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ISBN 978-3-030-20197-5                      ISBN 978-3-030-20198-2 (eBook)  
<https://doi.org/10.1007/978-3-030-20198-2>

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# Preface

There are a large number of native plants used by traditional medicine in Argentina. The intention of this book is not to describe all the medicinal native species from Argentina but those with pharmacological studies that validate their pharmacological properties. To carry out this selection, the work by Barboza et al. (2009) was of fundamental importance. The websites of the Darwinion Institute ([www.darwin.edu.ar](http://www.darwin.edu.ar)) and Flora Argentina ([www.floraargentina.edu.ar](http://www.floraargentina.edu.ar)) have been consulted to update the scientific names and corroborate the distribution data and botanical characteristics found in other sources. The botanical terms used correspond to the glossary compiled by P.P.J. Herman. Each chapter begins with a brief description of the geographical, ecogeographical, or phytogeographical region in which the selected species grow. It has not been the intention of this book to describe the medicinal flora of each of these regions but to locate the selected species within the context of one of the several regions where they could be found. For this reason, for each species, all the provinces in which it is possible to find it are specified.

This work would not have been possible without the invaluable collaboration of Dr. Chana Pilberg who gave me as a gift a large part of her botanical library; her friendship is one of my greatest privileges. I must also thank my sister, Patricia G. Alvarez, for generously giving me some of the photographs that illustrate this book. I also thank all the colleagues who shared with me their publications and my colleagues from the Pharmacy and Biochemistry School and CEBBAD at Maimónides University, and Universidad de Buenos Aires for their constant support. Finally, I thank my family and in particular my daughters for their patience and affectionate collaboration.

Buenos Aires, Argentina  
May 2019

María Alejandra Alvarez

## References

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# Book Introduction

The aim of this book is to offer information about native plants with pharmacological properties from Argentina to students, researchers, and graduates interested in the fields of Ethnobotany, Pharmacognosy, Phytochemistry, Pharmacy, and Medicine. It describes some of the native species used in folk medicine whose pharmacological activities have been experimentally tested. Chapter 1 summarizes the characteristics of the geographical, ecological, and phytogeographical regions from the country. Also, a brief reference about the legal regulatory framework of medicinal plants in Argentina is included. Chapter 2 reviews some aspects of ethnobotany in Argentina. The following Chaps. 3, 4, 5, 6, 7, 8, and 9 describe native medicinal plants in their botanical aspects, ethnomedicinal uses, chemical activity, and toxicity and, when appropriate, in the establishment of *in vitro* cultures and their legal status. Each of those chapters begins with a brief description of the region in which the species grow. The following species are described: from Cuyo (Chap. 3), *Aloysia gratissima* (Gillies & Hook. ex Hook.) Tronc., *Lippia integrifolia* (Griseb.) Hieron., *Mintostachys mollis*, *Acantholippia seriphioides* (A. Gray) Moldenke, and *Achyrocline satureioides* (Lam.); from the Pampa (Chap. 4), *Erythrina crista-galli* L. var. *crista-galli*, *Phytolacca dioica* L., *Salix humboldtiana* Wild, *Grindelia pulchella* Dunal, *Larrea cuneifolia* Cav., *Larrea divaricata* Cav., and *Larrea nitida* Cav; from Mesopotamia (Chap. 5), *Cecropia pachystachya* Trécul (Cecropiaceae), *Anadenanthera colubrina* (Vell.) Brenan var. *cebil* (Griseb.) Altschul, *Ilex paraguariensis* A. St.-Hil var. *paraguariensis*, *Tabebuia impetiginosa* (Mart. ex DC.) Standl., *Allophylus edulis* (A. St.-Hil., A. Juss., and Cambess.) Hieron. ex Niederl., *Passiflora caerulea* L., *Blechnum occidentale* L., and *Maytenus ilicifolia* Mart. ex Reissek; from the Puna (Chap. 6), *Acacia caven* (Molina) Molina var. *caven*, *Chenopodium ambrosioides* L., *Anemia tomentosa* (Savigny) Sw. var. *anthriscifolia* (Schrad.) Mickel, *Plantago australis* Lam. subsp. *Australis*, and *Alternanthera pungens* Kunth; from the Yungas (Chap. 7), *Lepidium didymum* L., *Clinopodium gilliesii* (Benth.) Kunze., *Smilax campestris* Griseb., and *Smallanthus macroscyphus* (Baker ex Martius) A. Grau; and from Chaco and Espinal (Chap. 8), the medicinal species *Adiantum raddianum* C. Presl., *Aloysia citriodora* Palau, *Bauhinia forficata* subsp. *pruinosa* (Vogel) Fortunato & Wunderlin, *Caesalpinia gilliesii* var. *gilliesii*

