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SHORT COMMUNICATION
EVIDENCE OF ELEPHANT ROAD USAGE AT GUNUNG BASOR, JELI, KELANTAN

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Abstract: Sightings of wild elephants in Gunung Basor, Kelantan are common as this area is a known habitat for wild elephants. However, the presence of several stretches of tar roads that leads to the hydroelectric dam raises a question of whether wild elephants use the roads during movement from one place to another. What was found from 40 days of field observation and GPS tagging of elephant dung piles is that the elephants walk along the road to forage or move to other areas even though there were alternative routes in the forest. From the dung position, it can be estimated that the elephants passed by the same location once a week and tend to move towards higher elevation. Hence, the results of this study are beneficial to the management of this species in protected areas, as the presence of roads may alter the natural behaviour of wild elephants.

KEYWORDS: *Elephas maximus,* dung pile, bamboo sprout, *Cyathea.*

Introduction

Asian elephants (*Elephas maximus*) are large mammals of the Order Proboscidae and are known to occupy a large home range especially large tracts of forests. However, as Asian elephants are found in some of the most populated countries in Southeast Asia, these enigmatic mammals are faced with loss of habitat as forests are rapidly converted for other uses. Loss of habitat and fragmentation were the most severe effects on elephant population in many parts of Asia (Santiapillai & Jackson, 1990). This is aggravated by the fact that Southeast Asia is currently experiencing rapid development and will lose at least 75% of its natural forests by 2100 (Sodhi *et al.,* 2004). Among the effects of deforestation includes the construction of roads prior and post logging either for development purposes or for road access.

Roads have been known to have effect on wildlife either negatively or positively. Known negative effects include physical barriers to certain small mammals (Rico *et al.,* 2007), vertebrate mortality especially herpetofauna (Ashley & Robinson, 1996; Glista *et al.,* 2008), potential spread of zoonotic diseases (Bradley & Altizer, 2007) while some positive effects that have been mentioned include increased dispersal of rodents (Getz *et al., 1941*; Huey, 1941) and carrion feeders who occasionally feed on dead wildlife on roads (Bennet, 1991). However, little is known about road usage by Asian elephants prior to this. Hence this study describes some road usage by Asian elephants in Gunung Basor Forest Reserve. This was done via tagging of elephant dung and other evidence of road usage by the large mammals along the roads in Gunung Basor Forest Reserve.

Methodology

Establishing the road track of study area

The observations for this study were conducted along roads that lead to the Pergau Hydroelectric Dam in Gunung Basor Forest Reserve, Kelantan, Malaysia (5° 36’ 24.00 ” N, 101° 48 ’17.27” E; Figure 1). In order to locate, tag and plot the locations of elephant dungs in the study site, a base map with the road track was prepared. This was done by first driving along the roads in the study site while using a GPS to establish the

track. This track was then transferred as shape file using DNR GPS software and added to ArcMap version 10 (ESRI, Redlands, California, USA). The base map (Figure 2) was then used to plot all dung occurrences along the tar roads in the study area.

Dung tagging, tracing and mapping using GPS

Elephant road usage was determined by the occurrence of elephant dungs on the road. This was done by observing the occurrences of fresh elephant dung on tar roads in the study site Figure 3). All sighted elephant dungs were first tagged and these locations were recorded using Global Positioning System (GPS) to obtain exact coordinates. These were then traced into the base map using Arc-GIS version 10. Elephant dung that has been GPS tagged was removed from the road. This process of tagging and removing of fresh elephant dung were repeated throughout the sampling period. Other field observation such as branch of trees, palms and plants that were broken or consumed, soil dug and other behaviors were recorded as supplementary data or observation for this study. The GPS tagging of the dung location that was traced unto the base map was then used to generate maps on road usage by elephants and subsequently a heat map of elephant road usage in the study area.

