Mapping The Area of Human-Elephants Conflict in Kabupaten Aceh Jaya

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Abstract. In Kabupaten Aceh Jaya has displacing habitat of Sumatran Elephant (*Elephas maximus sumatranus*), because the change of forests became an estate monocultures. This has resulted in the elephants stuck in small blocks of forest which has not enough to support the elephant in the long term. This condition has been trigger of conflict between the elephant to the people. The data collected was done through: field observation, interview to respondents by purposive sampling and data conflict from related institutions. Over a period of 5 years, occurred 45 times conflict between the elephant with people in Kabupaten Aceh Jaya of the year 2010 to 2014 in 32 different locations. Direct observation in the field, the points scene conflict between human and elephant on this area can be explained that: was only at an altitude of ≤ 100 meters of the sea level; but based on slope the field stood at 0.72 area conflict is at slope ramps (0 – 15%) and 0,28 in 15 – 30%. Based on multiple regression analysis, showed that the altitude and slope of conflict location do not have significant effect to crops damaged.

Keywords: conflict area, displacing habitat, human, mapping, Sumatran elephant

1 Introduction

The reduced forest area (approximately 2 million hectares per year) is closely linked to the government's efforts to increase the country's foreign exchange, which in the past was dominated by logging / logging concessions for timber consumption (69 million ha); forest conversion for oil palm plantations (more than 3 million ha) and development of Industrial Timber Estate (7.861251 Ha) [1]. Should be recognized on one hand the exploitation of natural forest timber, expansion of oil palm plantations and HTI on forest land has increased foreign exchange, on the other hand the ecological balance is disrupted. These activities have led to problems and effects on the narrowing and fragmentation of species habitat, especially large mammals such as elephants [2] and [3], rhinoceros and tigers [3] and orangutans.

The land forest conversion has caused the elephant population were naturally in the forest as their natural habitat to be fragmented to occupy the remaining habitat. Naturally elephants need a vast space, is called *homerange,* to find the needs of life such as: feed, water and cover. But the narrowest conditions of the home range cause elephants to move out of their natural habitat to find new spaces so as to land, farms and even human settlements and cause conflicts with humans.

The conflict between Sumatran elephants (*Elephas maximus sumatranus*) and humans continues to occur in Aceh Province, especially in Kabupaten Aceh Jaya. Increased conflict is because most of the elephant habitat was damaged by uncontrolled illegal logging and land

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conversion to monoculture plantations (palm and rubber), clearing of forest areas for mining, settlement and roads; resulting in fragmented elephant habitat. This conflict has caused material losses due to damage to crops, property and even death to elephants and humans. This problem in Kabupaten Aceh Jaya almost every year occurred since post-tsunami in 2004 until now.

As a note that the need for timber for housing construction in the aftermath of the tsunami disaster in Aceh has been the reason for large-scale logging to support the need. Fulfillment of the people is a priority at that time than thinking about how we protect animals such as the endangered Sumatran elephants (IUCN) and according to CITES categorized in Appendix I. Starting from this, land clearing in some areas in Aceh is increasingly widespread resulting on increasing intensity of conflict between humans and wildlife. Elephant conflict with humans is a very complex problem; not only related to human safety but also a serious threat to the conservation of the Sumatran elephants. Moving from the above explanation, this study aims to determine the intensity of Sumatran elephant conflict with humans in Kabupaten Aceh Jaya and mapping the distribution of points of conflict. The results of this study are expected to be an input for the Government of Aceh and Local Government in taking policy related to spatial layout of the kabupaten and province.

2 Material And Methods

This research was conducted in Kabupaten Aceh Jaya from March 20 to April 30, 2015. The selection of research sites based on reports of elephant conflicts with human. The materials used in this research were; Indonesia earth map scale 1: 50,000; administrative map, land cover map, spatial planning plan map (Bappeda Kabupaten Aceh Jaya, 2014), questionnaires and reports from related institutions. The tools used were a computer that has ArcGIS software installed, *MapSource* to download data from receiver GNSS, GNSS navigation tool, digital camera for documentation. The research was conducted by descriptive survey method based on the result of field observation on conflict area of Sumatran elephant with human. The location coordinate point of the conflict was determined using the Garmin Brand GNSS Receiver with type E-Trex 10.

