

## **Sleep Tree use by White-Faced Capuchins (*Cebus capucinus*): Implications for Differences in Seedling Composition**

Authors: Valenta, Kim, Klemens, Jeffrey A., and Fedigan, Linda M.

Source: Neotropical Primates, 16(2) : 73-76

Published By: Conservation International

URL: <https://doi.org/10.1896/044.016.0208>

---

BioOne Complete ([complete.BioOne.org](https://complete.BioOne.org)) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at [www.bioone.org/terms-of-use](https://www.bioone.org/terms-of-use).

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

---

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

expected as other primate species have also been observed exhibiting this behavior. On November 2008 a group of more than 10 individuals of *Mico intermedius* was seen and three of them photographed crossing a small bridge on an unpaved road over the Rio Água Branca (9° 09' 41.4" S and 60° 28' 03.7" W, road MT-206 connecting Colniza – Mato Grosso State and Machadinho D'oeste, Rondonia State), a small tributary of the Rio Guariba in northern Mato Grosso (I. Theobald, pers. comm.). These bridges over the rivers Mucum and Água Branca do not exceed 30 and 15 m in length, respectively. These observations indicate that man-made structures may break down natural geographic barriers and thus interfere with biogeographic processes. The implications of such interference, e.g. potential for hybridization or displacement of one species by another, remain to be determined.

## Acknowledgments

This paper is an outcome of the project "Biodiversity of the Madeira-Purus Interfluvium" of the Geoma network of Brazil's Ministry of Science and Technology. We thank INPA (Instituto Nacional de Pesquisas da Amazonia), MPEG (Museu Paraense Emílio Goeldi), and Petrobrás for field support. Eckhard W. Heymann provided crucial comments. We thank Karl Mokross for English revision. Special thanks to Mike Hopkins and Paulo Assunção for the vegetation information and the record of *C. dubius* bridge crossing. We also thank Daniel P. Munari and Izac F. Theobald (SDS-AM) for information from the Rio Água-Branca, and Robert Wallace for the information from Pando Department, Bolivia. For grants and fellowships that made our work possible we thank the following agencies: Wildlife Conservation Society and Conservation Leadership Programme (support to F.R.).

**Fabio Röhe**, WCS – Wildlife Conservation Society/Projeto Sauim-de-Coleira, Department of Biology, Instituto de Ciências Biológicas, Universidade Federal do Amazonas. Av. General Rodrigo Octávio Jordão Ramos, 3000, Japiim, Manaus, Brazil. E-mail: <frohe@wcs.org>, **José S. e Silva-Jr.**, Museu Paraense Emílio Goeldi – MPEG, Setor de Mastozoologia. Caixa postal 399, 66040–170, Belém, PA, Brazil. E-mail: <cazuza.junior@gmail.com>.

## References

- Anderson, S. 1997. Mammals of Bolivia: taxonomy and distribution. *Bull. Am. Mus. Nat. Hist.* 231: 1–625.  
 Fonseca, G. A. B. 2001. Proposta para um programa de avaliação rápida em âmbito nacional. In: *Conservação da Biodiversidade em Ecossistemas Tropicais*, I. Garay and B. Dias (eds.), pp. 150–156. Editora Vozes, Petrópolis.  
 Hershkovitz, P. 1988. Origin, speciation, dispersal of South American titi monkeys, genus *Callicebus* (family Cebidae, Platyrrhini). *P. Acad. Nat. Sci. Phila.* 140: 240–272.

- Hershkovitz, P. 1990. Titi, New World monkeys of the genus *Callicebus* (Cebidae, Platyrrhini): a preliminary taxonomic review. *Fieldiana Zool., New Series* 55: 1–109.  
 Rowe, N. and Martinez, W. 2003. *Callicebus* sightings in Bolivia, Peru and Ecuador. *Neotrop. Primates* 11: 32–35.  
 van Roosmalen, M. G. M., van Roosmalen, T. & Mittermeier, R. A. 2002. A taxonomic review of Titi Monkeys, Genus *Callicebus* Thomas, 1903, with the description of two new species, *Callicebus bernhardi* and *Callicebus stephennashi*, from Brazilian Amazonia. *Neotrop. Primates* 10: 1–52.  
 Young, B., Sedaghtkish, G. and Rocha, R. 2003. Levantamentos de fauna. In: *Natureza em foco: avaliação ecológica rápida*, R. Sayre, E. Roca, G. Sedaghtkish, B. Young, R. Roca and S. Sheppard. (eds.). p. 91–117. The Nature Conservancy, Arlington.

