

## STRUCTURE AND DYNAMICS OF THE OUTER CANOPY IN A PANAMANIAN DRY FOREST

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The structure of the outer canopy of a tropical dry forest was described and contrasted with more common structural perspectives of the forest as seen from the ground. The forest is a successional stand (approximately 75 years old) on a hillslope in the Parque Metropolitana, near the Ciudad de Panamá. Observations on the topography and community composition of the outer canopy were made using plumb measurements taken above the forest from the gondola of a tower crane. These measurements were made in both the wet season of 1990 and the dry season of 1992. Optical measurements of the average vertical distribution of leaf area were made from the forest floor. The larger stems in the study area were censused and mapped.

A few large individuals of *Enterolobium cyclocarpum* and *Anacardium excelsum* dominated the basal area (>70%) of the 0.5 ha stand within range of the crane. Other important tree species were *Luehea seemanii*, *Astronium graveolens*, *Urera caracasana*, *Castilla elastica*, and *Antirrhoea tricantha*. At least 30 species were present as stems larger than 5 cm dbh. The mean foliage profile showed several leaf area maxima with height above the ground, with vertical stratification of species (e.g., *Piper* and *Castilla* near the ground, *Anacardium* predominantly at the top).

In contrast to the diverse community of stems in the study area, only a few species of trees (especially *Anacardium*, *Enterolobium*, and *Luehea*) and lianas dominated the leaf community of the outer canopy. On both sampling occasions more than a quarter of the projected canopy area was covered by leaves of various lianas. The leaves of both the tree and liana species formed distinct patches—the uppermost canopy is a mosaic of irregular zones each dominated by a single species. The shape of the outer canopy was extremely complex, with varied morphometry, including planar areas, deep canyons and sheer walls. The rumpled surface had more than twice the area of the ground below.

Treefalls, branch death, leaf shedding, gap closure and vertical growth caused substantial changes in canopy topography over an interval of 16 months. The total surface area of the outer canopy declined but the volume and height increased. The increase in the volume of forest beneath the outer canopy was the net result of both large declines in volume (gapping and leaf abscission) as well as large increases in volume (closure of gaps and height growth). According to several measures of complexity, the canopy shape became more simplified over the duration of the study.