

SESSION 3. ENVIRONMENTAL SCIENCES

HABITAT MAPPING AND STRATEGIES OF RESOURCES USE BY SUMATRAN ELEPHANTS (*Elephas maximus sumatranus* Temminck, 1847)

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Abstract. Scientific information in resources and habitat used by Sumatran elephant (*Elephas maximus sumatranus* Temminck, 1847) is needed for considering animal behavior in suitable population size in disturbed habitat. Lack of this information could cause decreasing population size and go extinction. The aim of this research was to find strategies of resources and habitat use considering constraint factors. The research conducted in Ulu Masen Area (± 750.000 ha) in Aceh Province.. Feeding ecology and daily activity data collected using focal animal sampling and scan animal sampling. Suitability habitat analyzed using Geographic Information System (GIS) technique. Based on the dominance of feces distribution of each class of habitat factor, we found the most preference level of each habitat factors were primary forest with very close coverage, food availability ($>75\%$), no big herbivore and predator, slope slightly ($0-20^\circ$), primary forest ($0-5$ m) and far to disturbance (>1.500 km). The animals spend more time in primary forest (feeding, social interaction, reproduction and parental care) than secondary forest and grassland (feeding and walking). The habitat suitability (corrected by time budget) resulted $143.678,60$ ha ($21,82\%$) for $16,56$ elephants by carrying capacity $0,000115$ elephant/ha. Strategies of habitat used: elephants use specific habitat (permanently wet forest and high in accessibility in primary forest and use food resource (high in availability and easy handling) and maximize feeding time and avoid habitat constraint (temporal strategy).

Keywords: Sumatran elephant, resources and constraint, and strategies of habitat use.

HABITAT MAPPING AND STRATEGIES OF RESOURCES USE BY SUMATRAN ELEPHANTS

1. INTRODUCTION

Estimation of Sumatran elephant (*Elephas maximus sumatranus* Temminck, 1847) in Sumatera was 2.800-4.800 elephants (44 groups). Aceh has four groups of elephants (Santiapillai, 1993). This numbers decrease each year because of pouching and habitat conversion [8, Nyhus and Tilson, 2004].

The province of Aceh, in the north of Indonesia, is believed to support one of the largest remaining tracts of intact rainforest on the island of Sumatra. Hence, this regions forest is inhabited by a number of threatened mammalian species, including the Sumatran elephant (*Elephas maximus sumatranus*), Sumatran tiger (*Panthera tigris*) and the Sumatran Rhinoceros (*Dicerorhinus sumatrensis*) [11]. The continuous deterioration of forested regions both within as outside protected areas and the rapid clearance of lowland forests threatens the future survival of both the Sumatran mammal diversity as numerous other animal and plant species [6, 3, 2]. Nonetheless, as Aceh still comprises relatively large stretches of undisturbed forest, it has recently been put forward as a critical region for the long term conservation of many large mammals occurring on the island. At present, elephant research and conservation has often focused on estimating elephant densities by monitoring population dynamics in disturbed landscapes. This has resulted in a wide range of field methods and corresponding analytical techniques to assess population numbers and dynamics [7]. Although such studies have been proven to be very useful for viability analysis and elephant population dynamics they provide limited information on elephant range and habitat use on a landscape level. Consequently, we will use a landscape level habitat modelling approach to produce habitat selection descriptors which will be used to estimate elephant range and distribution. Habitat modeling efforts, using information on species presence-absence to generate statistical functions, have been proven very effective to develop resource selection functions which can be used for predicting habitat suitability and hence the potential distribution for a range of species [4, 9, 10].

We estimated, the the animal using habitat selectively and constrained habitat factors [13, Nyhus and Tilson, 2004; 1]. Ecologically, habitat use strategy in habitat lack of information. We proposed using Geographic

Information System (GIS) described habitat use in disturbed habitat in Aceh Province.

2. METHODS

2.1 Study Area

Data was collected within the forests of northern of Aceh, ranging from 95°48'E-95°80'E and 05°44'N-05°80'N, which stretches over 7.500.000 ha of the districts of Aceh Pidie, Aceh Jaya, Aceh Besar and Aceh Barat. It completely covers the conservation area of Cagar Alam Jantho and Protected Forest and still support large tracts of intact lowland and montane rainforest. Forested areas are interspersed with patches of pineforests, macaranga dominated secondary forests and imperata dominated grasslands. Most of the area has a protected status, but illegal logging activities can be found everywhere along the forest edges. Prior logging concessions, which had been abandoned due to the armed conflict, have been enforced again and forested areas are being converted to agricultural areas at high pace.

2.2 Data Collection

Elephant presence was collected by means of a line transect following elephant tract. Elephant presence was recorded by means of 5 m wide transects which were walked by foot in elephant habitat. Due to the high variability of habitat types within the mountainous landscape of Aceh, transects varied in length from 200 to 2000 m. Presences were confirmed by means of elephant dung and were recorded along with a GPS position, the vegetation type, canopy cover and slope. For GIS analysis, environmental data was obtained from different sources or derived from original datasets. Vegetation data was obtained from satellite images (Spot-imagary, 2006) were generated using GIS (Arcview 9.0). Feeding ecology and daily activity data collected using focal animal sampling and scan animal sampling.

