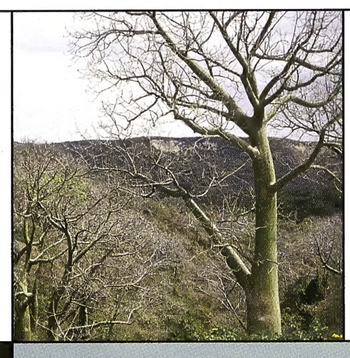
Research at the Missouri Botanical Garden

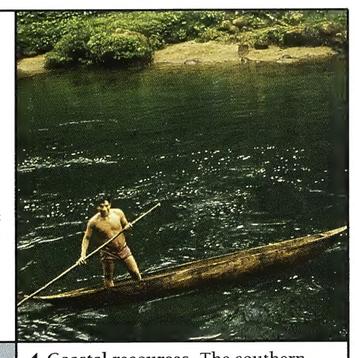
Center of Biodiversity–Ecuador

Ecuador, in northwestern South America, is the smallest of the Andean countries (about the size of Colorado) and the most densely populated, with 13 million people. Over 16,000 native plant species are known from Ecuador—about as many as in all of the continental U.S.—of which over 4,500 species are endemic to the country. This number is still growing because an average of 160 new species of plants are discovered in Ecuador each year.

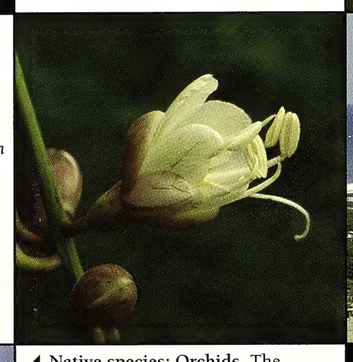
Regions: Coastal dry forest. Contintental Ecuador comprises three geographic regions: the Pacific coast on the west, the Andes mountains in the center, and the Amazon basin in the east. The Galápagos Islands are considered the fourth region. Pictured: dry forest in the coastal region, where the trees drop their leaves during the dry season; the dominant tree is *Ceiba trichistandra* (Bombacaceae). [DAN]

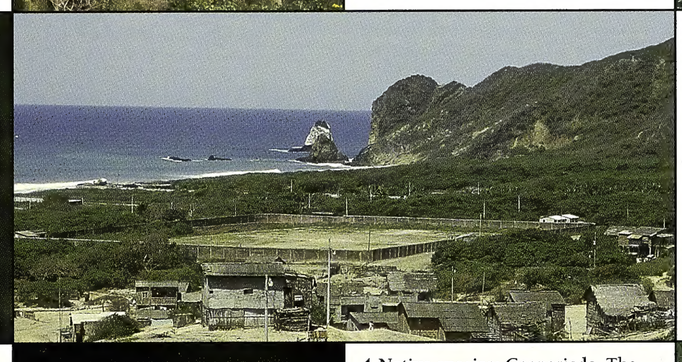


Indigenous groups: training. Ecuador has many indigenous ethnic groups whose territories include some of the country's most diverse forests. MBG botanist David Neill, with zoologists from the Wildlife Conservation Society, is conducting a training program in conservation biology for two indigenous groups: the Awá in the northwest and the Shuar in the southeast. Pictured: a native Awá in a dugout canoe. [PMJ]



Rare, endemic trees *Meriania pastazana* (Melastomataceae), above, is a spectacular flowering tree known from only two sites in Amazonian Ecuador. [WF]
At right, *Ecuadendron acosta-solisianum* (Fabaceae: Caesalpinioideae), a new genus and species discovered in 1996, is known from only three populations in patches of coastal forest. The tree grows up to 100 feet (30 m) tall and the flowers hang in 6-foot (2 m) long clusters. pollinated by bats. [DAN]





Coastal resources. The southern part of Ecuador's Pacific coast is bathed by the cold Humboldt Current, with its rich marine resources. Many small fishing villages, such as San Lorenzo (pictured) are along the coast; fisherfolk go out in small boats to catch tuna and other species. Ecotourism has developed around the migration of humpback whales arriving from the Antarcic to breed in these tropical waters from May to October. [DAN]

