Spatial Analysis of Potential Conflicts in the Forest Region in the Perspective of Sustainable Forest Planning

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ABSTRACT

Increasing encroachment, reduced biodiversity and increased conflicts in the forest region have become a national problem. The main cause is still contained forest areas that do not have regional boundaries, no forest managers at the site level and the lack of planning as referral activity. The research objective was to analyze the predictive potential conflicts in the forest region which is based on the biophysical aspects, accessibility and prediction of the potential for forest disturbance. The research method is applied research. This research uses descriptive quantitative and qualitative research. This research was conducted for 0.5 years at the KPH Model Tanah Laut, South Kalimantan Province. The variables measured were: a. biophysical (land cover, class slope, forest distance from settlements, landslides class) and the road network, b. prediction of potential disturbances in the forest. Sample Technique is stratified sampling technique with Random Start and purposive sampling. Data collection methods are literature studies, interviews, observations, field surveys and measurements. Methods of data analysis are 'Overlay Analysis', 'NDVI analysis ',' Buffer analyses, and 'AHP Spatial Analysis'

Based on the spatial AHP, in areas with a distance of 500m from the edge of the boundary and the road network, the potential for a very conflicted area reached 5.6%, 9.2% conflict, 22.9% quite conflicted, 16.1% somewhat conflicting. Total area of potential conflict reaches 53.8%

The results of in-depth interview about the potential for conflict are the supporting information on the results of AHP analysis. Based on the results of in-depth interviews with public figures around the forest, the potential disruption to forest region reached an average of 45.0% with the details of the potential for interference by historical land use reached 46.4%, the history of forest resource utilization reached 46.4% and the potential history land conflicts in forest areas reached 47.6%.

Keywords: Forest Planning, AHP Spatial, Conflict in Region Forest

INTRODUCTION

In the 1980-2000 period was the golden age of the logging industry in the province of South Kalimantan, with annual wood production peaked at 1.9 million m3 in 1998. During this period, the timber industry serve economic purposes such as increased foreign trade through exports, provide employment and add value to the production. However, little consideration is given to achieve a suitable crop or lower than the increment of forest growth, which is the starting point for sustainable forest management [1].

Deforestation is a change in the condition of land cover from forest to non-forest (including changes in the function of forest region for plantations, residential, industrial, etc.) [2]. For more than three decades, rehabilitation activities carried out at more than 400 locations in

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Indonesia. However, in 2002 the total area of forest and degraded lands has reached 96.3 million hectares (54.6 million ha in the area of 41.7 million ha of forest and outside the forest area) [3]. Based on the interpretation of satellite images LANDSAT ETM7+ years 2005/2006 and 2009/2010 the coverage area of deforestation in and outside forest areas across Indonesia respectively reached 610,376 ha / year and 221,751 ha / year [4]. Forestry Minister Zulkifli Hasan said that at the time of the reform, extensive destruction of forests in Indonesia reached 3.5 million ha / year, but then the condition of the value decreased to 300,000 ha / year. This damage, more than offset by illegal logging [5].

There are two driving factors causing deforestation, the driving factors directly and indirectly driving factors. The direct causes are logging, illegal logging, and forest fires cannot be controlled and often occur, especially in the long dry season. Indirect causes are market failures (e.g. pricing of timber that is too low), the failure of the policy (eg granting forest concessions (HPH) for 20 years as a disincentive for enrichment planting), as well as socio-economic issues and politics [3].

From deforestation patterns in 152 countries there are three causes of deforestation, namely the expansion of agriculture, timber exploitation and development of infrastructure. It is interacting with five factors: demographic, macroeconomic, technological, policy and culture [6]; [7]. Weak or no management plan is characterized by the absence of the manager at the site level [8]. Population pressures, economics and politics have contributed to the exploitation of natural resources, including forestry and land degradation [9]. Furthermore, [10], argued that based on the results of fishbone analysis, can be identified some major problems causes of deforestation and degradation are weak spatial, forest management unit ineffective, weak governance, the issue of tenure (land conflicts forest) and the basic legal and law enforcement is weak.

