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Short Communication

Selection of Topographic Characteristics and Preferences of the Habitat Forest Sumatran Elephant (*Elephas maximus sumatranus*) in the Serbajadi Forest Aceh, Indonesia

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ABSTRACT

Species conservation requires detailed knowledge of how populations interact with their environment. Habitat use by an animal is influenced by the context in which the animal is located. We aim to look at the selection of elephant route locations and the impact of topographical selection on the distribution of elephants in the natural forest area of East Aceh. The data collection assessment was carried out from August to November 2020. The determination of the data sampling area was along the Serbajadi forest area by dividing the area into 10 observation stations. Each station has a distance of 500 – 700 m. Station placement is based on the elephant route area. The data collected were analyzed descriptively qualitatively and quantitatively. The results show that elephants prefer to choose habitats with an elevation and slope range of 0-20^{o}, the area of the location of the water source with the route ranging from 0 -250 m and the habitat that is often used is the secondary forest area. The use of habitat in the area has sufficient carrying capacity for the sustainability of elephant habitat in the long term. The life of elephants is very dependent on the carrying capacity of the habitat, which has implications for elephant breeding and the resilience of elephant groups in Aceh's versatile forest area. The results conclude that elephants are so dependent on low topography that the protection of the remaining lowland forests and prevent the development of development and forest clearing into lowland areas within forests, especially near rivers which act as corridors between natural habitats, to reduce human-elephant conflict and protect species from extinction.

Key words: Habitat Selection, Topography, Habitat carrying capacity

INTRODUCTION

Climate change is one of the biggest challenges of our times. This change has an impact on changes in the topography of the land so that it has an impact on the condition of diversity and distribution of wildlife in the forest area. Recent land conversion has resulted in the condition of elephants being increasingly threatened, so the IUCN (International Union for Conservation of Nature) categorizes as Sumatra elephants included in the red list with endangered status (Desai & Samsuardi, 2009; IUCN, 2012). Massive conversion of forests into industrial forest plantations (HTI) and plantations which resulted in rapid changes in the elephant's natural habitat. The impact of these activities resulted in conflict between humans and elephants. Despite getting a high conservation priority, the current condition of the Sumatran Elephant is very critical. They could be completely erased from the Sumatra map in the near future if the threats and the recent trend of population decline are not addressed immediately. The decline in the Sumatran elephant population during 2011-2017 reached 700 individuals and local extinctions have occurred in more than 20 pockets of their habitat. Throughout centuries of history throughout Asia, the Asian elephant (*Elephas maximus*) has been revered and closely associated with culture, and used in religious and spiritual contexts, as a attractant and, more recently, as a tourist attraction (De Silva 2007; Fernando et al. 2011). Currently on the entire island of Sumatra there are only 22 elephant pouch of the elephant population and most of them are in critical condition. Hunting, electric fences, snares, and conflict are the direct causes of elephant deaths. Meanwhile, the reduction of elephant habitat for settlement and plantation needs has increased the intensity of conflicts and struggles for space with humans. Conflicts between humans and elephants not only cause death to elephants but also claim human lives (Directorate General of KSDAE. 2020). Elephants are very selective animals in choosing a habitat, to meet their food needs and avoid the scorching sun. Elephants always consider the optimal location by foraging for food and spending time in primary (protected) forest during the day and outside to the open forest (forest secondary) when the sun's heat has decreased (Abdullah, 2012). Elephants are one of the most sensitive animals. The use of elephant habitat is influenced by various variations in each habitat factor such as forest type, availability of abundant feed, availability of minerals, availability of scrubbing trees, land height, slope and distance to close water sources. The Sumatran elephant (*Elephas maximus sumateranus*) is a herbivorous animal that requires the availability of sufficient forage food in its habitat. They need a wide home