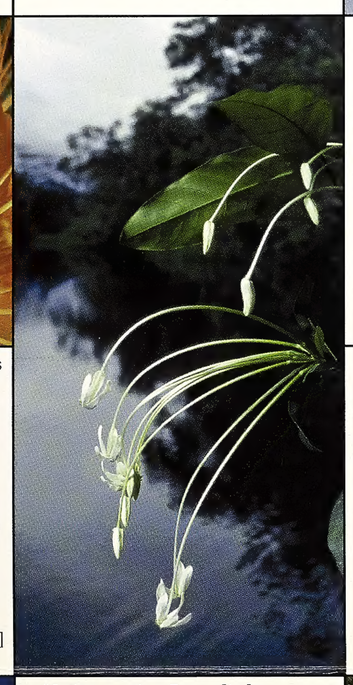
Environmental impacts: Oil pipeline Since the 1970s, development of petroleum reserves in the rainforest of Amazonian Ecuador has lead to colonization and deforestation of vast areas. Oil is piped over the Andes to the Pacific coast. But some new pipelines are being built with reduced environmental impact, such as this new narrow clearing above. [DAN]
Brownea macrophylla (Fabaceae: Caesalpiniodeae), a flowering tree in Amazon rainforests. [PMJ]

Insects: Animal-plant interactions. Insects, like plants, are very diverse in Ecuador, but have not been studied very thoroughly. Butterflies are the best-studied insect group; other groups such as the beetles are exceptionally diverse, but poorly known. Insects are vital to ecological processes, including insect-plant interactions such as pollination and herbivory. Pictured is an Ecuadorian moth, *Rothschildia* sp. [LJ]

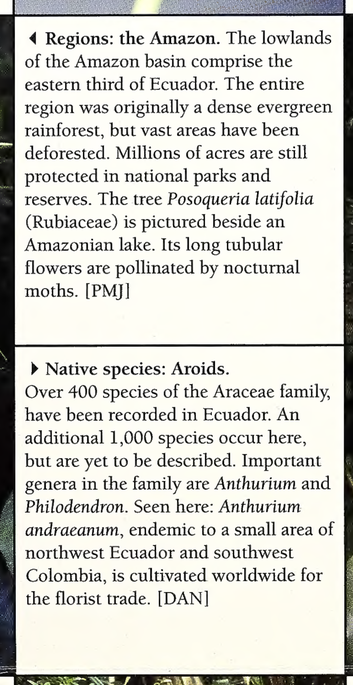
Native species: Orchids. The diversity of the Orchidaceae family in Ecuador is exceptional, with over 3,700 species registered at present, more than half of which are endemic to the country, and new species are being described every year. Pictured is *Telipogon hirtzii* from the eastern Andean cloud forests. The center of the flower mimics a female fly and is pollinated by visiting males. [LJ]

Native species: Gesneriads. The genus *Gasteranthus* (Gesneriaceae, African violet family) includes 35 species from Mexico to Bolivia. It is most diverse in western Ecuador, with 25 species, of which 16 are endemic to the region. Many of the endemics are highly endangered by habitat destruction. Pictured is *Gasteranthus corallinus* from the eastern and western Andean slopes. [JC]

Drugs. *Brugmansia arborea,* the angel's trumpet, belongs to the Solanaceae (Nightshade or Potato family) It contains many alkaloids and is a dangerous hallucinogen. It has been used in the Andes for hundreds of years to calm neurological pains. Shamans use this or other species from the genus to contact the spirit world. Not known in the wild, but these plants are one of the most common ornamentals praised for their large fragrant trumpet-shaped flowers. [CUU]



Native species: Bromeliads. Species of the Bromeliaceae family grow throughout the American tropics, with 455 species, about 16% of the total, known from Ecuador. Most bromeliads, like orchids, are epiphytes, with very high abundance and diversity in the ever-wet cloud forests of the Andes. The rosette of leaves forms a tank that collects rainwater and creates a mircrohabitat for insects and frogs. Pictured is *Guzmania longipetala* from the eastern Andean slopes. [LJ]



Regions: the Amazon. The lowlands of the Amazon basin comprise the eastern third of Ecuador. The entire region was originally a dense evergreen rainforest, but vast areas have been deforested. Millions of acres are still protected in national parks and reserves. The tree *Posoqueria latifolia* (Rubiaceae) is pictured beside an Amazonian lake. Its long tubular flowers are pollinated by nocturnal moths. [PMJ]

Training. Over 15 years, MBG has trained more than 70 Ecuadorian botanists in botanical inventory, research methods, and conservation biology, through field-based programs from two months to two years in duration. The graduates work in various research, educational, and conservation organizations, both governmental and private. Pictured: MBG curator David Neill with post-graduate trainees in the field. [DAN]

Bird pollination: *Heliconia*. The curved flowers of *Heliconia regalis* in coastal Ecuador are pollinated by hooked-billed hermit hummingbirds with similarly curved bills as they drink nectar from the flower. Nearly 1,600 bird species are native to Ecuador, and many have important ecological interactions with Ecuadorian plants.[CUU]