Primary data were obtained through interviews to selected respondents based on a pourposive sampling. The number of respondents taken is 98 people throughout Kabupaten Aceh Jaya; consisting of 45 people were respondents who were directly affected by conflict, while 53 respondents were taken by random from all of Kecamatan of Kabupaten Aceh Jaya. The secondary data comes from the data and reports of elephant and human conflict from non-governmental organizations and related institutions.

The field survey was conducted by direct review to the location of the conflict between the elephant and human in nine kecamatan in Kabupaten Aceh Jaya. By using GNSS receiver, the location of the conflict can easily be marked so that the location coordinates will be stored in the formats X and Y. For the area located north of the equator line X called the East Longitude, while Y is called the North Latitude. Marked coordinate point will be stored in GNSS device storage media. Coordinate data from the next survey will be downloaded using MapSource software. *MapSource* is an application to download data from GNSS devices.

To create a map of elephant conflict with the human, it was necessary to coordinate the results of the data to the field. The data that would be in overlaid with other geospatial data. In this activity we would overlaid it with geospatial data that fall into the category of base

map. The geospatial data were includes data on kabupaten boundaries, kecamatan boundaries, rivers, road networks and village centers (*gampong*). Coordinate data of the survey results were first converted into data shapefile (Shp). In addition to the base map, coordinate data can also be overlaid with other geospatial data such as land use data, geological data, watershed data, slope data, topographic data, soil type data and other thematic geospatial data so that it would add a reference in taking a decision. After coordinate data and supporting data such as complete baseline data then the last stage in making map of elephant conflict with the human was to do the map layout.

3 Results And Discussion

3.1 The Intensity of the conflict

According to data compiled over five years, from 2010 to 2014, there were 45 conflict incidents in 32 different locations in Kabupaten Aceh Jaya. Elephants come down from the forest into the plantation and community-owned fields on the edge of the forest. Some *gampong* that directly adjacent to forest area in Kabupaten Aceh Jaya can be seen in Table 1. Data from Dinas Kehutanan dan Perkebunan of Aceh Jaya said that the conflict between elephants and human occurs every year in 9 Kecamatan, but with different frequencies and months. The highest intensity of conflict occurred in

Table 1. List of *Gampong* Indicated in Conflict Area of Sumatran Elephant in Kabupaten Aceh Jaya Year 2010-2014

No.	Kecamatan	Gampong name	Date of the incident	Coordinate Point	Description of location
1.	Jaya	Sabet	24 April 2013	N 05º07'41.8" E 095 º25'23.1	settlement
		Bak Paoh	23 April 2013	N 05º05'55.8" E 095 º22'15.2"	plantation
2.	Indra Jaya	Meudang Ghon	28 Maret 2013	N 05º01'05.4" E 095 º23'19.9"	cultivation
3.	Sampoiniet	Krueng No	13 Mei 2013	N 04º55'54.5" E 095 º23'08.8"	settlement
		Krueng No	08 Maret 2015	N 04º55'52.9" E 095 º23'12.0"	settlement
		Blang Munlong	25 Agustus 2013	N 04º53'28.2" E 095 º25'51.0"	plantation
		Alue Groe	17 Agustus 2013	N 04º53'45.6" E 095 º26'41.8"	settlement
		Alue Groe	23 April 2015	N 04º53'45.4" E 095 º27'26.5"	plantation
		Ie Jeurengeh	28 Oktober 2013	N 04º53'42.5"	plantation
		Ie Jeurengeh	22 September 2012	E 095 º29'21.4"	
		Ranto Sabon	13 Juli 2013	N 04º52'59.5"	settlement
		Ranto Sabon	28 Maret 2010	E 095 º29'33.0"	plantation
		Cot Punti	25 Juli 2013	N 04º53'49.1" E 095 º30'35.5"	plantation
4.	Darul Hikmah	Teupin Asan	29 November 2013	N 04º49'12.3" E 095 º33'00.6"	settlement

