Mode of seed dispersal greatly shapes placement of rainforest trees

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The apple might not fall far from the tree, but new research shows that how it falls might be what is most important in determining tree distribution across a forest. This study of the seed dispersal methods of rainforest trees demonstrates that these methods play a primary role in the organization of plant species in tropical forests.

Joshua B. Plotkin, a junior fellow in the Faculty of Arts and Sciences at Harvard University, and co-author Tristram Seidler will publish their results in the November issue of the journal *Public Library of Science – Biology*.

"Overall, there is a highly significant relationship between mode of seed dispersal and the clustering and arrangement of mature trees in the rainforest," says Plotkin. "This strong correlation demonstrates the long-term impact that these dispersal methods have on the organization of the large-scale forest."

In order to address the paradox of how so many rainforest species can coexist while competing for the same resources, Plotkin and Seidler studied a 50-hectare (500 meters by 1,000 meters) plot of lowland tropical forest at Pasoh Forest Reserve in peninsular Malaysia. They analyzed the dispersal mechanisms and spatial distributions of 561 tree species found in the plot. What they found was that species clustering was strongly correlated to the species' mode of seed dispersal.

Each species was categorized by one of five dispersal methods: ballistic

(where seeds are liberated explosively), gravity, gyration (where the progression of seeds to the ground is slowed by the shape of the seeds), wind, and animal, the last of which was sub-categorized by fruit size. The animal subcategories were intended to distinguish among different sizes of animal that might disperse the fruit.

Plotkin and Seidler observed the distribution of individual tree species, determining an average spatial cluster size. Upon comparison across all species and seed dispersal categories, they determined that trees with ballistic dispersal methods tended to have the tightest cluster size, with trees dispersing their seeds via gravity, gyration, wind, and fruit of increasing size showing progressively more diffuse spatial distributions.

In addition to confirming the importance of seed dispersal, the results also supported some secondary hypotheses. Trees with smaller fruit tended to be less widely dispersed than trees bearing larger fruit, strengthening the argument that larger-bodied birds and mammals, in eating larger fruit, carry the seeds of these plants over larger distances. Wind-dispersed seeds were observed to have a surprisingly tight cluster radius, likely explained by the dense forest canopy stifling wind speeds.

These results are the first experimental evidence of their kind for an entire forest community, and are in agreement with the authors' additional results for a Panamanian jungle, suggesting the broader scope of these findings.

"Our results provide broad empirical evidence for the importance of dispersal mode in establishing the long-term community structure of tropical forests," Plotkin says, noting that it may not be possible to generalize his results for other types of forests.

Source: Harvard University