



## FIELD STATION PROFILE

### A HIDDEN GEM IN THE TUMBESIAN DRY FOREST IN SOUTHERN ECUADOR: ESTACIÓN CIENTÍFICA LAIPUNA

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#### NAME OF FIELD STATION

Estación Científica Laipuna, ECLP

#### GEOGRAPHIC LOCATION

- Ecuador, Province Loja, Andean region
- Lat 4°12'37"S (-4.210492) Long 79°53'12"W (-79.886800), 600m a.s.l. (WGS84)

#### RESEARCH AREA

The Laipuna reserve is located in southern Ecuador in the region of Macará and covers 2562 hectares of Tumbesian Dry Forest (Figure 1). The premontane semi-deciduous forest has been managed since 2002 as a private forest reserve by Nature and Culture International (NCI). In addition, the reserve is part of the UNESCO Bosques de Paz Transboundary Biosphere Reserve. The reserve is bordered by the Catamayo River and the villages Canguraca, Naranjito, Tangua and Numbiaranga. Laipuna reserve is characterized by steep slopes with an elevational gradient ranging from 480 to 1500 m a.s.l. The region is characterized by strong seasonality with a rainy season from January to mid-May (Figure 2) with higher elevations receiving more moisture input than lower elevations (Pucha-Cofrep et al. 2015; Spann et al. 2016). The annual mean air temperature is 24.2°C and the average annual rainfall is 441 mm (at 590 m asl). During the dry season-high leaf litter fall occurs. The whole reserve is surrounded by a fence to keep out farm animals. The landscape around the Laipuna reserve is characterized by Tumbesian dry forest (private ownership or under management by the Environmental Ministry MAATE = Ministerio del Ambiente, Agua y Transición Ecológica)

and diverse agricultural areas, with the latter covering, in particular, the higher slopes. Prevalent agricultural systems include pastures for ungulates as well as maize and bean fields. Some farmers still follow the multi-crop milpa system in which maize is intercropped with beans and squash. In recent years, extensive gold mining has also been performed along wide stretches of the riverbed of the Catamayo river.