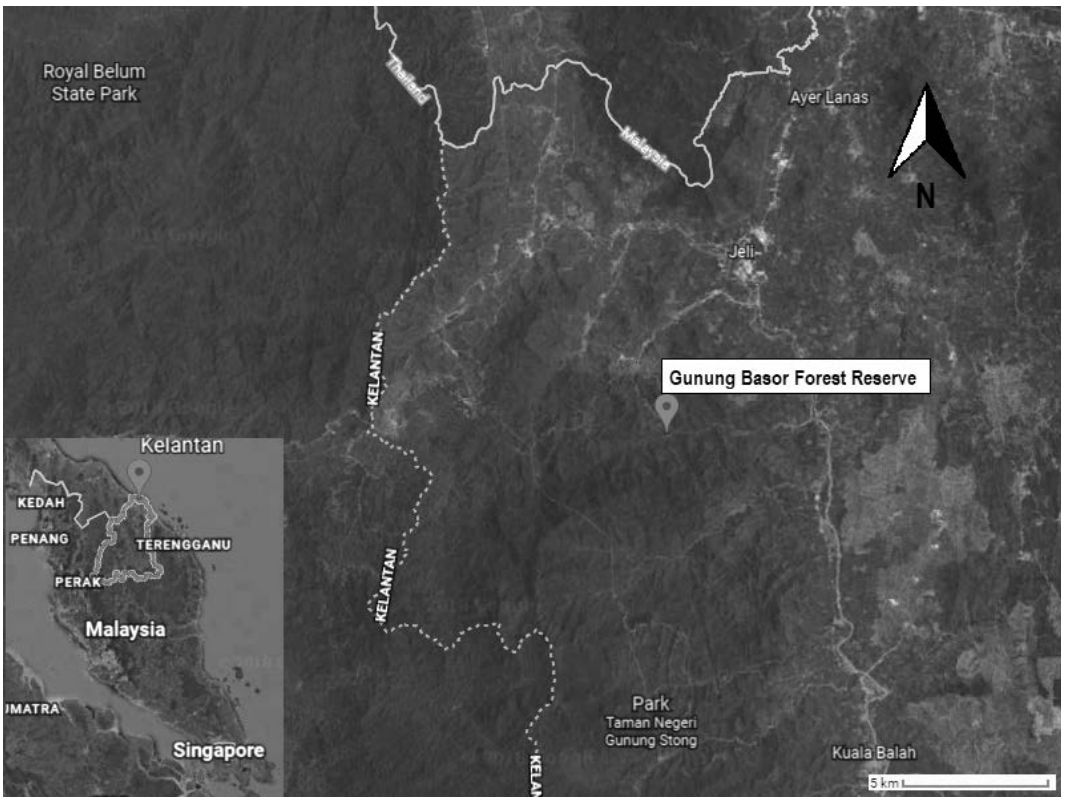

Figure 1: Map of Gunung Basor Forest Reserve indicating sampling site of this study (Source: Google Earth, 2016)

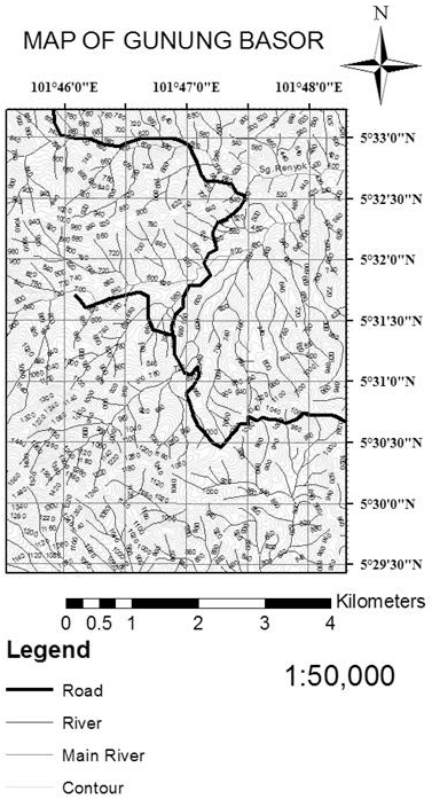

Figure 2: Base map of Gunung Basor, Kelantan

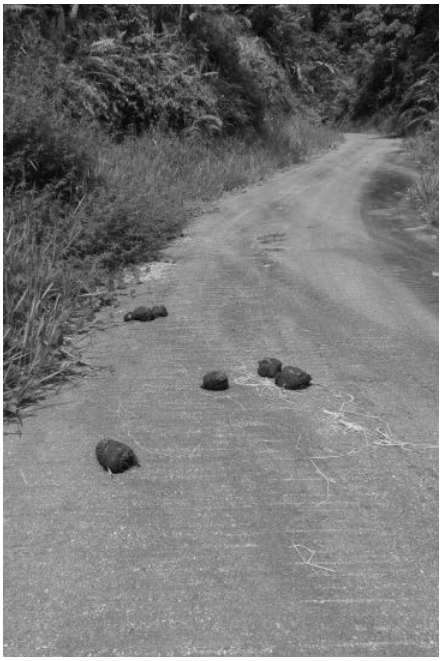

Figure 3: Elephant dung presence

Results and Discussions

There are several main river systems located at Gunung Basor Forest Reserve namely Sungai Pergau, Sungai Long, Sungai Suih, Sungai Renyok, Sungai Terang and Sungai Suda. The topography of the study area ranges from 420 to 1560 meters above sea level due to the high elevation of Gunung Basor. There were three main roads in Gunung Basor that lead to hydroelectric dam stations which includes the Terang Pumping station, Suda Intake station and Renyok intake. Based on the observation conducted for 40 days, only the Renyok intake routes were used by the wild elephants for foraging and movement. This was mainly because the Terang Pumping and Suda Intake station routes currently had road construction which may affect the movement of wild elephants. The Renyok Intake route which was used by the elephants trifurcates into Renyok 1 Intake, Renyok 2 Intake and Renyok 3 Intake. However, only the main road of the Renyok Intake and Renyok 1 Intake had fresh dung piles during our sampling period and these roads were focused in the study. The length or transect/ observation track was 19km divided into Renyok Intake = 10km and Renyok 1 Intake = 9 km, respectively, and the observation was done daily for 40 days in the month of July to August 2017. Hence the total sampling effort for this study was 760 km of transect/observation track length. The latitude and longitude coordinates of this study area ranged between 5° 30'30" N and 101° 46'0" E (Figure 3).

Fresh elephant dung piles were only observed on five days from the total 40 day sampling period (Table 1). Most dung piles were found on roads at higher elevation or roads that lead to higher elevation. There were also signs of elephants coming down from slopes leading to tar roads and eventually defecated on the tar roads. The dung piles do not indicate crossing road behavior, but from a previous study by Wadey *et al.* (2017) indicate that elephants prefer to cross the road at night. Although there is no strong evidence that indicate elephants prefer to use the roads to move to higher elevations, the absence of sites where elephants purposely move into forested areas right after encountering the road shows some preference in using tar roads for movement. All elephant movements into the forest (Figures 4-9) was far from dung piles. Elephants are known to be edge specialists (Campos-Arceiz, 2013); hence the preference of tar roads over forested areas may not be a surprise.