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home range to meet their high food demands. Although historically, the major causes of the decline of Asian elephants were habitat loss, poaching for the trade-in live elephants is an important factor adding to the declines of wild populations Hankinson, 2020). Elephants consume in portions the most so it requires green feed in large quantities which is about 200-300 kg of biomass per day for an adult elephant or 5-10% of its body weight. So that vegetation is an important component of an elephant habitat as a source of food needed. Elephants need a safe and comfortable atmosphere so that breeding behavior is not disturbed and the reproductive process can run well. Elephants are animals that are very sensitive to sounds. Deforestation is thought to have disrupted the safety and comfort of elephants due to high-intensity business activities, and the use of heavy equipment in them (Shoshani, 2005). The distribution of elephant habitat covers the entire forest on the island of Sumatra from Lampung to Aceh Province, from the Wet Forest and Brackish Forest near the coast to the Mountain Forest at an altitude of 2000 m. Sumatran elephant survival the more threatened due to high pressure and disturbance and lack of knowledge about how elephants live in their natural habitat which is needed as a reference for natural population management. Basically elephants are very selective in choosing their habitat, because elephants are one of the animals that have sensitivity. Ecological knowledge about how elephants use their habitat and resources is still very limited (Abdullah, 2013). Increased community activities into the forest affect disturbance against elephants. Activities lead to habitat fragmentation and increase the intensity of conflict. Conflicts often occur after the conversion of forest or elephant habitat into oil palm plantations or industrial forest plantations. As a result of the conversion of forest functions, it causes habitat fragmentation for animals (Nuryasin, 2014). Submission elephant in the Serbajadi forest area influenced by elephant habitat factors. Asian elephants (*Elephas maximus*) still occur in isolated populations across much of their historical range, but many populations are threatened by habitat loss (Hedges, 2005). Habitat is a place where animals live their lives such as eating, breeding and resting. The condition of habitat quality and quantity will determine the composition, distribution and productivity of wildlife. High quality habitats will produce high quality wildlife. Habitat management is needed to get good habitat quality. Habitat management is a practical activity to regulate the combination of physical and biotic environmental factors in order to achieve an optimal condition for the development of elephant populations. Elephant habitat consists of physical conditions in the form of mineral salts, water availability, slopes, wall conditions and biological conditions in the form of composition and structure of vegetation, vegetation profile, production and productivity of forage. Categorize Behavior and habitat selection The Sumatran Elephant (*Elephas maximus sumatranus*) habitat selection and Topographical Changes aim to confirm the impact of group composition in Serbajadi forests, in terms of interrelationships, on affiliative and agonistic interactions by comparing the structure of foraging site selection through relative distribution. Based on previous work, we hypothesized that there would be a higher frequency of affiliative interactions, and less agonistic interactions, in the more related groups, and stronger affiliation bonds between the more related group members compared to the less related groups.

MATERIALS AND METHODS

Research Place

This research was conducted in the Serbajadi Forest, East Aceh Regency. This forest is divided into two areas, namely primary forest and secondary forest. The topography of the forest area of Serbajadi District is very varied, ranging from bumpy to hilly 10-600 masl.

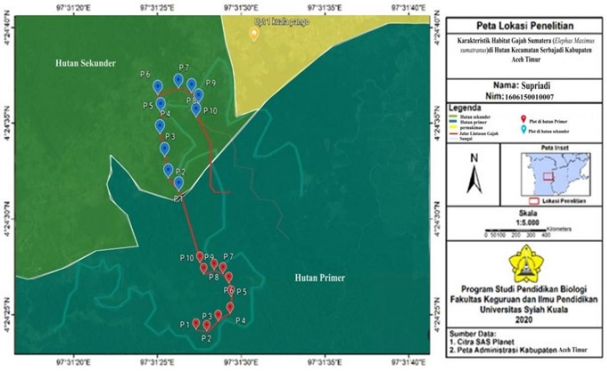

Figure 1. Research Site Map.

Research methods

The method used in this research is the observation method through purposive sampling, namely by exploring the locations that are the home range of the Sumatran Elephant (*Elephas maximus sumatranus* Temminck, 1847). The parameters observed were the types of habitat used by elephants as well as biotic and abiotic factors. Biotic factors include the amount of feces found, the availability of feed (food and water), the availability of mineral source trees, the availability of scrub trees, forest type and canopy cover area. Abiotic factors in the form of altitude, land slope and the distance of elephant habitat from primary forest to other places. Determination of the habitat used by elephants based on the feces (feces) left behind.

Data collection technique

Data collection was carried out through the stages of selecting a sampling location where elephant feces were found in different habitat types. Then it was done by setting plots along the path traversed by elephants using quadrant plots with a size of 20x20 meters from plot to plot with a size of 100 meters as many as 10 quadrant plots for each different habitat type. In each different habitat type (primary forest and secondary forest) biotic and abiotic factors were recorded. Determination of a habitat used by elephants is based on the feces they leave in the Serbajadi Forest. The plots of the survey area were found by purposive sampling method on the elephant track, the distance between one plot and another was 100 meters in size with a total of 20 plots spread over the Serbajadi Forest area. recorded with GPS, and recorded the characteristics and physical factors of the habitat.

Data analysis

The data collected will be collected and analyzed descriptively to obtain the number of supporting factors for the characteristics of elephant habitat

RESULTS AND DISCUSSION

Based on the results of research that has been conducted

on the Habitat Characteristics of the Sumatran Elephant (*Elephas maximus sumatranus*) in the Forest of Serbajadi District, East Aceh Regency, it was found that the use of elephant habitat is influenced by various variations in each habitat factor, but not all variations of habitat factors are the determining factors in using habitat. Meanwhile, based on the amount of feces found, it can provide an overview of the priority factors in choosing a location to carry out their activities. In each variation of the habitat factor, there are conditions used by elephants which can be described as the amount of elephant feces found in the conditions of the habitat factor

Land Height

The relationship between the height of the land used by elephants as a location for activities and the distribution of feces is low (0-400 masl), moderate (401-600 masl) and high (>600 masl). The elephant's home range is usually always at an altitude below 400 meters above sea level, this is because the water source (river) has a relatively low altitude in the Serbajadi District Forest area which is easily accessible by elephants. Groups of elephants will rise to areas with high altitude if they will migrate to other places or look for mineral salts or reproduction. The data obtained from 20 observation plots on the distribution of faeces based on land height are presented in Table 1.

