

CORDILLERA DEL CÓNDROR



John L. Clark



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BOTANICAL TREASURES BETWEEN THE ANDES AND THE AMAZON

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My four botanical companions and I had been hiking uphill for two days, ascending the steep slopes through epiphyte-laden cloud forests, toward the crest of the Cordillera del Cóndor in south-eastern Ecuador near the border with Peru. We emerged into the sunshine on a ridge with low shrubby vegetation. A thousand metres below us lay the Shuar village of Tinkimints, on the banks of the rushing Coangos River, with its palm-thatched houses surrounding the village's grass airstrip, soccer field and one-room schoolhouse. Before us, and still several hundred metres higher, was the flat-topped summit of this part of the Cóndor range, known to the Shuar as *Cerro Ijiach Naint* or Mountain of the Grubs. With us were nine Shuar companions, the entire able-bodied male population of Tinkimints, who were leading us to our destination and helping

us carry the gear, food for 10 days and plant-collecting supplies.

Raúl Pitiur, the leader of Tinkimints village, pointed to a waterfall that emerged from the vertical sandstone cliff face below the summit, and plunged 50 m into a pool below. "We have been to this waterfall many times before", said Raúl, and he explained the significance of waterfalls in the traditional Shuar male initiation rites. When a boy reached manhood, he was led by the elders to a place beside a powerful waterfall, where he was obliged to fast for several days and then ingest a mind-altering plant, *Brugmansia* (Solanaceae), well known to many indigenous peoples in tropical America for its hallucinogenic properties. Under the influence of the drug, the young initiate had a vision in which he gained strength and *arutam* or 'soul-power', from the power of the waterfall, and thus attained

the stature of an adult Shuar warrior. The waterfall before us had been the site for initiation rites for several generations of Shuar from Tinkimints.

The thunderous waterfall was truly an impressive sight, but my gaze drifted up to the summit of the mountain above. "What is above the waterfall?" I asked Raúl. "We have never been above the waterfall", he replied. So, with the help of our Shuar hosts, our group of botanists – José Manzanares, Paul Berry, Lou Jost,

▲ A fantastic richness of plants: (left to right), *Guzmania pearcei* (family Bromeliaceae), *Bejaria zamorae* (Ericaceae), *Besleria comosa* (Gesneriaceae).

▼ View from lower montane forest on the northeastern-most spur of the Cordillera del Cóndor. The Santiago River meanders through the vast plain of lowland Amazonia.





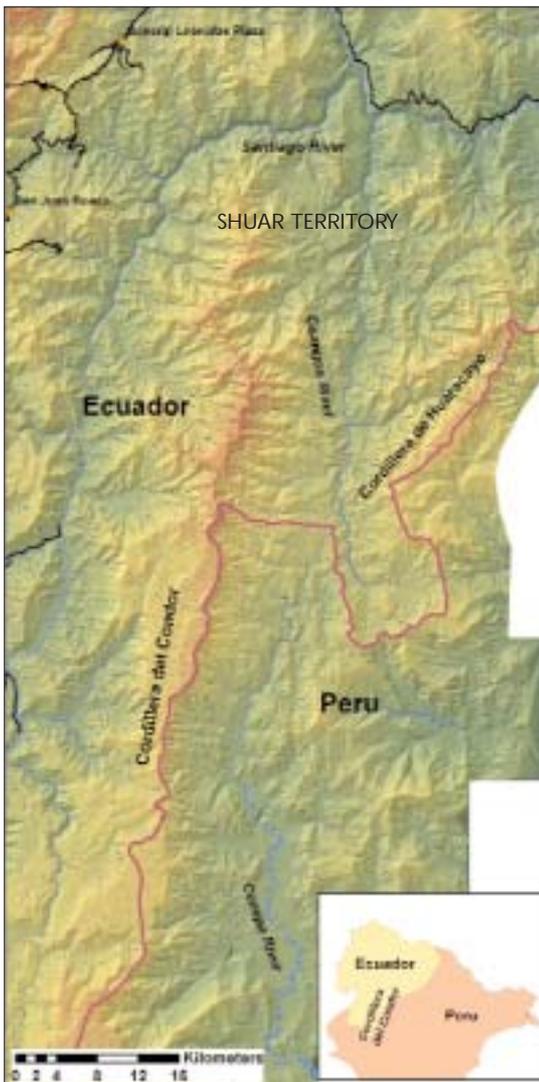
▲ (from left to right) *Axinaea* sp. (Melastomataceae), *Pitcairnia dodsonii* (Bromeliaceae), *Drymonia* sp. (Gesneriaceae).

All photos by John L. Clark

▼ The northern part of the Cordillera del Cóndor region, along the Ecuador-Peru border. The Cordillera extends 100 km further south.