(Wall. ex Hook.) D. Dietr., *Pilocarpus pennatifolius* Lemaire, and *Jodina rhombifolia* (Hook. & Arn.) Reissek. Finally, from Patagonia Argentina, the species *Adesmia boronioides* Hook f., *Berberis microphylla* G. Forest, *Buddleja globosa* Hope, and *Verbena litoralis* Kunth var. *litoralis* are portrayed (Chap. 9).

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## About the Author

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# Abbreviations

2,4-D	2,4-dichlorophenoxyacetic acid
2iP	2 inositol phosphate N6-(2-isopentenyl) adenine
ALT	Alanine aminotransferase
ANMAT	National Administration of Drugs, Foods and Medical Technology
AST	Aspartate aminotransferase
BAP	6-benzilaminopurine
DPPH	(2,2-difenil-1,2-picirilhidrazil)
DW	Dry weight
EOs	Essential oils
FNA	Argentina National Pharmacopeia
FW	Fresh weight
IAA	Indole-3-acetic acid
IBA	Indole-3-butyric acid
Kin	Kinetin
m.a.s.l.	Meters above sea level
m.b.s.l.	Meters below sea level
MBC	Minimum bactericidal concentration
MIC	Minimum inhibitory concentration
MPs	Medicinal plants
MS	Murashige and Skoog medium
MSG	MS medium with Gamborg's vitamins
MSRT	MS medium with Khanna and Staba vitamins
NAA	1-Naphtalene acetic acid
PIC	Picloram
ROS	Reactive oxygen species
TDZ	Thidiazuron

# Argentina Provinces

BAI	Buenos Aires
CAT	Catamarca
CHA	Chaco
CHU	Chubut
COR	Córdoba
COS	Corrientes
DFE	Distrito Federal
ERI	Entre Ríos
FOR	Formosa
JUJ	Jujuy
LPA	La Pampa
LRI	La Rioja
MEN	Mendoza
MIS	Misiones
NEU	Neuquén
RNE	Río Negro
SAL	Salta
SCR	Santa Cruz
SDE	Santiago del Estero
SFE	Santa Fe
SJU	San Juan
SLU	San Luis
TDF	Tierra del Fuego
TUC	Tucumán

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# Chapter 1

## Introduction: Native Plants of Argentina – A General Overview



### 1.1 Introduction

Plants are the perfect machinery that transforms light into chemical energy and produce also oxygen, a vital element for most of the organisms on Earth. They are a source of food, fodder fuel, cellulose, paper, timber, textile fibers, essences and flavors, and medicines. They are also natural pesticides, are helpful to mitigate environmental pollution, and have a vital role to fight climate change. Plants are also central to scientific research on basic aspects of plant life and on challenges related to agriculture, health, and environment. Besides, plants have been part of ritual, religious, and festive practices.

### 1.2 República Argentina

Argentina is located in the Southern tip of South America. It shares borders with Bolivia and Paraguay to the North; Chile to the West; Brazil, Uruguay, and the South Atlantic Ocean to the East; and Chile and the South Atlantic Ocean to the South. Their endpoints are North, 21° 46' S, 66° 13' W.; South, 55° 03' S, 66° 31' W; East, 26° 15' S, 53° 38' W; and West, 50° 01' S, 73° 34' W. The Antarctica Argentina is located between the meridians 25° W and 74° W and the parallels 60° S and 90° S (South Pole). The country has a total surface area of 3.761.274 km<sup>2</sup>, 2.791.810 km<sup>2</sup> in the American continent and 969.464 km<sup>2</sup> in the Antarctica. The population is around 40.117.096 inhabitants with a population density of 10.7 inhabitants/km<sup>2</sup> (*Instituto Geográfico Nacional República Argentina*). The country is composed of 23 provinces and the Autonomous City of Buenos Aires which is the capital city of the country. It is also divided in seven geographical regions: Northwest, Mesopotamia, the Gran Chaco, the Sierras Pampeanas, Cuyo, Región Pampeana, and Patagonia. The country has various ecosystems with a substantial biodiversity due to its large size, geographic variety, and diverse climate types.

