

H O T S P O T S

R E V I S I T E D



EARTH'S BIOLOGICALLY RICHEST AND MOST ENDANGERED TERRESTRIAL ECOREGIONS

RUSSELL A. MITTERMEIER • PATRICIO ROBLES GIL • MICHAEL HOFFMANN • JOHN PILGRIM
THOMAS BROOKS • CRISTINA GOETTSCH MITTERMEIER • JOHN LAMOREUX • GUSTAVO A.B. DA FONSECA

PREFACE BY PETER A. SELIGMANN FOREWORD BY HARRISON FORD

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PATRICIO ROBLES GIL

RUSSELL A. MITTERMEIER
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MICHAEL HOFFMANN
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CRISTINA GOETTSCH MITTERMEIER
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FOREWORD
HARRISON FORD

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CHILEAN WINTER RAINFALL- VALDIVIAN FORESTS

MARY T. KALIN ARROYO¹²⁵ • PABLO MARQUET¹²⁷
 CLODOMIRO MARTICORENA¹²⁸ • JAVIER SIMONETTI¹²⁶
 LOHENGRIIN CAVIERES¹²⁹ • FRANCISCO SQUEO¹³¹ • RICARDO ROZZI¹³¹



This hotspot includes the area of central-northern Chile characterized by a winter-rainfall regime, together with the northern part of southern Chile, characterized by rainfall all year round. The winter-rainfall area is divided almost equally between a typical Mediterranean-type climate area (155 000 km²) and a more arid area of winter-rainfall deserts (145 000 km²). This hotspot has, therefore, been modified from its definition five years ago by extension to the east, to cover a sliver of similar habitats in neighboring Argentina, and by addition to the south of a substantial extra portion of the temperate forests, to cover the full extent of the Valdivian temperate forests ecoregion. Although it is somewhat unusual to lump such climatic variation into a single hotspot, we feel that since the subunits are part of a continuum with no clear floristic breaks, it is justified to join them together in one hotspot. As we define it, then, the hotspot extends from the Pacific Coast to the crest of the Andean mountains between 25°S and 47°S, to include a narrow coastal strip from 25°S to 19°S (Arroyo et al. 1999), and also the offshore Juan Fernández Islands (these having been treated separately in Mittermeier et al. 1999), such that this hotspot now covers some 397 142 km².

The uniqueness of this hotspot derives from several factors, notably its position at the crossroads of two major floristic and faunistic regions: the Neotropical and ancient Gondwanan provinces. The island-like features of this hotspot, determined by the Pacific Ocean to the west, the Andean crest to the east, and the absolute desert to the north, are another determinant of diversity: with only strong vegetation continuity to the south, interchange with adjacent continental areas has been restricted, unequal among the different groups of organisms, and predominantly in one direction (Arroyo et al. 1996; Villagrán and Hinojosa 1997; Armesto et al. 1998).

Among the more interesting and unusual elements in the northern desert communities (from the northern extreme to around 30°S) are the extended band of coastal fog (*camanchaca*) desert and the more southerly inland *desierto florido* (Squeo et al. 2001). South of 30°S, the dominant vegetation types are coastal and inland matorral (*jaral*) and savannas dominated by *Prosopis chilensis* and *Acacia caven* (Fuentes et al. 1990). On the lower western slopes of the Andes and the eastern slopes of the Coast Range, the typical matorral is open and contains a rich assemblage of endemic herbaceous and geophyte species (Arroyo et al. 1995). In the wetter climate of the western side of the Coast Range, the forests are closed. At higher elevations, the typical Mediterranean sclerophyllous vegetation grades up to *Nothofagus* forest. In addition, there is a small tongue of coastal rainforest along the southern coast from 39°S southwards.

