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Distribution of Terrestrial Bromeliads along the La Paz to Caranavi Road in Bolivia

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Illustrations by the Author

A drive along the road from La Paz to Caranavi is certainly one of the most exciting trips in the world. Along a 150 km (90 miles) stretch of road, one can observe nearly all tropical Andean vegetation zones in a period of just 6 hours while descending more than 4000 meters (13,100 feet) along the Cordillera Real. A striking element of the vegetation in the area is the high number of terrestrial bromeliads of the genera *Fosterella*, *Greigia*, *Pitcairnia*, and *Puya*. During several trips along this way between 1997 and 1999, I had the opportunity to observe 21 species of bromeliads and took notes on their distribution and flowering characteristics.

Beginning the trip in the city of La Paz, one can observe the beautiful blue-flowered *Puya meiziana*. Some ragged plants of *P. ferruginea* can also be seen along the streets of the urban area itself. Eroded slopes in the same vicinity are home to *Tillandsia sphaerocephala*, an "atmospheric" species with pink bracts and purple flowers. Upon leaving the world's highest capital city at about 3800 m (12,540 ft), the road passes through *puna* grasslands until reaching "La Cumbre." At 4650 m (15,345 ft), this is the highest point along the road. From here you have a spectacular view of the nearly 5400 m (17,820 ft), surrounding, snow-covered mountain tops. Along this pass, the landscape seems to be composed mostly of barren rock, but *Puya fosteriana*, with its 1.5 m (5 ft) tall, thick-cylindrical inflorescences, and another, unidentified species of *Puya*, with its smaller, club-shaped inflorescence, appear as dwarves in the distance. Both of these species are characterized by their spinose-serrate leaves that form a dense rosette. Their flowers are surrounded by dense woolly scales, which probably help protect them against the frigid night temperatures.

After the pass, one begins to drop again in elevation as the road descends into a series of seemingly endless switch-backs. Here the slopes become dominated more and more by grasses (*Stipa spp.*, *Festuca andicola*) and small shrubs (*Baccharis ssp.*, *Brachyotum microdon*) that are typical elements of the unique Andean vegetation called *páramo yungeño*. Passing Pongo, a small village at 3800 m (12,540 ft), always a good place to get some fresh trout, there are big stands of *Puya riparia*. This species is quite variable in size, having arching inflorescences from 40 cm to 1.5 m long. Its large, more or less secund (1-sided) flowers are bluish-green and have orange colored anthers that stick out beyond the petals. The flowers are open during the day and provide large amounts of nectar for pollinating hummingbirds. The next "must stop" point is Unduavi, the coca control station at 3300 m (coca is the plant from which cocaine is made). In this area, the vegetation has changed again, this time to a