Forest areas that do not have their area boundaries can mean 'Properties Unclear' or 'ill define property right'. Forest area, although it 'de jure' is owned by the state (state property) but are 'de facto' forest area under open access conditions [11]. In addition, the forest area close to the village has a high level of accessibility so as to facilitate the community and out of the forest area, the consequences can occur forest disturbance. [12] argued realization of settlement boundaries until 2009 only reached 77.64% (219,200km) of 282,300 km, up to 2014 will be completed 25,500 km. [13] delineation said it has completed about 12 percent (14.2 million hectares). This uncertainty triggered tenurial conflicts with the various parties concerned with forest areas.

In general, tenurial conflicts that occur in the forest areas in Indonesia are grouped into (1) a conflict tenurial weight, typically are the strong reasons of public rights, (2) light tenurial conflicts, typically are their tenure can be proved through the weakness of his right reasons and generally arise as a result of poverty, (3) the issue of access to forest resources, the utilization of forest resources in the absence of land tenure claims, but the historical evidence that can rationally be accounted for, and (4) the problem of illegal activity, namely land tenure and / or resource use rights which do not have strong bases or do not have historical evidence rationally justifiable [14].

The purpose of this study are can predict the location of potential conflict in the entire area and 500 meters from the edge of the forest area or road network in Tala KPH Model Tala in DAS Tabunio, can determine the extent of the potential conflicts in the forest region in the opinion of people on the forest, especially things that could potentially lead to conflict on forests, and can know the extent to which the results of the analysis of spatial AHP in point 1 can support the analysis results of the study in-depth interviews in point 2.

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MATERIALS AND METHODS

Location research on KPHP Model Tanah Laut, DAS Tabunio, District Tanah Laut, South Kalimantan Province, Indonesia, as shown in the following figure 1. Study period reached six months.

