https://doi.org/10.65646/3rc20dmg1l0617
Proceedings of the International Research Conference of the Open University of Sri Lanka (IRC-OUSL 2025)

SPATIAL VARIATION OF FORAGE MATTERS OF ASIAN ELEPHANTS IN HUMAN-DOMINATED AND NATURAL AREAS IN WASGAMUWA, SRI LANKA

Ravina Gallage[1*], Chandima Fernando[2] and Saminda Fernando[1]
[1]Department of Zoology, Faculty of Natural Science, The Open University, Sri Lanka
[2]Department of Zoology, Faculty of Science, University of Colombo, Sri Lanka

Understanding the dietary patterns of Asian elephants *(Elephas maximus*) in varying habitats is critical for effective conservation and Human elephant conflict mitigation. This study investigated the dietary preferences of elephants in natural and human-dominated areas of Wasgamuwa, Sri Lanka, from August 2024 to March 2025. The Wasgamuwa National Park was chosen as the natural area. The villages near the southern border of the park were chosen as the human-dominated area. A total of 100 dung samples were collected, with 50 from each area, and analyzed under the microscope to identify forage matters. Nine plant species were identified from the analysis, where two species were distinctively found in the samples collected from the human-dominated area, and one plant species was found to be distinctive to the natural area. The remaining seven plant species were found in samples from both areas. Monocot leaves were present in all samples, and wood particles were more abundant in elephant dung from human-dominated areas. These findings indicate that elephants primarily consume monocot plants, with *Panicum maximum* as the most consumed species across both habitats. To identify the forage consumed by elephants in relation to availability in both areas, 24 quadrats (10 m × 10 m) were established in each area. A total of 14 plant species were identified:two species were exclusive to the natural area, five species were found only in the human-dominated area, and the remaining seven species were common to both areas. *Tectona grandis* was the most consumed species in human-dominated areas, while *Cynodon dactylon* dominated in natural areas. These findings suggest elephants adapt their diet to forage availability, favouring grass in natural areas and tree species in human-dominated areas. Surveys with farmers were conducted to assess and identify the crop preferences of elephants. Ninety-seven crop-raiding incidents were recorded. Through these recorded incidents, 15 crops were identified that were consumed by the elephants. With paddy being the most raided crop. The peak of raids happens in December. Physical properties of dung, including moisture (24.59% in human-dominated areas vs. 26.51% in natural areas; p=0.101) and crude fibre content (47.27% vs. 40.47%; p=0.33), were analyzed using standard methods. Minor differences were observed in the physical condition of dung between the two areas. These findings provide a baseline for future research on foraging variations and inform habitat management strategies to reduce human-elephant conflict while supporting elephant conservation.

Keywords: Asian elephants, crops, human dominated area, natural area

[*]*Corresponding Author: ravinagallage5@gmail.com*

SPATIAL VARIATION OF FORAGE MATTERS OF ASIAN ELEPHANTS IN HUMAN-DOMINATED AND NATURAL AREAS IN WASGAMUWA, SRI LANKA

Ravina Gallage[1*], Chandima Fernando[2] and Saminda Fernando[1]
[1]Department of Zoology, Faculty of Natural Science, The Open University, Sri Lanka
[2]Department of Zoology, Faculty of Science, University of Colombo, Sri Lanka

INTRODUCTION

Asian elephants (*Elephas maximus*), a keystone species, are discontinuously distributed across Asia, facing significant threats from habitat loss and human encroachment (Katole et al., 2014). In Sri Lanka, human-elephant conflict (HEC) is a critical conservation challenge, particularly in regions where elephants inhabit both the protected and adjacent human-dominated agricultural landscapes (Ishida et al., 2018; Fernando & Pastorini, 2011). Asian elephants consume approximately 150 kg of diverse plant material each day (Siddiqui, 2023). As mega-herbivores, they adjust their diets based on the availability, nutritional quality, digestibility, and palatability of plants. Consequently, they often raid crops when these factors make cultivated plants more attractive than wild forage (Desire et al., 2011; Katole et al., 2014). Elephants feed on a diverse range of plants, but food availability differs in natural and human-dominated areas.

METHODOLOGY

The study was carried out from August 2024 to March 2025 in both human-dominated and natural areas in Wasgamuwa. The study was conducted in Wasgamuwa National Park (WNP) as the natural area, and the villagers near the southern border of the WNP as a human-dominated area (**Figure 1**).