Native species: Aroids. Over 400 species of the Araceae family, have been recorded in Ecuador. An additional 1,000 species occur here, but are yet to be described. Important genera in the family are *Anthurium* and *Philodendron*. Seen here: *Anthurium andraeanum*, endemic to a small area of northwest Ecuador and southwest Colombia, is cultivated worldwide for the florist trade. [DAN]

Botanical inventories: Cordillera del Cóndor. In collaboration with the National Herbarium of Ecuador and several Ecuadorian universities, MBG has carried out botanical inventory programs since the 1970s. Current inventory work is concentrated in the Cordillera del Cóndor, a sandstone mountain range on the Ecuador-Peru border with many endemic plants, and others disjunct from the sandstone Guayana highlands of southern Venezuela. [DAN]

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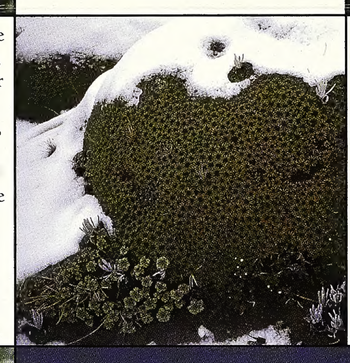
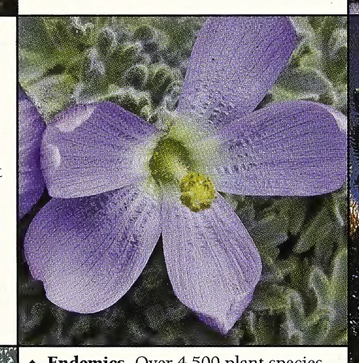
Snow on the equator. To tolerate the cold climate of snowcapped volcanoes, plants grow in cushions, one branch or plant pressed closely to its neighbor. Dead leaves remain inside the cushion, and their decomposition provides warmth. The plants are, so to speak, growing on top of a compost heap. The round cushion illustrated is *Plantago rigida* that sometimes reaches sizes of more than 3 feet (1 m) across. [PMJ]

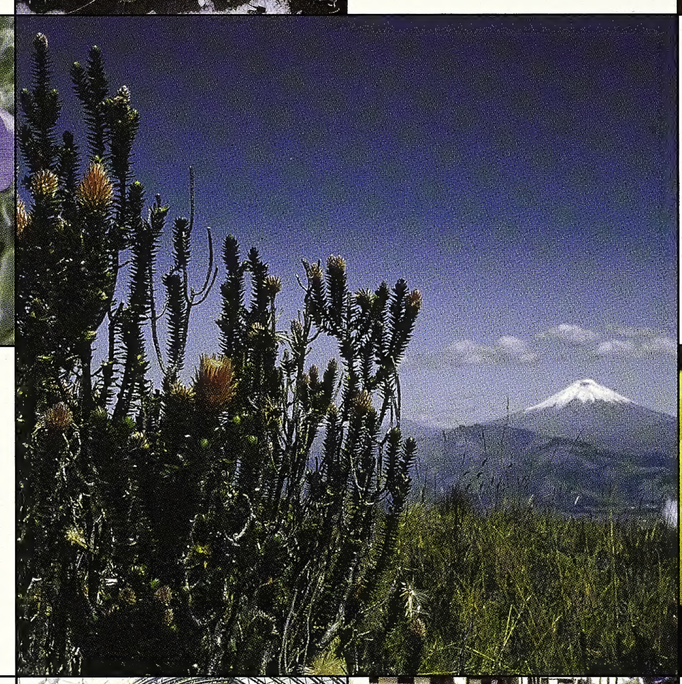


Páramo is a mainly treeless vegetation type found above 9,800 feet (3,000 m) from Costa Rica to northern Peru. The páramo and cloud forests capture water and gradually release it into the rivers. Plants are adapted to this cold climate, here exemplified by two members of the Asteraceae. *Chuquiraga jussieui*, with volcano Cotopaxi in the background [DAN] has small, coriaceous leaves, while *Espeletia pycnophylla* (right) is covered by a dense mat of wooly hairs. [CUU]