Overall, this hotspot holds 3 892 vascular plant species, of which 1 957 (50.3%) are endemic to the hotspot per se (this is around three-quarters of all vascular plant species/ endemics known to occur in continental Chile). The entire southern Valdivian forest region, considering all habitats, supports 1 284 species; however, based on present information, a surprisingly small number (less than 100) appear to be entirely restricted to the rainforest zone on account of continuity with contiguous vegetation types. Part of the problem resides in defining the limits of the rainforest. With more precise limits in hand, this last number is likely to increase. Incorporation of new data (since Arroyo and Cavieres 1997) brings plant diversity in the winter-rainfall area to 3 539 species, of which 1 769 (50%) are endemic to that subunit. The Juan Fernández Islands have a flora comprised of 200 native species (Marticorena et al. 1998), as well as over 200 introduced species, many of which, interestingly, are natives of continental Chile. The isolation of these offshore islands causes high endemism in their native floras, with 62% endemism.

A salient feature of this hotspot is the number of endemic higher taxa. For example, many woody plant genera on the continent, including trees, as well as a number of genera of geophytes and Cactaceae are endemic to the hotspot. There are also a number of endemic genera on the Juan Fernández Islands (Stuessy et al. 1992). In addition, three plant families (Alectoaceae, Gomortegaceae, and Lactoridaceae) are restricted to the hotspot.

Although not rich in species, the Valdivian rainforest habitat is characterized by an outstanding number of endemic and/or monotypic plant genera, with one-third of all woody plant genera endemic to the general area of the hotspot (Arroyo et al. 1996). This rainforest contains several genera important to our understanding of angiosperm evolution, as seen in the presence of primitive members of the Asteraceae (*Dasiphylum*) and representatives of the Andean family Calyceraceae (*Moschopsis*), considered to be remnants of the original sunflower alliance that evolved on East Gondwanaland (Bremer and Gustafsson 1997).

Vertebrate richness is relatively low, but endemism can be high, particularly among reptiles and amphibians. There are a total of 43 amphibian species in the hotspot



On the opposite page, Cerro Las Peñetas, Villarrica National Park. This park includes three volcanic cones and extends from the hills opposite Pucón, Chile to the border with Argentina.