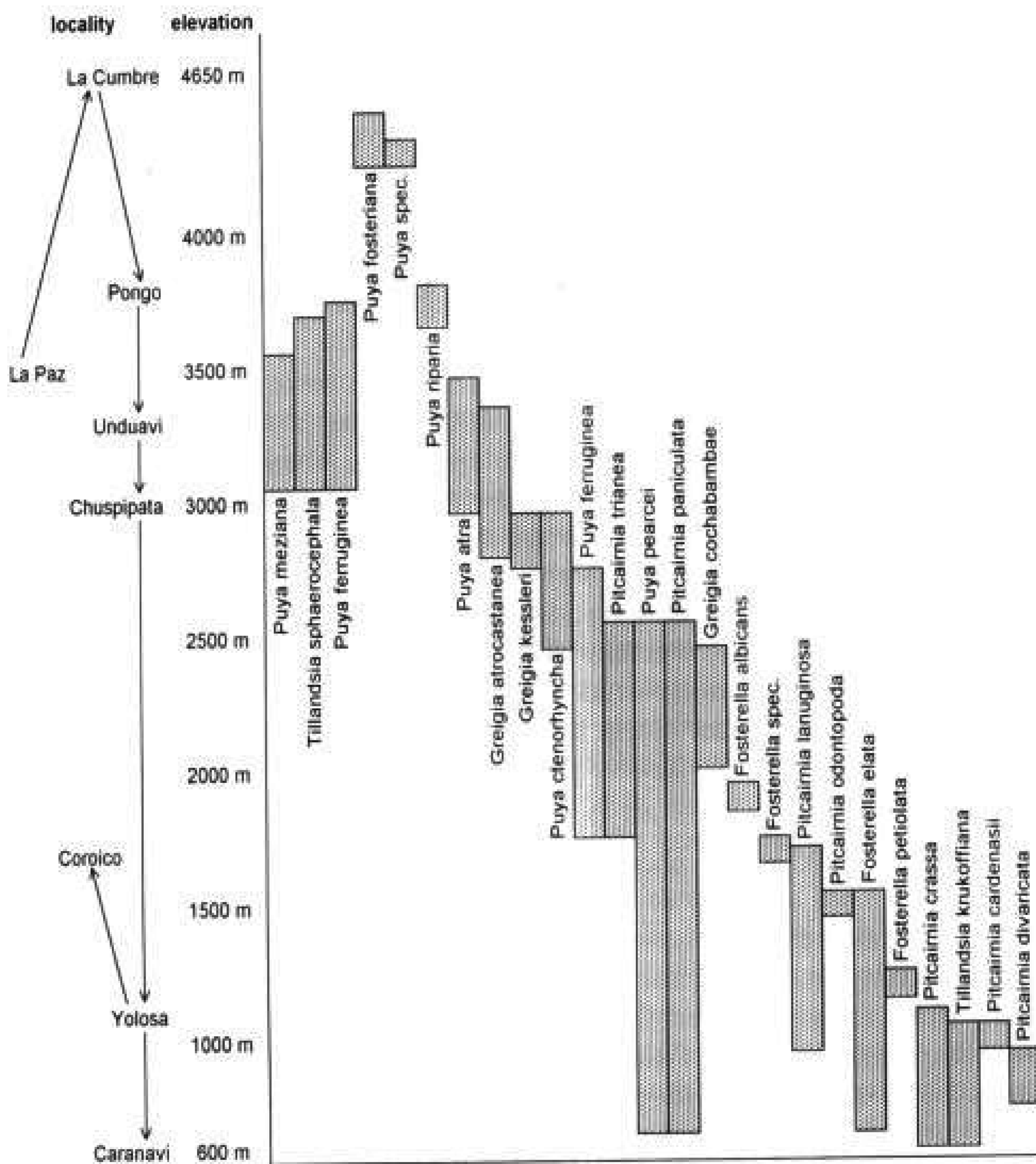
cloud forest characterized by small trees between 10 and 15 m tall (*Weinmannia* spp., *Podocarpus* spp., *Juglans boliviana*, *Alnus acuminata*) that are festooned with mosses and ferns. Here, in the understory, I found two recently described species of *Greigia*: *G. atrocastanea* and *G. kessleri*. Both of these species have stems to 1.5 m long that are covered by the old leaf sheaths, and have lateral inflorescences with pink to purple flowers. No pollinator observations could be made with the *Greigia* species: the flowers are open during the day but are hidden deeply in the axils of the big rosettes, so that hummingbird pollination seems unlikely. Another bromeliad at this altitude, growing along the rocky roadside, is *Puya atra*. This species is about 2 m tall in flower and has a dense white-woolly inflorescence and yellow-green flowers.

Near the few houses of Chuspipata, the paved road turns into a small, bumpy dirt road. There are no crash barriers so the precipice right along the edge of the road is always visible and threatening. Because of many accidents in the past, the government has converted the section up to Yolosa into a one way road. So, during the first half of the day, all traffic goes down, and in the afternoon and at night, the other way.

Continuing downwards, the vegetation becomes more luxuriant with every 100 m of vertical elevation loss. Below 3000 m, the first tree ferns (*Cyathea* spp., *Alsophila* sp.), as well as some epiphytic bromeliads (*Tillandsia ionochroma*, *Racinaea seemannii*) appear. On wet slopes at this elevation, *Greigia atrocastanea* and *G. kessleri* are accompanied by two species of *Puya*, *Puya ctenoryncha*, which forms big stands with its large, protruding, white-woolly inflorescences and showy yellow-green flowers, and *P. ferruginea*, with branched inflorescences to 4 m tall. The flowers of *P. ferruginea* are up to 14 cm long (5 1/2") and cream-colored. Although these flowers are odorless, I observed bats visiting the widely opened flowers at night to collect the large amounts of nectar that the flowers produce. After dawn, the petals hang down and close together.

