

ROLE OF MEGA-FAUNA IN SEED DISPERSAL

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Annotated Bibliography

Dinerstein E. & Wemmer C.M. (1988) Fruits Rhinoceros eat: dispersal of *Trewia nudiflora* (Euphorbiaceae) in Lowland Nepal. *Ecology*, 69, 1768-1774.

This paper is about a study of seed dispersal of specific tropical plant species *Trewia nudiflora* (Euphorbiaceae), which is dispersed by Rhinoceros, one of the extant mega-fauna, in Nepal. Its fruits are big, hard, and dull color when ripening and it is not attractive for other frugivores such as monkey, bats and birds. However, it is important food source for one-horned Asian Rhinoceros.

They observed radio-collared rhinoceros, from the elephant back, 24 hours a day for two years. They used binoculars for watching and sampled dung once a month. I think their observation on feeding is good enough to measure the daily consumption of the fruit by rhinoceros. From their study of heavy seed amount in dung, low germination rate of uningested fruits, and fast growth of *Trewia* seedlings on grassland latrines, they suggest that the rhinoceros plays the important role in dispersal and recruitment of woody plant species in riverine grassland.

Howe H.F. & Smallwood J. (1982) Ecology of seed dispersal. *Annual Review of Ecology and Systematics*, 13, 201-228.

For me, this paper is very useful for understanding the terms and definitions. It provides about the dispersal mechanisms, advantages to dispersal and hypotheses: Escape Hypothesis, Colonization Hypothesis, and Directed Dispersal Hypothesis. It also describes the patterns of production and dispersal. After reading this paper, it makes me much easier to understand the other papers related with seed dispersal by animal.

Chapman L.J., Chapman C.A. & Wrangham R.W. (1992) *Balanites wilsoniana*: Elephant dependent dispersal? *Journal of Tropical Ecology*, 8, 275-283

This paper presents about elephant dependant dispersal in Africa. They study the forest elephant and *Balanites wilsonia* species interaction in Kibale Forest Reserve: in which there are two study sites, in Uganda. Their method is not quite clear. Their observation focuses on three *Balanite wilsonia* adult trees but when elephants are in the study site, they do not observe, as elephants are dangerous. I think this makes weak their study. They found that distribution of seedlings in two study sites supports elephant-dependent dispersal. At one study site where elephants were rare seedlings were only found under

conspecific adult trees. At another study site, where elephants were common, a good proportion of seedlings were found some distance from large conspecific tree. Thus, they suggested that elephant appeared to be significant in the seed dispersal.

Kitamura S., Yumoto T., Poonswad P. & Wohandee P. (2007) Frugivory and seed dispersal by Asian elephants, *Elephas maximus*, in a moist evergreen forest of Thailand. *Journal of Tropical Ecology*, 23, 373-376.

This paper is about study of seed dispersal by Asian elephant in moist evergreen forest of Khao Yai National Park in Thailand. They focus on quantitative aspect of seed dispersal and frugivory. They sample elephant dung, test seed germination between defecated seed from elephant dung and collected seed from ripen fruit under the parent tree. However their germination trial is destroyed by a Malayan Porcupine in the middle of the process. And they cannot continue their trial over two weeks and find no significant difference of germination success between defecated seed and collected seed from ripen fruit. Although their germination test is incomplete, they find that there are seven species dispersed by Asian elephant (from sampled dung) in KY National Park, which is much lower than African elephant's dispersal.

Fragoso J.M.V. & Huffman J.M. (2000) Seed-dispersal and seedling recruitment patterns by the last Neotropical megafaunal element in Amazonia, the tapir. *Journal of Tropical Ecology*, 16, 369-385.

This paper concentrates on the tapir role as a disperser of large seed. The authors did their research in old growth tropical evergreen lowland rain forest in Roraima, Brazil. Their study sites cover five habitats such as Terra firme Forest, Mauritia wetland, Low forest, Riverine forest and Seasonal marsh. They examine the diversity, abundance and viability of seeds defecated over thirteen months to find out the role of seed dispersal by tapir. They explain their study clearly and comprehensively and I think this paper gives the good example on designing study of the seed dispersal by large herbivore. Interestingly, they find that the tapirs do not always disperse the seeds in wetland as other researchers have thought.