### 1.2.1 Geographical Regions

The geographical regions from Argentina are the Northwest region, Mesopotamia, the Gran Chaco, Cuyo, the Pampas, Patagonia, and South Atlantic Islands and Antarctica.

The *Northwest region* includes the provinces of Catamarca (CAT), Jujuy (JUJ), La Rioja (LRI), Salta (SAL), Santiago del Estero (SDE), and Tucumán (TUC). The climate is varied, with rainfall diminishing from North to South and from East to West. It comprises two subregions, the Puna and the Yungas. The Puna, to the high Andean west, is dry and with a great temperature oscillation, mostly cold, frequently decreasing below freezing point at night. The Yungas, to the East, is tropical, very hot, and humid.

*Mesopotamia* includes the provinces of Misiones (MIS), Entre Ríos (ERI), and Corrientes (COS). The climate is mostly subtropical, with a hot and very humid tropical climate to the North, gradually becoming temperate and semi-humid to the South.

The *Gran Chaco* includes the provinces of Chaco (CHA), Formosa (FOR), and Santiago del Estero (SDE). The region has a very hot subtropical to tropical climate, characterized by humid summers and mild dried winters. It has heavy seasonal rainfalls and periodic droughts.

*Cuyo* includes areas from the provinces of San Juan (SJU), San Luis (SLU), and Mendoza (MEN). It has an arid or semiarid climate with an average annual precipitation of about 100 to 500 millimeters (4 to 20 in). The diurnal temperature range is very large with extremely hot temperatures during the day followed by cold nights.

The *Región Pampeana* could be divided into *Llanura pampeana* (Pampa's plains) and the *Sierras Pampeanas* (Pampa's hills). The *Llanura pampeana* covers the provinces of Buenos Aires (BAI), La Pampa (LPA), Córdoba (COR), Santa Fe (SFE), and Entre Ríos (ERI). The climate is temperate, with hot, stormy summers, and cool winters. The *Sierras Pampeanas* comprises sectors from the provinces of San Luis (SLU), San Juan (SJU), Córdoba (COR), La Rioja (LRI), Catamarca (CAT), Santiago del Estero (SDE), and Tucumán (TUC). They have a temperate and semiarid climate, with warm summers and cool winters. The Northern-East slope is covered by rainforest, generating high humidity. The area inside COR and SLU has a Mediterranean-type climate, with intense summer rainstorms and snowy winters. The eastern slopes that receive the moist winds from the Atlantic Ocean have more rainfalls.

*Patagonia* includes the provinces of Neuquén (NEU), Río Negro (RNE), Chubut (CHU), Santa Cruz (SCR), and Tierra del Fuego (TDF). The region is very windy, with mild summers, cold to very cold winters, and heavy snowfall and frost, especially in mountainous zones. Precipitation steeply diminishes from west to east.

*South Atlantic Islands and Antártida Argentina.* Argentina is a founding signatory member of the Antarctic Treaty and is also a permanent consulting member. There are 13 Argentinean bases (6 permanent and 7 seasonal) in Antarctica with

activities coordinated by the *Instituto Antártico Argentino* and the *Dirección Nacional del Antártico*. There the temperatures range from 0 °C in the summer to -60 °C to -80 °C in winter.

