Questioning law enforcement against forest fire in Indonesia

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Abstract. Forest fires in Indonesia occur repeatedly every year and longer droughts are generally followed by more widespread forest fires. The impact caused by the forest fire is very significant environmentally, economically, and socially. Almost all of these forest fires are triggered by human actions, so it makes sense that actors who cause forest fires must take responsibility for their actions before the law. But unfortunately, law enforcement against forest fires is very awkward and unfair. Using satellite imagery and land use maps, one can detect the distribution of hotspots that are most likely to cause forest fires and who controls the burning land. Forest fires generally occur on land that appears neglected. Law enforcement is generally carried out against private actors who are considered to control land that is on fire, while government actors who also have the responsibility for the absence of forest fires have never been prosecuted as happened to private actors. Furthermore, the way the government calculates losses due to forest fires is very unreasonable.

1. Introduction

Forest and land fires create devastating impacts on the environment and human lives. Hence, it is very important to minimize the forest and land fires as far as possible and also it is sensible when the parties who are responsible for the forest fires should be punished accordingly. It is polluter pays principle (PPP). The PPP aims to correct market failure and its resulting social injustice by shifting pollution costs from the public at large to polluting agents, in order to reduce the amount of pollution produced. The opposite of PPP is pollute pays principle. According to Coase theorem, any approach chosen will not affect market outcomes, if transaction costs are negligible. Law enforcement against parties deemed responsible for forest and land fires has been carried out through litigation, both criminal and civil. But in public talks, many argued that the law enforcement is artificial and unfair, especially in the case of environmental loss assessments. The amount of fines to be paid by the convicted is considered very unrealistic. The main problem is the double counting of the value of ecosystem services. Whereas, there have actually been many studies on the valuation of ecosystem services and warnings about the possibility of double counting [1-6].

Forest fires are repeatedly seasonal occurrences in Indonesia. The hotspots are detected all year along, but during dry season the intensity of the spots are usually higher than that during rainy season. The forest and land fires occur every year and their intensities are dependent upon the annual rainfall; relatively dryer year usually is coincided by more hotspots. A long drought that comes periodically is usually followed by more intent hotspots and finally forest and land fires. A scientific evidence based on radiocarbon dating of charcoal deposits found in the soils of East Kalimantan indicates that forest fires have repeatedly burned areas of lowland rainforest, starting at least 17,500 years ago [7]. A more
spectacular figure is shown by [8] who suggest that natural fires have repeatedly occurred in the lowland dipterocarp rain forest of East Borneo since the late Pleistocene.

Actually, research on forest and land fires in Indonesia has been widely carried out. The focus of research is generally on biophysical aspects, such as their impact on biota [9], the relationship between drought and fire [10], on the value of losses in economic term [11-13], and on international cooperation to tackle forest fires [14], [15]. But how the environmental losses from forest and land fires are used in the judicial process have never been done or are rarely done. In the judicial process, the accuracy of who is responsible for an event and how much damage must be accounted for is very critical.

By using Landsat image technology, where hotspots start to emerge as a cause of a fire can be determined with a very adequate level of accuracy. When supported by data from field observations, the level of accuracy of the determination of the point where a fire starts is almost perfect. This information can help law enforcement officials identify the party responsible for a forest or land fire. Several cases of the forest fire trials are more related to who is responsible for managing the land where the forest fires have happened rather than who is responsible for causing the fires. But no one has seen whether the environmental law has been applied correctly and fairly? Are all parties involved in forest fires treated equally before the law? If the law is enforced correctly and fairly, then the distribution of parties involved and must be prosecuted before the law is more or less similar to the distribution of hotspots. Unfortunately, the data do not fit this view.

This paper questions law enforcement against those deemed responsible for forest or land fires. Law enforcement that has been carried out includes criminal law and civil law. Some people have been jailed after undergoing criminal legal proceedings. Against those who have been convicted, the government has filed a civil law suit to claim damages for environmental damage that are fantastic and unreasonable. For this reason, the components of compensation for environmental damage need to be examined more closely so that justice can be upheld in a fair manner.

2. Method
2.1. Data collection
The identification of hotspots is conducted through analysis of Landsat Image. Since a hotspot does not necessarily result in a forest or land fire, then we establish a criterion that only hotspots with a Confidence Level higher than 80% are chosen for further analysis. The hotspots meet this criteria very likely produce forest or land fires. The identification of the hotspots is limited to the Provinces of Riau and Central Kalimantan from 2007 to 2017. Hotspot data is expressed in terms of the number of hotspots in square kilometers.