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Betty Patterson and myself – climbed up the last cliff face, using ropes to aid our ascent, to the summit of Cerro Ijiach Naint, in search of botanical treasures. We were not only the first botanists to reach the summit on that day in March 2001, but with our hosts we were the first humans, in living memory at least, to set foot on that mountain top. The vegetation we found was a very dense, low scrub dominated by shrubs and treelets with small, thick sclerophyllous leaves; in particular, several species of *Clusia* were most abundant. Terrestrial orchids, such as *Sobralia ciliata* with its tall cane-like stems and showy purple blooms, flourished at the cliff-edge. As I struggled up the rock-face and emerged on the summit, I noticed a low shrub with clusters of small white flowers and was surprised to realize that it was a species of *Weinmannia* (Cunoniaceae) – a genus that is usually a tall canopy tree in Andean cloud forests. Our excitement was palpable as we made our way through the dense vegetation on the summit, making collections and photographing the plants. José and Betty searched for bromeliads, Lou for orchids, and Paul and I for whatever else we could find in flower or fruit. Several of the plant species found on that sandstone summit were new to science and have been published in botanical journals, and others are in the publication process.

An overlooked mountain range

Most educated people around the world have heard of the Andes Mountains and the Amazon Basin, and can point to



▲ *Weinmannia auriformis* (Cunoniaceae), a newly discovered species.

them on a map of South America. Relatively few people, however, realize that *between* the Andes and the Amazon there is a series of lower mountain ranges, separated from the main Andean chain by deep river valleys, and forming a discontinuous chain of cordilleras east of the Andes and at the western margin of the Amazon lowlands. These 'sub-Andean cordilleras' include, from north to south, the Cordillera de la Macarena in Colombia, the Galeras and Cutucú ranges in Ecuador, the Cordillera del Cóndor along the Ecuador-Peru border, and the Yanachaga and Cordillera Azul ranges in central Peru. The main Andes are composed mostly of volcanic and metamorphic rocks, but the sub-Andean ranges are largely made up of sedimentary rocks – limestones and especially sandstones. Igneous intrusive formations, with deposits of gold, copper and other minerals, also form part of these ranges.

Our field research in recent years seems to suggest that the sub-Andean cordilleras have certain geological and biological features that set them apart from the Andes and the Amazon, and they merit special attention. These mountain ranges are mostly remote and difficult to get to. They are also some of the last large areas on earth where numerous plant species



▲ (from left to right) *Guzmania gracilior* (Bromeliaceae), *Alloplectus panamensis* (Gesneriaceae), *Stilpnophyllum oellgaardii* (Rubiaceae). All photos by John L. Clark

still remain unknown to science and that are just beginning to be explored for their plant diversity. Recent explorations have also begun to reveal a fascinating and unexpected biogeographical connection between these ranges and the Guyana Shield area in north-eastern South America. Some genera once thought to occur only on the sandstone mountains of the Guayana region have now been found as disjuncts on the sandstone parts of the sub-Andean cordilleras, but not anywhere else in the Andean region. Botanical exploration is turning up many endemic plant species in these mountain ranges, species that occur in only one or a few of the sub-Andean cordilleras.

The Cordillera del Cóndor is the longest and tallest of the sub-Andean ranges. Situated along the border between Ecuador and Peru, it stretches about 150 km and reaches a maximum height of 2900 m. The precise location of the border in this region was in dispute between the two countries for more than a century, leading to armed conflicts in 1941, 1981 and 1995, and was only finally agreed in a treaty signed in 1998.

The Cóndor region is part of the ancestral homeland of the Shuar ethnic group. About 10% of the Shuar population of 80,000 people in Ecuador live in and near the Cordillera, in dispersed villages in the Coangos River watershed as well as along the larger Zamora, Nangaritza and Santiago rivers. The Shuar communities are organized politically into the Shuar Federation, which represents them on a national level in Ecuador.

Botanists from National Herbarium of Ecuador and Missouri Botanical Garden

began inventories of the flora of the Cordillera del Cóndor region in 1990, but for most of the 1990s border conflicts interrupted the work. We resumed fieldwork in 2000, with initial support from the National Geographic Society. With botanists from the universities of Loja in Ecuador and Trujillo in Peru, and with the cooperation of the Shuar communities, we are now exploring representative areas throughout the Cóndor region in both countries.