2.3 Analysis

Suitability habitat analyzed using Geographic Information System (GIS) technique. The phase of GIS technique are: 1) scoring of habitat factors, 2) the factors built in thematic map, and 3) overlay phase. Habitat quality

HABITAT MAPPING AND STRATEGIES OF RESOURCES USE BY SUMATRAN ELEPHANTS

consist of three classes (bad, medium and good). In order to prevent over parameterization of the model, any environmental variable that appeared to be more than 50% correlated to any other variable was subjectively removed from the dataset based on their assumed biological relevance.

3. RESULT S AND DISCUSSION

3.1 Habitat Factors Analysis

Based on feces distribution in varied habitat factors, we identified nine habitat factors used by elephants and its preferences.

Table 1. Preferences of Habitat Factors

No	Habitat Factors	F Value	P	Preference
1	Distance to forest	39,044	0,001	Close (0-5m)
2	Slope	18,808	0,001	Plain (0-20°)
3	Availability of scrabing tree	11,211	0,001	Many (>5 tree/plot)
4	Availability of herbivore	8,097	0,001	No herbivore
5	Disturbance	7,884	0,001	Very far (>1500 m)
6	Availability of tree skin	6,079	0,006	Many (>3 tree/plot)
7	Coverage	5,624	0,002	Dense (88-100%)
8	Availability of predator	5,264	0,010	No predator
9	Availability of food plant	4,143	0,025	Many (>75%)

Habitat analysis showed distance to forest was the most important habitat factor considered elephant in habitat selection. The forest factor needed to protect body, escape, reproduction area and social interaction. Forest reserved suitable space and resource [8, 1]. In tropical rain forest, elephant could not stay long term in open area, they needed close forest for protection, resting and sleeping [12, 14].

3.2 Habitat Suitability and Preference

Suitability habitat using habitat evaluation concept using Geographic Information System (GIS) technique. Based on the dominance of feces distribution of each class of habitat factor. Each habitat factors built in thematic map and scoring. Finally the thematic map overlaid getting suitability habitat unit and it numbers. The suitable habitat recommended Sumatran elephants habitat.

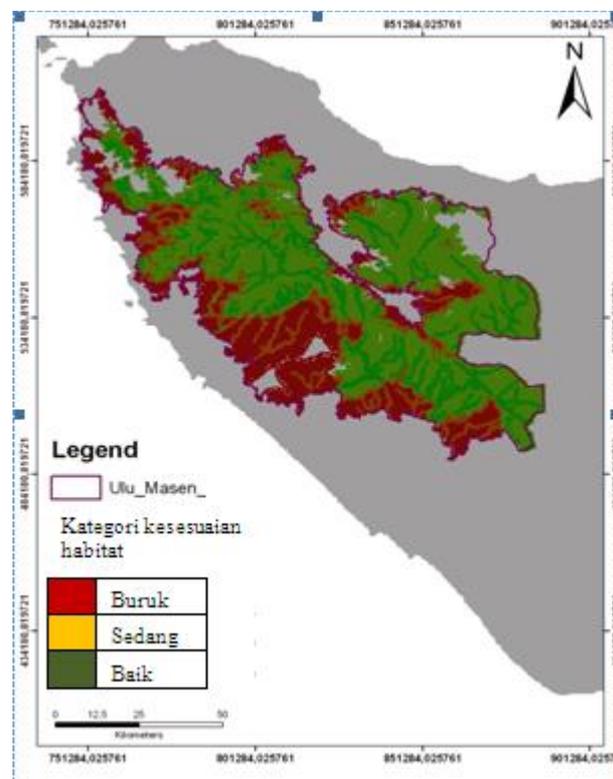


Figure 1. Map of suitability analysis

Suitability habitat found 143.678,60 ha (21.82 %) in good quality used elephant. This area reserved suitable space and resource for elephant ecologically and biologically in primary forest (Table 2).

HABITAT MAPPING AND STRATEGIES OF RESOURCES USE BY SUMATRAN ELEPHANTS

Table 2. Result of Habitat Suitability

No	Habitat suitability	Wide (ha)	Percentage
1	Bad	167.236,65	25,40
2	Medium	347.594,28	52,79
3	Good	143.678,60	21,82
		658.509,53	100%

Suitable habitat needed elephant and use more time than unsuitable habitat. In suitable habitat separated far than either, the area did not use by elephant (unsuitable habitat). Gajah used suitable only, some elephant used habitat marginally in fragmented or isolated habitat. This result also supported by data in Tesonilo Forest Riau Province [1]; Forest of West Ghat, India [14; Vidya, 2005]. Unsuitable area punctuated barrier habitat [13].

4. CONCLUSION

Sumatran elephants were selective animal and used specific habitat, mainly used closed and wet rain forest and high in accessibility. The animal found more time in primary forest for protection, resting, social interaction and feeding. Sometime, they used open forest for feeding only. Aceh province has suitable habitat for minimum population size of Sumatran elephant. In the province possible established elephant sanctuary for elephant protection area.

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HABITAT MAPPING AND STRATEGIES OF RESOURCES USE BY SUMATRAN ELEPHANTS

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