The components of the environmental damage compensation are collected from the verdict of the judges. Since we do not deal with probabilistic samples and the components of the environmental damage constructed by the government are similar, then one sample of the verdict is enough. An example of a judge’s decision does not have to be from a case that occurred in Riau or Central Kalimantan, given the contents and arrangement of the government’s lawsuit about losses due to forest and land fires are more or less the same.

2.2. Data analysis
A statistical analysis is done to test whether the intensities of the hotspots in various land uses and two provinces are different. The analysis employs the t-test to compare between the hotspot density in Riau Province and Central Kalimantan Province, between the hotspot density in areas of non-forest land use and areas claimed as forest area, and finally between the hotspot in production forests on the one hand and protection forest and conservation forest combined on the other hand. The differences or similarities of the intensities of the hotspots should be reflected in the parties prosecuted before law if the law enforcement is conducted fairly. For comparing two means of the hotspot density, the null hypothesis is that the means are equal

\[ H_0: \mu_1 = \mu_2 \]  

(1)
with the alternative hypothesis

\[ H_1: \mu_1 = \mu_2 \] (2)

Analysis of losses due to forest and land fires is carried out by using economic theories that are commonly used in calculating a loss due to environmental damage. The problem that often arises in calculating the value of environmental losses is the occurrence of double counting. In addition, the difference in understanding between one item and another one is often problematic. In order to avoid or at least to minimize the problem, we follow the approach suggested by [4] including: a) identifying the spatio-temporal scales of ecosystem services; b) valuing the final benefits obtained from ecosystem services; c) establishing consistent classification systems for ecosystem services; and d) selecting valuation methods appropriate for the study context.

The environmental loss analysis is conducted through reviewing the court verdicts regarding the forest fires related charges. The review covers the components included in the calculation of the loss and the value assigned to each component. In addition, data on the environmental losses due to forest and land fires from other sources is employed for comparison.

3. Results and discussion

3.1. Spatial distribution of hotspots

Fires spread throughout all types of land legal status without showing any significant difference between two different types of land legal status. Even in areas claimed to be conservation and protection forests, they are not free from fires. Figure 1 shows the distribution of hotspots that occurred in 2015 in Riau Province and Central Kalimantan Province just as an example. Numerically, Table 1 shows the distribution of hotspots in various types of land use. At first glance it appears that the density of hotspots in Riau Province is higher than the density of hotspots in Central Kalimantan Province. The mean value of hotspot density in Riau Province is 29, while the mean value of hotspot density in Kalimantan Province is 42. Even though the two mean values look very different, the variance of the hotspot density in each province is very large. This makes the density of hotspots in the two provinces cannot be called significantly different. The variances of the hotspot density of each province are 2197 and 1909 respectively for Central Kalimantan Province and Riau Province.

| Year | Non-Forest | Convert | Regular | Limited | Protect | Conserve | Mean Forest |
|------|------------|---------|---------|---------|---------|----------|-------------|
|      |            |         |         |         |         |          |             |
| **Central Kalimantan** | | | | | | | |
| 2007 | 13.1       | 7.8     | 5.1     | 2.7     | 5.1     | 1.5      | 6.1         |
| 2008 | 5.8        | 53.8    | 0.5     | 1.4     | 0.5     | 0.4      | 2.1         |
| 2009 | 39.7       | 1.6     | 123.3   | 8.6     | 123.3   | 53.3     | 72.5        |
| 2010 | 1.5        | 19.9    | 0.4     | 0.4     | 0.4     | 0.1      | 0.6         |
| 2011 | 18.4       | 16.7    | 15.3    | 3.5     | 15.3    | 10.4     | 12.9        |
| 2012 | 10.7       | 11.5    | 20.8    | 4.6     | 40.8    | 9.0      | 18.4        |
| 2013 | 9.2        | 50.1    | 11.1    | 4.7     | 12.2    | 6.0      | 9.1         |
| 2014 | 32.5       | 87.7    | 44.2    | 7.1     | 56.4    | 27.6     | 37.1        |
| 2015 | 65.3       | 1.8     | 89.8    | 19.5    | 210.4   | 170.0    | 115.5       |
| 2016 | 1.3        | 0.8     | 1.2     | 1.5     | 0.7     | 0.1      | 1.1         |
| 2017 | 0.5        | 0.8     | 0.2     | 0.4     | 0.2     | 0.5      |             |
| **Riau** | | | | | | | |
| 2007 | 13.0       | 19.0    | 21.0    | 34.0    | 18.0    | 3.0      | 19.0        |
| 2008 | 23.0       | 30.0    | 30.0    | 62.0    | 32.0    | 25.0     | 35.8        |
| 2009 | 24.0       | 75.0    | 59.0    | 104.0   | 46.0    | 39.0     | 64.6        |
| 2010 | 9.0        | 18.0    | 28.0    | 18.0    | 12.0    | 18.0     | 18.8        |
| 2011 | 16.0       | 36.0    | 41.0    | 68.0    | 37.0    | 19.0     | 40.2        |
In the case of Riau Province, the density of hotspots in non-forest areas appears to be lower than the density of hotspots in areas claimed as forest areas. In the case of Central Kalimantan Province, the difference is more difficult to see. Of these two provinces, the average density value of the hotspots is 24.0 in non-forest use areas and 44.0 in areas claimed as forest areas. The difference in hotspot density in various forest land uses is even more difficult to see in plain view. In cases like this, statistical analysis assistance is expected to help. As a matter of fact, the t-test shows that the hotspot density in the two provinces does not show any significant difference (t = 0.013). Likewise, the hotspot density in non-forest areas and in areas claimed as forest areas (t = 0.107). Finally, between production forests on the one hand and protection forest and conservation forest combined on the other hand does not show a significant difference in the density of the hotspots (t = 0.522).

