

THE GEOGRAPHY OF CLOUDS

by Mary Ellen Hannibal

Call it fog or cloud-cover, San Francisco is blessed with plenty—a frequent blanket of palpable atmosphere in large part creates our distinctive sense of place. San Francisco Botanical Garden takes advantage of our temperate climate to cultivate many mediterranean gardens, but also optimizes our chilly, drear days as well. Now counting three “cloud forest” gardens—the Mesoamerican, the Southeast Asian, and the Andean Cloud Forests—the Garden takes significant place internationally among botanical gardens. We are now home to a world-wide premier collection of plants from this lesser-known and precious biome, which occurs in high-elevation tropical mountains. The distinction could not come at a more important time. Climate change, development, and deforestation are among the world’s woes currently threatening native cloud forests. Many species we cultivate have already become unknown in the wild and may be extinct. Our role as ark, living museum, and educational portal

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has never been more relevant. Plus, cloud forest vegetation is lush, gorgeous, often exotic, and to experience it right here at home is a lucky pleasure.

Location, location

San Francisco is foggy because we are perched between the Pacific on one side and a semi-arid continental interior on the other. Cool air from ocean currents collides with hot air from inland resulting in fog; our hills hold it here and slow its dissipation. Our mild, usually wet winters and cool, foggy summers provide conditions in which many cloud forest species thrive. While we can never really approximate the precipitation levels these plants prefer, we can give them pretty much everything else they need. Like many special vegetation types, cloud forest evince the Goldilocks syndrome: Huntington Gardens, to our south, is too hot for them; the U.C. Botanical Garden at



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MAGNOLIA CAMPBELLII

This illustration of *Magnolia campbellii* is from *Flora and Sylva: A monthly review for lovers of garden, woodland, tree or flower; new and rare plants, trees, shrubs, and fruits; the garden beautiful, home woods, and home landscape*, 1904, Volume 2, edited by William Robinson, 1838-1935.

Berkeley, to the east, gets just a wee bit too cold for them. But the Garden is just right.

“Cloud forests” sounds like a childhood realm of imagination, but they are very real vegetation zones around the world. They

basically result from a mixture of the heavy precipitation of the tropics with high elevations on mountains. Down below, water takes the form of a gas—humidity. As this dense air gets pushed up the mountainside by wind, it encounters lower pressure; it cools, condenses, and forms a perennial cloud cover. Pretty much constant condensation and cool temperatures alter the composition and ecology of tropical vegetation. Leaves become smaller and harder, and lose their elongated tips. Surfaces including rocks, trunks, branches, and stems become laden with lichens and mosses. Cloud forests have been called “elfin” or “fairy” forests because they are tangled, wet, green, and glistening; tree forms bending and buckling under pressure from the windy, foggy exposure can indeed look like chilly Hobbit abodes. While not matching quite the riotous density and profusion of form found in the wild, our cloud forest gardens are a good bit more hospitable to most *Homo sapiens*.

Given the dotty devotion frequently on display in the trade, Dennis Breedlove would seem to have been fated by his name to become a botanist. Now retired, Breedlove was a curator at the California Academy of Sciences (CAS) for more than 25 years, and started San Francisco Botanical Garden on its cloud forest path. Botany curators often “work on the flora” of a region, which means they set out to identify and document all the plants that occur there. This sort of catalog tells a story that reaches back into time and sheds light on the history of a place.

Thus, when Breedlove set out to work on the flora of Chiapas, Mexico’s southernmost state, he was helping to discern the full picture of its unique evolution. Breedlove brought standard



DAVID W. KRUISE-PICKLER

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herbarium specimens back to CAS. But even in the 1960s and early seventies, he anticipated that the rare species he was encountering were in need of special protection, and also brought back seeds for propagation at the U.C. Berkeley Botanical Garden. These propagules, and additional seeds provided by Breedlove, became the foundation of the Mesoamerican Cloud Forest Garden first established here in 1984. The plantings were experimental; virtually none of these species had ever been cultivated. In 1996 our cloud forest garden was recognized by the North American Plant Collections Consortium; membership recognizes a collection as a national and international resource for science. It also entails ensuring that the plants are duplicated, propagated in other botanical gardens (in our case, at Berkeley) to provide a safety net in the event of their loss.

Making Global Connections

Most of our gardens are organized by biogeographical location, which allows us to appreciate how assemblages of plants grow together, questions about which were fundamental to helping Darwin parse out his famous theory. Of equal importance in the world of conservation today is to understand how different cultures interact with their natural heritages. Former San Francisco Botanical Garden Collections Manager Brian Tan is passionate about the “ethnobotanical” connection, and during his tenure here he cultivated relationships with many Southeast Asian botanical groups. One of the results was our Southeast Asian Cloud Forest, first planted here in 2006. In the last two years our Southeast Asian Cloud Forest Garden was amplified considerably, with the planting of 30 new canopy trees and 55 vireya rhododendrons and companion plants.