No.	Kecamatan	Gampong name	Date of the incident	Coordinate Point	Description of location
		Masen	08 Desember 2013	N 04º49'07.2"	settlement
		Masen	17 Oktober 2011	E 095 º32'49.1"	plantation
		Gampong	24 Mei 2014	N 04º49'43.7"	plantation
		Baro		E 095 º31'49.9"	
		Alue Gajah	18 Juni 2014	N 04º50'43.9"	plantation
		Alue Gajah	4 November 2010	E 095 º31'52.6"	plantation
5.	Setia Bakti	Gampong	05 Agustus 2014	N 04º45'51.8"	plantation
		Baroh		E 095 º35'39.4"	
		Pante Kuyun	30 April 2014	N 04º46'30.6"	cultivation
				E 095 º34'34.2"	
		Rigaih	26 Mei 2014	N 04º40'50.4"	cultivation
				E 095 º33'49.6"	
		Lhok Bot	15 Maret 2014	N 04º40'47.8"	settlement
		Lhok Bot	3 April 2011	E 095 º36'17.1"	plantation
		Gunong	27 Maret 2015	N 04º40'29.3"	plantation
		Jambe		E 095 º36'56.5"	
6.	Krueng Sabee	Curek	24 Maret 2013	N 04º73'48.7"	plantation
				E 095 º41'07.1"	
		Geuni	06 September 2014	N 04º41'22.0"	plantation
				E 095 º41'15.1"	
		Panggong	27 November 2013	N 04º40'26.1"	cultivation
				E 095 º40'22.9"	
		Buntha	18 September 2014	N 04º38'56.8"	plantation
				E 095 º39'36.3"	
7.	Panga	Gunong	25 November 2013	N 04º33'17.0"	plantation
		Buloh		E 095 º47'15.2"	
		Gunong	27 Agustus 2014	N 04º33'08.4"	plantation
		Meulinteng		E 095 º46'56.0"	
		Glee Putoh	18 April 2014	N 04º35'46.3"	plantation
		Glee Putoh	16 Juni 2012	E 095 º44'41.6"	plantation
8.	Teunom	Alue	02 Oktober 2013	N 04º33'19.7"	plantation
		Meuraksa		E 095 º50'37.7"	
		Alue	15 Januari 2011	N 04º33'19.7"	plantation
		Meuraksa		E 095 º50'37.7"	
		Pasie Timon	17 Maret 2015	N 04º27'20.5"	plantation
				E 095 º52'36.3"	
9.	Pasie Raya	Alue Jang	7 Oktober 2013	N 04º34'28.5"	cultivation
		Alue Jang	24 Desember 2011	E 095 º54'46.3"	plantation
		Bintah	13 Desember 14	N 32º45'52.0"	plantation
				E 095 º55'37.6"	

Source: Dinas Kehutanan & Perkebunan Kabupaten Aceh Jaya, 2014

Kecamatan Sampoiniet and the most rarely in Kecamatan Pasie Raya., Based on field observations and reports from community residents at the conflict site, the damage occurring in the plantation area was wider than on the farmland. Farmland was not damaged by elephants because, elephants prefer to eat plantation crops. This is allegedly due the plantation area is more varied sources of feedplant when compared with farmland that there is only one type plant, that is rice. According to the results of interviews with the community, the elephant likes the palm oil that is still young around the age of two years. Although palm oil is not the main feed of elephants, but elephants tend to re-eat the palm that they met along the path of

their homerange. However, the disturbance will decrease when the age of oil palm has been more than two years. According to[4], elephants are prefer species of rattans (*Callamus* spp.) and other species of Arecaceae family, especially the younger shoots (buds). The elephant's fondness for the species of the arecaceae / palmae because of its high cobalt content in the plant [5]. [6] added that crop damage was occurred in plantations and cultivation, due to the high level of elephant palatability of the planted commodities.

3.2 Causes of the conflict

Forest areas in Kabupaten Aceh Jaya are part of Krueng Sabee protected forest areas, which have many changes due to land clearing of forest areas for

various development interests, such as the gold mining, transmigration area, etc. This is one of the early factors of Sumatran elephant conflict (*Elephasmaximus sumatranus*) with humans in Kabupaten Aceh Jaya.