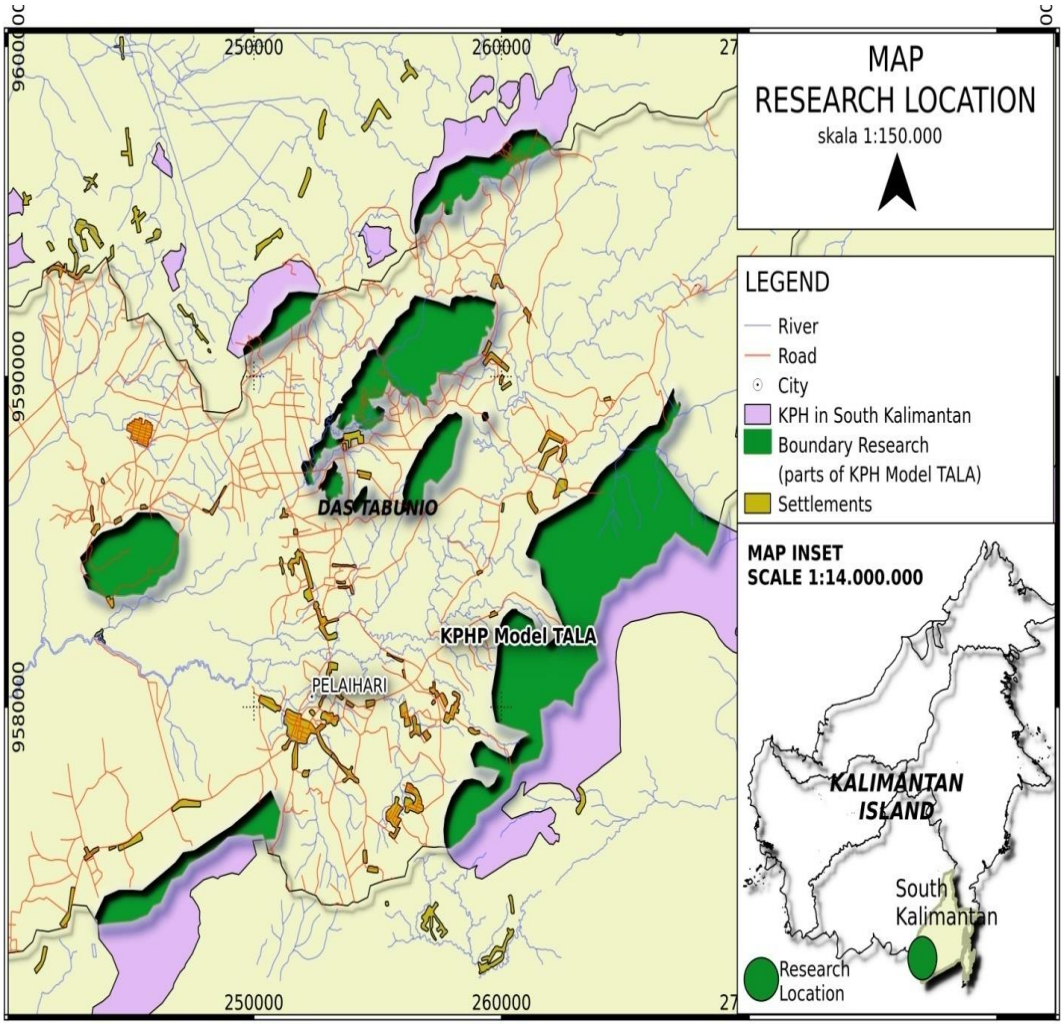

Figure 1. Map of Research Location

The approach used in this research there is qualitative and quantitative. Quantitative approaches are used for biophysical conditions and the level of accessibility of roads area. Qualitative and quantitative descriptive approach used to analyze the predictive potential disruption to the forest region.

Method of data collection is a survey method. Data collection was performed by taking a sample. Techniques example used is Stratified Random Sampling with Start and purposive sampling. Data collected by a variety of ways: through the secondary data request to the relevant agencies, observations directly to the field, interviews with community leaders, survey potential biophysical conditions of the study site, and download data from the internet.

The analysis methods used in this study are: Overlay Analysis, NDVI (Normalized Difference Vegetation Index) analysis, Buffer analysis, and AHP (Analytical Hierarchy Process) Spatial Analysis for biophysical conditions (land cover, class slope, forest distance from settlements, landslides class) and the road class. Structure Hierarchy on AHP-based spatial analysis for conflict in the forest region can be seen in Figure 2.

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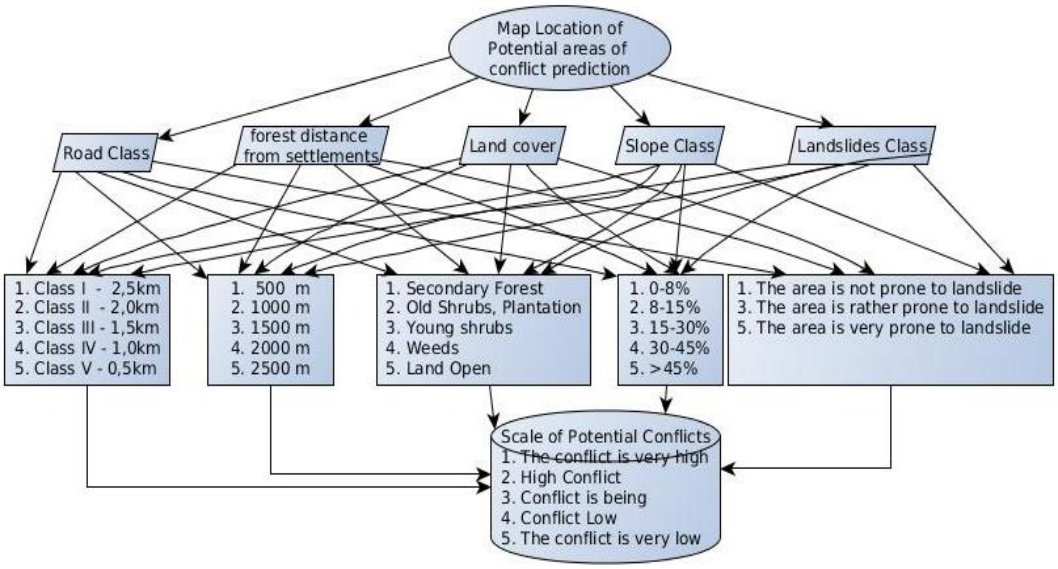