Because of their remote locations and high elevations, cloud forests have been explored less than other environmental hotspots around the world, and many species new to science are still being discovered in them. In 1997 a new bird was identified in an Ecuadorian cloud forest, the jocotoco antpitta —“jocotoco” is onomatopoeic for the bird’s hooting call. The world of avid birders soon descended to get a (respectful) look at this new creature, thus bringing welcome ecotourism dollars to the area. Other new species recently discovered in Vietnamese and Laotian cloud forests include a new bovid, two new barking deer, a short-eared rabbit and a palm civit. A new species of *Vaccinium*, an endangered *Fuchsia*, and a new tree genus (*Ticodendron*) have all been recently discovered in Mexican cloud forests.

The Future of Water

Wild cloud forests are rich biodiversity bank accounts, and they also play a unique and fundamental role in the water cycle, which is the support system for life on earth. Mountains in general are called nature’s “water towers.” A healthy forest cover on



Cloud forests are home to epiphytes, which absorb water and nutrients from the atmosphere. Epiphytes growing on *Magnolia poasana*.

mountains helps absorb and stabilize what scientists call the flow regimes of streams and rivers; without this vegetation, the water would sluice down quickly eroding stream banks, moving too fast to be absorbed along the way.

The vegetation in cloud forests “strip” the wind-blown fog of water and absorb it directly. Because trees wetted by rain or fog don’t absorb as much water from the soil, overall water use by cloud forests is less than that of forests at lower elevations. In turn this means that the stream flow coming down the mountain from cloud forests is larger for the same amount of rainfall, and in dry times, more dependable. Because of this abundance of atmospheric water in cloud forests, much of its vegetation is “epiphytic,” which hardly needs explanation to the orchid lovers among you; epiphytes are plants that grow nonparasitically on other plants and absorb water and nutrients from the atmosphere. In an interesting note about human perspectives, it was once thought that because there are fewer tree species, large vertebrates, birds, and butterflies in cloud forests, they were less diverse than lower tropical zones. This point of view completely ignored the bromeliads, orchids, mosses, lichens, and ferns that make up a substantial part of the cloud forest biomass, which have been more recently recognized as playing a fundamental role in cloud forest ecosystems. All these epiphytes

contribute to the cycling of the fog through the system, eventually condensing as water below.

Identity Crisis

Long-time San Francisco Botanical Garden gardener Bob Fiorello has been responsible for most of the work on the new Andean Cloud Forest Garden, and he explains that it evolved as a natural complement not only to the other cloud forests here but to the Chilean Garden as well. “The Chilean collection had over the years given way to species more appropriately deemed South American. Many of these plants are colorful, showy representatives of the *Solanaceae* (nightshade) family that include *Cestrum*, *Ichroma*, and *Brugmansia*. Some of the selections, such as *Brugmansia sanguinea*, come from regions that include Chile, but much of what we have been growing really hail from neighboring countries Venezuela, Columbia, and Brazil,” he says. In pondering what he terms a garden identity crisis, Fiorello says he was inspired by the results the Garden has had with Andean Wax Palms to really start thinking “cloud forest.” Additional high elevation palms will provide overstory for the renovated cloud forest garden, while lowland South American plants will have their own space along the MLK fenceline—Janet Lopez manages this portion of the Garden.

The Once and Future Garden

On a sunny day earlier this year, I tagged along as Curator of Horticulture and all-around beloved San Francisco Botanical Garden stalwart Don Mahoney spoke to a group of docents about plans underway to complete the Andean Cloud Forest Garden. We gathered in the Chilean Garden, which is being partly repurposed in this effort. The docents applauded Mahoney, who is not only a key proponent of this latest achievement but who helped steward the Mesoamerican and Southeast Asian Cloud Forest Gardens as well. Associate Curator David Kruse-Pickler has likewise carried the torch first passed by Dennis Breedlove and Bian Tan to capitalize on the remarkable capacity we have here to showcase and care for some of the world’s most special and imperiled plants. Currently in our gardens we have 64 species listed by the International Union for the Conservation of Nature (IUCN) as endangered or extinct in the wild, and many more that are considered rare and vulnerable.

Mahoney pointed out a big tree trunk which will become home base for fuchsias; and a spot where sun-loving *Brugmansia* will be able to soak it up. He talked about the winter color provided by salvias; and mentioned a new one never cultivated before, its seeds brought back to us from Ecuador. The docents and I listened as the sun rose higher in the sky. A hummingbird zinged past my nose, mindless of past and future cloud forests gardens, wholly focused on the present profusion.