### 1.2.2 Eco-regions

An eco-region is defined as a relatively large geographical area characterized by a unique geology, weather, soil, hydrology, and plant and animal species. Argentina is divided into eighteen eco-regions, fifteen of them are continental, two marine, and one Antarctic. The eco-regions are *Altos Andes* (High Andean Complex), *Puna* (Puna grassland), *Monte de sierras y bolsones* (Argentine Northwest Monte and Thistle of the Prepuna), *Selva de Yungas* (Yungas), *Chaco seco* (Arid Chaco), *Chaco húmedo* (Humid Chaco), *Bosques patagónicos* (Patagonia forests), *pastizales y matorrales* (grasslands and shrublands), *Delta e Islas del Paraná* (Paraná flooded savanna), *Espinal* (Espinal), *Estepa patagónica* (Patagonian steppe), *Esteros del Iberá* (Iberá Wetlands), *Monte de llanuras y mesetas* (Argentina Low Monte), *Pampas* (Pampa), *Selva Paranaense* (Alto Paraná Atlantic forests), *Islas del Atlántico Sur* (South Atlantic islands), *Mar Argentino* (Argentina sea), and *Antártida* (Antarctic Peninsula) (Burkart et al. 1999; Diminich et al. 2018).

The *High Andean Complex* or *Altos Andes* is the high mountain sector in the West of Argentina, from the border with Bolivia to the North of the province of NEU, across the provinces of JUJ, SAL, TUC, CAT, LRI, SJU, and MEN. To the North it includes the summits and slopes of the Eastern Andes mountain range. Towards the South it includes some sections of the Andes foothills (Matteucci 2012). The climate is cold with everlasting snow. The rains are around 100 to 200 mm. Vegetation is grassy or shrubby, highly adapted to the extreme weather and altitude.

The *Puna grassland* or *Puna* extends from the Northwestern border of the country (province of Jujuy) to the North of the province of SJU. It has a cold desert climate characterized by cushion bog vegetation. Its plateau is crossed by mountains with numerous volcanoes.

*Argentine Northwest Monte and Thistle of the Prepuna* extends from JUJ to the North of MEN. It has extensive and pronounced slopes that connect with the Puna to the North and with the High Andes to the South. At the foothills are the *Quebrada de Humahuaca*, the *Quebrada del Toro*, the *Calchaquí Valleys*, and the rivers Jáchal and Bermejo. The climate is subtropical dry to the North; in their valleys and canyons, the rains concentrated in the summer season, while in the South, rains are distributed throughout the year. The radiation is intense, and the cloudiness is low. Temperature changes are very marked, both during the day and between seasons. Soil is predominantly sandy and poor in organic matter.

The *Yungas* are located to the north of the country with a discontinuous distribution in the provinces of SAL, JUJ, TUC, and CAT. The climate is warm and humid

to sub-humid. The conditions of temperature and humidity are variable according to altitude and latitude. The region has a high biodiversity with evergreen forests.

*Arid Chaco* extends over the western half of FOR and CHA; the eastern half of SAL; almost all of SDE, North of SFE, and COR; and sectors of CAT, LRI, and SLU. The climate is continental and subtropical, with areas that attain the maximal absolute temperature of the country. The type of vegetation is the xerophilous forest, whose trees become lower and narrower towards the southwest. There are abundant mountain forests, savannas, and grasslands.

*Humid Chaco* occupies the eastern half of FOR and CHA and the extreme northwest of COS and North of SFE. The climate is subtropical warm. The average annual temperature decreases from North to South and from 23 °C in the border with Paraguay to about 18 °C in the center of the Province of SFE. The vegetation has greater diversity than in the Arid Chaco.

*Patagonia forest* is the driest part of the Andean-Patagonic forest; it extends from NEU to TDF. The landscape is mountainous, with abrupt and steep reliefs, snowy peaks, glacial valleys, volcanic geo-forms, numerous water courses, and lakes that drain through different rivers to the slopes of the Atlantic or the Pacific oceans. The climate is temperate to cold and humid, with heavy snowfall, rains, strong winds, and frost most of the year. The dominant plant formation is the humid, semidry temperate forest.

*Grassland and shrublands* are located in South MIS and Northeast COS being mostly pastures and grasslands corresponding to the phytogeographical Paraná flooded savanna. The dominating flora is herbaceous.