Kabupaten Aceh Jaya in recent years has made land clearing for oil palm plantation and resettlement areas. Land clearing was done on lands adjacent to protected forest areas. This condition causes, wildlife including elephants trying to adjust to environmental changes. The loss of elephant feed plants would result in elephants continue to explore foraging out their habitat even to plantations and human settlements, this was the beginning of the elephant conflict with humans. This condition would threaten the existence of elephants, among others: elephants were killed because it was considered harmful by destroying the settlements and plantation communities or companies.

Respondents from all kecamatan located in Kabupaten Aceh Jaya stated that the location of the conflict areas of Sumatran elephant with humans were agricultural land, plantation and settlement. The elephant roaming area of Kabupaten Aceh Jaya, which is partly the upstream part of this region, has been converted by communities into plantation and cultivation areas. Very reasonable if this area has great potential for elephant and human conflict, because the plantation and cultivated land is directly adjacent to the forest area, which is also a elephant homerange. Similar conditions was occured in the vicinity of Taman Nasional Gunung Leuser, in cultivation and plantations that’s close to the forest were more frequently visited by elephants because of the availability of feed; so there was often conflicts [7].

3.3 Distribution of Conflict Areas

Map of the distribution of elephant conflict areas in Kabupaten Aceh Jaya, can be described after going through several stages. The coordinate data has been converted to the shapefile (.shp) format opened with the ArcGIS application so that the spread of the conflict will spread in every sub-district. After coordinate data and supporting data such as complete baseline data then the last stage in making the map of human-elephant conflict was to do the map layout. The maps are as shown in Figures 1 and 2a-i.

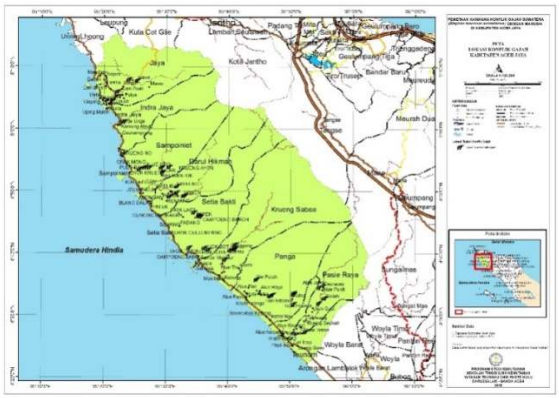
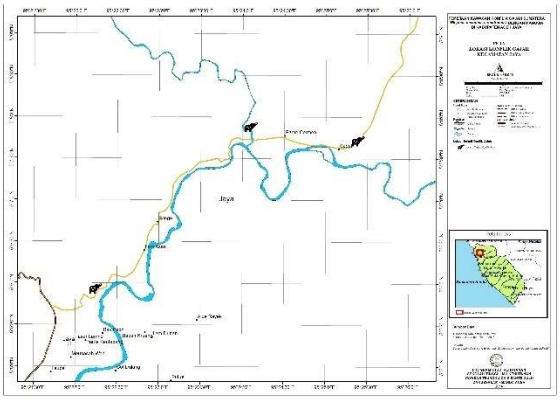