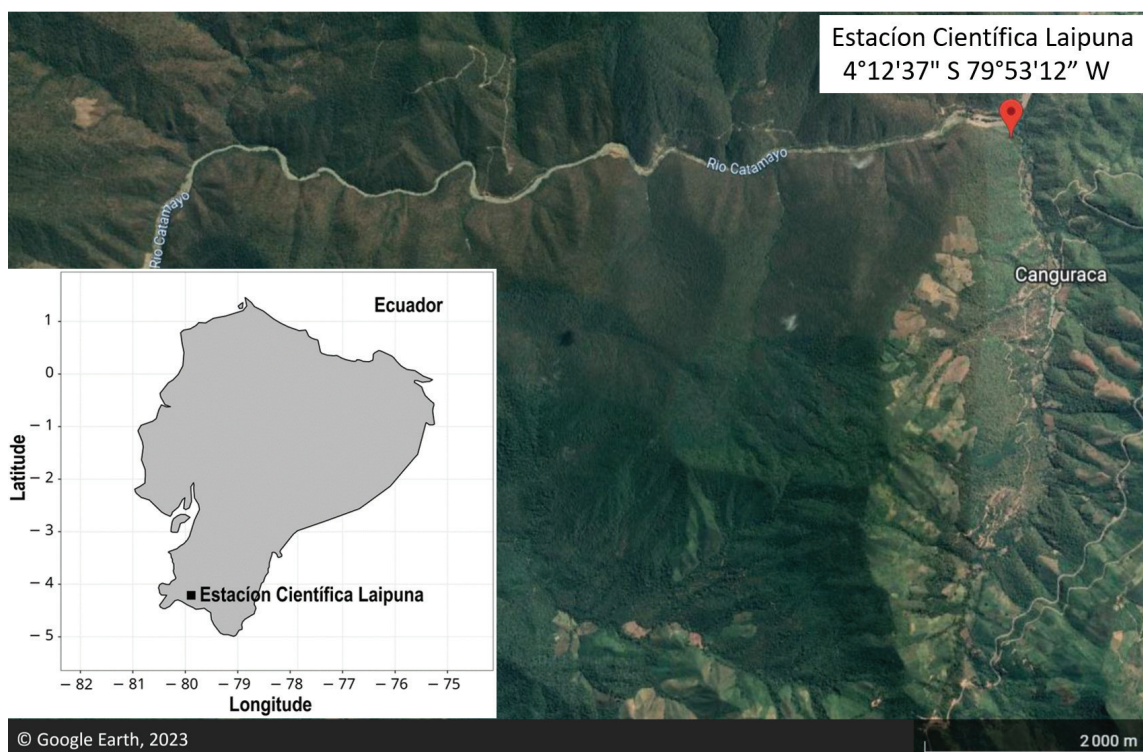
#### FAUNA

According to NCI, 115 bird species have been recorded of which 39 species are endemic. Species such as *Brotogeris pyrrhoptera*, *Synallaxis tithys*, *Syndactyla ruficollis* and *Lathrotriccus griseipectus* are categorized as Vulnerable by the IUCN (2022). In terms of amphibians and reptiles, *Prostherapis tricolor*, *Pristimantis lymani*, *Leptodactylus labrosus*, *Physalaemus pustulatus*, *Ameiva edracantha* and *Callopistes flavipunctatus* are endemic to southwestern Ecuador (Aguilar 2008). Regarding mammals, deers, anteaters, puma, squirrels, ocelots, foxes, anteaters, and opossums are iconic animals of the Tumbesian dry forest (Aguilar 2008). Among these, *Sciurus stramineus*, *Artibeus fraterculus*, *Eumops glaucinus*, *Eumops bonariensis* and *Lycalopex sechurae* are endemic to the Tumbesian region (Aguilar 2008).

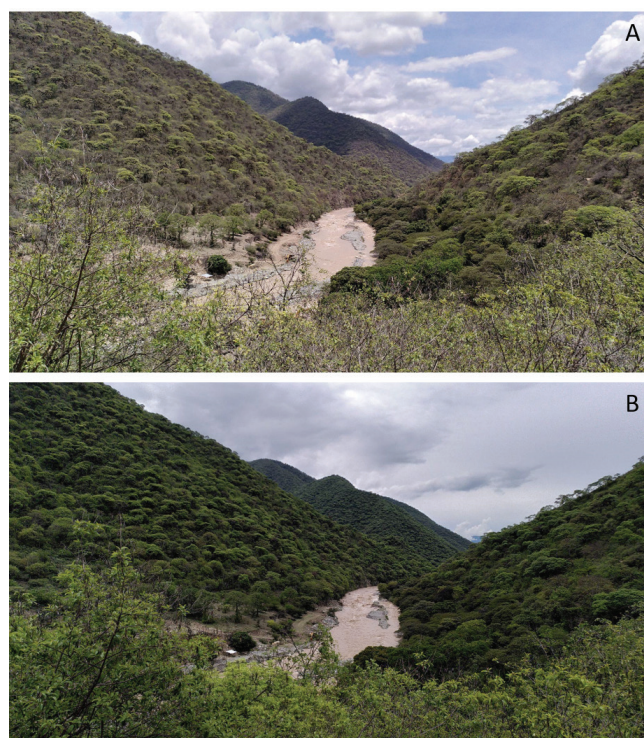
#### FLORA

The Laipuna reserve is characterized by high levels of endemism and plant diversity. The thorny dry forest harbors about 80 tree species of which most are deciduous. Among the more than 30 tree families present in the dry forest, Fabaceae (15 species) is by far the most species-rich, other important families are Moraceae (4 species) and





**Figure 1.** Map of Ecuador (left corner) with the location of Laipuna reserve indicated with a square. Map of Laipuna reserve in the background with the location of Estación Científica Laipuna indicated with a red pin. Map data from © Google Earth, 2003.



**Figure 2.** Tumbesian dry forest across seasons with Catamayo river at the beginning of March (A) and in April (B). © Annemarie Wurz

Capparaceae (3 species). The most abundant tree species in the lower elevation forests (below 900 m) are *Bursera graveolens*, *Eriotheca ruizii* and *Ipomoea wolcottiana*, whereas *Handroanthus chrysanthus*, *Fulcaldea laurifolia* and *Terminalia valverdae* are common in the upper elevation forest (above 900 m). There are 350-650 stems (dbh  $\geq$  10cm) /ha and the basal area reaches 18-27 m<sup>2</sup>/ha. Trees rarely reach heights of more than 20 m. Tree species richness increases from 14-19 species/ha in the dry lower elevation forest to 28-35 species/ha in the moister upper elevation forest. In addition, cacti from the genera *Opuntia* and *Armatocereus* are abundant.

