

Habitat use and diet of African forest elephants (*Loxodonta cyclotis*) in and around Moukalaba-Doudou National Park, Gabon

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Introduction

Many animals adjust their activity in space and time to balance foraging efficiency with predator avoidance. The distribution and quality of food resources strongly affect foraging patterns of animals. In addition, individual differences such as body size, sex, or developmental stage influence their foraging behavior and decision-making. In large herbivorous mammals, clarifying these differences is essential for understanding population-level impacts on vegetation and ecosystems.

Elephants (order Proboscidea) are particularly large herbivorous mammals. In African tropical forest regions, the African forest elephant (*Loxodonta cyclotis*) contributes to ecosystem diversity as ecosystem engineers and keystone species. Therefore, understanding the elephants' habitat use is crucial not only for elucidating their behavioral ecology but also for considering the ecology of other species that coexist with them.

This study examined habitat use and diet of African forest elephants in the Moukalaba region of Gabon. The area is a mosaic of forest and savanna, with a national park adjacent to a village, creating uneven distributions of food resources and human-encounter risks. I aimed to provide baseline information on habitat use and diet, and to assess intraspecific differences, such as sex and age, and their driving factors.

Methods

I surveyed trails and dung of African forest elephants in and around Moukalaba-Doudou National Park and adjacent Doussala Village in Gabon.

First, I quantified the spatial distribution of elephant trails and their structural features, such as trail width and degree of compaction. I established 55 plots of 100 m per side and followed trails within each plot, recording trail width and compaction every 20 m.

Second, I assessed the elephants' habitat use by different age–sex classes by calculating their dung proportions. Fresh dung was collected, dung diameter was measured, and DNA samples were obtained for identifying sex. Dung diameter was used as a proxy for body size.

Third, I conducted dung content analysis to clarify the diet of the elephants with respect to season and age–sex class. Collected dung was washed and dried, and diet composition was analyzed using four categories: forbs and broadleaves (including dicotyledonous leaves and Marantaceae and Zingiberaceae leaves; forest origin), woody materials, fruits, and grass (savanna origin) and fine fibers. Seasonal and age–sex differences in relative volumes and fruit species number were examined.

Results

Elephant trails were unevenly distributed across the landscape. In savannas, trail density was lower and trails were more compacted compared with forests. Outside the park, trails were denser and wider than those inside the park.

Regarding sex differences in dung distribution, adult male dung tended to occur more frequently in areas with active human activity, such as crop fields, compared with female and juvenile dung. In contrast, the proportion of adult male dung was lower in the savanna within the park than in forests or savannas outside the park.

African forest elephants consumed more fruits during the fruiting season, showing clear seasonal differences in diet. In the dry season, dung contained a high proportion of forbs and broadleaves, whereas from late dry season to early rainy season, it contained more grass and fine fibers. Adults showed little or no sex differences, but adults and juveniles differed in diet. Juvenile dung consistently contained a high proportion of categories including grass across all seasons.

Discussion

Savanna trails are highly compacted suggesting that they are mainly used for movement. The presence of numerous wide trails outside the park implies that the attractiveness of food resources near villages outweighs human-encounter risk, leading African forest elephants to frequently use such environments.

The high proportion of adult male dung in crop fields suggests that adult males take risks for high-quality food resources. Conversely, the low proportion of adult male dung in the savanna within the park implies that females and juveniles more frequently consumed grass shoots emerging after burning in the late dry season.

As observed in other elephant species, African forest elephants appear to adjust their diet seasonally, switching between leaves and grass. Large-bodied elephants, with high daily nutritional requirements, are likely to shift their foraging according to the most readily available food each season. Juveniles traveling with adult females, appear to select grass near the ground, as their smaller body size limits access to taller tree leaves. In habitats where open savanna and three-dimensional forest coexist, using these boundary zones may allow individuals of different body sizes within the same family group to meet distinct foraging needs.

Conclusion

African forest elephants used a variety of environments in Moukalaba, including forests, savannas, and areas inside and outside the national park, in a manner that varied with season and sex. This differential use appears to be driven by differences in nutritional requirements

associated with body size, as well as sexual differences in the tendency to avoid encountering humans. These findings add a perspective of behavioral plasticity to the study of elephant ecology and provide new insights into the survival strategies of mammals, particularly large herbivores.