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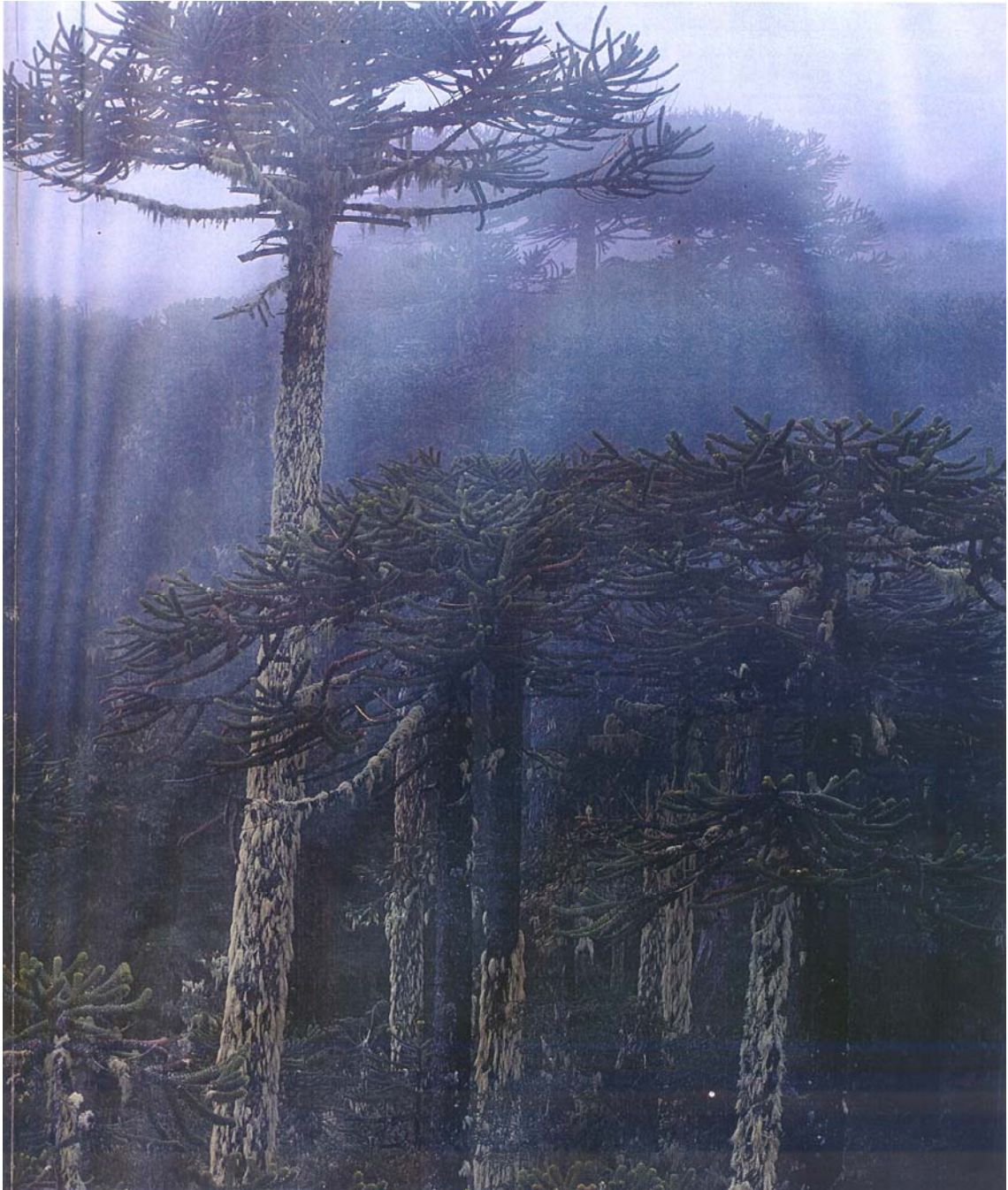
Above, flower of the quiscuito (*Neoporteria aspillagae*), a cactus that grows along the coast of Norte Chico (the region between the Pacific and the Andes) and in the central part of Chile.

