Agoutis and Seed Dispersal in Tropical Rainforest

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Seed dispersal is a vital component of all tropical rainforests; it is the means by which plants can spread their seeds and successfully reproduce. Without the use of dispersal agents, seeds must compete with parent plants and with one another in order to survive. Many of the seeds within neotropical forests are dispersed by animals. These plant-animal interactions have considerable effects on plant distribution and diversity and the structure of rainforest communities (Howe & Smallwood 1982). In some cases, animals act as both seed predators and seed dispersers, ingesting and damaging some seeds, while dispersing others (Theimer 2005). The species of plants and animals involved in these intricate relationships are thus able to rely on one another for their own survival.

A number of the seeds in these forests are adapted for dispersal by either species that live within the forest canopy, such as primates, or species, such as birds and bats, that are capable of flight. They are generally dispersed after being swallowed and passing, intact, through the animals' digestive system. These seeds are sometimes dropped after being partially eaten, or they simply fall to the ground if they have not been picked for consumption (Smythe 1986). A significant proportion of the trees in neotropical forests, however, produce fleshy fruits with relatively large seeds that are often encased in a tough pod or seed coat. These seeds are generally too large to be swallowed by birds, bats, and primates, which suggests that seeds of this type evolved in such a way that they would be dispersed by terrestrial mammals (Smythe 1986). In neotropical forests, the dispersal of these seeds is most often facilitated by various species of rodents.

Agoutis (*Dasyprocta* spp.) are among the terrestrial mammals that act as seed dispersers in neotropical forests. Agoutis are relatively large (3.0-5.9 kg) caviomorph rodents (Peres et. al. 1997) that are primarily frugivorous, which suggests that the majority of their diet is comprised of fruit and/or seeds (Smythe 1986). *Dasyprocta* have incisors that that allow them to open hard fruit pits and gnaw through the hard outer layer of some seeds. Agoutis play a critical role in the dispersal of the seeds of many large-seeded plant species found within tropical rainforests (Silvius & Fragoso 2003). They scatterhoard seeds, collecting and burying seeds within their home ranges for future use, thus providing security for times when food may be scarce. Agoutis inhabit a wide range of tropical rainforests, from areas in southern Mexico to northern Argentina (Nowak 1991, as cited in Jorge & Peres 2005). Their relatively widespread distribution in neotropical forests is indicative of their importance as a member of their ecological communities.

Furthermore, during the fruiting season, agoutis are thought to survive primarily on ripe fruit, which is abundant and easily accessible on the forest floor. During this time, they eat until they are full and then search for surplus food to bury in caches, which they rely on heavily during the rainforest's dry season, when fruit is no longer readily available (Henry 1999). Additionally, when fruit is in limited supply, agoutis use visual and olfactory cues to find their caches, depending on these resources to help fulfill their energy requirements (Henry 1999). Agoutis have also been known to eat animal material, leaves, and fiber, particularly during the dry season. The consumption of these materials is thought to compensate for the extra time and energy that agoutis spend when they must forage and search for caches of stored food when few resources are available on the forest floor (Henry 1999). It is unlikely that other species will deplete the agoutis' stores of food by hunting for the buried seeds because doing so would be energetically inefficient; as a result, it is more likely that these species would depend on sources of food that are more readily available (Smythe 1986). Thus, agoutis are able to maintain an adequate diet during both tropical seasons by consuming buried seeds and relying on alternative food sources when fruit is not available.

Theimer (2005) argues that the relationship between plants and the rodents, such as agoutis, that scatterhoard their seeds is a conditional mutualism. This is based on his observations that the interaction is often, but not always, beneficial to both species. In addition to providing food during the dry season, scatterhoarding seeds for later consumption makes it possible for agoutis to reproduce year round, which can prove to be an ecological advantage (Henry 1999). Moreover, scatterhoarding provides protection for the seeds from pathogens and other predators and gives them the opportunity to germinate if they are not consumed (Smythe 1986; Theimer 2005). Hence, the complex interaction between agoutis and large-seeded plants is essential for the success of both species.

The importance of this relationship is demonstrated by one species of agouti, *Dasyprocta leporina* or the red-rumped agouti, and Brazil nut trees (*Bertholletia excelsa*) found in Amazonian rainforests (Jorge & Peres 2005; Peres & Baider 1997; Peres et al. 1997). In fact, agoutis are thought to be the principal predators and dispersers of this species (Peres et al. 1997). *Dasyporcta* is one of the only species of rodent that is known to consistently bury large seeds intact after removing the hard seed capsule, or pxyidium (Dubost 1988; Forget 1990, 1991; Smythe 1978; as cited in Peres and Baider 1997). *Bertholletia* seeds that remained inside mature pyxidia were found to encounter mortality nearly 100% of the time due to attacks by fungal pathogens and rotting (Peres et al. 1997). As a result, the regeneration of Brazil nut trees is largely dependent on the dispersal of seeds by agoutis following their removal from inside of the hard seed capsule (Peres & Baider 1997 & Peres et al. 1997), which has significant implications for the survival of this species of tree.