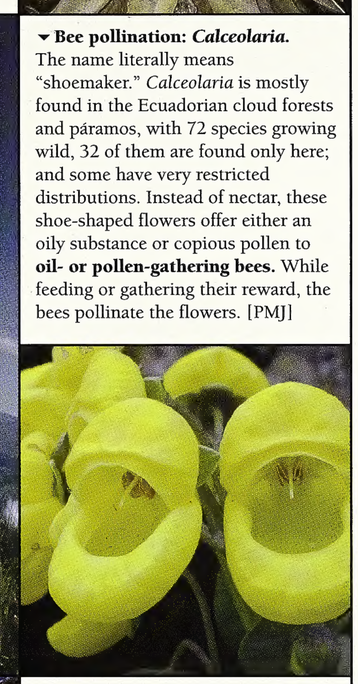
Plants in the mist. The cloud forest is found on the slopes of the Andes at an elevation of between 4,900 and 11,500 feet (1,500–3,500 m). The climate in these forests changes dramatically during the day. From clear sky and sun in the early morning, the cloud cover increases before noon, and fog and mist envelop the forest. In the afternoon, a misty rain falls, and by the end of the day, heavy rain or thunderstorms may occur. These forests are less diverse than the lowland tropical rain forest, but detailed inventories of cloud forest sites result in different plant composition at each site. Turnover rates are high in cloud forest while lower in lowland rain forest. Consequently, the Ecuadorian cloud forest is among the most diverse on Earth, but still not well explored. Mosses, lichens and an impressive array of epiphytic bromeliads and orchids cover the tree trunks. The majority of these epiphytes are endemic, found here and nowhere else. [JK]



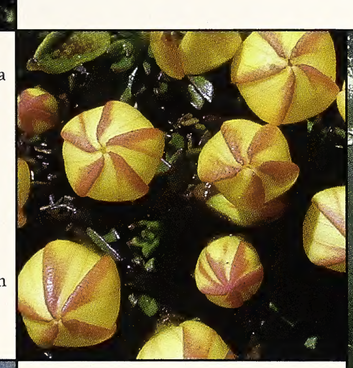
Endemics. Over 4,500 plant species are only found in Ecuador. These correspond to 25% of the country' s almost 16,000 native species of vascular plants. Ecuador's "Red List" of endemic species reports that 83% of the endemic species are threatened under the IUCN standards. *Nothotriche hartwegii,* previously considered part of another species, is an endemic from southern Ecuador recently rediscovered after almost 100 years. [CUU]

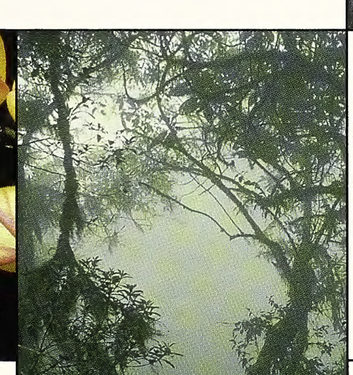


Bee pollination: *Calceolaria*. The name literally means "shoemaker." *Calceolaria* is mostly found in the Ecuadorian cloud forests and páramos, with 72 species growing wild, 32 of them are found only here; and some have very restricted distributions. Instead of nectar, these shoe-shaped flowers offer either an oily substance or copious pollen to **oil- or pollen-gathering bees.** While feeding or gathering their reward, the bees pollinate the flowers. [PMJ]



MBG botanists Carmen Ulloa Ulloa and Peter M. Jørgensen are working in a **collaborative project** with Ecuadorian colleagues to produce an illustrated florula of the páramo of the **Cajas National Park**. The Park has over 15,000 visitors per year; a flora will further stimulate and increase awareness of the plants and vegetation of this complex ecosystem. Pictured is *Gentianella hirculus*, an endemic gentian only known from Cajas. [PMJ]



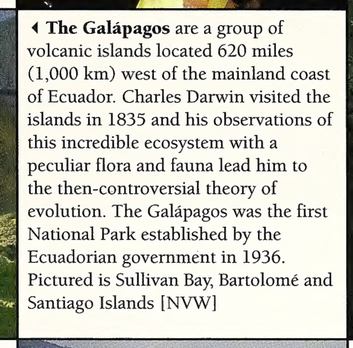


The Galápagos are a group of volcanic islands located 620 miles (1,000 km) west of the mainland coast of Ecuador. Charles Darwin visited the islands in 1835 and his observations of this incredible ecosystem with a peculiar flora and fauna lead him to the then-controversial theory of evolution. The Galápagos was the first National Park established by the Ecuadorian government in 1936. Pictured is Sullivan Bay, Bartolomé and Santiago Islands [NVW]

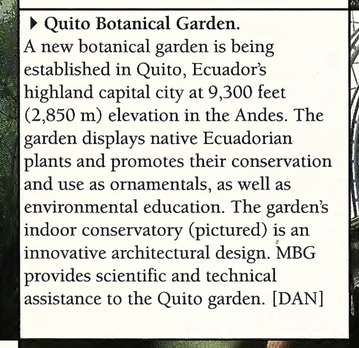
Quito Botanical Garden. A new botanical garden is being established in Quito, Ecuador's highland capital city at 9,300 feet (2,850 m) elevation in the Andes. The garden displays native Ecuadorian plants and promotes their conservation and use as ornamentals, as well as environmental education. The garden's indoor conservatory (pictured) is an innovative architectural design. MBG provides scientific and technical assistance to the Quito garden. [DAN]