Fig. 1. The map of human-elephant conflict in all of Kabupaten Aceh Jaya



Fug. 2a. The map of human-elephant conflict in Kecamatan Jaya

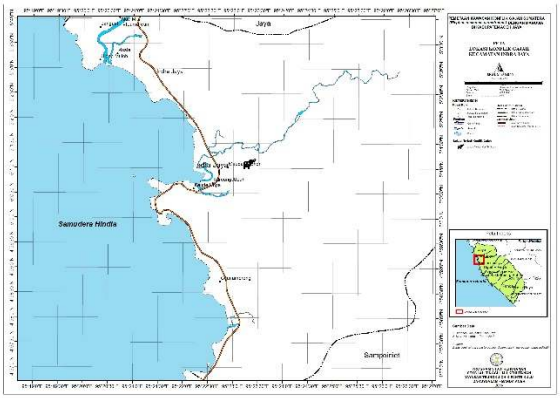


Fig. 2b. The map of human-elephant conflict in Kecamatan Indra Jaya

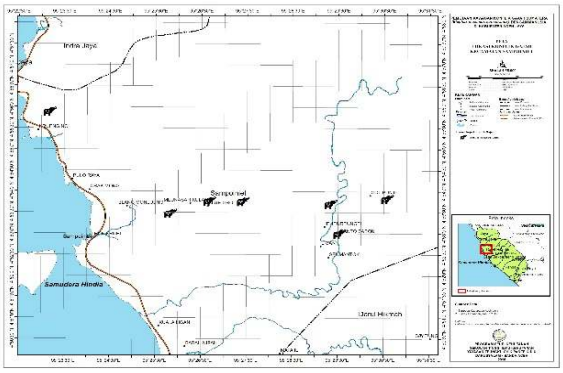


Fig. 2c. The map of human-elephant conflict in Kecamatan Sampoinet

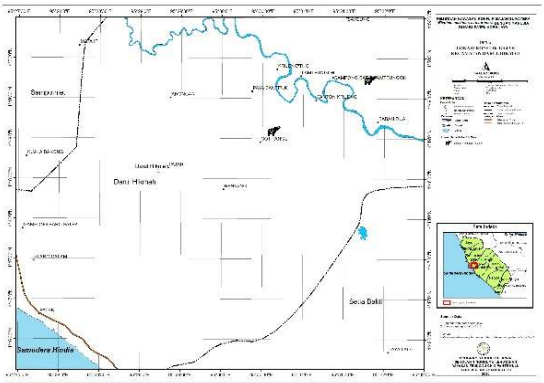


Fig. 2d. The map of human-elephant conflict in Kecamatan Darul Hikmah

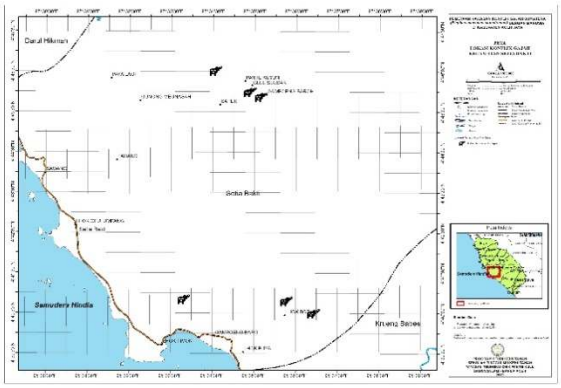


Fig. 2e. The map of human-elephant conflict in Kecamatan Setia Bakti

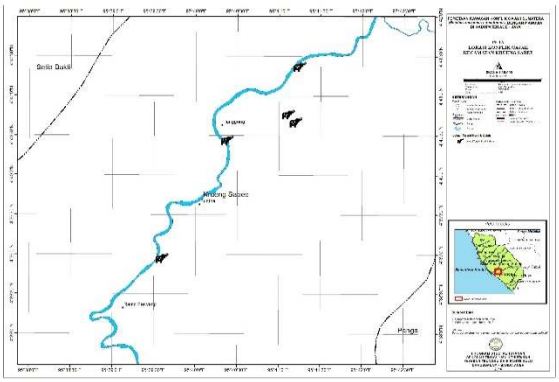


Fig. 2f. The map of human-elephant conflict in Kecamatan Krueng Sabee

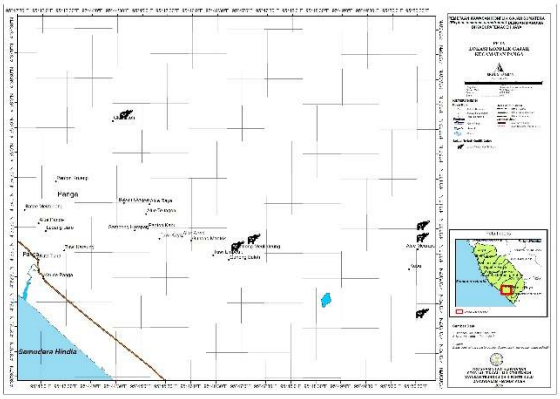


Fig. 2g. The map of human-elephant conflict in Kecamatan Panga

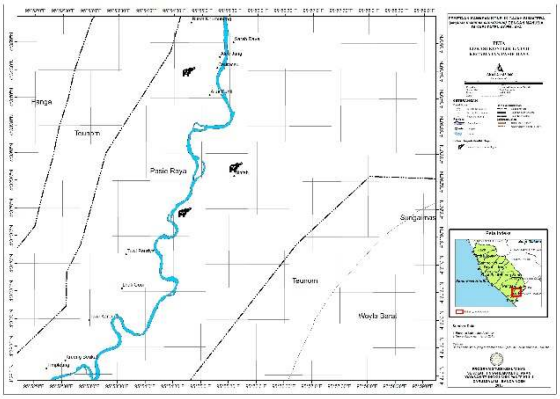


Fig. 2h. The map of human-elephant conflict in Kecamatan Pasie Raya

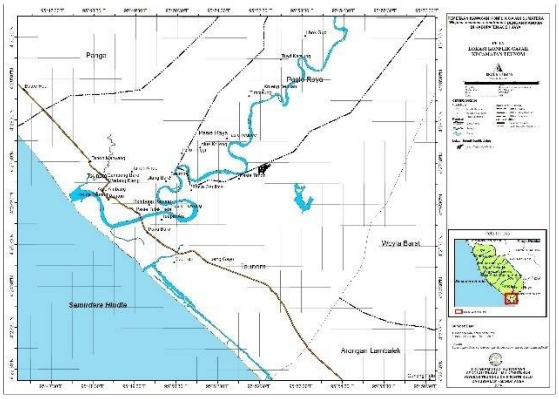


Fig. 2i. The map of human-elephant conflict in Kecamatan Teunom

Part of the area in Kabupaten Aceh Jaya has now converted to agriculture, plantation and settlement. This resulted in reduced elephant movement. Based on the data collected in the field related to the distribution of conflict location, it turns out that all conflict occurrence were at altitude between 0 - 100 m above sea level and on a flat to wavy topography (slope 0 - 30%), and did not occur in other height ranges. Based on multiple regression analysis, the dependent variable Y is the amount of damage and the independent variables are altitude (X_1) and slope of location (X_2); regression equation is obtained: $Y = 26{,}116 - 0{,}0411X_1 + 0{,}727X_2$ with value $R^2 = 0{,}011$ dan F calculated < F table, showed that the altitude and slope of conflict location do not have significant effect to crops damaged. There was a difference with the research of [7] said that the rate of damage decreases with increasing