MANGROVE FOREST STRUCTURE AND DYNAMICS, PUNTA GALETA, PANAMA

A long-term study, led by Dr. Wayne Sousa (University of California, Berkeley), is investigating a variety of biotic and abiotic processes that may account for the structure and dynamics of mangrove forests on the Caribbean coast of central Panama. The study forests of Punta Galeta, near the Smithsonian Tropical Research Institute's Galeta Marine Laboratory, contain three canopy tree species, which exhibit a pattern of shoreline zonation that is typical of the region. Seaward fringing stands are monopolized by *Rhizophora mangle*, low intertidal stands are a nearly even mixture of *R. mangle* and *Laguncularia racemosa*, and *Avicennia germinans* dominates more inland stands. *L. racemosa* often reappears in the canopy near the upland edge, and sometimes forms small monospecific stands along the mangrove–rain forest ecotone.

Image 1: Fringing stand of *Rhizophora mangle* at seaward end of tidal gradient. Photo by Anand Varma.

These photographs are associated with the article, "Supply-side ecology in mangroves: do propagule dispersal and seedling establishment explain forest structure?" by Wayne P. Sousa, Peter G. Kennedy, Betsy J. Mitchell, and Benjamín M. Ordóñez L., tentatively scheduled to appear in *Ecological Monographs* 77(1):53–76, February 2007.

Image 2: Low intertidal mixed stand of *Rhizophora mangle* and *Laguncularia racemosa*.

Image 3: Upper intertidal stand of *Avicennia germinans*; seedlings on the forest floor are predominantly *Avicennia*.

Image 4: A small stand of *Laguncularia racemosa*, with epiphytic bromeliads (*Werauhia sanguinolenta*) near the upland edge; an annual cohort of *Laguncularia* seedlings covers the forest floor.

Our forthcoming paper examines the roles of propagule dispersal and establishment in explaining species distributions along the tidal gradient. The propagules of mangroves are buoyant and dispersed by tidal currents and runoff following rainstorms. We quantified dispersal patterns by monitoring the movements (directions and distances) of marked propagules released at different distances from the water's edge. A separate experiment measured rates of seedling establishment at these same positions along the tidal gradient. Rabinowitz' Tidal Sorting Hypothesis posits that zonation is the product of (1) the differential landward movement of propagules of different size by incoming tidal flow (i.e., tidal sorting) and (2) the greater ability of larger propagules to establish in the deeper water characteristic of the low intertidal zone. Our observations were not consistent with this model of zonation, but revealed a different form of dispersal limitation that seems to strongly influence species' vertical distributions and forest structure. All photographs by Wayne Sousa unless noted otherwise. All rights reserved.

Image 5: A small river running through a mixed stand of *Rhizophora mangle* and *Laguncularia racemosa*. Mangrove propagules that disperse into a river channel can be transported longer distances.

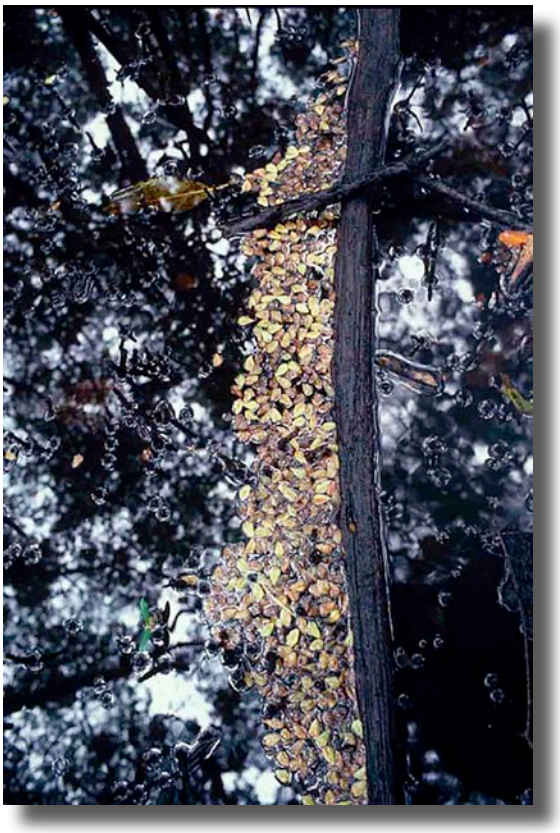

Image 6: Dispersing propagules of *Laguncularia racemosa* trapped behind a log.