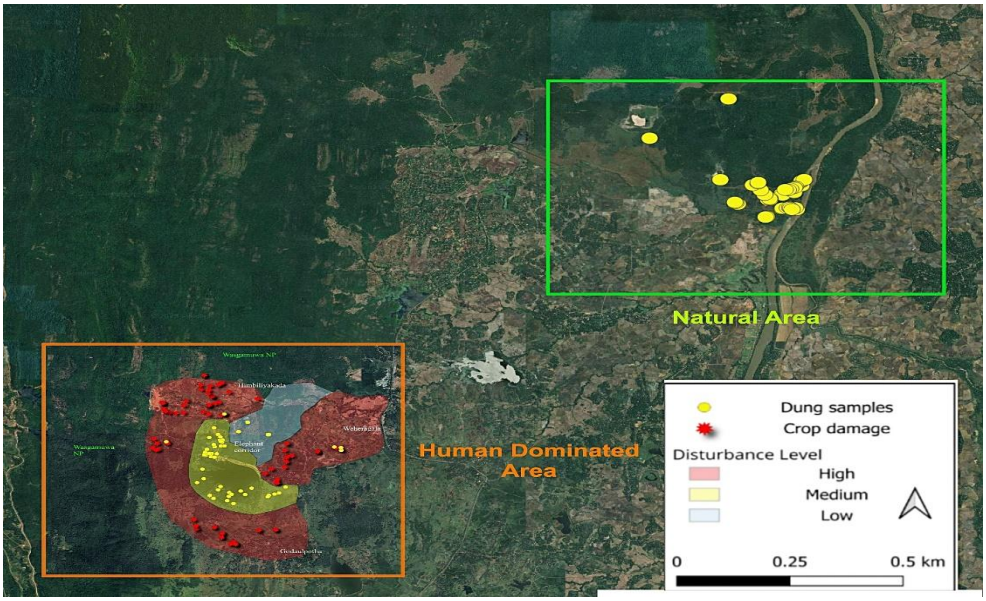

Figure 22 Map of the Data collection

Total 100 dung samples were collected 50 from WNP and 50 from Human dominated area, dung bolus was separated by hand and 100g sample was collected from each sample for the laboratory analysis. Microscopic analysis was conducted to identify the consumed forage matters. For that, A 50g sample was mixed with boiling water, filtered, and treated with household bleach. The residue was separated into Petri dishes, and parts were dipped in alcohol and water. The samples were then observed under a light microscope. Sample slides were created and compared with reference slides to ensure accurate results (Widanalage, 2019).

In the quadrat sampling method from direct observation, food habitats of the elephants were identified and marked with GPS locations, then 24, 10m x 10m plots were set up in those locations in each area, all the plants showing signs of being fed by elephants and the parts of the plants eaten were recorded and to identify grass and herbs and 1m x 1m quadrat was randomly laid 5 times inside the 10m x 10m quadrat. Reference guides and field guides were used for further identification of plant matter. Surveys with farmers were conducted to assess to identify the crop preferences of elephants. Twenty farmers from a village were randomly selected to gather information on crop damage caused by elephants, which was surveyed on three occasions over two months. The physical properties, moisture of dung, were identified using the oven drying method, and the crude fibre content of dung was identified using a standard method (ISO 6541: 1981).

RESULTS AND DISCUSSION

All dung samples were analyzed under the microscope to identify forage matter consumed by elephants. 9 plant species were identified from the analysis. Including seeds, leaves, barks, and twigs. Out of the 9 plant species, two species were

distinctively found in the samples collected from the human-dominated area. Similarly, from the samples collected in the natural area, one plant species was found to be distinctive to the area. The rest of the 7 plant species were found in samples from both areas. Monocot leaves were found in every sample from both areas. Dicot leaves were found in 25 samples related to the human-dominated area and 44 samples related to the natural area. Furthermore, wood particles were found in 34 samples from the human-dominated area and 31 samples from the natural area. This leads to the assumption that elephants predominantly consumed monocots, and the most consumed forage matter was *Panicum maximum* grass species in both human-dominated and natural areas.