Figure 2. Structure Hierarchy on AHP-based spatial analysis for potential conflict in the forest region

Meanwhile, the potential for interference prediction parameters on forest use scoring and weighting analysis. Each informant answers will be converted into the potential value of the level of interference, if it is predicted to potentially interfere with the given value of 1, if it does not have the potential to disrupt it will be given a value of 0. There are three groups of questions, namely the history of land use (weighting 30%; 9 questions), history utilization of forest resources in the region (weighting 30%; 6 questions), and history of land conflicts in forest areas (weighting 40%; 5 questions). The total number of questions is 20 pieces, each question has a value different sub-weights. Informants (village community leaders were elected) number of aspects of forest land disturbance for a total of 32 people from 13 villages (total Villages 16) each taken 2-3 community leaders.

RESULTS AND DISCUSSION

To simplify information of land conflicts, then created a map of the prediction of potential conflicts in forest region. Map of the potential level of land conflicts are based on biophysical parameters such as land cover, class slope, road grade, class vulnerable to landslides, within the area of the settlement through the AHP-based spatial analysis in order to obtain results in the form of a map of the prediction of potential conflicts. The determination of the level of importance of each of the above parameters is based on the results of the questionnaire Expert Judgement.

From the results of the calculation and tabulation on AHP analysis, mathematical equations derived predictions of potential conflicts in forest region, such as the following

$$PK = (0,4732xsPL) + (0,2521xsKJ) + (0,1430xsJP) + (0,0850xsKTL) + (0.0466xsKL)$$

Description:

PK = Prediction of Potential Conflict in the Forest Region
sPL = Land Cover class score (1-5)
sKJ = Road class score (1-5)
sJP = Forest Distance from settlement (1-5)
sKTL = Landslide class score (1-5)
sKL = Slope class score (1-5)

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Based on the results of the above equation, land cover has a dominant influence than others, ie 47.3%. Other aspects respectively 25.2%, 14.3%, 8.5% and 4.7% respectively for the class roads, distance from settlements, sensitivity to landslides and slope grade. In the area of this research is the dominant land cover due to related production of wood which can make money while other resources such as coal mines do not exist. Non-forested acreage reached 71.7% (5,120.5 ha), this may an evidence of the high level of access to forest areas. Class roads and distance from settlements also support people to access forest resources in the forest. Settlements are inside and outside the forest area and the farthest is only 2km, almost all the existing roads can be passed. Soil sensitivity to landslides at several locations make an impact on the population not to access to forest areas. In general, people do not dare to to plant in locations they already know that the area has or potentially landslides. Meanwhile, class slope in principle the community does not care about that as long as there is a potential resource that can be accessed.

Graphically, the results of AHP-based spatial analysis of potential conflict in the forest region in KPHP Model Tala in Tabunio DAS are presented in Figure 3. Figure 3 illustrates the distribution of potential conflicts that exist in KPHP Model Tala, in the DAS Tabunio. Forest areas that have the highest potential for conflict (red color) is forest of Keramaian Mountain because this area is very close to the Tungkaran Village (203 ha) and Desa Ujung Batu Village (185 ha), and is still forested region in which there is a community garden. soil conditions around the Keramaian Mountain has the potential landslides that could occur mainly in the rainy season and there are springs that continue to flow despite the dry season. Communities around the Keramaian Mountain are not fully claim the land for their personal interests. Furthermore, the condition of the land in the area that there is no potential conflict (blue color) is dominated by the rocky land.