During 2002–2004, Fundación Natura, an Ecuadorian conservation organization, worked with the Shuar communities in the Cordillera del Cóndor region to help develop plans for conservation and sustainable development in the Shuar territory. The work included environmental assessments of the region, development of a computerized regional Geographic Information System (GIS) to aid in regional planning, and a series of meetings and workshops with the Shuar representatives. During the same period, Missouri Botanical Garden, with zoologists from the Wildlife Conservation Society, trained four young Shuar, together with four Awá from northwestern Ecuador, in the principles and methods of conservation biology as applied to their tropical forest homelands. The goal of this training programme, supported by the Liz Claiborne & Art Ortenberg Foundation, was to enable the four Shuar ‘parabiologists’ – Tuntiak Katan, Abel Wisum, Camilo Kajekai and Gilberto Tsuink – to serve their Federation and communities in programmes of environmental management and conservation of plants, animals and other natural resources.

A new protected area

The Shuar communities in the Cordillera del Cóndor region and their regional



J.M. Manzanares

▲ On a ridge at c. 1800 m, the vegetation changes from tall cloud forest below to very dense dwarf forest above.



J.M. Manzanares

▲ In a field camp in cloud forest, a team of botanists and Shuar parabiologists prepare plant specimens and press them in newspapers.

▼ Ecuadorian postgraduate botany interns, Shuar ethnobotanists and others in cloud forest on the ascent to the Cordillera del Cóndor crest.





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▲ *Pitcairnia bakeri* (Bromeliaceae), a new species of *Macrocarpaea* (Gentianaceae), *Sphryspermum lanceolatum* (Ericaceae).

▼ Dense, scrubby dwarf forest with trees just 3–5 m tall on flat-topped sandstone mountains at c. 2000 m. Many of the trees are local endemics.



▼ *Herrania cuatrecasana* (Sterculiaceae) is an unbranched, small treelet of the lowland Amazon forest with flowers along the trunk. It is a relative of the cacao (*Theobroma cacao*).



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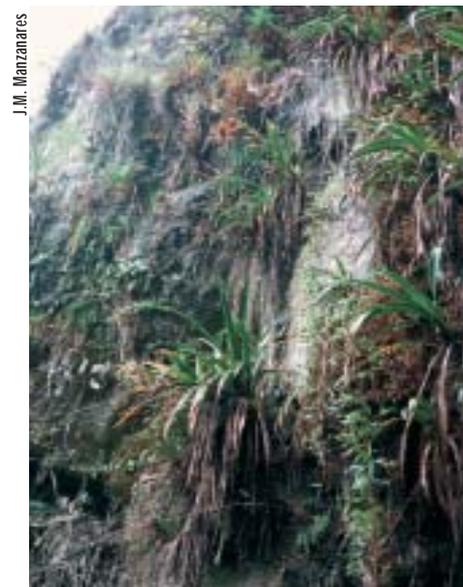
governing body, the Circunscripción Territorial Shuar Arutam (CTSHA), have decided to declare a large portion of their territory as a Shuar Indigenous Protected Area, to be administered as a biological reserve by the Shuar themselves, along the lines of a UNESCO Biosphere Reserve. In strictly protected 'core areas', harvesting of plants and animals, and other human extractive activities, would be prohibited; in the 'buffer zones', sustainable, non-destructive activities including traditional Shuar settlements, would be allowed. The proposed protected area is large, covering some 162,000 ha that includes the entire Coangos River watershed and 23 Shuar villages with about 4,000 people.

The Fundación Natura and Missouri Botanical Garden have now joined forces with the Shuar communities, to help make the Shuar Protected Area a reality. With participation of the trained Shuar parabiologists, we are helping the communities develop environmental management plans for each village. These plans will include land-use zoning and regulations for hunting, fishing and timber and plant harvesting to be adopted and implemented by all the communities. The Shuar parabiologists are helping to train six more young Shuar as 'community environmental monitors', who will assist in the implementation and monitoring of the management plans.

The proposed Shuar Protected Area has yet to be recognized officially by the government of Ecuador, but the concept of a nature reserve administered by the indigenous people that are the ancestral inhabitants and owners of the land, applying modern scientific principles and methods of conservation biology as well as the indigenous culture's traditional low-impact land use practices, is a model that could be used in many areas of the American tropics.

The prospects for conservation in the Cordillera del Cóndor, however, are clouded by the spectre of large-scale open-pit copper mining, which is being proposed by multinational mining companies who are also actively exploring the region. Portions of the Cóndor region, outside of the Shuar communities and outside the sandstone areas that are not mineral-rich, have been colonized by individual gold miners using primitive methods, including the use of environmentally hazardous mercury to purify the gold ore. Copper mining, if carried out in the region, would be on a much larger scale, and would have an impact on larger areas. One area where a multinational company is advancing plans for copper mining is outside the Shuar territory in the Cóndor region; if Ecuador's Ministry of Petroleum and Mining approves the plans, an open-pit copper mine covering hundreds of hectares may be opened in the coming years. Another area where copper mining is still in the exploratory stages, however, is in the heart of the proposed Shuar Protected Area, near the village of Warints in the Coangos River

▼ *Pitcairnia bakiorum* (Bromeliaceae), a new species discovered and published by José Manzanares, is known only from this population growing on the bare sandstone cliff beside a waterfall on Cerro Injiach Naint.



