The habitat characteristics of Sumatran Elephant (*Elephas maximus sumatranus*) in the forest of *Serbajadi* sub-district, Aceh Province

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**Abstract.** The purpose of this study was to determine the habitat characteristics of the Sumatran Elephant in the Serbajadi District Forest. Data collection by looking at the use of habitat which is characterized by the distribution of faeces found in various habitat units in the home range of the Sumatran Elephant. The method used is observation with a track with a size of 3,600 m which is divided into 20 observation plots with a distance between plots of 100 m. The data obtained in the field were analyzed descriptively and presented in tabular form. The results of this study indicate that the Habitat Characteristics of the Sumatran Elephant in the Serbajadi District Forest chose habitat units with very dense canopy cover (>75%), moderate feed availability (26-50%), rare mineral source trees availability (< 3 trees/plot), availability of sparse scrubbing trees (<3 trees/plot), close to primary forest (0-500 m), low land elevation (0-400 masl), gentle slope (0-20⁰), close to water sources (0-250m). Secondary forest/vegetation type and frequency of habitat use based on the findings of faeces that the Sumatran elephant most frequently visited was secondary forest than primary forest because the secondary forest was for feeding activities while the primary forest was used for resting and reproduction.

1. **Introduction**

Sumatran elephants (*Elephas maximus sumatranus*) are one of Indonesia's fauna riches and belong to members of the threatened order of Proboscidea. Sumatran elephants are a rare animal that is protected by law since the Dutch era with the Regulation of Protection of Wild Animals Year 1931 No. 134 and 266 [1]. Based on Law No. 05 of 1990 on Conservation of Ecosystems of biological natural resources and ecosystems need to be protected and preserved. Sumatran elephants are classified as endangered in the IUCN (International Union for Conservation of Nature and Natural Resources) Red List Data Book[2]. The survival of the Sumatran elephant is increasing threatened due to high pressure and disturbance and the lack of knowledge about how elephants live in their natural habitat which is needed as a reference for natural population management. Sumatran elephant habitat is in lowland tropical forests and swamps up to an altitude of 1000 meters above sea level (masl) [3]. [4] Elephant habitat covers all forests on the island of Sumatra from Lampung Province to, ranging from Wet Forests and Brackish Forests near the coast to Mountain Forests at an altitude of 2000 meters above sea level. In choosing their habitat, Sumatran elephants pay attention to various habitat factors such as...
the availability of foraging places, the closure of headers as shelter and water for drinking. In addition, this wildlife also pays attention to the time of doing various daily activities [5]. The one of areas that become the habitat of elephants is the forest area of the all-purpose district of Aceh Timur Regency. Serbajadi Forest is one of the forests inhabited by elephants (*Elephas maximus sumatranus*). Serbajadi Forest has an area of 2,165.66 km² with a forest height of 10-600 meters above sea level. Serbajadi Forest is divided into production forest, protected forest, primary forest, secondary forest and grassland. Elephants have a distinctive habitat, not all places in the Serbajadi Forest are chosen by elephants as habitats. The knowledge of the ecological characteristics of elephant habitats and habitat utilization is still very limited. There has been a conflict between elephants and humans in the region that has caused deaths in elephants. Based on this information to be a trigger to identify more about the selection of elephant habitat, the researchers wanted to examine about "Characteristics of Sumatran Elephant Habitat (*Elephas maximus sumatranus*) in the Forest of Serbajadi District of Aceh Timur Regency". There has been a conflict between elephants and humans in the region that has caused deaths in elephants. Based on this information to be a trigger to identify more about the selection of elephant habitat, the researchers wanted to examine about "Characteristics of Sumatran Elephant Habitat (*Elephas maximus sumatranus*) in the Forest of Serbajadi District of Aceh Timur Regency". There has been a conflict between elephants and humans in the region that has caused deaths in elephants. Based on this information to be a trigger to identify more about the selection of elephant habitat, the researchers wanted to examine about "Characteristics of Sumatran Elephant Habitat (*Elephas maximus sumatranus*) in the Forest of Serbajadi District of Aceh Timur Regency".

2. Materials and methods

2.1. Research location
This research was conducted in The Serbajadi Forest of Aceh Timur Regency. The forest is divided into two areas consisting of primary and secondary forests. The topography of Serbajadi Subdistrict Forest area varies, ranging from wavy to hilly 10-600 meters above sea level.