#### ACCESS, INFRASTRUCTURE, AND FEES

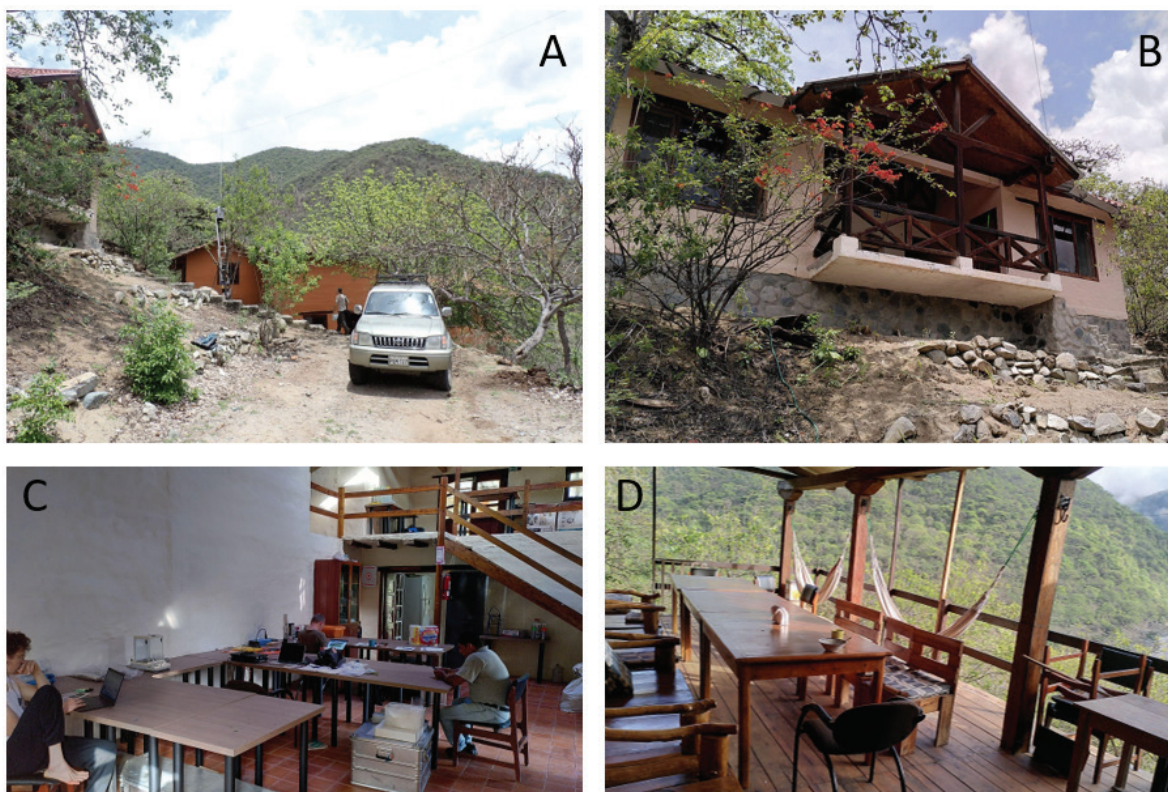
The Estación Científica Laipuna is situated at a lower slope of the Laipuna reserve at ~600 m.a.s.l. close to the Catamayo river and the Canguraca stream (largely dry most of the year). Canguraca village is a 5min drive away from the station. By car, the research station can be reached via the Panamericana (E35) from Macara in ~40 min (~30 km distance) and Loja in ~3 h (~160 km distance). The “Cooperativa de Transportes Loja” offers cheap (\$8) bus connections from Loja to Laipuna (get off at the Canguraca bus stop;



Lat -4.215846, Long -79.881109). From the bus stop, the research station is a ~45min walk or ~15min drive away. The station was built in 2009 and extended later on and consists of two clay-made houses. The main building is a two-storied house with a spacious multi-functional room with multiple tables, an elevated office space, a kitchen (equipped with one indoor and one outdoor gas stove as well as an outdoor oven), and three sleeping rooms (mostly bunk beds) which can accommodate a total of 10 people (Figure 3). The main building also includes three toilets with showers, a storage room, and a two-person bedroom for kitchen staff. The second building was added a few years after the inauguration of the main building and can accommodate an additional 10 people. Two additional toilets with showers can be found there. Overall, the station can accommodate a maximum of 22 people. A spacious outdoor terrace of the main building offers space to eat and work outside with a direct view of the Catamayo river. The research station is currently connected to high-speed internet and WLAN works at both buildings. Running tap water is provided via tanks. There are no washing machines available. An economic usage of water is recommended. Kitchen staff and drivers can be organized with the help of the nearby villages.