The effect of agoutis on the distribution of Brazil nut trees has been relatively well established, but little is known about the trees' influence on agouti populations. Jorge & Peres (2005) conducted a study in southeastern Amazonia to determine whether local agouti density and home range size are dependent on

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the presence of *Bertholletia* trees. The study indicated that the prevalence of Brazil nut trees, in an area, does in fact affect agouti populations. There were nearly twice as many agoutis in a large Brazil nut stand than in an area where Brazil nut trees were absent. Furthermore, the mean home range size for agoutis living in the Brazil nut stand was approximately half that for agoutis who lived in areas devoid of *Bertholletia excelsa*. This implies that when there is a rich supply of Brazil nuts, agouti densities increase and agouti home range sizes decrease. In an attempt to explain their findings, Jorge & Peres (2005) conjectured that agoutis might prefer some species of large seeds to others, which could result in larger agouti populations where these large-seeded plants are abundant. Thus, one can conclude that, while agoutis play a significant role in the distribution of many large-seeded plants, some of these plants are similarly influential on the distribution of agouti populations in neotropical forests, as well.

Understanding the complex interdependences between agoutis and the plant species, such as the Brazil nut tree, that they disperse has caused concern among a number of conservation biologists. It is likely that in the absence of *Dasyprocta*, tree species that depend exclusively on agoutis for seed dispersal would become locally extinct (Asquith, et al., 1999). A reduced agouti population has also been associated with a reduction in overall forest diversity (Asquith, et. al., 1999). Furthermore, in areas where large mammalian predators have been hunted to nonexistence, agouti populations have increased substantially; this has resulted in increased seed predation and decreased seed dispersal by agoutis, which has had a negative effect on the recruitment of large-seeded tree species within these forests (Redford, 1992). Therefore, future conservation efforts should focus on preserving tropical rainforest ecosystems through the maintenance of important plant-animal interactions.

References

Asquith, N.M., Terborgh, J., Arnold, A.E., & Riveros, C.M. (1999, March). The fruits the agouti ate: *Hymenaea courbaril* seed fate when its disperser is absent. *Journal of Tropical Ecology, 15* (2), 229-235. Retrieved March 14, 2006 from JSTOR database.

Henry, O. (1999, May). Frugivory and the importance of seeds in the diet of the orange-rumped agouti (*Dasyprocta leporina*) in French Guiana. *Journal of Tropical Ecology, 15*, 291-300. Retrieved March 26, 2006 from JSTOR database.

Howe, H.F. & Smallwood, J. (1982). Ecology of seed dispersal. *Annual Review of Ecology and Systematics, 13,* 201-228. Retrieved April 20, 2006 from JSTOR database.

Jorge, M.S.P., & Peres, C.A. (2005). Population density and home range size of red-rumped agoutis (*Dasyprocta leporina*) within and outside a natural Brazil nut stand in southeastern Amazonia. *Biotropica, 37* (2), 317-321.

Peres, C.A., & Baider, C. (1997, July). Seed dispersal, spatial distribution and population structure of Brazilut tree (*Bertholletia excelsa*) in southeastern Amazonia. *Journal of Tropical Ecology, 13*(4), 595-616. Retrieved April 2, 1006 from JSTOR database.

Peres, C.A., Schiesari, L.C., & Dias-Leme, C.L. (1997, January). Vertebrate predation of Brazil-nuts (*Bertholletia excelsa*, Lecythidaceae), an agouti-dispersed Amazonian seed crop: a test of the escape hypothesis. *Journal of Tropical Ecology, 13* (1),69-79. Retrieved March 29, 2006 from JSTOR database.

Redford, K.H. (1992). The empty forest. *Bioscience, 42*(6), 412-423. Retrieved from Academic Search Elite database.

Silvius, K.M., & Fragoso, J.M.V. (2003). Red-rumped agouti (*Dasyprocta leporina*) home range use in an Amazonian forest: Implications for the aggregated distribution of forest trees. *Biotropica, 35*(1), 74-83. Retrieved March 25 2006 from Ovid database.

Smythe, N. (1986). Competition and resource partitioning in the guild of neotropical terrestrial frugivorous mammals. *Annual Review of Ecology and Systematics, 17*, 169-188. Retrieved March 25 from the EBSCO database.

Theimer, T.C. (2005). Rodent scatterhoarders as conditional mutualists. In P.-M. Forget, J.E. Lambert, P.E. Hulme, & S.B. Vander Wall (Eds.), *Seed Fate* (pp. 283-295). CAB International.