---

---

## SLEEP TREE USE BY WHITE-FACED CAPUCHINS (*CEBUS CAPUCINUS*): IMPLICATIONS FOR DIFFERENCES IN SEEDLING COMPOSITION

Kim Valenta  
 Jeffrey A. Klemens  
 Linda M. Fedigan

## Introduction

White-faced capuchins are highly frugivorous, diurnal animals, and previous studies indicate that they are effective primary seed dispersers (Wehncke *et al.*, 2003; Smith, 2004; Valenta and Fedigan, 2009a) across several measures of seed dispersal effectiveness: quantity of seeds dispersed (Wehncke *et al.*, 2003; Valenta and Fedigan, 2008), quality of seed dispersal (Chapman, 1989; Smith, 2004; Wehncke and Dalling, 2005; Valenta and Fedigan, 2009a), and diurnal spatial patterns of seed dispersal (Wehncke *et al.*, 2003; Wehncke and Dalling, 2005; Valenta and Fedigan, 2009b). One aspect of capuchin seed dispersal that has not been studied is nocturnal seed input at sleeping sites. White-faced capuchins spend approximately half of their lives sleeping in a limited number of trees (Fragaszy *et al.*, 2004). Although they have not been observed to consume fruit at night, their gut passage rate of 35 minutes to 5 hours (Rowell and Mitchell, 1991; Wehncke *et al.*, 2003; Valenta and Fedigan, 2009b), coupled with their consumption of fruit until minutes before they retire to a sleeping tree (pers. obs.) lead us to the inference that they defecate a large number of seeds beneath sleep trees. Additionally, a great deal of capuchin feces is observed beneath sleep trees the morning after capuchins sleep in them, and capuchins defecate first thing in the morning before leaving sleep trees. Unfortunately, attempts to quantify nocturnal seed rain have not been successful, but the combination of capuchin gut passage rates, with observations of high seed input the morning after sleep trees are utilized by groups indicate that seed rain beneath sleep trees used by this species is significant. Here, we test the effect of repeated sleep

tree use by capuchins on forest regeneration by comparing seedling recruitment at two capuchin sleep trees to paired control trees. Given the increase in capuchin-dispersed seed input beneath sleep trees, we expect a higher density of capuchin-dispersed seedlings at these sites.

Methods

The study took place in the Area de Conservación Guanacaste (10.883611, -85.775), Santa Rosa Sector in Costa Rica. Sleep tree sites used by the group were flagged for each observation day that an observer remained with the group until 18:00 h (N = 59 observations). Two sleep tree sites were chosen for this study based on the existence of appropriate control sites. Both sleep trees were Guanacaste trees (*Enterolobium cyclocarpum*, FABACEAE) and were between 20 and 25 m tall. While there are two additional sympatric, diurnal primate species at the study site (*Alouatta palliata* and *Ateles geoffroyi*), *A. geoffroyi* have never been observed to enter into the home range of the capuchin study group, and *A. palliata* were never observed spending time in the capuchin sleep trees, and are primarily folivorous (Estrada and Coates-Estrada, 1985). Two control trees were chosen for sampling based on their similarity to sleep tree sites. Both are trees of the species *E. cyclocarpum*, and approximately the same height as the sleep trees. Control trees were in similar forest type (similar tree age in the immediate surroundings and similar location relative to forest edge) and located within 300 m of sleep trees. Over the course of 24 months of continuous researcher presence with this capuchin group, the monkeys were never observed to sleep in control trees.

