Bornean Pygmy Elephant habitat usage of natural salt licks in Segaliud Lokan Forest Reserve

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Abstract. Bornean pygmy elephant (Elephas maximus borneensis) is crucial in the forests ecosystem as it plays a vital role as a forest engineer. As such, it is crucial to conduct more research to contribute to the conservation of this species. This study examined the pygmy elephant usage of natural salt lick in Segaliud Lokan Forest Reserve (SLFR), also known as FMU19B. Salt lick is vital to maintain wildlife health. This study investigated the elephant’s visitation frequency and examined its activity pattern in the natural salt lick area. A camera trap survey was conducted from November 2019 till August 2020. Four natural salt licks (C50SL, C56SL, C59SL and C60SL), and three non-salt licks (C50NSL, C56NSL, and C59&C60NSL) was selected. The data were analysed using descriptive and statistical analysis. The results show a higher visitation frequency at the salt lick area than the non-salt lick area (p<0.01). The salt lick at C59 was the most frequently visited by the elephant. The activity pattern displayed by the Bornean pygmy elephant shows a higher degree of nocturnal activity (73.3%). This information is essential for the timber concession forest managers to design the conservation work for the species in balancing with the timber extraction activity.

Keywords: Borneo; species conservation; habitat conservation; camera trap; tropical forest.

1. Introduction

Malaysia is committed to Sustainable Development Goals (SDG). The SDG no. 15 emphasises terrestrial biodiversity conservation, including the megaherbivore like the Bornean pygmy elephant (Elephas maximus borneensis). The Pygmy elephant is endemic species to Borneo [1]. Under the IUCN Red List, Asian Elephant is categorised as endangered [2] due to habitat destruction and human-elephant conflict.

The species is crucial in the forests ecosystem as it plays a vital role as a forest engineer. Past research has long recognised its functions as an important seed disperser in the forest [3–6]. The pygmy elephant used to range all over the eastern part of Sabah, but this species is now confined to restricted areas [7]. As such, it is crucial to conduct more research to contribute to the conservation of this species. There are many existing natural salt licks in the forest of Sabah [8,9]. Salt lick is vital to maintain wildlife health [8,10]. This study investigated the elephant’s visitation frequency and examined its activity pattern in the natural salt lick area. This study examined the pygmy elephant usage of natural salt lick in Segaliud Lokan Forest Reserve (SLFR), also known as FMU19B. This information is essential for the timber concession forest managers to design the conservation work for the species in balancing with the timber extraction activity.
2. Materials and method

2.1 Study site
The study site was in Segaliud Lokan Forest Reserve (FMU19B), a logging concession managed by KTS Plantation located somewhat in the middle of Sabah. There are several existing natural salt licks SLFR. Four salt licks with three non-salt lick areas were situated in the middle of the concession (Figure 1). The salt licks and the non-salt licks selected were far away from human settlement and low human activities. All the research stations were old logged tropical rain forests. The latest timber extraction that was conducted in 2013. Compartment 50 (C50) covered 1,247 ha and was logged in 2006/07, while Compartment 56 (C56) covers 908 ha has not been logged since 1994. Compartment 59 (C59) covered 1,075 ha and was logged in 2013. Compartment 60 (C60) covered 773 ha and was logged in 2009 [11].

![Figure 1. The locations of the research area.](image)

2.2 Wildlife survey
A camera trap survey was conducted from November 2019 till August 2020. Four natural salt licks were selected (C50SL, C56SL, C59SL and C60SL), and three non-salt licks (C50NSL, C56NSL, and C59&C60NSL).

2.3 Data analysis
The data were analysed using descriptive and statistical analysis. The camera trap images were analysed at 60 minutes intervals for sighting and activity pattern analysis adapted from [8]. The Man-Whitney U
test was used to compare the mean of sightings for those at natural salt and non-salt lick. The visitation frequency was calculated by dividing the number of sightings by the trapping nights [12].

3. Results and discussion

There was a total of 279 trapping nights obtained from this study. At the salt lick stations, there were 175 trapping nights and 104 trapping nights at the non-salt lick areas.

3.1 Visitation frequency

The overall results show that there were 10 sightings at the salt lick area, and there was no record of sightings in the non-salt lick area. The visitation frequency of pygmy elephant in salt licks (0.054) was very significantly higher than at the non-salt lick (0.0) area ($n = 10896, u = 21971, z = -3.764, p = 0.000***$). Past studies [8,13] have reported that pygmy elephants frequent salt lick. The minerals available at salt licks are essential to maintain the health of wildlife as it stabilises the PH in the ruminant gut [13].

The pygmy elephant sightings were further investigated by looking at it at each of the camera trap stations. Stations Compartment 59 salt lick was the only salt lick visited by the elephant (Figure 2). The trapping nights vary from each station because its effectiveness was affected by weather, attacks ants and mammals. At least 10 camera traps became unusable within the study caused by the factors mentioned above. A significant amount of trapping effort was conducted at each station, but only C59 managed to record the visitation of the elephant.

![Figure 2](image_url)

**Figure 2.** The visitation frequency of Bornean Pygmy Elephant in each camera trap station with the trapping nights data.

The salt lick at C59 was compared with that at the C60, C56 and C50. The C59 were the biggest amongst the salt lick in this study, covering up to 20 meters radius. The size of the salt lick at C60, C56 and C50 were 10, 5 and 3 meters, respectively (Figure 3). The salt lick at C60 and C56 was in a ravine connecting to a small stream in terms of topography. The salt lick at C50 was at a foothill with a small flat area. The C59 salt lick was also located at the foot of a small hill. However, most of the surrounding areas were flat. Elephants usually prefer opened and undulatingly flat habitats [14] Elephants preferred opened areas to strengthen their members’ social bonds [15]. This could explain why the elephants highly preferred salt lick at C59 as opposed to other salt licks studied here.
Figure 3. Salt licks at C59, C60, C56 and C50 show the general physical environment with salt lick radius size.

3.2 Activity pattern
The activity pattern displayed by the Bornean pygmy elephant shows a higher degree of nocturnal activity (73.3%). It was active between 3 pm till 7 am (Figure 4). This nocturnal activity was also reported by the study conducted by [16]. However, [17] reported that the elephant exhibits a diurnal pattern in their study. [18] stated that the proximity of anthropogenic activity has triggered changes in the species activity pattern.

Figure 4: Activity pattern of Bornean Pygmy Elephant at natural salt lick.
4. Conclusions
There was higher habitat usage of Bornean pygmy elephant at salt lick area versus non-salt lick; this
was especially true for compartment 59. The Bornean pygmy elephant also displays a nocturnal activity
pattern in the salt lick area. We recommend that the salt lick at C59 be further developed into the wildlife
conservation area as it exhibits a vital role as an oasis for wildlife present at SLFR.

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