According to previous research, more fires were found in land covered by shrubs than in virgin forests or in plantations [16-18]. For example, pristine peat swamp forests (PSF) experienced only marginal fire activity (30 fire detections per 1000 km2) compared to deforested undeveloped peatlands (831-915 fire detections per 1000 km2) [17]. Indeed, shrubs have spread to all types of legal status of
land, including the lands claimed as protected forest and conservation forest areas. Likewise, there are indications that the fire incident at a certain place will be repeated at a later date.

The similarity in hotspot density across all types of land legal status is a serious warning. This shows that human activities in all types of land use are relatively the same. Protection forests and conservation forests that are supposed to be relatively sterile from human activities also experience the same fires. Why isn’t this called negligence from the officer responsible for securing protection and conservation forests as done to private license holders? The government blamed others more for the mistakes it made itself. The government blamed others more for the mistakes it made itself. Moreover, the contribution of the forestry sector to GDP over the past few years has been almost zero percent. Maybe there is a need for a show of existence.

3.2. Law enforcement
Law enforcement is not carried out fairly and impartially; no government apparatus, with the same criteria as actually responsible for a fire, is legally processed. Whereas, the government has adopted a strict liability strategy; all parties whose land was burnt could be punished, even though the fire was caused by another party. With a strict liability strategy, the real party of the victims of a fire can be punished, except for government officials. Who should be responsible for the fires that occur in areas claimed as protection forests and conservation forests? Both types of land use can be said to be fully managed by the government. The intensity of hotspots in the two types of land use is not different from the intensity of hotspots in other types of land use. All of the forest fires on Java Island in 2019 have occurred in the forest areas. But none of the individuals responsible for the burned forest area was prosecuted before law.

In forestry and environmental statistics of 2018, during 2016 to 2018 there were three cases of law enforcement of forest fires that reached the prosecution stage (P21). Until 2019, there are nine companies, which are assumed to be responsible for forest and land fires, have received decisions that have permanent legal force based on court decisions with compensation to be paid to the state in the amount of 3.15 trillion IDR. As a matter of fact, the simplified picture of big industries being the primary driver behind the fire and haze problems with communities playing a minor role at best through traditional burning methods, is not in line with reality and requires more nuanced analysis and discussion [19].

If it is true that the value of natural forests is so high, why doesn’t the government impose obligations on permit holders to provide performance guarantees that are mandated by law 41 of 1999? The government itself does not comply with the law. Furthermore, why is the permit fee for timber utilization in natural forests only 5,000 IDR per ha per year for the Kalimantan and Maluku islands and 3,500 IDR per ha per year for the regions of Sumatra, Sulawesi and Papua? As happened so far, forest damage is not only due to fire, but also due to improper management, even though the damage is not as great as the damage caused by fire.
Ideally, the law symbolized by the Lady of Justice is interpreted connotatively as a form of equality before law. In reality, however, the symbol of the Lady of Justice means denotatively, namely that the law is truly blind to justice. Law enforcement against forest and land fires is more political. Of course this approach is not very good for law enforcement in the long run. Massive destruction of forests occurred at the beginning of the reform era as an expression of community dissatisfaction with forest governance. It is not impossible that the explosion of dissatisfaction will recur in the future.