At about 2500 m, the upper extent of the montane forest can be observed. Here, you can see a variety of trees between 15 and 20 m tall forming a dense canopy, and small palms (*Geonoma* spp.) growing in the understory. In disturbed areas in this region, the tropical montane forest is replaced by smaller trees of the family Melastomataceae and the ubiquitous *Cecropia* or "trumpet tree". Also here, the yellow flowered *Pitcairnia trianae* is abundant, forming a beautiful display of 2 m tall inflorescences during October and November. Less conspicuous is *Greigia cochabambae*, which replaces the two other *Greigia* species in this zone. The big rosettes of this plant are concealed among the dense roadside vegetation and are nearly always covered with mud.

Below 2000 m, the temperatures begin to approach a "tropical level" and the road becomes more and more dusty. Coroico, a small tourist town, appears at the horizon. Little natural vegetation remains here. For centuries, people have



burned the forests to clear the land for the cultivation of bananas, citrus, and coca. Erosion has long since washed much of the soils away so that today the hills remain covered with poor grasslands. These changed conditions have led to the disappearance of the common *Puya ferruginea* and *Pitcairnia trianae* at about 1800 m, allowing other, more widespread bromeliad species to take their place, especially *Pitcairnia paniculata* with its shining red flowers, and the purple-cream flowered *Pitcairnia lanuginosa*. Both of these latter species are pollinated by hummingbirds.

Three species of *Fosterella*, *F. albicans*, *F. petiolata* and one unidentified species were each found only once in small populations and seem to be rare. All three of these species have entire, rosulate leaves and tiny white to green flowers that are probably pollinated by insects or are possibly wind-pollinated. Only one of the species of *Fosterella*, tentatively identified as *F. cf elata* was observed more than once, in the 1500 down to 700 m submontane zone. This species, however, is easily seen due to its flat rosette of succulent leaves, whereas the other species have less-conspicuous rosettes.

Leaving Yolosa at 1200 m, the driver must be instructed to stop looking for bromeliads, since from here on, all traffic going downhill must drive in the outside lane, as vehicles going up the mountain have the right-of-way to hug the mountainside on the inside lane. Consequently one had better not watch too closely for bromeliads! However, this is not as unfortunate as it might seem because the clearing of roadside vegetation associated with road construction has not left many bromeliads anyhow.

From about 1000 m elevation, nearly as far as Caranavi, the road runs parallel to the canyon formed by the Coroico River. Here, the roadsides are covered by *Puya pearcei*, a species with 1 m tall inflorescences and blue-green flowers, and *Pitcairnia crassa*. The latter is an impressive plant with a dense, simple inflorescence to 1.5 m tall, and large cream-colored flowers. The flower color, and the fact that the plants offer nectar only after dusk, provide a good indication of pollination by bats. On steep rocky slopes of the canyon in this area, *Tillandsia krukoffiana* is seen. This is a large tank bromeliad with wide leaves that grow to 1 m long. This species has an ample inflorescence at least 2 m tall and large purple flowers.

In summary, while traveling along the road from La Paz to Caranavi the author observed 21 species of terrestrial bromeliads. Three more *Pitcairnia* species, which I did not see, were collected by Kessler (*P. cardenasii*), Beck (*P. divaricata*), and Pearce (*P. odontopoda*) and must also be added to the total, resulting in 24 species in five genera: *Fosterella* (4), *Greigia* (3), *Pitcairnia* (7), *Puya* (8), and *Tillandsia* (2).

The diagram on page 160 shows the distribution of all of the species observed. The upper zone of the region traversed (3100\ 4500 m) is dominated by 6 species of *Puya*. Two species of *Puya* and two of *Greigia* have been found to