Panama hats are hand-woven by master artisans in Ecuador. Each piece is a unique, flexible, and durable piece of art. The fibers come from the young leaves of the toquilla palm-like plant (*Carludovica palmata*) that grows in the Amazon and Coastal regions. In the 19th century the hats were exported through the port city of Panama, thus the name. Prices vary from less than ten dollars to more than a thousand depending on the texture. [PMJ]

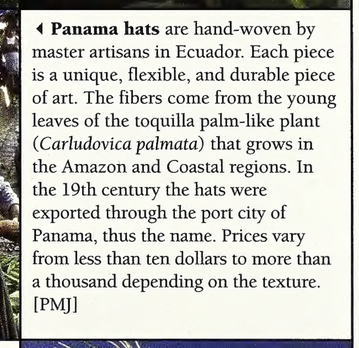
Galápagos tortoises are long-lived animals that can survive months without food or water. They were almost driven to extinction by buccaneers who used them as a source for fresh meat during long sea voyages. Later colonizers introduced plants and animals, threatening many of the native species. The Darwin Research Station and the Galápagos National Park carry out a successful reintroduction program along with a parallel program to eradicate introduced species. [NVW]



The countess's powders. *Cinchona pubescens,* quinine. Legend tells that in 1638 the Countess of Chinchón was cured of malaria using pulverized bark from a tree growing in presentday southern Ecuador. In 1753 Linnæus immortalized the name of Chinchón as *Cinchona*. The only known cure for 300 years, quinine was exported in tons, overexploiting the forests. Synthetic treatments were developed during World War II, sparing the trees, but even today the genus is rare. [CUU]



New species. Botanical exploration in the tropics is far from over. Every fourth day a new species of plant is being described from Ecuador. *Arnaldoa argentea* is an endemic species, recently described by MBG botanists who collected it in the southernmost part of the country. This new species also turned out to be a new generic record for the country, as the genus was previously known only from Peru. [JEM]



In memory of Dr. Fernando Ortiz Crespo, 1942–2001, Ecuadorian zoologist and ecologist whose teachings, support, and enthusiasm inspired a new generation of biologists and conservationists to be involved in research and preservation of Ecuador's immense biodiversity.

Research at the Missouri Botanical Garden

Plants are essential to sustaining the stability and quality of human life on this planet. Developing countries have 80% of the Earth's biodiversity, but less than one in 10 of the world's scientists. With operations in over 30 countries around the globe, the Garden is working for change. MBG botanists collaborate with local institutions in each country where they conduct research and field work, provide technical expertise, assist with fund raising, establish better communication with the worldwide scientific community, train botanists in the field and at MBG, and help to build infrastructure. The research division consists of 45 Ph.D. botanists assisted by 100 support staff and 32 graduate students. Studies concentrate on the plants of Meso- and South America, Subsaharan Africa, Madagascar, China, Vietnam, and North America. Individual MBG scientists are specialists in the plants of particular regions, in the systematics and evaluation of major plant families, and in the interactions between plants and people. The Garden serves as the headquarters from the Center for Plant Conservation and for several major collaborative publications, such as *Flora China* and *Flora Mesoamerica*. Visit our website: www.mobot.org.

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Greetings from

Sunny, scenic Ecuador. As the name implies, Ecuador lies across the equator. Situated in the northwest corner of South America, Ecuador can be divided into three geographic regions—the Amazon lowlands, the Andean highlands, and the coast. The Galápagos Islands, famed as the inspiration of Darwin's theory of evolution, are also Ecuadorian territory. Formerly part of the Inca empire, the country was colonized by Spain in the sixteenth century before gaining independence in 1822. The smallest country of the Andes, Ecuador is top ten when it comes to biodiversity. Dubbed a "megadiversity hotspot" by tropical ecologists, Ecuador boasts more than 16,000 species of native plants packed into a nation the size of Colorado, and new species are discovered nearly every two days. Efforts to conserve biodiversity have resulted in the establishment of 27 state-owned national parks and protected areas. Yet the problems of poverty, the pressures of population growth, and the misuse of natural resources continue to plague Ecuador. Researchers from the Missouri Botanical Garden work together with Ecuadorian botanists to apply their knowledge and train citizens to help in conservation, to stem the tide of destruction of natural forests, and to help restore habitats and repair ecological damage.

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