*Paraná flooded savanna* borders the southern Paraná River, from CHA to BAI. It runs through the Humid Chaco and the Humid Pampas eco-regions, ending up in the Río de la Plata estuary. It has a landscape of low and floodable islands, delimited by the lateral arms and main channels of rivers (e.g., Paraná Guazú, Paraná de las Palmas, Paraná Miní, Barca Grande, Luján) and extensive coastal waters. From the original habitat, only patches including strips of forest and shrubs, scrub and pasture, and hydrophilic and aquatic flora still remain.

*Espinal* is located in central Argentina involving the south of the Province of COS, northern half of ERI, a central belt of SFE and COR, central and southern SLU, and half East of LPA and south of BAI. The predominant landscape is flat plain to gently undulating, occupied by low forests, savannas, and grasslands, nowadays largely adapted to agriculture.

The *Patagonian steppe* is around 730.000 Km<sup>2</sup> extended from southwest MEN, center of NEU, southwest of RNE, and most of CHU and SCR. The soils are rocky and sandy, lacking rich organic materials. The weather is temperate-cold, with snow in winter and frosts almost at any time of the year. Precipitations are scarce, ranging from 100 to 300 mm per year, and are concentrated on the coldest months, from April to September. In spring and summer, strong West winds blow almost constantly. There are low shrubs with small leaves and thorns and grasslands.

*Iberá Wetlands* are a deposit of stagnant water that occupies the northern center of the province of COS. It is one of the most important fresh water reservoirs of the continent. The wetlands, with a deep no higher than 3 m, are covered by aquatic

plants (aguapés, poppies, and sequins of water) forming floating islands with up to 2 m of thickness. It is protected in the *Iberá* Provincial Reserve.

The *Argentina Low Monte* is the driest region of the country located in North-central Argentina covering the eastern foothills of the Andes. It extends from the Andean mountain range in MEN, along NEU and LPA, to the coast of the Atlantic Ocean of RNE and northeast of CHU. It shares with the eco-region of the *Monte de Sierras and Bolsones* the most arid characteristics of Argentina but differs on its prevailing landscape of plains and extensive plateaus. The climate is temperate-arid with scarce precipitations. Average annual temperatures are on the order of 10–14 °C. The vegetation is poorer than in the *Mount of Sierras and Bolsones*.

The *Pampa* represents around 60% of the grasslands of the country; it is extended from BAI (except the southern section), northeast of LPA, and south of COR, SFE, and ERI. The rains are distributed during the year. Average annual temperatures range from 15 °C in the South to about 18 ° in the North.

The *Alto Paraná Atlantic forests* extend from the center and North of the province of MIS through ERI as a streamside zone of narrow hills by the rivers from the basin of the Río de la Plata. The weather is warm and humid, with more intense rains in the summer. The average annual temperature is on the order of 20 °C. The red soils, characteristic of the eco-region, are a consequence of the transformation of the basaltic material under warm and humid conditions. It has 2000 vascular plants, and the Argentinean sector exhibits the highest biological diversity of all the country eco-regions. The dominant vegetation is the subtropical forest.

In the *South Atlantic islands*, due to the extreme climatic conditions and the rocky nature of the terrain, the soils are poorly developed. There are no natural forests, and the dominant vegetation is steppe grasses with tundra bushes. This eco-region is remarkably poor in phanerogams, several of which are endemic. Among the most prominent plant communities are the Tussock grass pastures, which occupy the coastal areas of Malvinas and South Georgia Islands, with different species of grasses and mosses, among other plants.

*Mar Argentino* includes the Argentina Continental Platform which can be subdivided into a coastal subregion, represented by the strip of coast up to 40 m depth and the subregion of the external platform, which extends from the depths of 40 m to 200 m. On the coasts of CHU, SCR, and TDF, marine vegetation develops with a huge diversity of green, red, and brown algae on the seabed.