One transect was laid out beneath each sleep tree and control tree. Transects consisted of a line running from the base of the trunk to the edge of the canopy, and were between 12 and 14.5 m long. All seedlings and saplings up to 200 cm in height lying within 2 m of the transect line (1 m on either side), or that were rooted within 2 m of the transect line, were identified to the species level in the field or transplanted to a shade house, where they were grown until positive identification could be made. Identifications were later confirmed by botanists at the Area de Conservación Guanacaste’s plant inventory project ([http://www.acguanacaste.ac.cr/paginas\\_especie/plantae\\_online/](http://www.acguanacaste.ac.cr/paginas_especie/plantae_online/)

division.html). For a very small number of taxa, definitive identification below the genus level could not be made, and all individuals belonging to the genus were pooled for the purpose of analysis. In all such cases, dispersal syndrome did not differ among congeners. Each species recorded in a transect was assigned to one of four categories based on dispersal syndrome. This was accomplished using behavioral observations (see Valenta and Fedigan, 2009a for a detailed description), as well as a long-term database of capuchin food plants maintained by Dr. Linda Fedigan. The four categories were: Group I, wind or bird dispersed taxa not known to be dispersed by monkeys; Group II, taxa consumed by monkeys but whose seeds are destroyed by handling or gut passage; Group III, taxa consumed by monkeys but for which behavioral data are unavailable, with the result that seed survival after monkey handling/gut passage is unknown; and Group IV, taxa known to be dispersed by monkeys, in that the seeds are known to survive monkey consumption of the fruit. Paired t-tests were performed to compare species richness, Shannon diversity and seedling density in each of the four dispersal categories for the two paired sleep tree and control units. Results were also compared graphically.

Results

Visual inspection of species abundances in the seedling community did not reveal any obvious effect of sleep tree status on the seedling communities beneath our target trees (Figure 1). The only differences between the control and sleep trees were significantly higher Shannon diversity in the control samples and a slight but significant difference in stem density of wind-dispersed taxa, with densities beneath sleep trees slightly higher than beneath the controls (Table 1).

Discussion

The lack of a significant increase in seedling recruitment of monkey-dispersed taxa at sleep tree sites is contra our expectation that increased seed input would result in increased capuchin-dispersed seedlings at these sites. It is possible that this lack of significant difference results from a density-dependent seed mortality effect – i.e. an increased clumping of seeds leading to the decreased survival of seeds

Table 1. Species richness and stem density beneath sleeping trees of a group of *Cebus capucinus* and control trees.

	Control 1	Sleep 1	Control 2	Sleep 2	t	p
Species Richness	25.00	24.00	54.00	34.00	1.11	0.47
Stem Density	5.03	10.55	6.25	8.25	2.14	0.28
Shannon Diversity	2.54	1.85	3.45	2.68	18.25	0.034
Group I Density	2.48	2.55	3.46	3.54	13.69	0.046
Group II Density	0.07	0.15	0.17	0.00	0.37	0.78
Group III Density	0.83	1.09	0.63	1.00	5.96	0.11
Group IV Density	1.66	6.53	2.00	3.46	1.85	0.31



M. Luinstra, J.P. Cragg, E. Murillo-Chacón and M. L. Briceño for contributions in the field, and to G. Laird and G. Bridgett for technical support. We also acknowledge our funding sources: University of Calgary, Province of Alberta, Sigma Xi (KV), National Science Foundation Postdoctoral Fellowship (JAK), the Canada Research Chairs Program and an NSERC Discovery Grant (LMF). All research described in this study was conducted in accordance with the protocols approved by our university's animal care committees and all research adhered to the national laws of Costa Rica, where the research was conducted.

**Kim Valenta**, Department of Anthropology, University of Calgary, 2500 University Drive N.W. Calgary, AB, T2N-1N4, Canada. E-mail: <klvalent@ucalgary.ca>, **Jeffrey A. Klemens**, Department of Biology, University of Pennsylvania, 102 Leidy Laboratories 433 S University Avenue, Philadelphia, PA 19104 USA. E-mail: <jklemens@alumni.upenn.edu> and **Linda M. Fedigan**, Department of Anthropology, University of Calgary, 2500 University Drive N.W. Calgary, AB, T2N-1N4, Canada. E-mail: <Fedigan@ucalgary.ca>.