J.M. Manzanares

valley. An open-pit mine in this area, with its associated roads and other infrastructure, would have a huge environmental impact in the Shuar territory. Although the Shuar government (CTSHA) opposed copper mining developments in their territory, the below-ground mineral rights belong to the state, not the communities or individual land-owners, so the final decision on whether to develop copper mines in Shuar territory is up to the government of Ecuador.

Continuing plant exploration

Meanwhile, we continue to explore the Cordillera del Cóndor for its plant diversity. During the next three years, we intend to cover as many areas as possible in the Peruvian portion as well as in Ecuador, to collect herbarium specimens and make them available for study. This work – supported by grants from the US National Science Foundation and the Taylor Fund for Ecological Research – involves botanists from Missouri Botanical Garden, the National Herbarium of Ecuador and the universities of Loja in southern Ecuador and Trujillo in northern Peru, as well as the Shuar parabiologists, and the Shuar government and the communities in the Cóndor region.

We are still a long way from a thorough knowledge of the plants of the Cóndor region. Many of the new species described since our first visit in 1990 are still known from only one locality. The island-like pattern of the sandstone areas surrounded by non-sandstone substrate suggests that some species may be restricted to a single sandstone mountain top; others may occur on numerous sandstone ‘islands’ within the Cóndor, while yet others extend further south to the Cordillera Azul and other sandstone mountains in central Peru. We can only make a wild guess as to the total number of flowering plant species in the Cóndor region.

One botanist who has visited the Cordillera, Robin Foster of Chicago’s Field Museum of Natural History, has written that the Cóndor region may have the “richest flora of any similar-sized area anywhere in the New World”. We believe that it undoubtedly has one of the highest concentrations of flowering plant

species yet unknown to science of any place on Earth. We have documented about 3,000 species of vascular plants in the region, and species new to science are being published each year as taxonomic specialists work through the specimens we’ve collected.

Although our plant explorations in the region are still very preliminary, some patterns of the distribution of the vegetation and flora on the sandstone and non-sandstone parts of the Cóndor region are beginning to emerge. The sandstone areas occur as island-like fragments ranging from a few hectares to tens of thousands of hectares in size, at elevations from 300 m in the lowlands to the summits of the Cordillera del Cóndor at nearly 3000 m, within a matrix of non-sandstone, igneous or limestone substrates. The flora of the sandstone fragments, therefore, can be studied using the concepts of island biogeography.

At about 1000 m elevation, the forest on sandstone is very dense and low, with pole-like small trees forming a canopy only 6–10 m tall. The dominant tree species of the sandstone forest, it appears, are genera that are absent from anywhere else in the Andes or the sub-Andean cordilleras, but are disjunct from the vast sandstone areas of the Guyana Shield region: *Digomphia* (Bignoniaceae), *Pagamea* (Rubiaceae) and *Stenopadus* (Asteraceae). The non-sandstone forest at 1000 m elevation, in contrast, is more open, with much larger, taller trees forming a canopy of about 25 m, and the forest is much more diverse with tree genera and species that are typical of the lower, eastern slopes of the Andes and adjacent areas of the upper Amazon basin.



▲ The upper Nangaritza River in the southern part of the Cordillera.

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At 2000 m, the patterns of flora and vegetation on sandstone vs. non-sandstone substrates are quite different. The sandstone outcrops at this elevation have a dense, low scrub-like vegetation, about 3 m tall, with a few emergent palms and tree ferns. Some of the shrubby dominants in this vegetation are locally endemic species of genera that normally form tall trees in the canopy of Andean cloud forests, such as *Weinmannia* (Cunoniaceae) and *Clethra* (Clethraceae); on the sandstone table mountains, these same genera form dwarf, shrubby plants with very small, thick leaves – evidently an adaptation to the nutrient-poor sandstone substrate and very wet climate of the mountain tops. The non-sandstone forests at 2000 m in the Cordillera del Cóndor, on the other hand, resemble the typical cloud forests of the nearby eastern slopes of the Andes at the same elevation.

We have not yet managed to reach the sandstone fragments at the highest elevations – nearly 3,000 m – but our team of botanists and Shuar parabiologists hope to climb these areas in the coming year and discover yet more botanical marvels of the Cordillera del Cóndor. ○

David Neill (left) is a curator of Missouri Botanical Garden, and honorary curator of the National Herbarium of Ecuador. He has lived in Ecuador and studied the flora there since 1985.

The growing list of the flora of the Cordillera del Cóndor is posted and updated on Missouri Botanical Garden's website, at: <http://mobot.mobot.org/W3T/Search/Ecuador/projsdc.html>