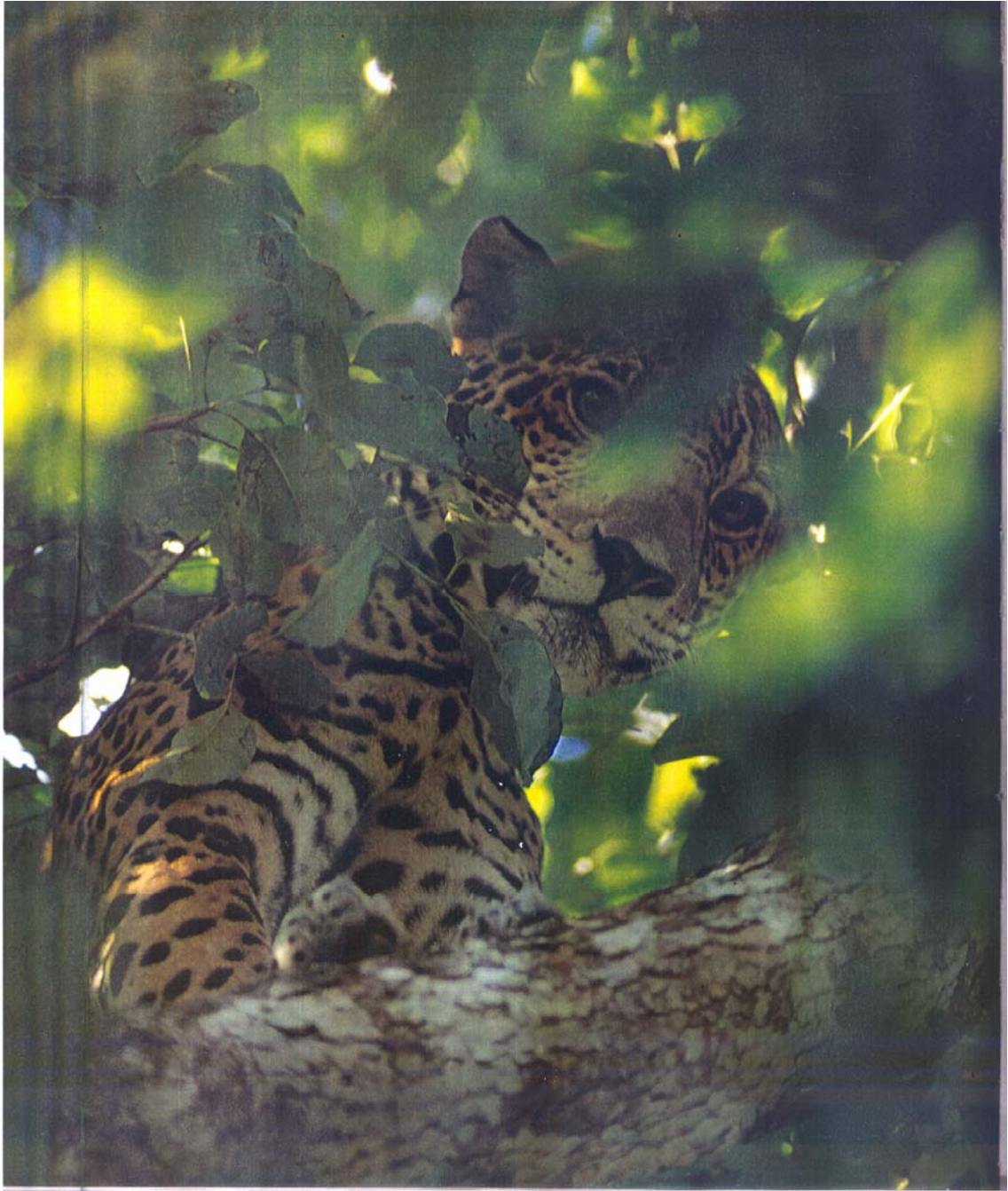
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On pp. 100-101, araucaria forest (*Araucaria araucana*) in the Nahuelbuta National Park.

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(29 endemic). In addition, five of the 12 genera present are endemic: *Tritonohyla*, with three species; *Rhinoderma*, with two species; and *Isozootophrynus*, *Caudivertera*, and *Hyla*, each with a single species. Furthermore, this is one of the few hotspots with an endemic amphibian family (Rhinodermatidae), with Darwin's frog (*Rhinoderma darwini*, VU) and the Chile Darwin's frog (*R. rufo*, CR) among the most important flagship species for this region. An impressive 27 of the 41 reptile species known from this hotspot are endemic. The lizard genus *Liolaemus* accounts for 30 of the reptile species, with 19 of them endemic to the hotspot—a striking radiation.

Mammal diversity is low, with 64 species and 13 endemics. However, there are five endemic genera. The rodent genus *Onychomys* comprises three species of degus, while the remaining four genera are all represented by single species: the Chilean climbing mouse (*Dromomys australis*), the Chilean shrew opossum (*Rhyncholestes raphanurus*), the cururo (*Spalacopus cyanus*), and the *monito del monte* (*Dromomys gliroides*, VU). The last-named species is the only genus in an endemic family, the Microbiotheriidae, and is known only in the proximity of Concepción south to Chiloé Island, south-central Chile, and in the mountains east of the Argentine border. One of the best-known endemic mammals of this hotspot is the chinchilla (*Chinchilla lanigera*, VU), an unusual rodent species. Another is Darwin's fox (*Pseudalopex fulvipes*), a canid species with only two known populations, one found in the forests of Chiloé Island, and another in the coastal mountains in Nahuelbuta National Park.

