

# Seed survival of the elephant-dispersed *Carapa grandiflora* (Meliaceae) tree in Nyungwe National Park: preliminary observations

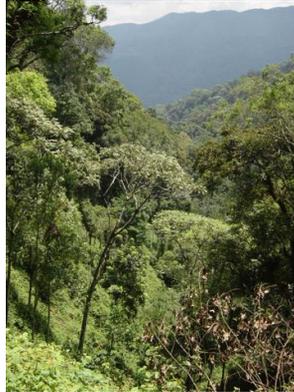
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## ABSTRACT

Elephants are known to act as primary seed dispersers of large-seeded fruit species in Central Africa. Seed survival of the elephant-dispersed tree *Carapa grandiflora* (Meliaceae) was studied at Nyungwe National Park (Rwanda) which now lack megafauna after their extinction in 1999 due to continuous poaching in the Natural Reserve. An experiment was carried out to analyse survival of *C. grandiflora* seeds that accumulate beneath (lacking dispersal) and in clump away from the adult trees simulating elephant-dispersal. All seeds were unlikely to survive above the ground within few days, all of them been removed within 9-12 days without evidence of post-dispersal predation. This result along with observations of seedlings one-year old with the cotyledons buried several cm into the ground and dispersed within 20 m from the nearest adult suggest that *C. grandiflora* seeds are removed and most likely secondarily dispersed by a scatterhoarding rodent as observed in other tropical rainforests



## INTRODUCTION

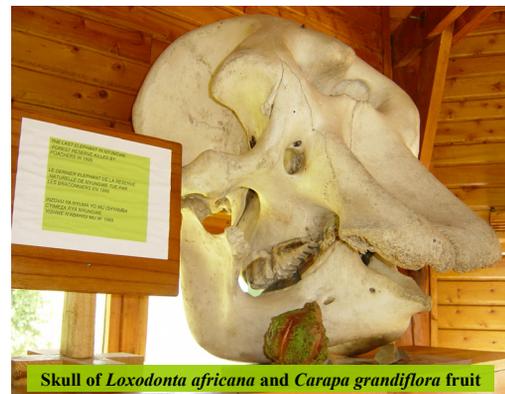
Tropical forests support a large percentage of the world's plant and animal species. However they become progressively empty due to anthropogenic activity in general and hunting in particular. Our ability to protect these communities requires a better understanding of tropical forest processes including regeneration dynamics and the maintenance of tropical biodiversity. Forest Elephant (*Loxodonta africana*) are important contributors to these processes through their seed dispersal behaviors. In Africa especially, their role as primary seed disperser has been well demonstrated. Today, poaching and ivory traffic continue to pressurize elephant. This illegal trade was largely responsible for reducing the forest elephant population to current levels. Their extinction should be followed by plant recruitment failure (Babweteera *et al.*, 2007). Studies in Borneo, Queensland, and Tropical America has showed that rodents contribute to secondary seed dispersal while carrying seeds away from the source, and caching them for future use (Vander Wall *et al.*, 2005). Similar scatterhoarding behaviour are likely to occur in tropical Africa with a diversified guild of forest rodents.

## STUDY SITE

Nyungwe National Park (NNP) (2°15'-2°55'S, 29°00'-29°30'E), a forest reserve established in 1933 is one of the largest East African protected high-altitude rainforest remaining in Africa. It is located in the Albertine Rift, a series of mountain ranges beginning at the Rwenzori mountains in western Uganda and Congo, continuing south into the Lendu Plateau in eastern Congo. Contiguous with Kibira National Park in Burundi. It covers 970 square kilometers (378 square miles), the largest single forest block in East Africa. Vegetation at NNP is characteristics of a high-altitude, mountainous rainforest. The forest at NNP is made up of a complex matrix of Albertine Rift montane forest, is known for its rugged terrain and complex mosaic of dense vegetation types from tall dense forests to open, flower filled marshes.