The *Antarctic Peninsula* has an extremely cold climate, with average temperatures below zero and with snow and ice all year round. Two types of climate are distinguished: the glacial one, dominant in the sectors covered by ice, and the insular one that includes the Antarctic Peninsula and adjacent islands. Winds are very strong; temperature is always very low, reaching –42 °C on polar night and 0 °C in the hottest months. The flora is very scarce and limited to sectors near the sea, which lose the snow cover during the brief Antarctica summer. There are lichens or moss cushions. The only native vascular plant species are *Colobanthus quitensis* (with tiny white flowers) and *Deschampsia antarctica* (Antarctic grass) usually among moss communities. A nitrophilous alga (*Prasiola crispa*) grows associated with penguin breeding ground. There are two introduced species (*Poa* spp.), which grow near to the permanent bases.

### 1.2.3 *Phytogeographical Regions*

Phytogeography can be defined as the geographical distribution of plants according to the temperature, humidity, light intensity, day length, soil composition, and biological communities, among other characteristics, of each region. With the exception of some species that grow in very hostile environments, plants usually grow with other individuals, from the same or other species, establishing plant communities or associations with all their members having similar ecological needs. There have been several attempts to organize the Argentine vegetation in phytogeographical regions, as is shown in the works of Lorentz (1876), Holmberg (1898), Hauman (1920, 1931), Frenguelli (1941), Castellanos and Pérez Moreau (1941, 1945), Cabrera (1953, 1958, 1971), and Cabrera and Willink (1980).

Cabrera (1971) divided Argentina into three phytogeographical regions: Neotropical, Antarctic, and Oceanic. Each region is categorized in domains, which are divided in provinces that in turn are subdivided into districts. For each domain Cabrera specifies its geographical location and for each province the location and characteristic vegetation. The Neotropical region was divided in the Amazonian (subdivided in the Yungas and Paranaense provinces), Chaqueño (subdivided in the Chaqueña, Espinal, Prepuna, Monte, and Pampeana provinces), and Andino Patagónico (subdivided in Altoandina, Puneña, and Patagónica provinces) domain. The Antarctic region was subdivided into the sub-Antarctic (subdivided in the sub-Antarctic and insular provinces) and the Antarctic (Antarctic province) domain and the Oceanic region without subdivisions (Cabrera 1971) (Fig. 1.1).

#### 1.2.3.1 **Neotropical Region**

Amazonian domain: Despite its small area, the Amazonian domain is the largest floristic wealth in Argentina.

Yungas province: it has many genus and species in common with the Paranaense Province, such as *Nectandra*, *Cedrela*, *Blepharocalyx*, *Jacaranda* sp., etc. However, unlike the Paranaense province, it has few bamboos and no palm trees. It presents exclusive genera such as *Tipuana*, *Juglans*, *Phoebe*, and *Myroxylon*.

Paranaense province: more than 200 arboreal species have been counted in the Misiones Forest. In the district of the Mixed Jungle are arboreal communities of laurel forest (*Nectandra saligna*), Guatambú (*Balfourodendron riedelianum*), palo rosa (*Aspidosperma polyneuron*), and palmito (*Euterpe edulis*). Also, there are arboreal species such as anchico colorado (*Parapiptadenia rigida*), cancharana (*Cabialea oblongifolia*), and cocó (*Allophylus edulis*) among others. The pindó (*Syagrus romanzoffiana*) palm are scattered and distributed into the forest. In the northeastern sector of the MIS jungle, there are Paraná pine (*Araucaria angustifolia*) communities.