Bird diversity is also low: 226 species, but only 12 endemics, including two monotypic endemic genera, *Sephanoides* and *Sylviorthorhynchus*. The former is represented by the Juan Fernández firecrown (*S. fernandensis*, CR), which is confined to the offshore Juan Fernández Islands, and the latter by Des Murs' wiretail (*S. desmursii*), restricted to the temperate forest in south-central Chile.

The hotspot's fish fauna is small with only 43 native species, but it is remarkable in having two endemic families, the mountain catfishes (Nematogenyidae) and the perch-like fishes of the genus *Percilia* (Perciliidae). Although the majority of species belong to South America's large endemic fish groups, nearly 20% are relicts of Gondwanan groups and are shared with southern Africa, Australia, and New Zealand.

The hotspot faces many major threats to its biodiversity, the most serious being habitat degradation, plantation forestry, forest fires, overgrazing, spread of alien species, and trade in native species (Armesto et al. 1998).

Although it is difficult to come up with an estimate of natural vegetation remaining in pristine condition, we believe that no more than 30% of the original extent of this hotspot would fall into this category. Current land-use survey data indicates that highly intensive kinds of land use occupy 72 000 km² (16.5%) of the total land area of the hotspot (derived from figures given in Armesto et al. 2000), with this increasing to as much as 58% in the southern part of the Mediterranean area. The bulk of the more pristine land is found in the winter-mild deserts subunit. In the more heavily impacted Mediterranean-type subunit, remaining pristine vege-

tation amounts to no more than 10 000–13 000 km². In the Valdivian forest, the total remaining intact, fairly pristine area is perhaps about 50 000–67 000 km².

The National Protected Area System (SNASPE) of Chile falls into three main categories (national parks, national reserves, and national monuments). Although 19% of continental Chile as a whole is currently protected, this hotspot unfortunately has only 12.8% of its original extent under some form of official protection. However, particularly in the northern part of the rainforest zone, the current protected areas tend to be located at mid-elevations and concentrated in the Andean Cordillera (Armesto et al. 1998), leaving the richest rainforest areas along the coast practically unprotected. Pumalin Park, a well-known private conservation initiative, is situated in the rainforest zone, as are several other small parks of this nature.

In November 2003, an important step was taken towards conserving the Valdivian Coastal Range in southern Chile. The Nature Conservancy, in partnership with CI's Global Conservation Fund, the World Wildlife Fund, and local conservation organizations acquired 60 000 ha of biologically rich temperate rainforest in an open auction. This parcel of land lies between the Chaihuin and Bueno rivers, in the Coast Range of the Lakes Region in Chile. A portion of this land will be cooperatively managed with three adjacent national reserves that together will ideally be elevated to national park status, while the remainder will be owned and managed by a new Chilean conservation organization.

An integrated and successful conservation strategy will require many different and novel approaches. Collaboration among government, the private sector, and civil society will be essential to maintain the biodiversity of this scenically beautiful hotspot for the future.

MESOAMERICA

RUSSELL A. MITTERMEIER¹ • JAN SCHIPPER^{1,2} • GERITT DAWDSE^{2,3}
PATRICIA KOLEFF^{2,4} • JORGE SOBERON^{2,5} • MANUEL RAMIREZ^{2,6}
BARBARA GOETSCH^{2,6} • CRISTINA G. MITTERMEIER¹



The Mesoamerica Hotspot includes all tropical and subtropical natural plant formations from eastern Panama west and north through Costa Rica, Nicaragua, Honduras, El Salvador, Guatemala, and Belize, as well as in portions of southern and coastal Mexico. Within Mexico,

On the opposite page, the jaguar (*Panthera onca*) is a wide-ranging species that is still common over much of the wilderness portion of its range in areas like Amazonia and the Pantanal, but is becoming increasingly rare in hotspots like the Atlantic Forest and Mesoamerica. © Patricia Robles Gil / World Wildlife Fund