

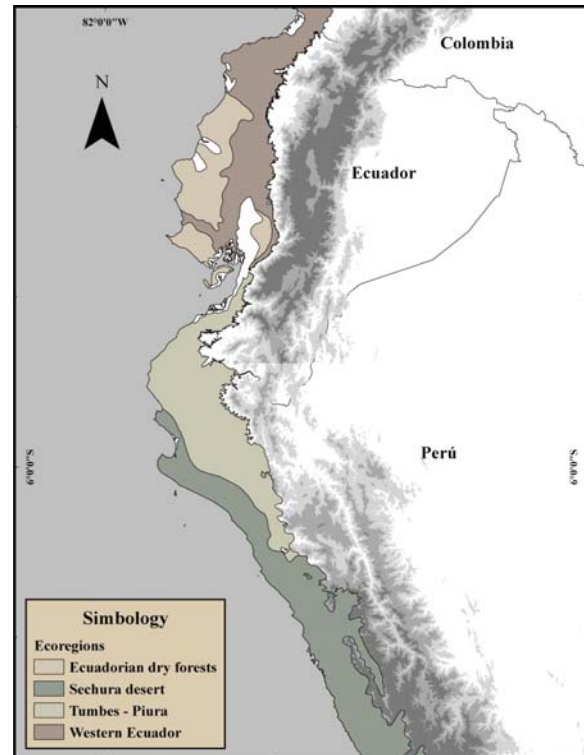
## LEAD ARTICLE

## The Tumbesian center of endemism: biogeography, diversity and conservation

Christian R. Loaiza S.

The equatorial dry forest also called the Tumbesian region or Tumbesian center of endemism, is a natural region of Ecuador and Peru (Fig. 1) constituted by ecosystems of tropical dry forest and located in the coastal region of the equatorial Pacific, between southwestern Ecuador and northern Peru (Best & Kessler 1995). This region encompasses several provinces in central and southwestern Ecuador, of which the provinces of Azuay, Loja and El Oro are prominent for their endemic flora and fauna. Other important provinces that will be highlighted here are: Cañar, Chimborazo, Guayas, Manabí and Santa Elena. In the north of Peru, the Tumbesian region extends along the coast through the departments of Tumbes, Piura, Lambayeque, north from La Libertad, and along the lower floor of the valley of the Marañón. These two areas are connected through the pass of Porculla (2100 m), the lowest elevation in Peruvian Andes.

At a geographic level, the Tumbesian region comprises a wide coastal strip of 135.000 km<sup>2</sup> between 0° 30' S up to and 5° S, from the peninsula of Santa Elena (Ecuador) to the middle basin of the Chicama River (La Libertad), and in the valley of the Marañón to 9° S. In the Department of Tumbes, the Tumbesian Region extends between sea level and the western slopes of the Pacific basin to about 1500 m, and



**Fig. 1** Ecoregions of tropical dry forest in Ecuador and Peru.

in the valley of Marañón, it extends between low elevations up to 2800 meters of elevation.

This natural region in turn has been subdivided into three regions recognized internationally by the World Wildlife Fund and accepted as valid by several specialists and biogeographers (Best & Kessler 1995):

- Ecuadorian dry forest
- Marañón dry forest
- Tumbes - Piura dry forest

Subsequent to the classification of Best



*Melocactus bellavistensis*  
Foto: Christian R. Loaiza S.

& Kessler (1995), a new biogeographic analysis based on the patterns of distribution of the South American biota served to establish a new arrangement based on biogeographic provinces. One of the most relevant classifications on this theme was proposed by Morrone (2001), who brought together the equatorial dry forests in three biogeographic provinces: Arid Ecuador, Western Ecuador and Tumbes - Piura. Other studies, framed in the types of vegetation of a particular type of altitudinal range resulted in the classification of plant formations of dry forests proposed by Aguirre, et al. (2006). The latter classification includes seven dry forest types: Dry thorny scrub, Deciduous dry forest,

Semideciduous dry forest, Low montane dry forest, South interandean dry forest, North interandean dry forest and Oriental interandean dry forest.

Finally, floristic and biogeographic analysis, based on groups of characteristic flora of the dry forests of Ecuador and Peru, resulted in the designation of three biogeographic districts (Loaiza & Morrone 2011), that bring together the plant formations proposed by Aguirre et al. (2006) under the system proposed by Morrone (2001).