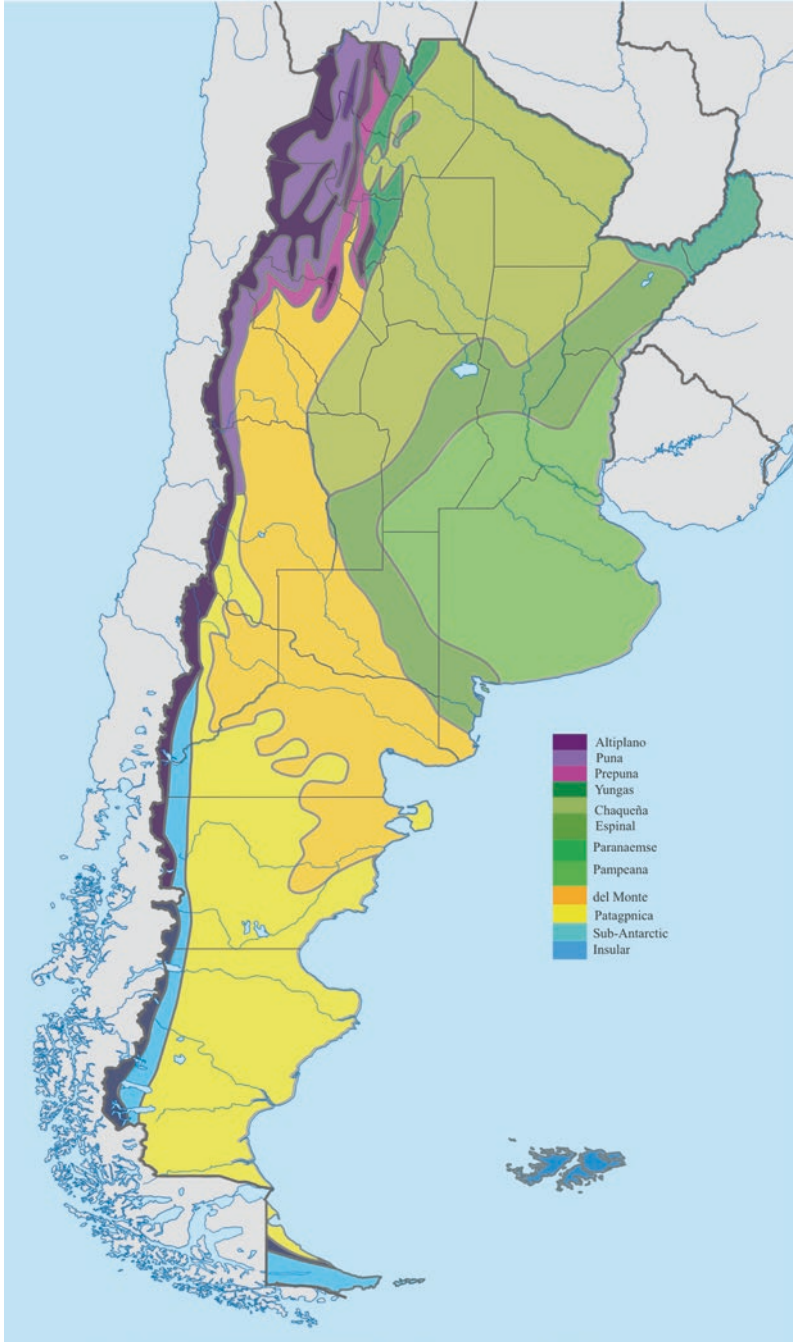


Fig. 1.1 Phytogeographical regions from Argentina. (Adapted from Cabrera (1971))

Chaqueño domain: it has polymorphic vegetation with deciduous xerophilous forests, steppe shrubs, palms, savannas, meadows, steppes, grasslands, etc. The weather is varied, with predominance of the continental type with moderate to scarce rainfall, moderate winters, and warm summers.

Chaqueña Province: in this province the predominant species are from *Schinopsis*, *Aspidosperma*, and *Prosopis* genus.

Province of Espinal: this province has connections to Chaqueña province, but in Espinal species from the genus *Prosopis* predominate.

Prepuneña province: it has few tree species, with prevalence of cacti, Zygophyllaceae spp., and shrubs.

Monte province: it mainly has trees from the genus *Prosopis*, dwarf arboreal species, and prevalence of Zygophyllaceae shrubs (*Larrea* spp.).

Pampeana Province: here predominate xerophilous grasses and species from the genus *Stipa*, *Piptochaetium*, *Andropogon*, *Leonurus*, etc.

Andino Patagónico domain: its climate is cold and dry, with frost almost all year round and snow in the winter months.

Altoandino province: it has a rocky, stony, and sandy soil. It has shrub and grass steppes with supremacy of xerophilous grasses and creeping or cushioned dicotyledons. The endemic genera are numerous (Compositae, Cruciferous, Verbenaceae, Poaceae, Papilionaceae, and Solanaceae).