![Figure 1. Map of research location.](image)

2.2. Method
The method used in this study is the observation method through purposive sampling by exploring the locations that became the home range of Sumatran elephants (*Elephas maximus sumatranus* Temminck, 1847). The parameters observed are the types of habitats 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 body scrub trees, forest types and the area of header cover. Abiotic factors in the form of height, slope of land and distance of elephant habitat from primary forest to other places. Determination of habitat used by elephants based on abandoned feces. The observed habitat units are then recorded using GPS to map the habitat location used by Sumatran elephants in all-round forest.

2.3. Data collection
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 that it leaves 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. The survey of these plots was carried out by following the elephant track with a size for each plot of 180 meters, the coordinates of the points where the elephant feces were found recorded with GPS, and recorded the characteristics and physical factors of the habitat.

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

3. Results and discussion

3.1. Tree Canopy Closure
The results of this study indicate that the Habitat Characteristics of the Sumatran Elephant in this research area there are 2 areas of canopy cover based on 2 types of forest, namely primary forest with very dense canopy cover and secondary forest with fairly dense and moderate canopy cover. The data obtained from 20 observation plots on the distribution of feces based on crown closure are presented in Table 1.

Table 1. Distribution of feces in various crown closures

| Title Closing       | Number of faces (in 20 plots) | Average per plot |
|---------------------|-------------------------------|------------------|
| Very tight (>75%)   | 44                            | 4.4              |
| Meetings (51-75%)   | 14                            | 1.4              |
| Moderate (26-50%)   | 15                            | 1.5              |
| Rarely (0-25%)      | 0                             | 0                |
| Total               | 73                            | 7.3              |

The table above shows that the average number of faeces in 10 plots based on canopy cover was dominated by very dense canopy cover (>75%) found in primary forest with an average number of faces in 10 plots of 4.4 faeces per plot. Meanwhile, the average number of faeces in 10 plots was at least found in dense canopy cover (51-75%) which was 1.4 faeces per plot which was usually found in secondary forest. This proves that elephants need a habitat that has a very dense canopy cover. Canopy cover is strongly influenced by the diversity of plants that grow in forest areas [8].
3.2. Moderate feed availability
The comparison between primary forest and secondary forest in this study is the difference in feed availability in the form of grass which is the elephant's preferred food. The data obtained from 20 observation plots on the distribution of faces based on the availability of feed are presented in Table 2.

### Table 2. Distribution of faces in feed availability.

| Feed Availability  | Number of faces (in 20 plots) | Average per plot |
|--------------------|-------------------------------|------------------|
| Very Much (>75%)   | 0                             | 0                |
| A lot (51-75%)     | 8                             | 0.8              |
| Moderate (26-50%)  | 43                            | 4.3              |
| Few (0-25%)        | 22                            | 2.2              |

The table above shows that the average number of faeces in 20 plots based on feed availability is dominated by areas with moderate food availability (26-50%) with an average of 4.3 faeces in 10 plots in the study area. Meanwhile, the lowest average number of faeces was 0.8 faeces per plot in areas with a lot of feed availability (51-75%). The availability of feed is a very important factor for the survival of elephants and it greatly affects the potential for feed ingredients that are available continuously throughout the year both in terms of quantity and quality [9].

3.3. Rare mineral source trees availability
The availability of mineral source trees in the habitat is a less important factor for elephants in choosing their habitat, but they must be present. Elephants also need mineral salts, including: calcium, magnesium and potassium. These salts are obtained by eating lumps of soil containing salt, loosening the hard rocky soil with the forelegs and tusks, and eating on a rainy day or after it rains [10]. As well as certain tree bark that contains mineral salts. The data obtained from 20 observation plots on the distribution of faces based on the availability of feed are presented in Table 3.