3.3. Compensation on environmental damage
The value of environmental losses used by the government in civil lawsuits is very unrealistic, which seems to be aimed more at killing rather than educating those responsible for forest or land fires. Calculation of environmental losses due to forest and land fires refers to the regulation of the environment minister number 7 of 2014. Scientifically, this regulation contains a lot of conceptual confusion. Even so, there have been 9 civil lawsuits won by the government with a compensation claim of 3.15 trillion IDR. An example is plantation company PT. Ricky Kurniawan Kertapersada (RKK) that was
convicted by the Jambi High Court of being guilty and must pay material compensation and ecological restoration costs of 181.8 billion IDR for fires that occurred in the company’s plantation area of 591 hectares in 2015. Initially, PT RRK was sued by the government at 1200 billion IDR; material 200 billion IDR and immaterial 1000 billion IDR. The judge asked for the details of the lawsuit which turned out that the government was not willing to give it. Indeed, it was a spectacular figure built on the jelly like land. The details of the losses are presented in the Table 2.

### Table 2. Compensation components of PT RKK (IDR)

| Components                              | Value based verdict                  |
|-----------------------------------------|--------------------------------------|
| **1. Ecological damage**                |                                      |
| a. Costs of reservoir construction      | 37,500,500,000                       |
| b. Costs of reservoir maintenance       | 1,500,000,000                        |
| c. Water regulation                     | 17,730,000                           |
| d. Erosion control                      | 723,975,000                          |
| e. Soil formation                       | 29,550,000                           |
| f. Nutrient recycle                     | 2,724,510,000                        |
| g. Waste decomposition                  | 257,085,000                          |
| h. Biodiversity                         | 1,595,700,000                        |
| i. Genetic resources                    | 242,310,000                          |
| j. Carbon release                       | 359,032,500                          |
| k. Carbon reduction                     | 125,661,600                          |
| **2. Economic losses**                  |                                      |
| a. Loss of usage time of land           |                                      |
| b. Loss of sale value for 11 years      |                                      |
| c. Loss of profit                       |                                      |
| **3. Costs of restoration**             |                                      |
| a. Costs of compost purchase            | 118,200,000,000                      |
| b. Costs of compost transport           | 23,640,000,000                       |
| c. Costs of compost dispersal           | 2,364,000,000                        |
| **4. Costs of activating ecological function** |                |
| a. Nutrients recycler                   | 272,451,000                          |
| b. Waste decomposer                     | 257,085,000                          |
| c. Biodiversity                         | 1,595,700,000                        |
| d. Genetic resources                    | 242,310,000                          |
| e. Carbon releaser                      | 359,032,500                          |
| f. Carbon releaser                      | 125,661,600                          |
| **Total**                               | 192,132,294,200                      |

With the loss of 192,132,294,200 IDR for 591 ha, the average loss is 325,096,945 IDR per ha. If this number is true and the government truly believes in it, then the development of industrial timber plantations (HTI) would have never taken place, especially HTI that was developed at the expense of natural forests. The value of benefits from HTI will never reach this number, while HTI is developed in areas claimed as forest areas. But the fact is HTI is permitted even by converting natural forests, as shown by the issuance of timber utilization permits (IPK). It would be very sweet if that fantastic figure is used as a basis for negotiations with developed countries that want Indonesia to protect its forests that are facing the threat of conversion. It would be even better if the fantastic value is only for a period of 11 years as mentioned in the Minister of Environment regulation number 7 of 2014. Currently, at least there is still a relatively good forest covering an area of 30 million ha that is facing extreme pressure.
Thus, Indonesia will get an additional income of 886 trillion IDR per year from developed countries that are very concerned with tropical rain forests. Previous studies of the value of forest destruction have shown very different results. For the case of forest fires in East Kalimantan in 1997-1999 which damaged around 5-6 million ha of forest, a loss of 10 billion USD was obtained by [7], while another study found a figure of 21.1 billion USD loss [13]. Using the figures obtained by [13], the value of forest damage due to fire is 53,069,755 IDR per ha assuming that the exchange rate of the rupiah against the dollar is 14,000 IDR per USD. There is a huge difference in the value obtained.

4. Discussion
The most critical issue in the process of enforcing forest destruction is the inconsistency of the government’s own attitude and the basis on which to calculate the value of forest destruction. On one hand the government states that the value of natural forests is very high, but on the other hand the government imposes very low tariffs on forests whose management is given to the private sector. The government does not even carry out the mandate of the article of the law 41 of 1999 governing performance guarantee funds. In this case, basically, the government has broken the law. In addition, law enforcement also gives the impression of being unfair. Forest and land fires occur equally in almost all types of land use, no exception on the lands which are under full control of the government because, namely the state lands that does not carry any permit. However, so far no government official has been prosecuted before the law. There is clearly a difference in the enforcement of the law to those responsible for forest and land fires. Thus, it is difficult to avoid the impression that law enforcement against forest and land fires is political.