Puneña province: it has a vegetation of steppe, grasslands, meadows, and bushes. There are some shrubby communities such as *Adesmia* sp., *Azorella yareta* (yareta), *Stipa* sp., *Festuca* sp., *Fabiana densa*, *Baccharis boliviensis*, and *Opuntia* sp., among others.

Patagonia province: depending on the characteristics of soil and water availability, there are shrubby, halophytic, or grass steppe and, near small streams, fertile valleys (*vegas*). Some typical species are *Festuca pallescens*, *F. gracillima*, *Mulinum spinosum*, *Trevoa patagonica*, *Chuquiraga avellanadae*, *Nassauvia glomerulosa*, and *Junellia tridens*.

### 1.2.3.2 Antarctic Region

The only native species from the region are *Deschampsia antarctica* and *Colobanthus quitensis*. Also, there are several species of lichens, mosses, and algae.

Sub-Antarctic domain.

Sub-Antarctic province: The dominant vegetation is the deciduous and evergreen forest. Other types of vegetation are scrubs, meadows, tundra, etc.

Insular province: the Malvinas Islands have a poor phanerogam flora that is still poorer in the South Georgia. The dominant species is the tussock grass (*Poa flabelata*). There is no community of shrubs.

Antarctic domain: Antarctic province—the seaweed *Prasiola crispa* forms green wavy, snow-free emerald mats. There are also mosses and lichens grass.

### 1.2.3.3 Oceanic Region

It is the most extensive region that covers all the oceans. In Argentina, it extends through the epicontinental sea, from the mouth of the Río de la Plata to the Antarctica.

The Cabrera classification of the phytogeographical regions is still the most popular. However, there are other classifications that should be considered.

For Takhtajan (1986), the terrestrial flora of Argentina could be distributed in three phytogeographical regions, two within the Neotropical (Brazilian and Andean) and one in the Holantarctic (Patagonian-Chilean) kingdoms. According to Takhtajan, the region and kingdom categories are equivalent to the domain and region categories defined by Cabrera (Matteucci et al. 2016). In a detailed work, for each of the phytogeographical regions defined by Cabrera, Apodaca et al. (2015) established the eco-regions involved, its dominant vegetation, area (in km<sup>2</sup>), general weather, annual rain (expressed in mm), average annual temperature (expressed in °C), and species, genus, and/or families from its endemic and characteristic plant species. They also included a concise description of international, national, and provincial protected areas. They recognized three main biomes in Argentina: steppe (that include seven of the phytogeographic provinces), woodland (Chaco, Espinal, sub-Antarctic), and forest. In the steppe predominate the Gramineae; according to the accompanying species, the steppe could be shrubby, herbaceous, etc. In the woodlands prevail trees, and in the forest prevail tall trees along with copious lianas and epiphytes and stratified vegetation (Paranaense, Yungas) (Apodaca et al. 2015).

Ribichich (2002) disclosed weaknesses and discrepancies in the work of Cabrera (1971) and Cabrera and Willink (1980), particularly related to the imprecise use of the terms endemic and endemism, the irregular use of the taxonomic categories to classify phytogeographical areas in different hierarchical levels, the borderlines of the Argentinean provinces and geographical regions, and the ambiguities or incoherencies related to the characterization of the phytogeographical territories. Besides, Ribichich compares the phytogeographical systems from Cabrera and Takhtajan.

Recently, Oyarzábal et al. (2018) published a physiognomic-floristic map of spontaneous vegetation of Argentina based in vegetation surveys published in the last decades. For each phytogeographic province identified by Cabrera (1976), they reviewed the charts and available descriptions and mapped their internal heterogeneity. However, they made two modifications on Cabrera classification; on the one hand, they incorporated the documented ecotone Monte-Patagonia (León et al. 1998; Cingolani et al. 2000). On the other hand, they established slightly different phytogeographic limits (Cabrera 1976; León et al. 1998). The resulting map had 50 vegetation units as subdivisions of the phytogeographic ecotone and provinces described by Cabrera and a brief physiognomic-floristic description of each ecotone, province, and vegetation unit. A nomenclature of each vegetation unit based on dominant type of spontaneous vegetation and characteristic species was also proposed.