altitude; even at altitudes >200 m asl no crop damage found by elephant but the highest of crops damage was at an altitude of 0-100 m above sea level; while based on slopes, they were noted that the rate of damage by elephants was very high on slopes of 0 - 8%, and on slopes >25% no damage was found. The results noted that plantations and community cultivation that were converted from forests are mostly lowland with slopes from flat to ramps conditions. Seen from the slopes of the location, 0.72 incidents of conflict were on the slopes of 0 - 15% and the remaining 0.28 were on a 15-30% slope. The occurrence of conflicts was caused by the use of the same space between human and elephant. Several previous studies have reported; Sumatran elephants are more commonly found exploring on slopes of 8 - 15% [8] while [9] said that the Sumatran elephants prefer ramps conditions that tend to be flat, but that does not mean that other slopes do not find traces. Similar results were obtained by [10] which stated that the elephant's preferred land height is between 0 - 400 m asl, and the slope of the land between 0 - 20^o.

4 Conclusion

Conflicts between humans and elephants in Kabupaten Aceh Jaya was more common in plantation areas due to the variety of available feed sources and are prefered by elephants, such as: palm oil. The conflict areas were more prevalent in plantations and cultivation adjacent to forests, having a flat to ramps topography with altitude of 0-100 meters above sea level. To reduce the conflict between human and elephant is the people should plant the comodities that are not prefered by elephant. In addition, there must be synchronization of

spatial pattern either at kabupaten, province and national level. Further research is needed on plantation crops that are not preferred by elephants, but have a high economic value so as to improve the welfare of rural communities.

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