Table 3: Estimated parameters of Linear Regression Models.

Date of Sampling	Location of Elephant dung
12-13 July 2017	No result
14 July 2017	Renyok Intake and Renyok 1 Intake
15-26 July 2017	No result
27 July 2017	Renyok Intake
28 July to 6 August 2017	No result
7 August 2017	Renyok Intake and Renyok 1 Intake
8 to 17 August 2017	No result
18 August 2017	Renyok 1 Intake
20 August 2017	Renyok Intake and Renyok 1 Intake

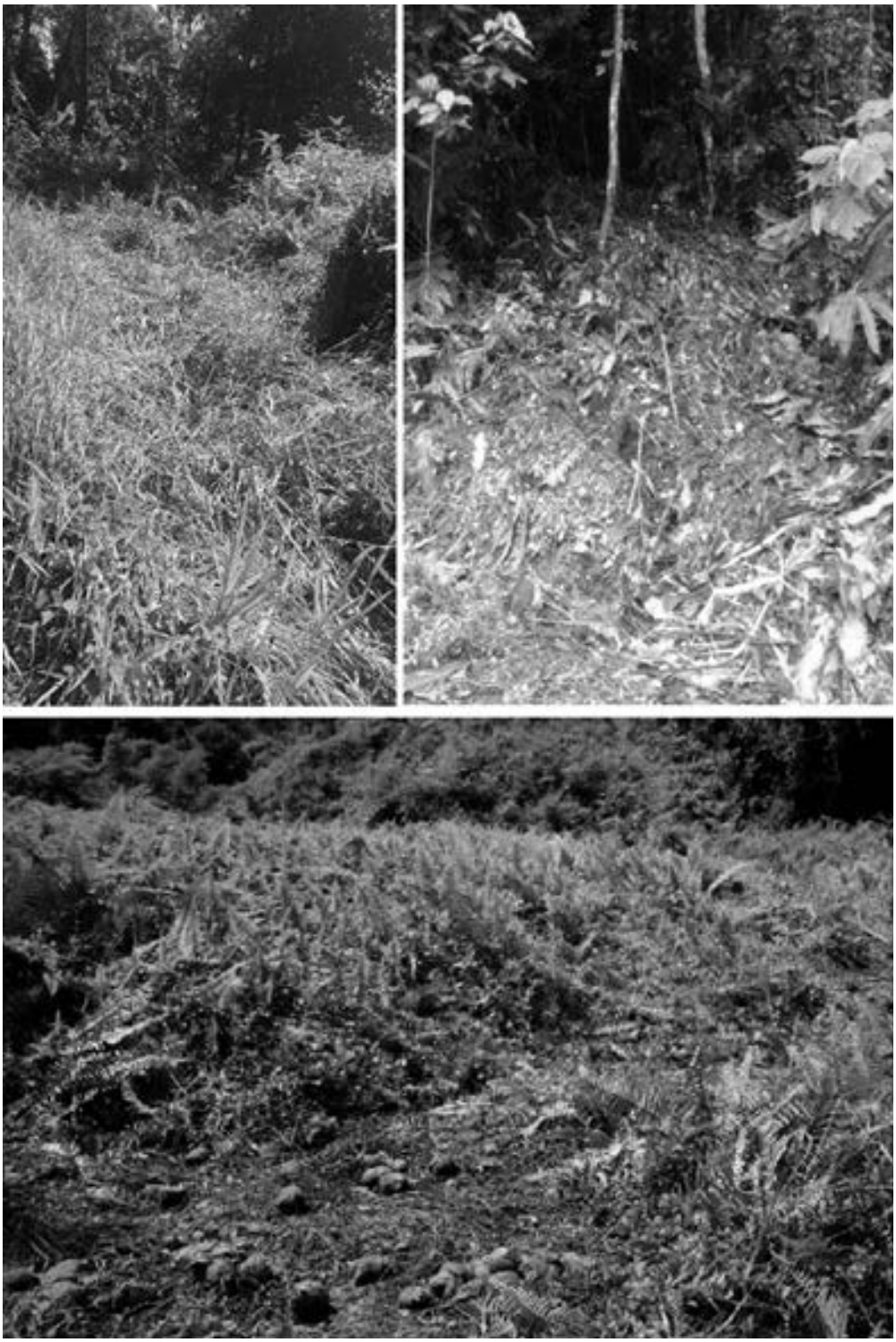

Figure 4: Evidence of elephant movement into forest.