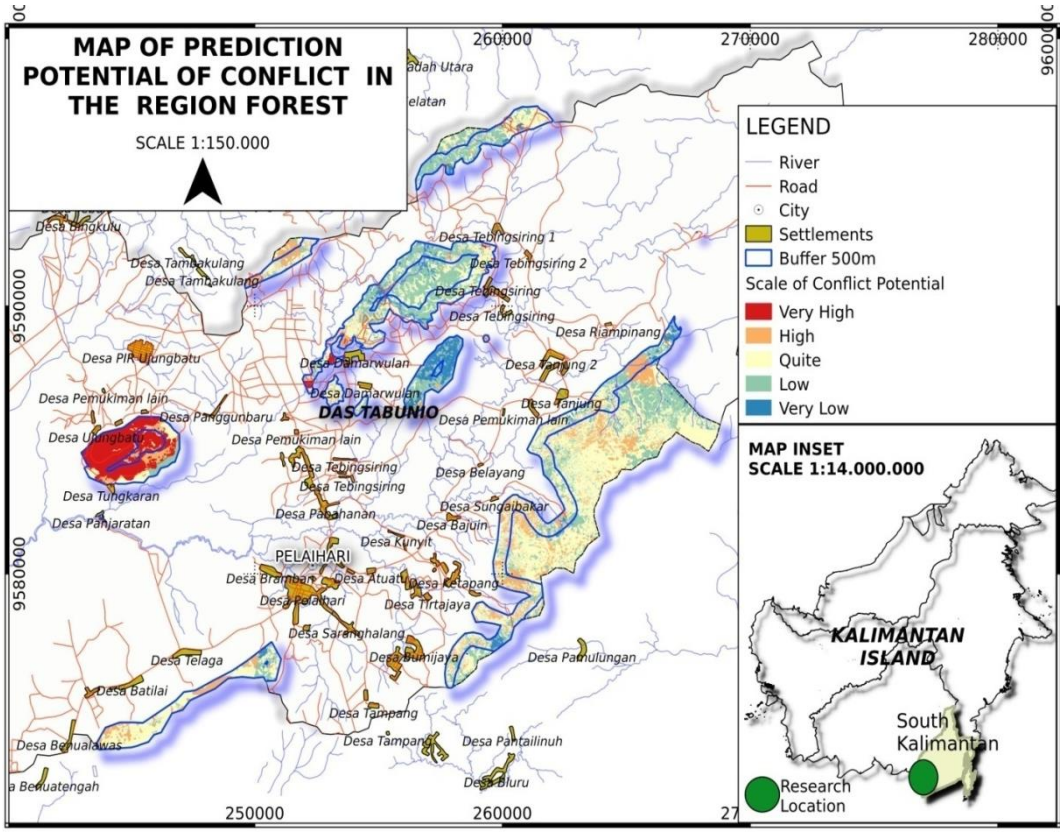

Figure 3. Map of Potential of Conflicts in the region forest based on results of AHP-based spatial analysis

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Based on the results of the analysis of pivot-tables of AHP spatial database, the forest contains a very high level of potential conflict reached 6.9% (504.5 ha), conflicted 15.4% (1,126.0 ha), 43.9% (3,210.0 ha) quite conflicted, 28.8% (2,105.9 ha) lower levels of conflict and 5% almost without conflict. Specifically in areas with a distance of 500m from the edge of the boundary and the road network, the potential for a very conflicted area reached 5.6%, 9.2% conflict, 22.9% quite conflicted, 16.1% very low conflict. Total area is located 500m from the edge of the boundary and the road network could potentially conflict reached 53.8% or 3,933.9 ha.

In-depth interviews conducted on 32 community leaders in 13 villages. Based on the analysis of scoring and weighting the results of in-depth interviews, then summarized as the following table 1.