Table 1. Distribution of Stool at Differences in Land Elevation

Land Height	Number of feces (in 20 plots)	Average per plot
Height (>600 masl)	0	0
Medium (401-600 masl)	0	0
Low (0-400 masl)	73	7.3
Total	73	7.3

The table above clearly shows that the elephant habitat based on the average number of faeces/plots is in the low land elevation category (0-400 masl), there are 7.3 faeces per plot. Meanwhile, in the medium and high land altitude categories, elephant feces were not found in the area. the carrying capacity of the Sumatran elephant habitat which includes the physical condition of the altitude, the slope of the place, the condition of the puddle, water sources and mineral salts and biological conditions (forage productivity) affect the development of elephants (Mahanani, 2012).

Land Slope

Habitat factor of land slope is one of the habitat factors considered by elephants in using habitat, because in general, megaherbivores avoid heavy areas and mountains. The following is data on the distribution of feces at a certain slope and can be seen in table 2.

Table 2. Distribution of feces on certain slopes

Tilt	Number of feces (in 20 plots)	Average per plot
Steep (>30^o)	0	0
Tilt (21-30^o)	7	0.7
Ramps (0-20^o)	66	6.6
Total	73	7.3

The data from the table shows that the distribution of elephant faeces is most commonly found in habitats with a slope of 0-20^o (6.6 faeces per plot) then on a slope of 21-30^o (0.7 faeces per plot) and at a slope of more than 30^o no more feces are found. elephants in this research area. The slope of the land is an important factor for the growth of feed and is also included in one of the factors of the carrying capacity of the habitat. The concept of carrying capacity is the right technique to calculate and determine the availability of environmental factors to accommodate an animal species (Thohir, 2018).

Distance To Water Source

The habitat factor of water source distance is one of the most important habitat factors to indicate the presence of elephants. Elephants always visit rivers to bathe and also small ponds to get muddy. Elephants cannot tolerate heat during the day so air temperature and distance to water sources can be limiting factors. The elephant's preference for habitat use tends to increase with the presence of water sources. The following is data on the distribution of elephant feces based on distance to water sources as shown in Table 3.

Table 3. Distribution of feces at different distances to water sources

Distance To Water Source	Number of feces (in 20 plots)	Average per plot
Very Distance (>750 m)	0	0
Distance (501-750m)	0	0
Medium (251-500 m)	33	3.3
Close (0-250m)	40	4
Total	73	7.3

It is clear that the distribution of elephant faeces is most commonly found in habitats at a distance of close water sources (0-250 m), which is 4 faeces/plot. Furthermore, elephant faeces were also found in habitats with a moderate distance to water sources (251-500 m) as many as 3.3 faeces/plot and at a further distance (501 m) from water sources, elephant feces were no longer found in these habitats. This faecal distribution identified that habitat factors often limit elephants in obtaining resources and space through the distribution of faeces in the habitat (Abdullah, 2009).

Frequency of Habitat Use

The use of elephant habitat is influenced by various variations of each habitat factor, but not all variations of habitat factors are the determining factors in using habitat. Based on the number of feces found, it can provide an overview of the priority factors in choosing a location to carry out their activities. The following is summary of the condition of the Sumatran elephant habitat factors in the Forest area of Serbajadi District, East Aceh Regency based on the distribution of feces found in 20 research plots. The following is a table of the condition of the habitat factors that are often visited by elephants. The data can be seen in Table 4.

The distribution of faeces in the habitat table above can be stated that the habitat that is often visited by elephants is with variations in habitat factors based on forest type, which is secondary forest. Temporarily, the use of forest-type habitat factors by elephants did

Table 4. Conditions of Habitat Factors Frequently Visited by Sumatran Elephants in the Forest Area of Serbajadi Di Strict

No	Habitat factor	Condition
1	Availability of mineral source trees	Rare (<3 trees/plot)
2	Availability of body scrub tree	Rare (<3 trees/plot)
3	Distance from primary forest	Close (0-500m)
4	Land height	Low (0-400 masl)
5	tilt	Ramps (0-20^{o})
6	Distance to water source	Close (0-250m)

not show a significant difference. The average number of faeces found in each different forest type is not that big of a difference. This is because all types of forest become the elephant's home range. Elephant feces were more often found in secondary forest (4.4 feces per plot), Primary forest (2.9 feces per plot). From the data on the condition of physical factors, it shows that elephants have a roaming preference.

CONCLUSION

Based on the calculation of the number of faeces distribution in Serbajadi forest areas, it shows that elephants prefer to choose habitats with an elevation of 0-400 masl and the number of feces found is 73 feces and the range of land slope is 0-20^{o} with the distribution of feces in an area of 66 feces. The area of the location of water sources with routes ranging from 0-250 m contained 40 feces. For the habitat variable that is often used is the area in the secondary forest area. The use of habitat in the area has sufficient carrying capacity for the sustainability of elephant habitat in the long term. The life of elephants is very dependent on the carrying capacity of the habitat, these factors have implications for elephant breeding and the resilience of elephant groups in Aceh's versatile forest area.

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