### Facilities in the field

Trails provide access to the forest at various elevational levels. On steep paths, ropes have been installed for support. Six forest plots measuring 100 m x 100 m have been established by the DFG Research Unit 2730 RESPECT (Environmental changes in biodiversity hotspot ecosystems of South Ecuador: RESPonse and feedback effECTs). Three of these forest plots are located at ~600 m a.s.l. and an additional three at 1200 m a.s.l. On all of these plots, trees have been tagged and identified as well as plots have been marked with a rope grid system consisting of 25 subplots. Trails to these plots have been color-marked. One canopy tower each with a platform at 30 m and 35 m height, respectively, has been installed at one forest plot at 600 m and another one at 1200 m. The tower at 600 m is connected to electricity and the one at 1200 m has solar power. They are both equipped with diverse meteorological devices for measuring atmospheric variables such as air temperature, solar radiation, and wind. At the lower tower, an Eddy covariance station allows for measuring fluxes between the canopy and the atmosphere. The higher tower is equipped with two levels of standard meteorological sensors. Three climate-hydro stations have been established on a 600 m



**Figure 3.** Station setup: View on the main building, parking space and second building of Estación Científica Laipuna (A); Front of the second building with front terrace (B); Multi-purpose room of the main building with maisonette building structure (C); Big terrace with view on Catamayo river for eating, working and relaxing (D). © Annemarie Wurz

and 1200 m pasture as well as on a peanut field close to the research station.

### Administration and staff

The station is owned and managed by the US-Ecuadorian NGO Naturaleza y Cultura Internacional (NCI). The closest office of NCI is located in Loja, Av. Pío Jaramillo A. 13-120 y Venezuela, Loja – Ecuador (URL: <http://www.naturalezaycultura.org>, e-mail: [nciecuador@naturalezaycultura.org](mailto:nciecuador@naturalezaycultura.org)). The station manager Pedro Paladines is supported by the station and forest ranger José Acaro who supports researchers in the logistical organization of their research.

### STATION FEES (US \$)

The booking of the station costs \$35 per person and day and includes an overnight stay, workplace, and access to the reserve.

### LEGAL REQUIREMENTS

Ecuador is part of the Nagoya Protocol of the Convention on Biological Diversity (CBD). Thus, the collection of genetic resources has to comply with the benefit-sharing standards listed in the Nagoya Protocol and has to be granted by the Ministry of Environment (MAATE). In addition, the National Biodiversity Institute (Instituto Nacional de Biodiversidad, INABIO) is handling applications for biological research including the transportation and export of samples. Before research, negotiations with INABIO are recommended to certify your research as academic and non-commercial. For genetic analysis of biological material, an additional permit is necessary. It is recommended to start any kind of permit application at a good time ahead of the planned start of data collection, export, and sample processing.

### KEY RESEARCH

Since the establishment of the research station, largely German research projects in collaboration with the local Universities (Universidad Técnica Particular de Loja UTPL, Universidad Nacional de Loja UNL, Universidad de Azuay UDA, Universidad de Cuenca UC) have performed research in Laipuna. The main research focus in Laipuna in the past has been botany with diverse studies on tree diversity (Graefe et al. 2020), tree growth (Pucha-Cofrep et al. 2015; García-Cervigón et al. 2020), tree physiology (Butz et al. 2018), forest disturbance (Moreno et al. 2016; Graefe et al. 2020) and small-scale farming (Moreno et al. 2016). The current research within the framework of the DFG research

unit 2730 RESPECT (Bendix et al. 2021) is focusing on land-use change, ecosystem functioning (herbivory, predation, seed dispersal), forest dynamics, tree regeneration, plant functional traits, root physiology, water and carbon fluxes, hydrological processes, and soil properties.

### SELECTED PUBLICATIONS

- Bendix J, Aguirre N, Beck E, et al (2021) A research framework for projecting ecosystem change in highly diverse tropical mountain ecosystems. *Oecologia* 195:589–600. <https://doi.org/10.1007/S00442-021-04852-8/FIGURES/7>
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### Links

<https://www.natureandculture.org/protected-areas/biosphere-reserves-ecuador/>

<https://www.natureandculture.org/directory/ncis-work-supports-creation-of-ecuadors-6th-unesco-biosphere-reserve/>

### Contact

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- Pucha-Cofrep D, Peters T, Bräuning A (2015) Wet season precipitation during the past century reconstructed from tree-rings of a tropical dry forest in Southern Ecuador. *Glob Planet Change* 133:65–78. <https://doi.org/10.1016/J.GLOPLACHA.2015.08.003>
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## ACKNOWLEDGEMENTS

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