Campos-Arceiz A., Larrinaga A.R., Weerasinghe U.R., Takatsuki S., Pastorini J., Leimgruber P., Fernando P. & santamaria L. (2008) Behavior rather than diet mediates seasonal differences in seed dispersal by Asian elephant. *Ecology*, 89, 2684-2691.

This paper presents the seed dispersal by mega-fauna Asian elephant in two different sites: Sri Lanka and Myanmar. They use the data from feeding trials, seed germination test and GPS telemetry of Asian elephant movement.

They estimate the spatial scale at which Asian elephant disperse seeds to assess whether seasonal differences in diet and ranging behavior translate into seasonal differences in seed shadows and to evaluate whether dispersal scale and seasonal variation vary between two ecologically distinct elephant habitat.

They use Tamarind seed for study and two treatments, which are wet season diet and dry

season diet, are tested with captive elephant from Japan Ueno zoo for retention time. Here I doubt that putting bamboo in dry season diet does not make sense to me as bamboo are more edible and abundance in wet season in Myanmar. They find that changing diet composition does not affect gut retention time and ingested seed germination. In addition, they also find that elephant movements are slightly longer in Myanmar as Myanmar has stronger seasonal variation and seed dispersal curves vary with longer movement during the dry season in Myanmar but not in Sri Lanka. Because Sri Lanka has more stable water resources than Myanmar. I think that if their study includes more elephants and reasonable wet season diet it would be better in resulting.

Blake S., Deem S.L., Mossimbo E., Maisels F. & Walsh P. (2009) Forest Elephants: Tree planters of the Congo. *Biotropica*, 9999.

This paper examines the role of forest elephant in seed dispersal in the Ndoki forest of Congo. They try to answer three questions: 1. How many seeds do forest elephant disperse? 2. How far do forest elephant disperse seeds? 3. Are the effects of forest elephant seed dispersal reflected in the spatial distribution of established trees? They find the answers as follows; 1. Elephants disperse ca 345.6 seeds $\geq 1\text{cm}/\text{km}^2/\text{d}$ from 96 species. 2. The distance of seed dispersal by forest elephants is much bigger than that by other vertebrate dispersers. 3. The effects of forest elephant dispersal clearly reflected in the spatial distribution of adult trees in the Ndoki forest. This paper explains statistical analysis in detailed and, for me, it is hard to follow.

Myers J.A., Vellend M., Gardescu S. & Marks P.L. (2004) Seed dispersal by white-tailed deer: implications for long-distance dispersal, invasion, and migration of plants in eastern North America. *Oecologia*, 139, 35-44.

When I read the main paper (Campos-Arceiz et al. 2008), it compares the seed dispersal by Asian elephant with dispersal by other herbivores including White-tailed deer. Thus, I searched the article about seed dispersal by White-tailed deer and I find this paper is interesting. This species probably plays as an important long distance seed dispersal agent to the seed shadows of hundreds of plant species, in spite of negative effect of browsing on plants.

Janzen D.H. (1971) Seed predation by animals. *Annual Review of Ecology and Systematics*, 2, 465-492.

This paper was published in 1971. However, it gives very useful knowledge about seed predation by animals. The author explains many topics related with seed predation by animals with many examples such as pre-dispersal seed predation, postdispersal seed predation, chemical aspects of host specificity and parasites and predators of seed predators. Reading this paper makes me more convince to the subject of seed dispersal. As it also cited over 200 references, it is good to know that it is a great source for the references of particular topic in seed predation.

Blake S. & Hedges S. (2004) Sinking the Flagship: the Case of Forest Elephants in Asia and Africa. *Conservation Biology*, 18, 1191–1202.

This paper is not about seed dispersal by elephant but it is about status of both African elephants and Asian elephants expressing their population and conservation. I read this paper to get an idea of how many elephants are there for both African and Asian elephant. Their analysis is base on their own experience and reviewing published and unpublished papers. They mention that although several papers estimate elephant populations the data are weak and not accurate enough for designing conservation plan. Thus, they suggest that to conserve the both African and Asian elephant, appropriate methods, designs and funds are needed to create effective conservation action plan. They also introduce about MIKE program, which means, “Monitoring the Illegal Killing of Elephants”. It will be conducted with standardized methodology and has been already implemented in some area, which achieved methods for estimation of elephant density from dung count.

This paper gives the idea that we will have to carefully use the elephant population already estimated by previous studies as they are not entirely reliable sources for designing conservation plan and which can lead mismanagement for elephant conservation.