## References

- Chapman, C.A. 1989. Primate seed dispersal: The fate of dispersed seeds. *Biotropica* 21 (2): 148–154.
- Chapman, C.A., and Russo, S.E. 2007. Primate seed dispersal: Linking behavioural ecology and forest community structure. In: *Primates in Perspective*. C.J. Campbell, A. Fuentes, K.C. MacKinnon, M. Panger, and S. Bearder (eds.), pp.510–525. Oxford University Press, Oxford.
- Clark, D.A. and Clark, D.B. 1984. Spacing dynamics of a tropical rain forest tree: Evaluation of the Janzen-Connell model. *Am. Nat.* 124 (6): 769–788.
- Condit, R., Hubbell, S.P. and Foster, R.B. 1992. Recruitment near conspecific adults and the maintenance of tree and shrub diversity in a Neotropical forest. *Am. Nat.* 140 (2): 261–286.
- Estrada, A. and Coates-Estrada, R. 1985. A preliminary study of resource overlap between howling monkeys (*Alouatta palliata*) and other arboreal mammals in the tropical rain forest of Los Tuxtlas, Mexico. *Am. J. Primatol.* 9 (1): 27–37.
- Fragaszy, D., Visalberghi, E. and Fedigan, L.M. 2004. *The Complete Capuchin: The Biology of the Genus Cebus*. Cambridge University Press, Cambridge.
- Harms, K.E., Wright, S.J., Calderón, O., Hernández, A., and Herre, E. A. 2000. Pervasive density-dependent recruitment enhances seedling diversity in a tropical forest. *Nature* 404: 493–495.
- Howe, H.F. 1990. Survival and growth of juvenile *Virola surinamensis* in Panama: Effects of herbivory and canopy closure. *J. Trop. Ecol.* 6: 259–280.
- Howe, H.F. 1989. Scatter-and clump-dispersal and seedling demography: Hypothesis and implications. *Oecologia* 79 (3): 417–426.

- Julliot, C. 1997. Impact of seed dispersal by red howler monkeys (*Alouatta seniculus*) on the seedling population in the understorey of tropical rain forest. *J. Ecol.* 85 (4): 431–440.
- Rowell, T. and Mitchell, B. 1991. Comparison of seed dispersal by guenons in Kenya and capuchins in Panama. *J. Trop. Ecol.* 7 (2): 269–274.
- Russo, S. E. and Augspurger, C. K. 2004. Aggregated seed dispersal by spider monkeys limits recruitment to clumped patterns in *Virola calophylla*. *Ecol. Letters* 7:1058–1067.
- Smith, S. 2004. A preliminary study of seed dispersal by white-faced capuchins (*Cebus capucinus*) and mantled howlers (*Alouatta palliata*) in Costa Rica. *Am. J. Phys. Anth.* 123 (Supplement 38): 184.
- Valenta, K. and Fedigan, L. M. 2008. How much is a lot? Seed dispersal by white-faced capuchins and implications for disperser-based studies of seed dispersal systems. *Primates* 49: 169–175.
- Valenta, K. and Fedigan, L. M. 2009a. Effect of gut passage, feces and seed handling on latency and rate of germination in seeds consumed by capuchins (*Cebus capucinus*). *Am. J. Phys. Anth.* 138 (4): 486–492.
- Valenta, K. and Fedigan, L. M. 2009b. Spatial patterns of seed dispersal by white-faced capuchins (*Cebus capucinus*): Evaluating distant-dependent seed mortality. In Press, *Biotropica*.
- Wehncke, E. V., Hubbell, S. P., Foster, R.B. and Dalling, J.W. 2003. Seed dispersal patterns produced by white-faced monkeys: Implications for the dispersal limitation of Neotropical tree species. *J. Ecol.* 91: 677–685.
- Wehncke, E.V. and Dalling, J.W. 2005. Post-dispersal seed removal and germination selected tree species dispersed by *Cebus capucinus* on Barro Colorado Island, Panama. *Biotropica* 37 (1): 73–80.

---

## POSSIBLE EVIDENCE OF MALE DISPERSAL IN COMMON WOOLLY MONKEYS (*LAGOTHRIX LAGOTRICA*)

Angela Maldonado  
Sergio Botero

## Introduction

The genus *Lagothrix*, the woolly monkeys, contains four closely related species, formerly considered subspecies (Groves, 2005). *Lagothrix spp.* are known to have female-biased dispersal (Nishimura, 2003; Di Fiore and Campbell, 2007), but genetic evidence suggests that male dispersal also occurs (Di Fiore and Fleischer, 2005). Through long term field studies, female dispersal has been observed in the wild (Stevenson *et al.*, 1994; Nishimura, 2003; Di Fiore and Campbell, 2007), but to date no observations of male dispersal have been recorded. Solitary adult males of *Lagothrix poeppigii* have been observed trying to join existing groups, but have been expelled by resident males (Di Fiore