Table 1. Summary Results of in-depth Interviews Related Interference Potential to the Forest

History of Land use (Weighting 30 %)										*Total*
Question No.	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*%*
Sub-weight Value (%)	15	5	5	5	20	5	10	20	15	
Total Score at All Villages (%)	75.7	0.0	51.4	16.2	100	59.5	37.8	24.3	0	
Sub-weight Value x Score (%)	11.4	0.0	2.6	0.8	20.0	3.0	3.8	4.9	0	46.4
History of Utilization of forest resources (Weighting 30 %)										
Question No.	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*%*
Sub-weight Value (%)	25	15	25	15	10	10				
Total Score at All Villages (%)	75.7	43.2	75.7	0.0	24.3	8.1				
Sub-weight Value x Score (%)	18.9	6.5	18.9	0.0	2.4	0.8				47.6
History of land conflicts in forest areas (Weighting 40%)										
Question No.	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*%*
Sub-weight Value (%)	35	20	20	10	15					
Total Score at All Villages (%)	67.6	32.4	59.5	0.0	0.0					
Sub-weight Value x Score (%)	23.6	6.5	11.9	0.0	0.0					42.0
Prediction of the potential disruption to forest										45.0

Table 1 presents a summary of the results of in-depth interviews related to the potential disruption to the forest. In general, in Table 1 it can be seen that the magnitude of the potential disruption to forest reaches 45%. The magnitude of the potential disruption to forest resources reached 47.6%, and based on the amount of land utilization reached 46.4% of potential interference, as well as the potential for interference reaches 42% if it is based on the history of land conflicts.

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In the historical aspects of land use there is the potential disruption to 0%, which means there is absolutely no disruption to points 2 and 9. Point 2 means that all the villages in the 'KPH Tala DAS Tabunio' no Customary Law. Customary law in this case not as the potential for interference. Whereas in point 9 all village leaders replied willing to collaborate with the manager of the FMU/KPH. At point 5 the interference potential to reach 100% this is because based on the information village leaders, there are some people claim to have owned land in the forest with an area of 1-5 hectares.

In the history of the utilization of forest resources in the region, at point 1 level reaches 88% of potential interference due to the public in the 'KPH Tala DAS Tabunio' exploit forest region to plant crops as a source of livelihood and on point 4 level of potential interference to 0% because people are willing to cooperate with the management of the FMU/KPH.

Meanwhile, in the aspect of land conflicts in forest areas, the potential interference points 5 to 0% because the community is deemed to have had a pattern of conflict resolution while at one point had reached 68% of potential disruptions due to conflicts have occurred regarding the use of the area for the mine, forestry activities by the forest service that has not been accepted by the community and issues forest boundaries are unclear. Among these conflicts have been completed as specified by 3 points to the value of the potential disruption to reach 59%.

To convince potential disruption of these forests should be supported other information such as land cover, potential and plant species found in the forest area. Based on the analysis of NDVI, forested area only remaining area that consists of 2,121.4; 1,886.9 ha located on Protected Forest areas, and 234.5 ha located in production forest and limited production forest. Based on the survey results and field observations, the general condition of forested areas generally forested areas are located on slopes above 15%, the condition of the land prone to landslides and there are fruit trees (Durian, Jengkol, tarap, Jackfruit, etc.) or rubber trees ever planted by the communities living in and around forests.

Prediction of potential conflicts based on this in-depth interview cannot refer to space (where it is located). This weakness may be assisted by the AHP-based spatial analysis results. potential conflicts of spatial-based information is very helpful to explain the prediction position of potential conflict areas and a variety of explanations related to the space that has the potential for such conflicts. In addition, spatial database based conflict APH is easily organizing the handling of conflicts spatially and time as specified in the formulation sustainable forest planning.

CONCLUSION

1. The total percentage of acreage potential conflicts at locations with a distance of 500 m from the edge of the boundary and the existing road network in the forest area reached 53.8% or 3,933.9 ha.
2. Potential forest disturbance based on in-depth interviews to community leaders in villages around and inside the forest reached an average of 45.0%.
3. Results of analysis of potential conflicts by using spatial AHP is helpful to explain the results of in-depth interview about the potential conflicts, particularly in determining any location that has the potential and the level of conflict.

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