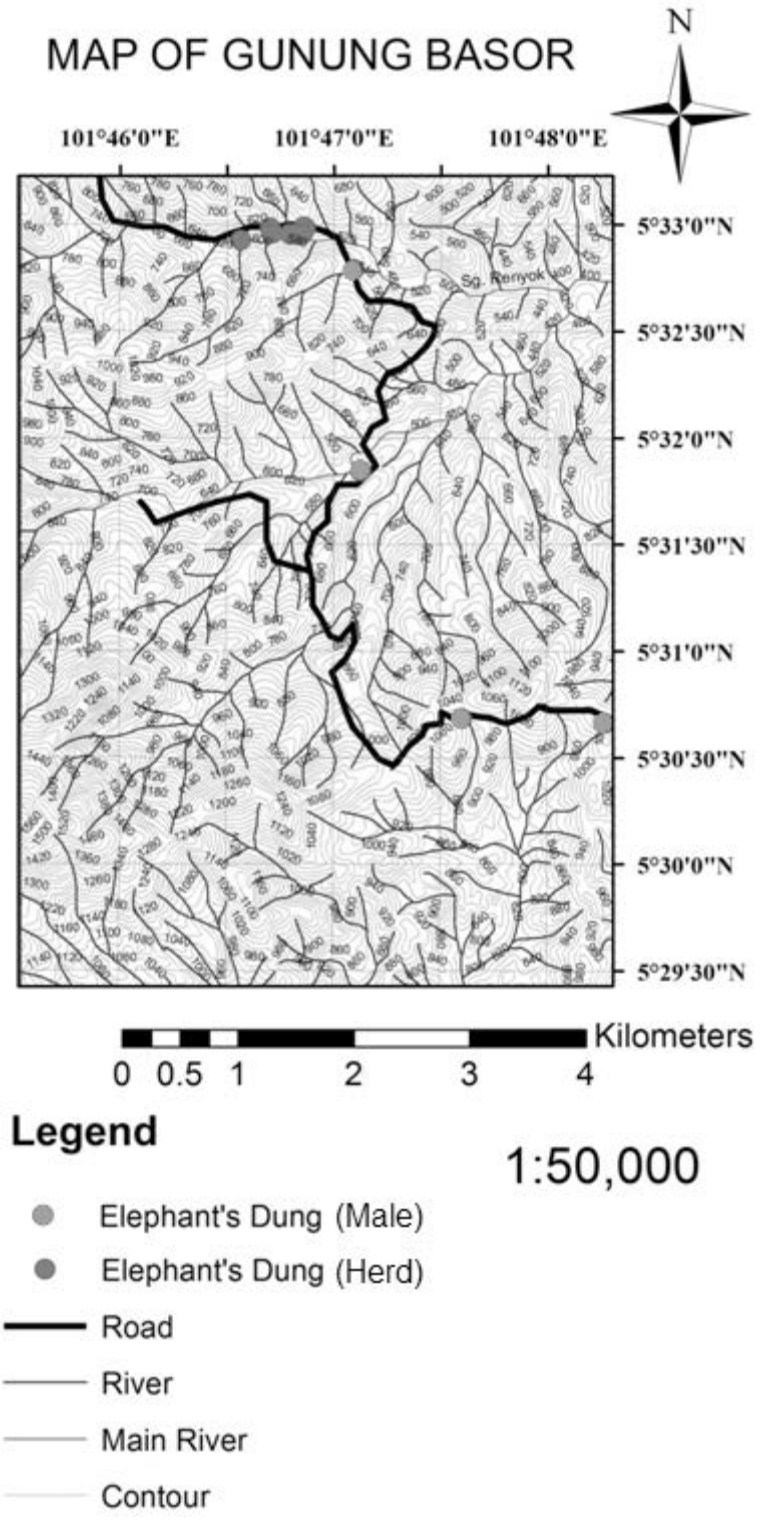

Figure 5: Map of first sighting of elephant's dung at Gunung Basor, Kelantan

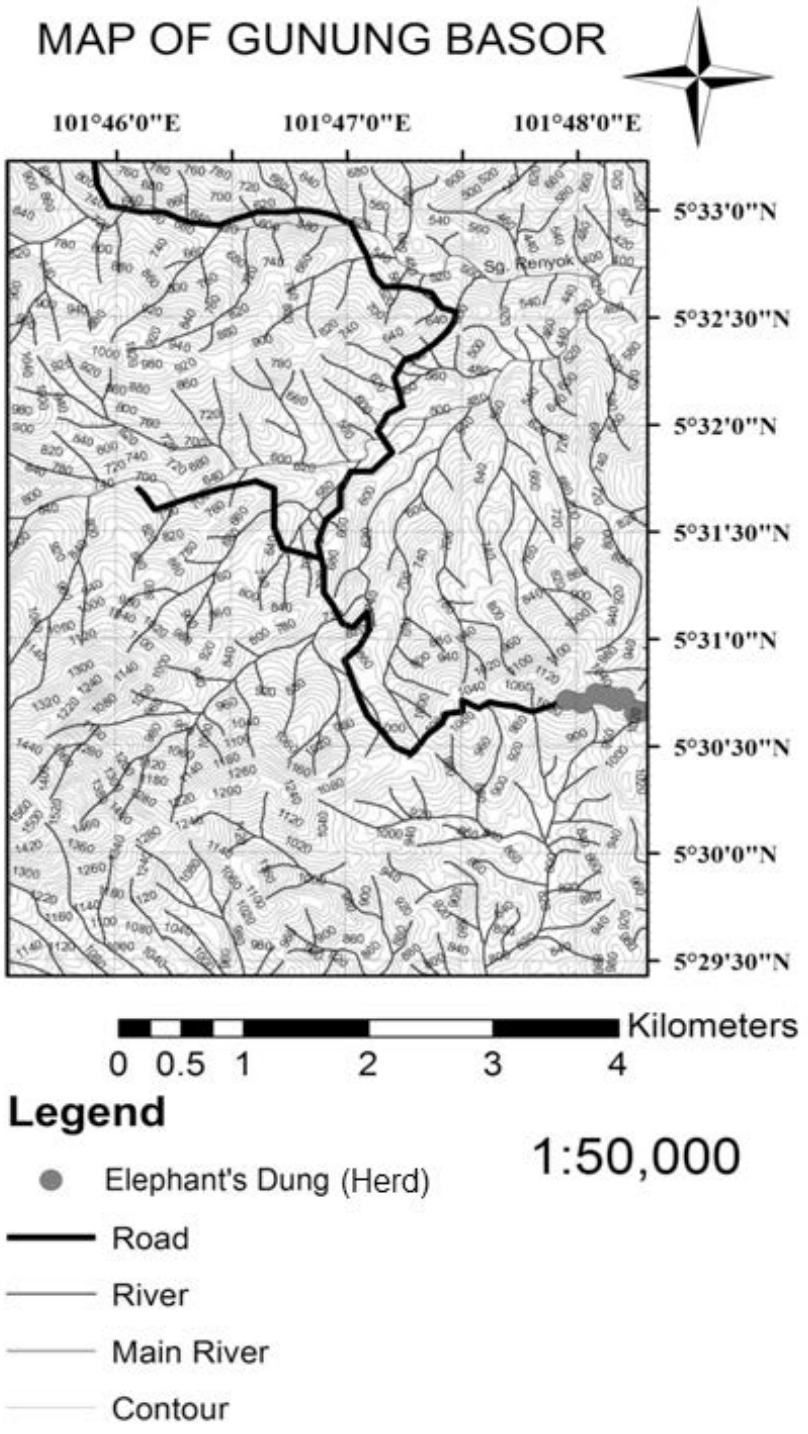

Figure 6: Map of second sighting of elephant's dung at Gunung Basor, Kelantan

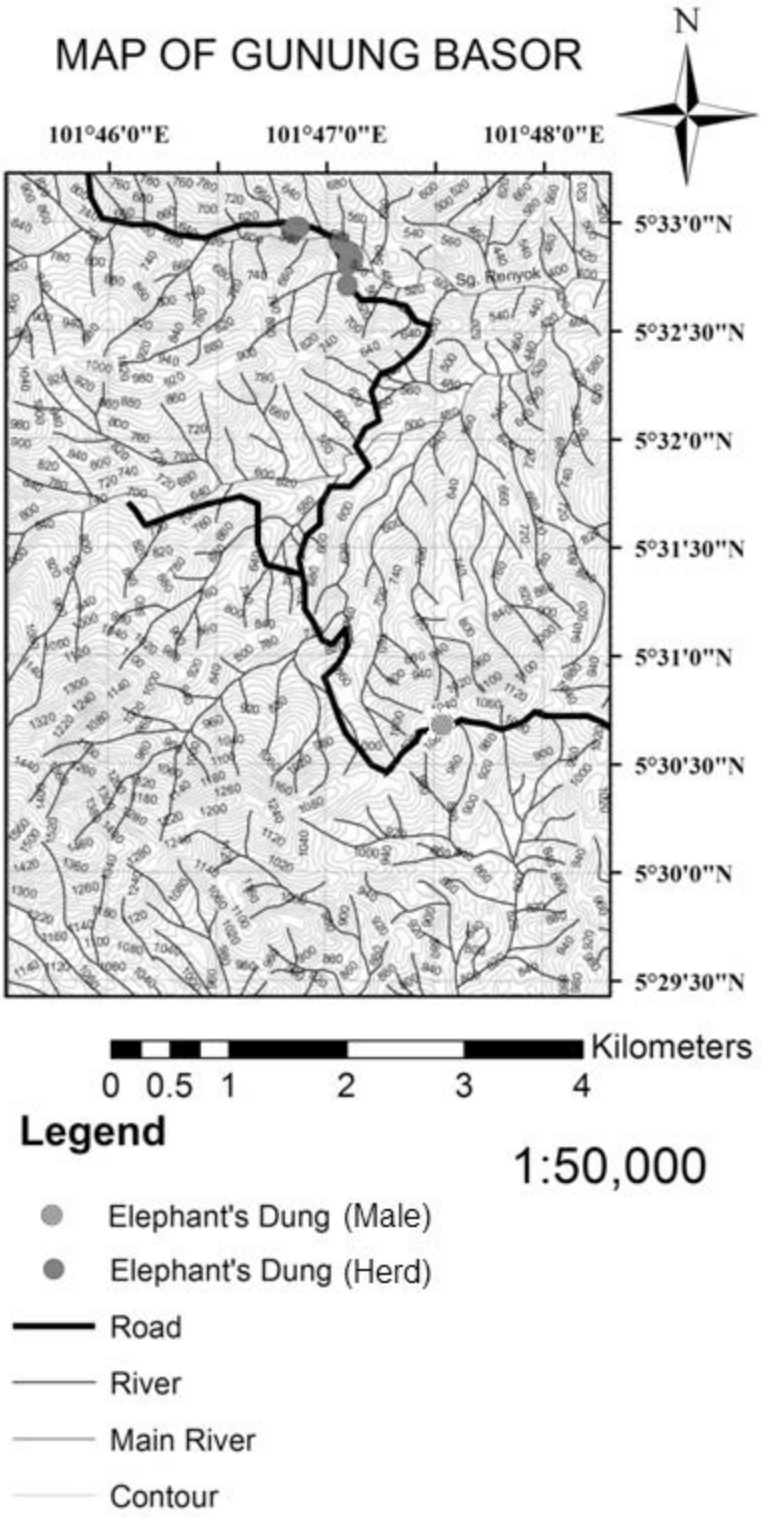

Figure 7: Map of third sighting of elephant's dung at Gunung Basor, Kelantan

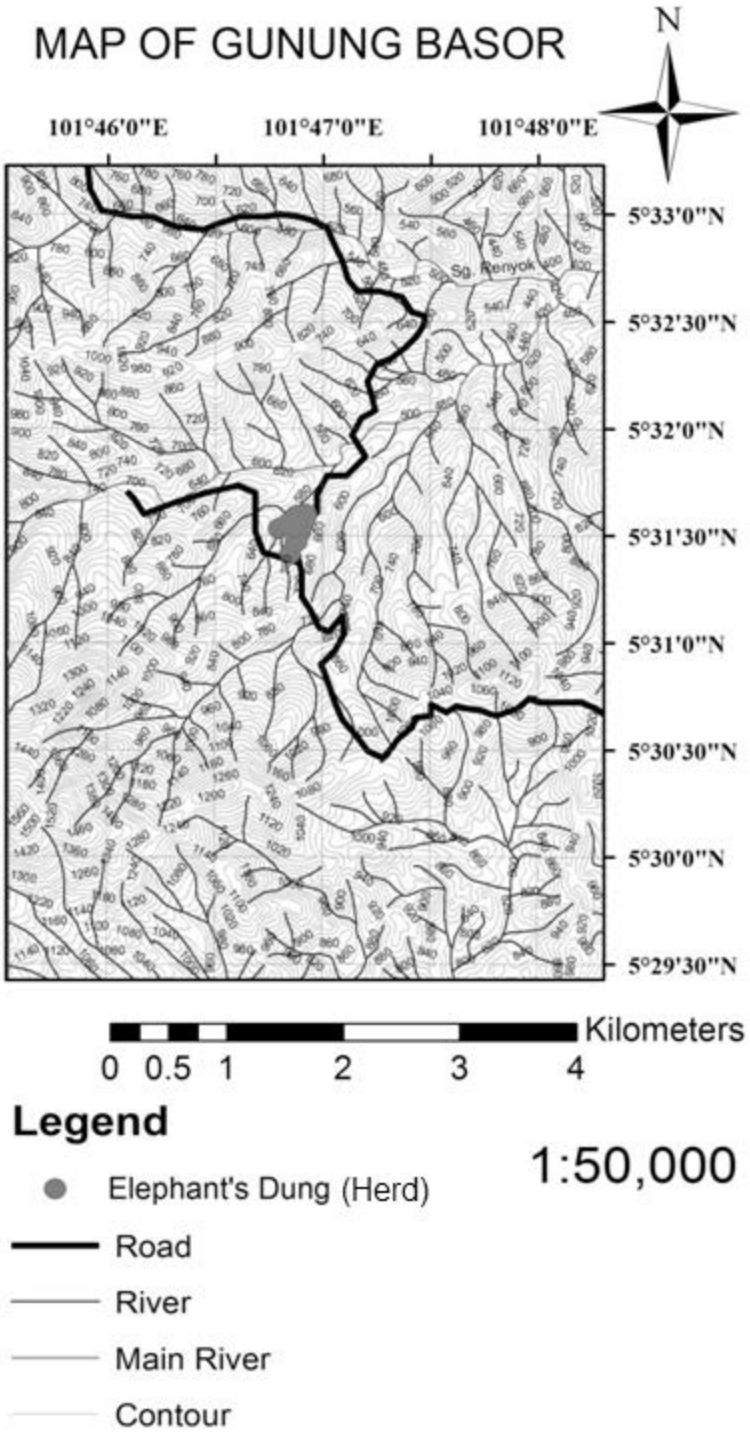

