Plant Formations in the Central Andean BioProvince

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Central Andean Puna (general)
UNESCO described the puna as an entire phytogeographical area comprising the vegetation of both the altiplano and the neighbouring mountain slopes. It is generally described as dry highland vegetation of the Central Andes, while its northern counterpart, the paramo, is generally regarded as wet highland vegetation of the Northern Andes. Nevertheless, puna can still be broadly divided into dry, moist and wet puna. Grasses such as *Deyeuxia*, *Festuca* and *Poa* typically dominate, with prevalence in the dryer areas of *Festuca orthophylla* and several species of *Stipa*. Low standing grasses of *Muhlenbergia* and *Distichlis humilis* together with halophytic shrubs cover much of the extended salt plains, while local fresh water cushion peat bogs or fens (bofedeales or ciénagas) are dominated by the plant families Juncaceae, Cyperaceae and Asteraceae. Few trees besides *Polylepis* and *Buddleja* are present today.

Central Andean Dry or Tola Heath Puna
Found at elevation ranging from 3,500-5,000 m, the rainfall in these zones is very seasonal with dry seasons lasting up to eight months. This unique vegetation extends from the Peruvian Western Cordillera crossing the central altiplano in northern Bolivia and then gets restricted to the eastern edge of the altiplano in southern Bolivia. The sparse vegetation is typically dominated by shrubs up to 1 m high often characterized by tola (*Parastrephia lepidophylla*), but there are also small stands of *Polylepis*, the only arborescent genus that occurs naturally at these high elevations. Vast areas are also covered by bunch grasses, typically dominated by *Festuca orthophylla* especially in the slightly wetter areas, and cushion plants may also be present. Other typical plant genera include *Aciachne*, *Adesmia*, *Margyricarpus* and *Tetraglochin*, and there are various species of Andean camelids. All of the flora and fauna are highly adapted to the extreme conditions.

Central Andean Moist Puna
This seems to be synonymous with humid or grass puna, which covers vast areas from central Peru, where it spans the entire width of the Andes, to the central parts of the Bolivian altiplano where it is confined to a northerly exposed zone adjacent to montane forest. The zone widens again near Santa Cruz but then gradually disappears north of Tarija. The vegetation has well developed ground cover and largely consists of tussock grasses of the genera *Calamagrostis*, *Festuca* and *Stipa*. In between the tussocks are various delicate grasses and herbs. Also present are various rosette plants and cushion plants of the genera *Azorella*, *Aciachne*, *Distichia*, *Plantago* and the endemic *Pycnophyllum* (Caryophyllaceae). Cacti are generally rare but large cushion of the wooly *Tephrocactus lagopus* and *T. floccosus* can be conspicuous. Around the margins of Lake Titicaca, the humid puna is characterized tussocks of *Stipa ichu* and *Festuca* together with various species of *Baccharis*, while the mountainous hinterland includes low bushes of *Adesmia miraflorensis*, *Calceolaria parvifolia*, *Mutisia orbignyana*, *Satureja boliviana*, *Tetraglochin cristatum* and several species of *Senecio*.

Central Andean Wet Puna
Wet puna is mainly found in northern Peru, where it is influenced by moist air from both the Amazon Basin and the Pacific Ocean, and along the Eastern Cordillera, where most of the moist air comes from the Amazon Basin. On the altiplano it occurs at elevations ranging from 3,700 to 4,200 m. On the Eastern Cordillera the vegetation is characterized by
several species of *Cortaderia*. Between the tussocks there are often other grasses, sedges and low-growing forbs, together with ferns such as *Jamesonia* and lycopods such as *Lycopodiella*. Mosses and lichens are also common.