Fourteen plant species were identified from the quadrat sampling method. 2 species were exclusive to the natural area; 5 species were distinctively found in the human-dominated area, and the other 7 species were common to both areas. *Tectona grandis* is the most consumed species in the human-dominated area. *Cynodon dactylon* is the most consumed species in the natural area. Through these findings, it was concluded that the elephants consumed more grass species in natural areas while more tree species were consumed in human-dominated areas (**Figure 2**). This study was conducted during the rainy season, when elephants consumed more fresh grass due to increased availability (Alahakoon et al., 2017). In natural areas, they had more ground grass to feed on.

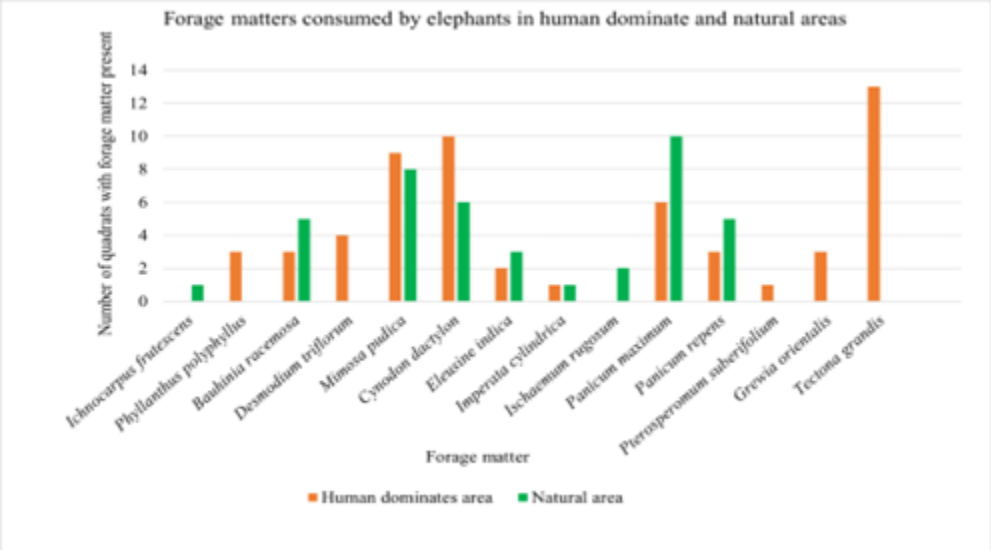

Figure 23 Plant species consumed by elephant in human dominated and natural areas - quadrat sampling method

Fifteen plant species of crops were identified as being associated with crop raiding incidents; the most raided crop was Paddy accounting 26 raiding incidents. According to the findings, the peak of the crop damage was in December. Paddy damage has started from October when rainy season starts and peak in December

when rice becomes mature stage. Throughout the year, perennial crops like bananas (19 incidents), coconut (14 incidents), and seasonal crops like mung (5 incidents) and maize (10 incidents) were heavily damaged by elephants, particularly in August and September. For paddy and mung beans, elephants consumed almost all plant parts when they reached the intermediate growth stage. In bananas, they specifically targeted the fruits and floral stems, while in coconuts, they consumed the nuts and tender leaves. For maize, elephants preferred corn from its intermediate growth stage. These findings indicate that elephants selectively consume specific parts of crops based on palatability and digestibility.

Crude fiber content of the dung in the human-dominated area was 47.27%, and in the natural area it was 40.47% ($p = 0.33$). The moisture content in dung samples was 24.59% in human- dominated areas and 26.51% in the natural area ($p = 0.101$). No significant differences were found between the physical condition of dung samples in these 2 areas. Elephants normally consume high amounts of water daily and also consume plant species with high moisture content (Sukumar, 2006). Therefore, in general, both elephants can show the same moisture content. Information about Fiber content in the dung matter is lacking in past studies but in some study has mentioned that Elephants are known to produce dung with high Fiber content due to their diet being rich in cellulose and hemicellulose, which are obtained from more fibrous plants(Farah et al., 2014).Together with the microscopic analysis and quadrat sampling data, the results indicate that elephants consume more fibrous browse species in human-dominated areas, while a greater proportion of grasses is consumed in natural areas. Additionally, the production of dung with higher Fiber content may indicate a healthier diet for elephants (Ullrey et al., 2014).