### Table 3. Distribution of feces on differences in availability of mineral source trees.

| Availability of Mineral Source Trees | Number of feces (in 20 plots) | Average per plot |
|-------------------------------------|--------------------------------|------------------|
| Many (>5 trees)                     | 20                             | 2                |
| Medium (3-5 Trees)                 | 3                              | 0.3              |
| Few (<3 Trees)                     | 50                             | 5                |
| Total                               | 73                             | 7.3              |

From the table above, it can be seen that the most faeces distribution can be in habitats with few mineral source trees (<3 trees/plot) with an average of 5 faeces per plot. Meanwhile, the distribution of faeces was less in areas of moderate feed availability (3-5 trees/plot) with an average of 0.3 faeces per plot. The availability of trees used to meet mineral needs is indicated by the peeling of tree bark for consumption by elephants. Apart from trees, elephants also choose habitats by taking into account various conditions of habitat factors, such as the availability of places for foraging, closing the canopy as a shelter and the availability of mineral water sources and mineral salts such as salt licks [11].

3.4. Availability of sparse scrubbing trees
The movement of elephants rubbing their bodies against trees in the forest is related to the presence of blood-sucking ectoparasites. This animal also smears its body with dirt and mud because various types of elephant ectoparasites attach to its organs such as ears, groin and skin. The grouping of the availability of trees for scrubbing the body was done equally, namely many (>5 trees/plot), moderate (3-5 trees/plot) and rare (<3 trees/plot). The data obtained from 20 observation plots on the distribution of faeces, the differences in the availability of body scrub trees can be seen in Table 4.
Table 4. Distribution of stool on differences in distance to primary forest.

| Availability of Body Rub Tree | Number of feces (in 20 plots) | Average per plot |
|-------------------------------|-------------------------------|------------------|
| Many (>5 trees)               | 0                             | 0                |
| Medium (3-5 Trees)            | 0                             | 0                |
| Rarely (<3 Trees)             | 73                            | 7.3              |
| Total                         | 73                            | 7.3              |

From the table above, it can be seen that the habitat factor that has the largest average faeces is the distance to primary forest which is close (0-500 m) with an average of 6.7 faeces per plot, followed by habitats that have a distance to medium primary forest. (501-750 m) contained 0.6 faeces per plot. This condition indicates a significant difference in elephant habitat at a certain distance to primary forest. In addition to reducing the heat in their bodies, elephants usually wallow in mud. After wallowing, the next activity is to rub his body against the tree trunk to reduce the itching on his body. The trees used for rubbing their bodies (rubbing trees) will be clearly visible because there are traces of mud stuck in certain places, which are usually quite tall according to the elephant's height [12].

3.5. 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.

Table 5. Distribution of feces on a certain slope.

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

The table above shows that the distribution of elephant faeces is most commonly found in habitats with a slope of 0-20° (6.6 faces per plot) then on a slope of 21-30° (0.7 faces per plot) and at a slope of more than 30° no more feces are found elephants in this research area.

3.6 Availability of water sources

The habitat factor of water source distance is one of the most important habitat factors to show 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 4.9

Table 6. 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 (501-750 m)     | 0                             | 0                |
| Medium (251-500 m)       | 33                            | 3.3              |
| Close (0-250 m)          | 40                            | 4                |
| Total                    | 73                            | 7.3              |

From Table 6 above, it is clear that the distribution of elephant faeces is most commonly found in habitats at close water sources (0-250 m), which is 4 faces/plot. Furthermore, elephant faeces were
also found in habitats with a moderate distance to water sources (251-500 m) of 3.3 faces/plot and at a further distance (501 m) from water sources, elephant feces were no longer found in these habitats.

4. Conclusions
A characteristic of elephant habitat is an important point for the sustainability and distribution of elephant populations in an area. The characteristics of the Sumatran Elephant habitat in the Serbajadi Forest area in the Serbajadi District Forest are gentle slopes (0-20°), close distance to water sources (0-250 m), close to primary forest (0-500 m), availability of trees mineral sources with infrequent frequency (<3 trees/plot), land elevation with lowlands (0-400 mdpl), moderate availability of feed (26-50%), very dense canopy cover (>75%), availability of trees infrequent scrubbing (<3 trees/plot) and with Secondary forest type. The frequency of habitat use based on the findings of feces that the Sumatran elephant most frequently visits is secondary forest compared to primary forest. This is due to the function of the secondary forest being used for feeding activities while in the primary forest it is used for resting and producing. So that in the future it is necessary to carry out a data collection related to estimation of the carrying capacity of the habitat by considering many important habitat factors according to the appropriate standards of habitat for the Sumatran elephant.

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