**Central Andean Cushion Plant Formations**

At high elevations over 4,000 m, cushion bogs or *bofedales* can be found with floating and submerged cushion plants (see below). The larger cushion plants include *Distichia muscoides*, *Oxychloe andina* and *Plantago rigida*, while other genera include *Gentiana*, *Hypsela*, *Isoetes*, *Lilaepopsis*, *Oursia*, and *Scirpus*. In the less wet areas other cushion plant species occur such as the endemic *Azorella compacta* (Araliaceae) and *Werneria aretioides* ( Asteraceae). In fact, *Azorella compacta* extends over vast areas between 4600-5200 m particularly on exposed slopes covered by rocky outcrops.

**Central Andean Peat Bogs (Bofedales)**

Peat is basically the remains of partially decayed plant material that accumulates in waterlogged situations. It is prevented from decaying fully by acidic and anaerobic conditions. However, peat bog are mainly associated with the more humid parts of the world, so it is rather strange that they occur here in one of the most arid parts of the world just east of the Atacama desert. It seems that groundwater is the prominent source of water and they generally lie in the bottoms of narrow, glacially modified alpine valleys or alpine basins at altitudes ranging from 3200-5000 m. Not surprisingly the vegetation of these remarkable peat bogs stands out in marked contrast to the surrounding vegetation. Much of it is composed of compact cushion plant formations (see above) mainly *Oxychloe andina* and *Patosia clandestina* while grasses such as *Distichia filamentosa* and *D. muscoides* dominate the ‘lawn’ and hummock formations. Sphagnum moss is also characteristic especially in northern peatlands. Wet peripheral areas typically include *Deschampsia caespitosa*, *Deyeuxia velutina* together with various species of *Carex* and *Eleocharis*.

**Aquatic Vegetation**

In the Nevada Coropuna volcano area of southern Peru the aquatic vegetation often includes *Azolla filiculoides* and *Ranunculus limoselloides*, while the marshy areas typically include *Distichia muscoides*, *Lilaepopsis macloviana*, species of *Carex* and the endemic *Werneria pygmaea* (Asteraceae). Characteristic of the drier marsh margins are *Calamagrostis ovata* together with species of *Astragalus* and *Lupinus*. The aquatic vegetation of Lake Titicaca is characterized by *Elodea potamogeton Juncus arcticus subsp andicola*, *Myriophyllum quitensis* and *Schoenoplectus californicus subsp. tatora*. Growing in the shallow margins of high-Andean lakes in the centre-north of the eastern ranges of Bolivia are swards characterized by *Lachemilla diplophylla* and *Lilaepopsis macloviana*. These areas often become completely dry towards the end of the dry season. Other species here include *Alopecurus hitchcockii*, *Cotula mexicana*, *Deyeuxia jamesonii*, *Distichia muscoides*, *Oritrophium limnophilum* and *Plantago tubulosa*.

**Central Andean Shrubland Steppe**

From east to west the vegetation gradually changes from shrubland steppe with xerophilous shrubs such as *Adesmia*, *Baccharis*, *Fabiana*, and *Senecio* to grassy steppe with grasses of the genera *Calamagrostis*, *Festuca*, and *Stipa*. Some of the common shrubs are *Baccharis incarum*, *B. boliviensis*, *Parastrephila lepidophylla* and *Fabiana densa*. These can reach heights of up to 2.5 m. On the Nevado Coropuna volcano in southern Peru there are stands of shrubby vegetation characterised by *Mutisia acuminata* (Asteraceae), together with species of Fabaceae and Solanaceae. Associated species
include various endemics such as *Chersodoma arequipensis, Diplostephi um tacorense* (Asteraceae) and *Opuntia corotilla* (Cactaceae).

**Central Andean Polylepis Forest**

*Polylepis* (Rosaceae) is only found in the South American Andes, and represents the characteristic taxa of the highest forests in the world. Twenty species of *Polylepis* are trees or shrubs and typically have a very gnarled appearance. The foliage is evergreen with dense, small leaves, and most of the species are exposed to harsh climatic conditions. They belong to the tribe Sanguisorbae, which mainly include herbs and small shrubs, and unique in the rose family having a tendency towards wind pollination. The most primitive species, including *Polylepis lanuginosa, P. multijuga* and *P. pauta*, found in the Ceja se selva (Yungas) forest share traits with the genus *Acaena* (see the Chacoan BioProvince).