The results highlight that differences in the availability of forage between natural and human-dominated habitats have a direct influence on the diet of elephants. The presence of variations of forage matters in natural habitats is low, and elephants are compelled to rely more heavily on crops and other human-associated vegetation because of the availability and the palatability of the crops. Therefore, habitat restoration programs should priorities the re-establishment of key forage matters that elephants most consumed in natural areas, as well as the creation of buffer zones that provide elephants with sufficient natural forage. Such measures would reduce elephants' dependence on human-dominated landscapes, thereby averting conflict. Community-directed reforestation and conservation of existing vegetation can also foster the long-term viability of elephant habitats and human livelihoods.

CONCLUSIONS/RECOMMENDATIONS

Understanding the dietary preferences of elephants is crucial for mitigating human elephant conflict and implementing conservation strategies in a region where habitat fragmentation drives elephants into human-dominated areas from natural areas. The study leads to the conclusion of the importance of habitat restoration programs. Also, it shows that there is a preference for the elephants to consume grass species in the ground areas. Maintaining such areas in the national park is therefore important.

Furthermore, the cultivation of nutrition-rich plants in the forest areas can be suggested. These findings provide a baseline for future research on foraging variations and inform habitat management strategies to reduce human-elephant conflict while supporting elephant nutrition and conservation in the Wasgamuwa area.

REFERENCES

M. D. B. Alahakoon, E. M. A. B. Pushpakumara, G. Ellepola, & Ranawana, K. B. (2017). Food and Feeding Patterns of Asian Elephants in Udawalawe National Park, Sri Lanka. *Gajah*, *46*, 4–13. https://www.researchgate.net/publication/320857265_Food_and_Feeding_Patterns_of_Asian_Elephants_in_Udawalawe_National_Park_Sri_Lanka

Deacute sireacute, F., Martin, N. T., Legr, Nono, G., Pierre, N., & Mike, L. (2011). Nutritional status of forage plants and their use by elephant in Waza national park, Cameroon. *Scientific Research and Essays*, *6*(17), 3577–3583. https://doi.org/10.5897/sre09.500

Farah, N., Amna, M., Naila, Y., & Ishtiaq, R. (2014). Processing of Elephant Dung and its Utilization as a Raw Material for Making Exotic Paper. *Research Journal of Chemical Sciences*, *4*(8), 94–103. https://www.isca.me/rjcs/Archives/v4/i8/15.ISCA-RJCS-2014-134.pdf

Fernando, P., & Pastorini, J. (2011). Range-wide status of Asian elephants. *Gajah*, *35*. https://doi.org/10.5167/uzh-59036

Ishida, Y., Gugala, N. A., Georgiadis, N. J., & Roca, A. L. (2018). Evolutionary and demographic processes shaping geographic patterns of genetic diversity in a keystone species, the African forest elephant (Loxodonta cyclotis). *Ecology and Evolution*, *8*(10), 4919–4931. https://doi.org/10.1002/ece3.4062

Katole, S. B., Das, A., Agarwal, N., Prakash, B., Subodh Kumar Saha, Saini, M., & Anil Kumar Sharma. (2014). Influence of work on nutrient utilisation in semicaptive Asian elephants (*Elephas maximus*). *Journal of Applied Animal Research*, *42*(4), 380–388. https://doi.org/10.1080/09712119.2013.875904

Sukumar, R. (2006). A brief review of the status, distribution and biology of wild Asian elephants Elephas maximus. *International Zoo Yearbook*, *40*(1), 1–8. https://doi.org/10.1111/j.1748-1090.2006.00001.x

Ullrey, D., Crissey, S., & Hintz, H. (2014). *Elephants: nutrition and dietary husbandry • AZA Nutrition Advisory Group*. Nagonline.net. https://nagonline.net/807/elephants-nutrition-dietary-

Wettasin, M., Chaiyarat, R., Youngpoy, N., Jieychien, N., Sukmasuang, R., & Tanhan, P. (2023). Environmental factors induced crop raiding by wild Asian

elephant (Elephas maximus) in the Eastern Economic Corridor, Thailand. *Scientific Reports*, *13*(1), 13388. https://doi.org/10.1038/s41598-023-40070-3

Widanalage, M. (2019). Spatial and temporal variation of habitat relations and genetic variation of elephas maximus maximus in maduru oya national park of Sri Lanka. *Ou.ac.lk*. http://repository.ou.ac.lk/handle/94ousl/1549

ACKNOWLEDGMENTS

I thank my supervisors and the Undergraduate Research Grant of the Open University of Sri Lanka for all the support I received