Figure 8: Map of fourth sighting of elephant's dung at Gunung Basor, Kelantan

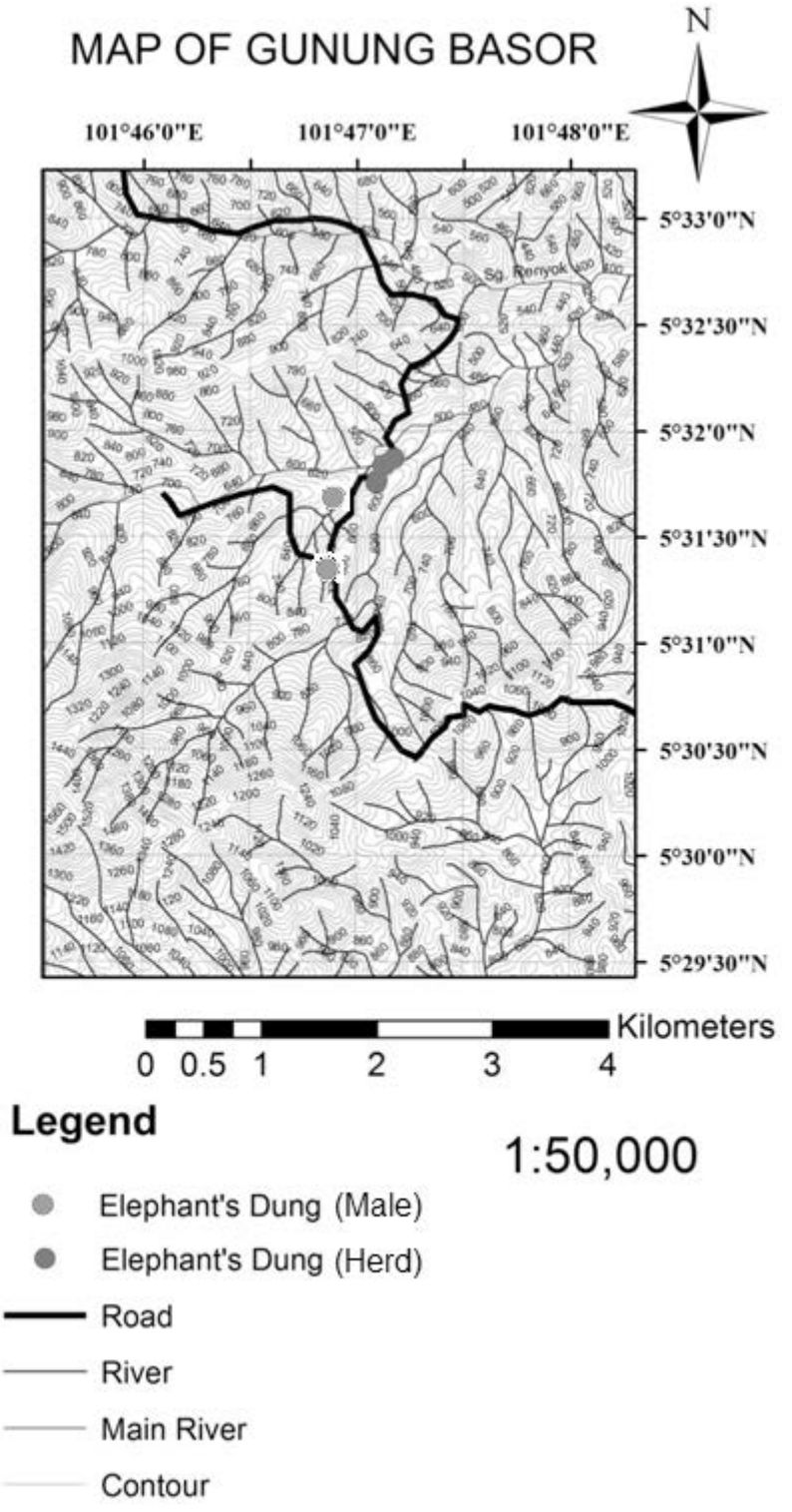

Figure 9: Map of fifth sighting of elephant's dung at Gunung Basor, Kelantan

Figure 10 shows dung piles that are left by adult bulls that move solitarily in Gunung Basor Forest Reserve. These were plotted as green dots on in Figures 4 to 9 while the multiple red dots indicate elephant herd dung piles. The results of this study do not indicate the number of males in the study site but 3 out of 5 days where bull dung piles were present showed that the bulls were near by the elephant herd. We are unsure whether the tar roads facilitated this behavior but it is certainly a research question worth exploring. A rough estimation of the elephant herd size was 5 individuals but there is no sighting to corroborate this number as the estimate was based on the dung pile arrangement and numbers. Generally, a group of elephants is inclusive of an adult cow, some sub adult cows, juveniles and calves (Joshi *et al.,* 2009). The heat map (Figure 11) showed that the elephants do revisit the same sites, over the span of 40 days sampling but the frequency varies between weeks (Table 1).