There are serious problems with the regulation of the Minister of the Environment Number 7 of 2014 concerning damages caused by environmental pollution and/or damage to the environment. The elements covered for calculating losses appear only to produce spectacular numbers. Besides that, the value given to each element is astounding. The following are the elements of environmental damage listed in ministerial regulation number 7 of 2014:

1. Ecological damages: (a) Construction costs of reservoir, (b) Maintenance costs of reservoir, (c) Water regulation, (d) Erosion control, (e) Soil formation, (f) Nutrient cycles, (g) Waste decomposition, (h) Biodiversity, (i) Genetic resource, (j) Carbon release, (k) Carbon reduction.
2. Economic damages: (a) Loss of usage time of land, (b) Loss of sale value for 11 years, (c) Loss of profit.
3. Recovery costs: (a) Costs of compost purchase, (b) Costs of compost transport, (c) Costs of compost dispersal
4. Costs of activating ecological function: (a) Nutrients recycler, (b) Waste decomposer, (c) Biodiversity, (d) Genetic resources, (e) Carbon releaser, (f) Carbon reduction.

All elements of environmental damage are translated as is without interpretation. If it looks odd and inconsistent, that’s what is listed in ministerial regulation number 7 of 2014. Besides the value of each element raises questions, the understanding of some elements is also unclear. Some examples are as follows:

1. What exactly is the function of the reservoir that must be built? In a general sense, forests have the function of regulating water regime, so that when forests are damaged their function as regulators of water regime is reduced. The function of the reservoir is to replace the function of the forest as a regulator of the water system. Therefore, it must be chosen between the cost of building and maintaining a reservoir or the value of a water regulation so that there is no double counting.

2. The value of erosion control is 1,225,000 IDR per ha. We know that erosion rate is determined by the slope of land; the land on steep slope will be eroded more severely than the land on gentle slope. However, this value is applied also to the land on the perfectly flat landscape such as peat
lands. The judges who handle the case may not be aware of this situation, so they need helps from competent and honest scientists.

3. How is it possible to separate genetic resources from biodiversity? One function of biodiversity is as a stock of genetic resources. Genetic resources are not possible to be available without biodiversity. This is actually a concept that is expressed in two ways. In order to avoid double counting, one of them must be eliminated.

4. The loss due to carbon release is estimated by calculating the costs of recovering carbon. It is stated that the cost of recovering the carbon released is 10 USD per ton. Assuming that the carbon content is 400 ton per ha, then the loss because of carbon release is 4000 USD per ha. How to recover the carbon stock other than replanting and waiting? Certainly, the cost of replanting is not that much. In addition, how can carbon be released without causing a decrease in carbon stocks? Once again, there is a double counting here.

5. The elements that make up economic damage are tremendous chaos. It is clear that profit is part of the value of sales. How to estimate the value of lost opportunities from land utilization? Of course, by calculating the value of sales or more precisely profit. In other words, the elements that make up economic damage will cause not only double counting but triple calculation or even worse.

6. Compost-based recovery costs need to be applied carefully. The basic idea is that fire destroys soil organic matter. Compost is useful for recovering soil organic matter content. It makes no sense when this component is also taken into account in the case of peatland fires, which are all organic matter.

7. How do you activate ecological functions? What actions need to be done? Is the provision of compost not part of an effort to reactivate ecological functions? How to activate the function of biodiversity and genetic resources? Nature is a living system, which will function when all the required conditions are met. Moreover, ecological functions of carbon release and carbon reduction are supposed to be carbon sequestration and carbon storage.

To be fairer and more accurate, the calculation of environmental damage from forest and land fires should also take into account the benefits of these fires, because forest fires also generate benefits [20, 12]. Accordingly, the value of the loss obtained is the net loss value, not the gross value exacerbated by such double counting.

5. Conclusion
The law enforcement of forest fires is political in nature. There are many parties who commit the same negligence and can be identified relatively easily but it turns out that not all of them are processed by the same law; even many parties are not prosecuted at all. Of course this is not a good law enforcement practice and therefore needs to be corrected in the future. There is a huge difference among some calculations of environmental losses due to forest and land fires. This raises questions about the methodology used in producing a loss value, especially the one based on the ministerial regulation number 7 of 2014. For the sake of upholding a just law, the methodology issue needs to be resolved. Calculation of environmental damage due to forest and land fires should also take into account the benefits derived from these fires. Thus, the value of environmental damage obtained is the value of net environmental damage, as is commonly done when calculating profits.

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