In the Central Andes, unique forests of *Polylepis tomentella* and *P. tarapacana* are found, for example, around the Sajama Volcano at 5000 m above sea level in Bolivia, and there are stands of *Polylepis tomentella* in the puna belt of the Laguna de Pozuelos Biosphere Reserve in northwest Argentina, while *Polylepis besseri (= P. rugulosa)* is the main species found on the southern slopes of the Nevada Coropuna volcano in southern Peru. Most forests are encountered at altitudes ranging from about 3700-4600 m and seem to generally occur where there are high incidences of fog or cloud cover or in river gorges. However, in some places they can cover entire slopes where there are no particularly favourable environmental conditions. The trees are often festooned with mosses, vines such as *Bomarea, Loasa, Mutisia, and Passiflora*, mistletoes (*Tristerix*) and many epiphytic flowering plants. At ground level, often between moss-covered rocks, there is often a rich herbaceous flora, which on deep soils may include various nitrophilous plants like *Cajophora* and *Urtica* and several species of wild potatoes (*Solanum*). In the more arid stands, however, the undergrowth often hardly differs from the surrounding steppe or semi desert. On the Nevado Coropuna volcano, for example, the undergrowth is characterised by species *Baccharis, Chuquiraga, Parastrephia* (Asteraceae), *Astragalus, Lupinus* (Fabaceae) and various cacti. Other species often associated with these high-Andean *Polylepis* forests include *Berberis chrysacantha, Berberis communata, Berberis rariflora, Bomarea dulcis, Citharexylum punctatum, Colletia spinosissima, Dunalia brachycacantha, Fuchsia apatala, Gynoxis asterotrichia, Ribes brachybotrys, Satureja boliviana and Schinus microphyllus*.

**Central Andean Saltmarsh**

These halophytic or salt-loving communities are mainly found in areas close to salt flats. Some of the typical species include *Atriplex atacamensis, Distichlis humilis, Muhlenbergia fastigiata, Parastrephia lucida, Salicornia pulvinata, Senecio pampae, Suaeda foliosa, Tassaria absinoides* and *Triglochin maritima*. On the Uyuni salt flats there are ‘islands’ of low salinity supporting cacti of the genus *Oreocereus*. In the Lake Titicaca area the saline vegetation has been described as halophytic prairie with stands occurring in both dry and humid puna - examples can be found adjacent to the Desaguadero River. Characteristic species include *Anthobryum triandrum, Distichlis humilis, Muhlenbergia fastigiata, Parastrephia lucida, Salicornia pulvinata, Suaeda fruticosa var crassifolia* and *Triglochin maritima*.

**Central Andean High Altitude Formations**

Above the puna region, at altitudes between about 4200 m and the highest limit of vegetation, grows sparse communities dominated by a few grasses such as *Deyeuxia, Poa*, together with endemics such as *Anthochloa lepidula, Dielsiocloa floribunda, Dissanthelium calycinum, D. trollii* and *D. macusaniense* and a large number of cushion
plants, rosette and dwarf shrubs (Azorella, Xenophyllum and the endemic Pycnophyllum, Nototriche, and Werneria). At slightly lower altitudes denser grass swards develop with Agrostis, Deyeuxia (e.g. Deyeuxia minima), Poa and Stipa. Associated taxa include Luzula racemosa, species of Gentianella and Trichophorum and the endemic Oreobolopsis tetalifera (Cyperaceae), together with various perennial herbs. Most common plant families include Asteraceae, Caryophyllaceae, Geraniaceae and Malvaceae.

Further information required (especially regarding endemic plants).

References