#### **BIODIVERSITY**

In terms of biodiversity, the Tumbesian region is mainly characterized by its high levels of endemism, and for this reason it has been recognized by several agencies and institutions as one of the major sites of conservation importance for birds around the world (Best & Kessler 1995). This biodiversity has been strongly favored by the equatorial location in the región, by the low altitude of the andes in northern Peru and southern Ecuador, and the influence of two ocean currents: Humboldt and El Niño. These currents have generated ideal conditions of humidity and temperature, that combined with the rugged topography have contributed to the origin and development of a wide variety of climates and vegetation types (Emck et al. 2006). These conditions so allowed geographic isolation over small geographic distances for many species. Thus, the distribution and development of endemic

**Table 1** Diversity of endemic mammals of the Tumbesian region.

Order	Family	Genera	Species
Artiodactyla	Cervidae	1	1
Carnivora	Canidae	1	1
Chiroptera	Furipteridae	1	1
	Molossidae	2	2
	Phyllostomidae	5	5
	Vespertilionidae	1	1
Rodentia	Chinchillidae	1	1
	Cricetidae	2	2
	Echimyidae	1	1
	Sciuridae	1	1
<b>Total</b>	10	16	16

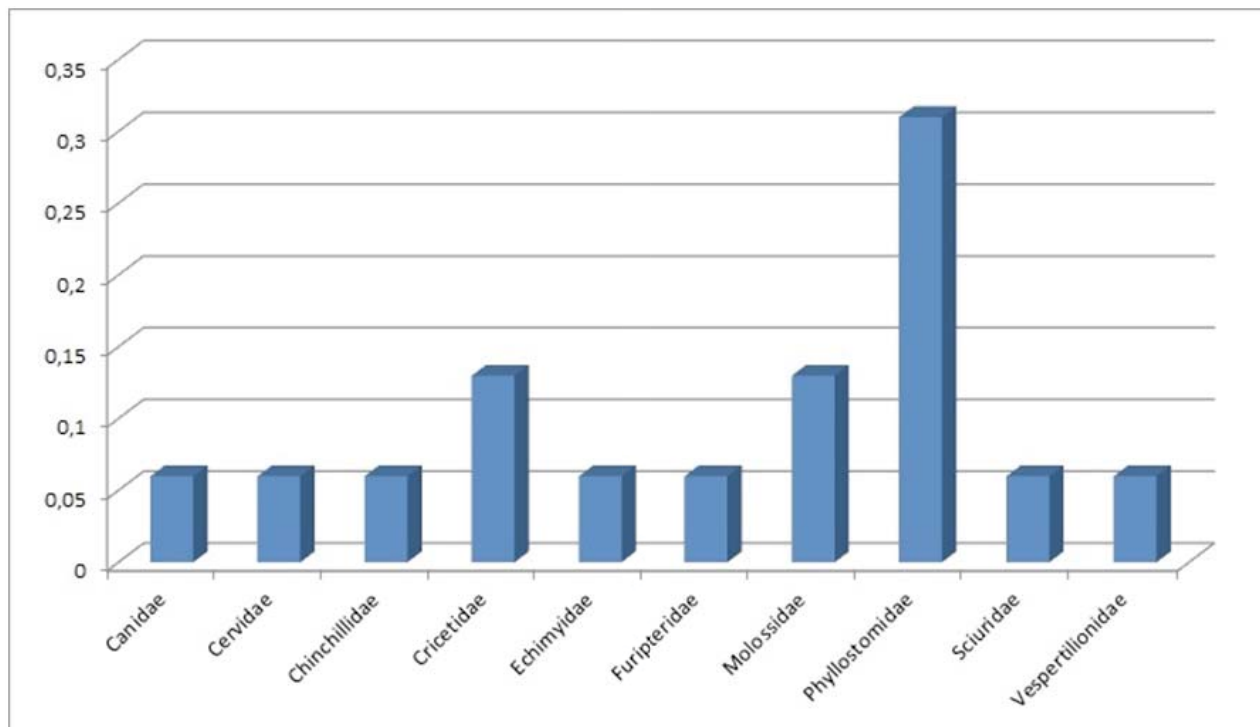
species it due to climatic seasonality that determines forest dynamics and ecological differences between different habitats.