## STUDY SPECIES

*Carapa grandiflora* (Meliaceae) is an endemic tree species in the Albertine Rift. At Nyungwe National Park (NNP), *C. grandiflora* is a tall canopy tree 20-30 m in height that occurs between 1700 and 2450 m in altitude. Flowering peaks twice a year between June and November, fruits being produced in each wet season, i.e. March-June and September- November. Trees produce 5-(to 6)-part capsules that weigh 690 g (range 430-1010, N = 10). Freshly-fallen fruit are characteristic of elephant-dispersal syndrome as described by (Gautier-Hion *et al.*, 1985), e.g. with a fibrous indehiscent husk, green with red coloration on ridges when fresh, turning brown when remaining above ground (pers. obs.), each containing up to on average 10 (range 4-15) seeds 6.2 x 4.3 x 3.5 cm (Length x Width x Depth, N = 41 seeds) that weigh 38 ± 11 g (range 20-71, N = 26 ; seeds of 100-115 g has been casually observed) in average and that are embedded in a yellow starchy pulp when freshly fallen.



Skull of *Loxodonta africana* and *Carapa grandiflora* fruit



## METHOD

This study examines seed removal and survival in *Carapa grandiflora* (Meliaceae), an endemic tree species in the Albertine Rift, in the Nyungwe National Park (Rwanda) where elephant disappeared in 1999. An experiment was carried out in November 2006 at NNP in order to measure survival of seeds of *C. grandiflora* lacking fruit consumption and removal by elephants. We placed fresh fallen-seeds close collected from beneath trees close and away from adult fertile trees simulating natural dispersal by gravity and secondary seed dispersal by elephant. First, four set of clumped 10 seeds corresponding to an entire fruit (with on average two seeds per locule) were placed in the four cardinal direction underneath 7 adult crowns where fruit normally fall and accumulated at maturity (Undispersed treatment). Second, eight set of 50 seeds (equivalent of 5 fruits) were artificially and experimentally « dispersed » 500 m apart along two tracks 3.5 km long that used to be frequented by elephants (Elephant-dispersed treatment). Seeds were not embedded in herbivores-faecal material. Seeds were counted within two weeks.

## RESULT AND DISCUSSION

In both treatments (Undispersed and Elephant-dispersed), all seeds have been removed within 9-12 days, many of them disappearing within 2-4 days. No post-dispersal predation by vertebrates or invertebrates has been observed. This result is therefore consistent with other previous observations of removal and secondary seed dispersal by scatterhoarding rodents in Asia, Australia, Central and South America (Forget & Vander Wall, 2001) among other large-seeded species which size prevent them from being transported by other means beside Megafauna. Some rodents larder-hoards food in their burrow. They can also scatter-hoard food around the source. Forget (1991) suggests that large paleotropical rodents might behave similarly to large neotropical rodents (*ex. Myoprocata acouchy*) comparable in body mass. At Dja forest in Cameroon, Giant Pouched Rat or Emin Rat (*Cricetomys emini*) stored seeds in their burrow. At NNP, *C. emini* is very abundant and is likely to be the secondary seed disperser of *C. grandiflora* seeds. Based on our results of 100 % seed removal without and with simulated seed dispersal by elephants, large rodent such as *Cricetomys emini*. is an alternative surrogate to maintain seed dispersal of large-seeded species in African rainforests lacking frugivores megafauna.

## REFERENCES

Babweteera, F. *et al.* (2007). **Biological Conservation**, 134, 40-47; Gautier-Hion, A. *et al.* (1985). **Oecologia**, 65, 324-337; Forget, P.M. & Vander Wall, S.B.V. (2001). **Trends in Ecology & Evolution**, 16, 65-67; Forget, P.M. 1991. **Tropical Ecology**, 32, 155-167; Vander Wall, S.B., Kuhn, K.M., & Beck, M.J. (2005). **Ecology**, 86, 801-806 <http://www.nyungwe.org>

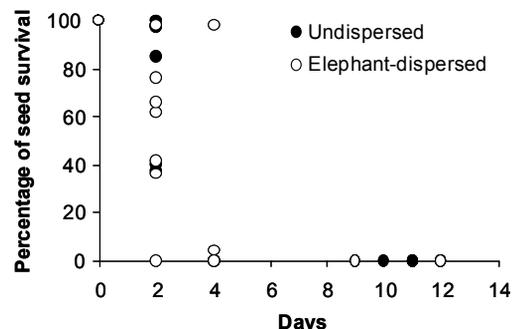


Fig. 1: Survival of *C. grandiflora* seeds below seven adult tree crown (Undispersed) and along two tracks 3.5 km long (Elephant-dispersed) formally used by extinct elephant at Nyungwe National Park, Rwanda.