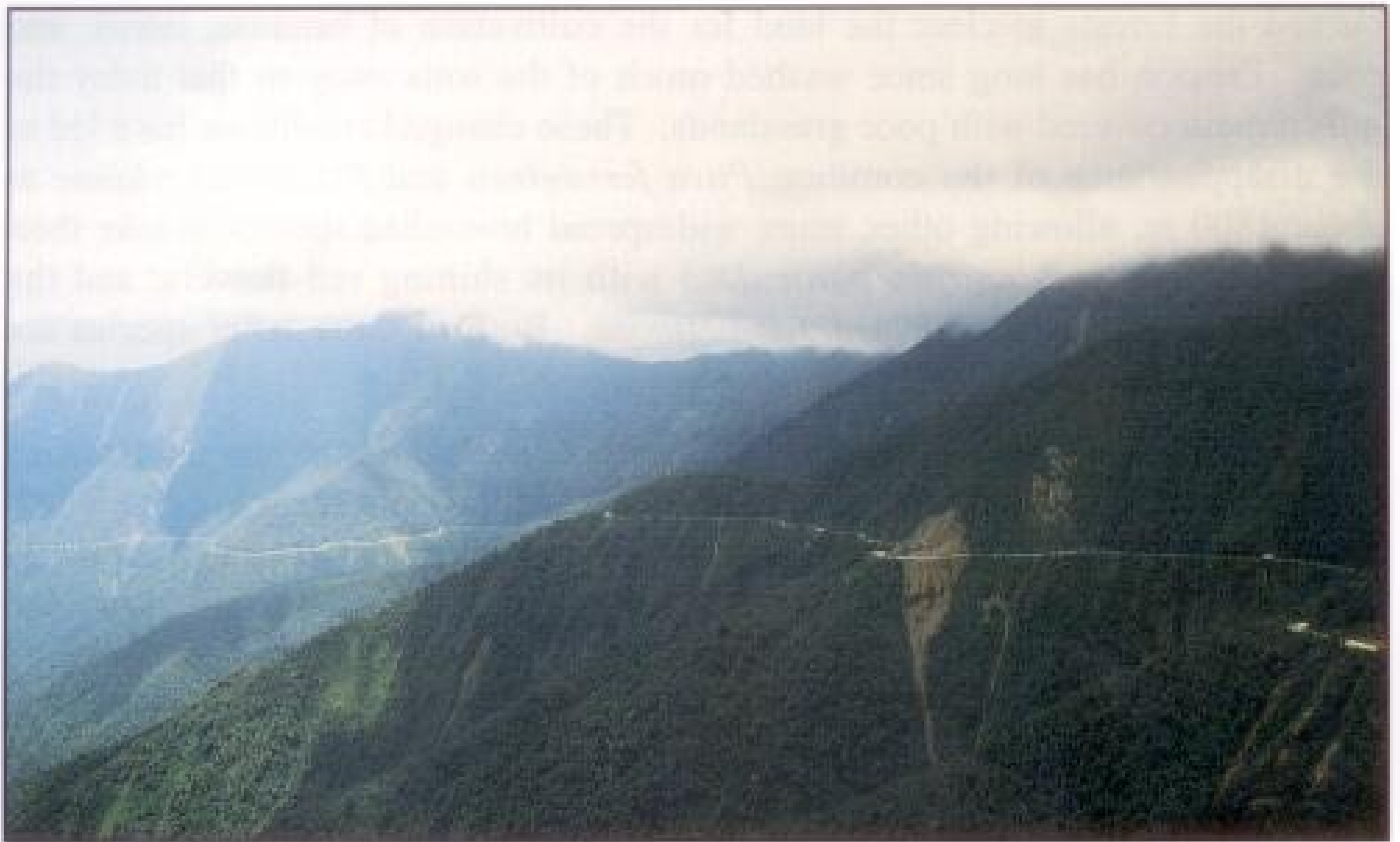


Figure 7. Road from La Paz to Caranavi in Bolivia. View from Chuspipata.



Figure 8. Flowers of *Puya riparia*.



Figure 9. *Puya atra* in habitat.



Figure 10. Inflorescence of *Puya ctenorhyncha*.

2600 m. The montane forest zone (1500\ 2500 m) contains the highest number of species (10) and four genera with *Pitcairnia* and *Fosterella* taking the place of higher altitude *Puya*. Below 1500 m and up to Caranavi there are nine species and also four genera: *Pitcairnia* is still the dominant genus and *Greigia* is replaced by *Tillandsia*. The high number of terrestrial species along just this short 150 km stretch of road indicates the importance of this group for the bromeliad diversity of Bolivia: counting a total of 28 1 species, about 33 % belong to the genera *Fosterella*, *Pitcairnia* and *Puya* (Krömer et al. 1999). These three genera also comprise more than 50 % of the country's endemic bromeliads. Only the large genus *Tillandsia* can compete with this.

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La Paz, Bolivia