One of the most important biodiversity components is represented by the endemic birds with nearly 800 species representing 8% of the global bird species diversity (Best & Kessler 1995). This component is represented by 55 endemic species (Flanagan et al. 2005) of which 5 % of the species and 17.5 % of the subspecies only live in dry forest. Some examples are: *Aratinga erythrogastris*, *Campephilus gajaquilensis*, *Leptotila ochraceiventris*, *Penelope albipennis*, *Pyrrhura orcesi*, etc. A more detailed list of native and endemic species can be found in *Bird Life International* or field guides (see Best & Kessler 1995, Flanagan et al. 2005)

The amphibians and reptiles also highlight

many species endemic to the region. One of the most representative groups that seems to have had its origin in the northern andes of Peru and southern Ecuador is the genus *Stenocercus* (Torres - Carvajal 2009). Examples of endemic amphibians and reptiles of this region are: *Atractus carrioni*, *Bothrops lojanus*, *Epipedobates anthonyi*, *Gastrotheca monticola*, *Micrurus catamayensis*, *Polychrus femoralis*, *Stenocercus carrioni*, and *Stenocercus puyango* (Duellman & Wild 1993, Torres - Carvajal 2011, Valencia et al. (2008a, b).

Mammals also stand out as one of the most representative groups due to their diversity and with some genera and several species endemic to the Tumbesian region. The endemic genera are: *Amorphochilus*, *Platalina* and *Tomopeas*. A complete list of the endemic



**Fig. 2** Endemic mammals of the Tumbesian region (Families).

mammals is shown in Table 1 and Fig. 2. For details of distribution, natural history and conservation status see Albuja (1999), Pacheco et al. (2009), Tirira (2007).

Finally, we will refer to the Cactaceae as the most representative plant group in the dry forests of Ecuador and Peru. The diversity of the Cactaceae family varies greatly between Ecuador and Peru. In Ecuador the family is represented by 16 genera and 43 native species (Loaiza & Morrone 2001), in Peru by 43 genera and nearly 250 species (Arakaki et al. 2006). Of the endemic genera in the Tumbesian region and present in both countries there is only *Armatocereus* (Ostolaza 2006). Other genera in this region that are endemic to Peru are *Calymnanthium*, *Lasiocereus*, *Matucana*, *Mila*, *Oroya* and

*Pygmaeocereus* (Arakaki et al. 2006, Ostolaza 2011). Further details on the distribution, natural history and conservation status of the endemic flora of Ecuador and Peru can be found in Aguirre et al. (2006) and León - Yáñez et al. (2011).

## CONSERVATION

The conservation of the different ecosystems in the dry forest of Ecuador and Peru has been developed by several NGO's and several international agencies. These initiatives have led to the creation and declaration of several protected areas covering a good part of the southern region of Ecuador and northern Peru. However, much on the interandean dry valleys of the southern region of Ecuador, mainly within the province of Loja, have lost much of their original

plant cover and this has put many species, both endemic and native, at risk of extinction.

Species conservation still requires constant monitoring and study, and it is also very necessary and even urgent that there is adequate training of specialists for different groups of flora and fauna. Much of the diversity in this natural region has still not been fully quantified or studied, and there remain many undescribed species that are probably severely affected by deforestation and other anthropogenic activities.

#### LIST OF ENDEMIC MAMMALS OF THE TUMBESIAN REGION

**ORDER:** Artiodactyla

**FAMILY:** Cervidae

(*Odocoileus peruvianus*)

**ORDER:** Carnivora

**FAMILY:** Canidae

(*Lycalopex sechurae*)

**ORDER:** Chiroptera

**FAMILY:** Furipteridae

(*Amorphochilus schnablii*)

**FAMILY:** Molossidae

(*Eumops wilsoni*)

(*Tomopeas ravus*)

**FAMILY:** Phyllostomidae

(*Anoura peruana*)

(*Artibeus fraterculus*)

(*Lonchophylla hesperia*)

(*Platalina genovensium*)

(*Platyrrhinus matapalensis*)

**FAMILY:** Vespertilionidae

(*Eptesicus innoxius*)

**ORDER:** Rodentia

**FAMILY:** Chinchillidae

(*Lagidium ahuacaense*)

**FAMILY:** Cricetidae

(*Aegialomys xantheolus*)

(*Sigmodon peruanus*)

**FAMILY:** Echimyidae

(*Proechimys decumanus*)

**FAMILY:** Sciuridae

(*Sciurus stramineus*)

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*Epipebobates anthonyi*  
Foto: Christian R. Loaiza S.

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