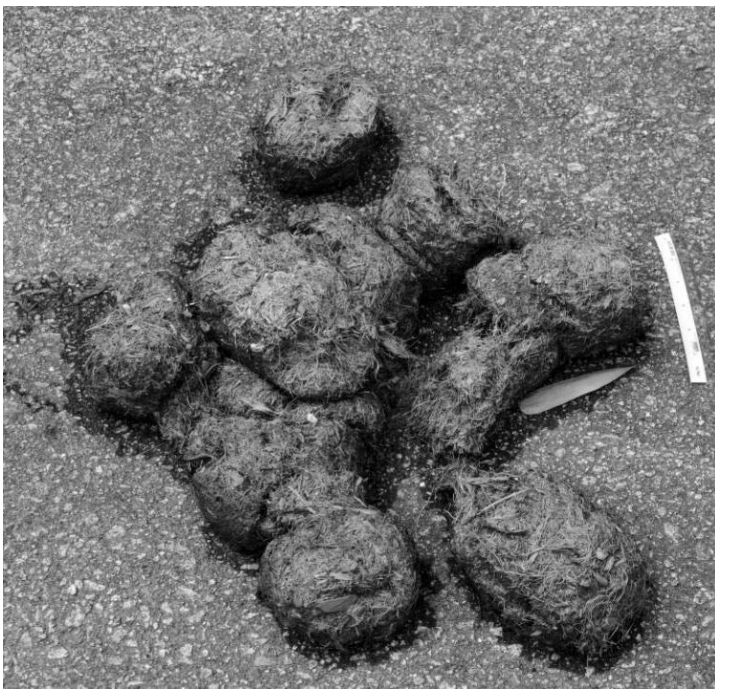

Figure 10: Solitary male elephant dung presence

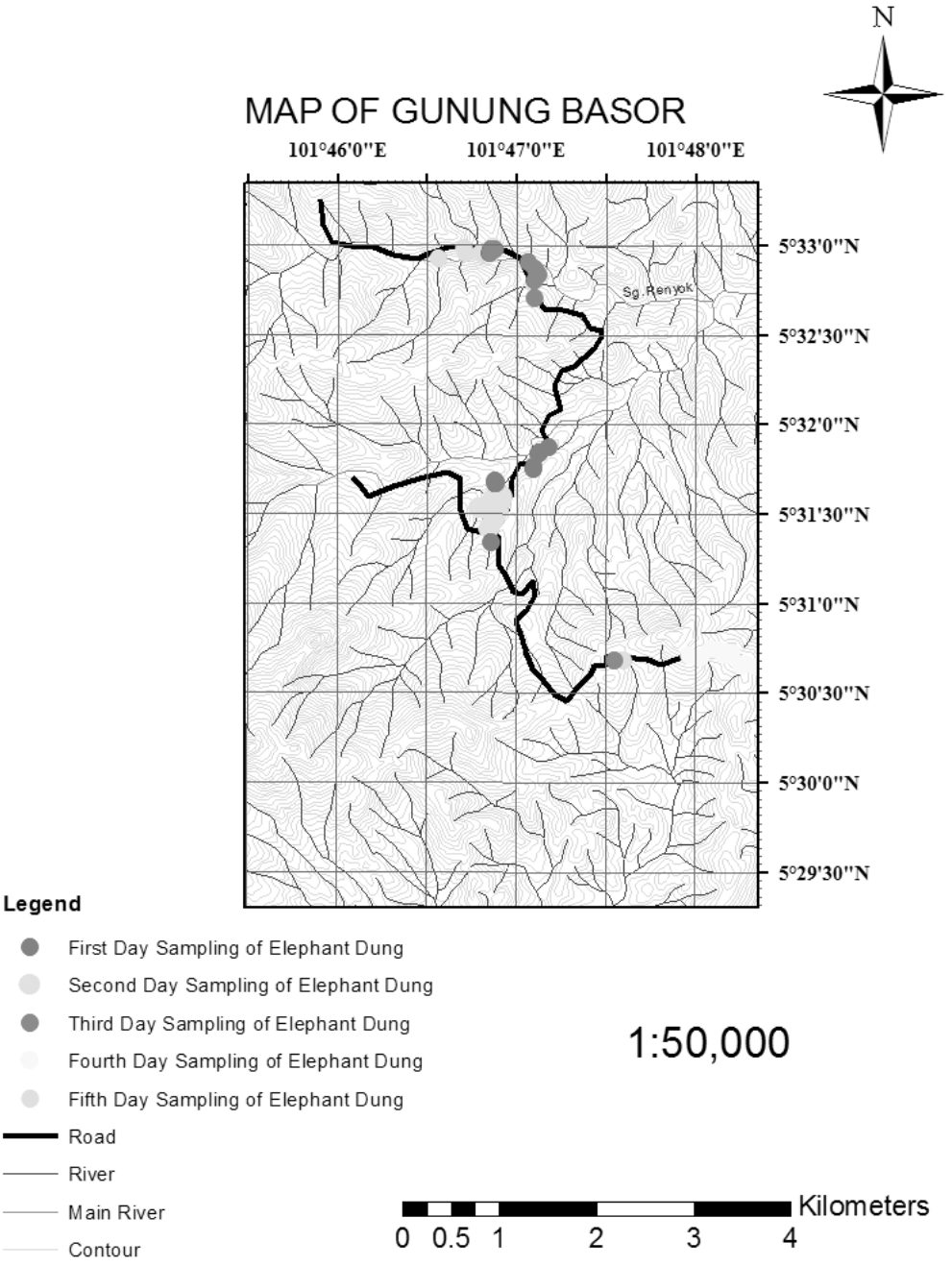

Figure 11: Map of overall sampling result of elephant's dung at Gunung Basor, Kelantan

Besides crossing the roads and moving up to higher elevation, the elephants also opportunistically feed on plants along the road. It was also observed that many of the tree ferns of the genus *Cyathea* were broken by the elephants and the barks were peeled off leaving the stems exposed. Although we don't have direct evidence to indicate that the elephants feed on tree ferns, it is highly likely that the soft inner stem of the tree ferns were eaten as many of stems on the damaged trees were missing. The height of the position where the tree fern

was damaged indicates that it was done by a tall mammal that can reach at least 2 meters high. There were also elephant signs in areas where bamboo trees were found. Remains of bamboo sprouts and browse were also observed in some of the elephant dung piles. Bamboo sprouts and browse is mostly utilized by elephants because it can easily be uprooted and eaten (Sukumar, 1989). Wild elephants were also known to feed on fodder at roadsides (Wadey *et al.,* 2017).

Conclusion

Our results indicate that the elephants prefer roads and probably cleared areas for movement despite the presence of alternative routes within the forest, and may forage along the road opportunistically in Gunung Basor Forest Reserve. However, this does not mean that wild elephants prefer road side over forested areas, as there are many more factors that play a role in influencing the preference of these large mammals. One such factor is the amount of traffic on these roads. In Gunung Basor Forest Reserve, the traffic was minimal if not zero as these roads were only used for the management of the hydroelectric dam and the forest reserve itself, hence allowing the elephants to freely roam and use the roads. Hence caution should be given in concluding that elephants prefer roads over forested areas. However the observations in this study are beneficial to the management of this species in protected areas, as the presence of roads may alter the natural behaviour of wild elephants.

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