the environment, loss of economic sectors, tourism and potential lost due to paralysis of the flight.

## 4. Conclusions

From the results of compiled data and discussion can be summarized as follows:

1. The impact of the forest fires occur due to serious deforestation and threaten the destruction of both flora and fauna which are located in forest areas.
2. The mitigation management of fire for biodiversity are (a) to necessary revitalization by Law No. 5 of 1990 [25] on Conservation of Natural Resources and Ecosystems; (b) to develop SPD (Early Warning System) in synergy with relevant agencies, especially between BMKG (Meteorology and Geophysics) and BPBN (Disaster Management Agency State) both of located in central, and BPBDs (Regional Disaster Management Agency) in each area; (c) prevention to true forest fires into RTRWP (Provincial Spatial Plan) in each province to reduce the risk of catastrophic fire hazard, especially for mankind and rescue biodiversity; (d) to build capacity for manage larger fire hazards such as with building fire preventive rationalization which coordinated between national, provincial and local; (e) to strengthen local capacity to develop local management plans such as rehabilitation, reforestation and forest restoration, so that the preservation of natural resources beneficial immediately restored to human life on planet Earth.

## Suggestions

1. When forest fires started about 1960s properly government and license holders should had strong and solid program in tackling fire disasters because these phenomena anticipatory implemented and evaluated every year to harm State economically so we must prevent and mitigate.
2. Government need to revitalize and review legislation on the rights, powers and obligations for license holders both concessions and / or other companies which were owned by foreign capital, each holder of rights and permissions must be responsible for forest fires in the work area and must keep preserve their forests in accordance with Article 49, by Law No. 41 of 1999 [19] and Article 1 letter h by Law No. 32 of 2009 [26].
3. Government should conduct rigorous oversight of each permit engaged in forestry in force, namely by Law No. 41 of 1999 Article 60 paragraph (1) and (2) until Article 65 [19].
4. Government must have courage to act decisively over the criminal offense with demand of criminal penalties in accordance with the by Law No. 32 of 2009 Section 116 paragraph (1) letter a and b, and paragraph (2) for the forestry license holders [26].

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## References

[1] Ministry of Environment. *Fourth National Report The Convention on Biological Biodiversity.* Jakarta: Biodiversity Conservation Unit; 2009.

[2] Soemarwoto, O. *Ke Mana Harus Melangkah? Masyarakat, Hutan dan Perumusan Kebijakan di Indonesia.* Jakarta: Yayasan Obor Indonesia, 2003.

[3] Pemerintah Republik Indonesia. UU No. 1/tahun 1967 tentang Penanaman Modal Asing. Jakarta: Sekretariat Negara; 1967.

[4] Pemerintah Republik Indonesia. UU No. 5/1967 tentang Ketentuan-ketentuan Pokok Kehutanan. Jakarta: Sekretariat Negara; 1967.
[5] Hardjono, J. *Resource Utilizator and The Environment. In Indonesian New Order*, editor: H. Hill. Sydney: Allen and Unwin; 1994.
[6] Ardhana. The developmental policy for conservation of biological natural resources and its problems. *Proceedings of the Seminar on Biodiversity Indonesia Society-UNS* 2015.
[7] Grahame A., R. Smith, James J. Fox, A. Mitchell, D. Packham, N. Tapper, and G. Baines. *Going? Where Should Society, Forest and policy formulation in Indonesia "Fires in Indonesia: Impact and Solutions"*. Jakarta: Obor Indonesia; 2003.
[8] Departemen Kehutanan. *Sejarah Kehutanan Indonesia*. Jakarta: Departemen Kehutanan; 1986.
[9] Forest Watch Indonesia. Potret Keadaan Hutan Indonesia Periode Tahun 2000-2009. Jakarta: Forest Watch Indonesia; 2011.
[10] Forest Watch Indonesia. *Potret Keadaan Hutan Indonesia*. Bogor: Forest Watch Indonesia dan Washington DC; 2001.
[11] Departemen Kehutanan. Aktualisasi Kebijakan Kehutanan Kumpulan Siaran Pers Tahun 2005. Jakarta: Departemen Kehutanan; 2005
[12] Liew, S.C., O.K. Lim. Kwoh, and H. Lim. A Study of the 1997 Forest Fires in Southeast Asia Using SPOT Quicklook Mosaics. *Paper presented at the International Geoscience and Remote Sensing Symposium*. July 6 to 10. Seattle, WA, 1998.
[13] Soedarmo. *Forest in Indonesia, Condition, Causes, Impact, and Future Programs*. Unpublished report. Jakarta: State Ministry of Environmental, Republic of Indonesia, and the United Nations Development Programme; 1998.
[14] Nabet, E., PTC ASIA SPOT Ltd. Personal communication; 1998
[15] Makarim, N., Y.A. Arbai, A. deddy, and Brady. Assessement of the 1997 land and forest fires in Indonesia: National Coordination. *International Forest Fire News* 1998; **18**: 4-12.
[16] Anonymous. Kabut Asap Kebakaran Hutan: Setengah Abud Kita Abai. Online (http://sains.kompas.com/read/2015/09/14/16272971/Kabut.Asap.Kebakaran.Hutan.Setengah.Abad.Kita.Abai). Accessed on November 7, 2015.
[17] Anonymous. Luas Kebakaran. Online (http://sipongi.menlhk.go.id/hotspot/luas_kebakaran). Accessed on November 7, 2015.
[18] Pemerintah Republik Indonesia. Decree No. 35/Kpts/DD/I/1972 on the procedures for logging using Selective Logging Guidelines for Indonesia (TPI). Jakarta: Sekretariat Negara; 1972.
[19] Pemerintah Republik Indonesia. UU No. 41/1999 on Forestry. Jakarta: Sekretariat Negara; 1999.
[20] Government Ordinance No. 45/2005 on the Protection of Forest in Article 12 paragraph (1) and (2)
[21] Indonesia Goverment. Presidential Instruction No. 4/2005 and Intruction Minister of Interior No. 3/2005 on the Eradication of Illegal Logging in Forest Areas and The plan in the whole territory of the Republic of Indonesia. Jakarta: Sekretariat Negara; 2005.
[22] Anonymous. Kebakaran Hutan Meluas ke Maluku-Papua, Titik Api Tembus 3000. Online (http://www.cnnindonesia.com/nasional/20151021105451-20-86282/kebakaran-hutan-meluas-ke-maluku-papua-titik-api-tembus-3000/). Accessed on November 7, 2015.
[23] Anonymous. Polri: Tujuh Korporasi Asing Tersangka Pembakar Hutan. Online (http://www.cnnindonesia.com/nasional/20151020193837-12-86184/polri-tujuh-korporasi-asing-tersangka-pembakar-hutan/). Accessed on November 7, 2015.
[24] Anonymous. Perusahaan Dituding Ikut Memicu Kebakaran Hutan. Online (http://www.dw.com/id/10-perusahaan-dituding-ikut-memicu-kebakaran-hutan/a-18704576). Accessed on November 7, 2015.
[25] Pemerintah Republik Indonesia. UU No. 5/1990 tentang Konservasi Sumber Daya Alam Hayati dan Ekosistemnya. Jakarta: Sekretariat Negara; 1990
[26] Pemerintah Republik Indonesia. UU No. 32/2009 tentang Perlindungan dan Pengelolaan Lingkungan Hidup. Jakarta: Sekretariat Negara; 2009.