

Chapter 8

South America

VEGETATION AND SPECIES COMPOSITION

Mangrove forests in South America are found on the Atlantic and Pacific coasts and in the bays and estuaries of eight countries. They are distributed from the Praia do Sonho in the south (State of Santa Catarina, Brazil) to the city of Sechura, along the Piura River (Peru), where only monospecific forests are found (*Avicennia germinans*).

A wide range of mangrove tree heights may be found in the different countries of this region and even within the same country. While their canopy cover rarely exceeds 20 m in height, tall trees of 45 to 50 m may be found, for example in the 'Manglares Cayapas-Mataje' Ecologic Reserve (Ramsar site) or in the states of Amapá, Pará, and Maranhão (Brazil), where there are specimens of *Avicennia* spp. with a diameter of about 1 m and trees of *Rhizophora harrisonii* reaching 40–45 m. In these areas, mangroves extend up to 40 km inland and they remain relatively unthreatened due to the inaccessibility and low human population density. Well-developed mangrove communities are also found in the delta of the Amazon River, where trees can reach 40 m in height, sustained by high rainfall and by the river system itself. Due to the extremely high inputs of freshwater here, mangroves have to compete with local freshwater hardwoods, lianas and palms, which restricts mangrove distribution in the area. The Pacific coast of Colombia and the Orinoco delta of the Bolivarian Republic of Venezuela have significant mangrove forests as well, with trees up to 30 m in height, while 20–25-m mangrove trees have been reported in Guyana.

As is the case in North and Central America, mangrove forest structure and species composition in South America differ from one coast to the other. Colombia is the only country with both Caribbean and Pacific coasts. More than 70 percent of its mangroves are found on the Pacific coast, where they form well-structured, tall forests. The lower rainfall and smaller tidal fluctuations of the Caribbean coast limit forest development, and only small, narrow fringes of mangroves are found (sometimes in the form of dwarf trees as in the Guajira department). Notwithstanding these limitations, some well-developed mangrove forests also grow along this coast, for example in the Magdalena river estuary.

The mangrove tree species diversity of this region is low – only ten native species (Table 13) – the lowest worldwide. Three species (*Avicennia germinans*, *Laguncularia racemosa* and *Rhizophora mangle*) are very common and are found in all eight countries; others, such as *Avicennia bicolor* and *Pelliciera rhizophorae*, are found with less frequency or their presence is uncertain.

MANGROVE RESOURCES: STATUS AND TRENDS 1980–2005

Mangroves in South America currently cover slightly less than 2 million hectares, down from some 2.2 million hectares in 1980.

About half the mangrove area of the region is found in Brazil – which also has the third largest mangrove area in the world (Table 14 and Figure 3, page 12). More than 90 percent is found in five countries: Brazil, Colombia, the Bolivarian Republic of Venezuela, Ecuador and Suriname (Figure 13). Guyana, French Guiana and Peru share the remaining 140 000 hectares. The relatively small mangrove area in these countries might be explained by the relatively small land area (Guyana) or by the narrow and in some zones arid or rugged coasts of Peru and French Guiana, which are not well suited to the development of mangroves.

TABLE 13
Mangrove species composition in South American countries

Species	Brazil	Colombia	Ecuador	French Guiana	Guyana	Peru	Suriname	Venezuela (Bolivarian Rep. of)
<i>Acrostichum aureum</i>		√	√				√	
<i>Avicennia bicolor</i>		? ^a						
<i>Avicennia germinans</i>	√	√	√	√	√	√	√	√
<i>Avicennia schaueriana</i>	√				√			√
<i>Conocarpus erectus</i>	√	√ ^b	√		√	√		√
<i>Laguncularia racemosa</i>	√	√	√	√	√	√	√	√
<i>Pelliciera rhizophorae</i>		√	√					
<i>Rhizophora harrisonii</i>	√	√ ^c	√			√		√
<i>Rhizophora mangle</i>	√	√	√	√	√	√	√	√
<i>Rhizophora racemosa</i>	√	? ^a		√				√
Total no. of species	7	9	7	4	5	5	4	7

^a Uncertain.

^b Found on both coasts, but rare on the Pacific coast.

^c Found only on the Pacific coast.

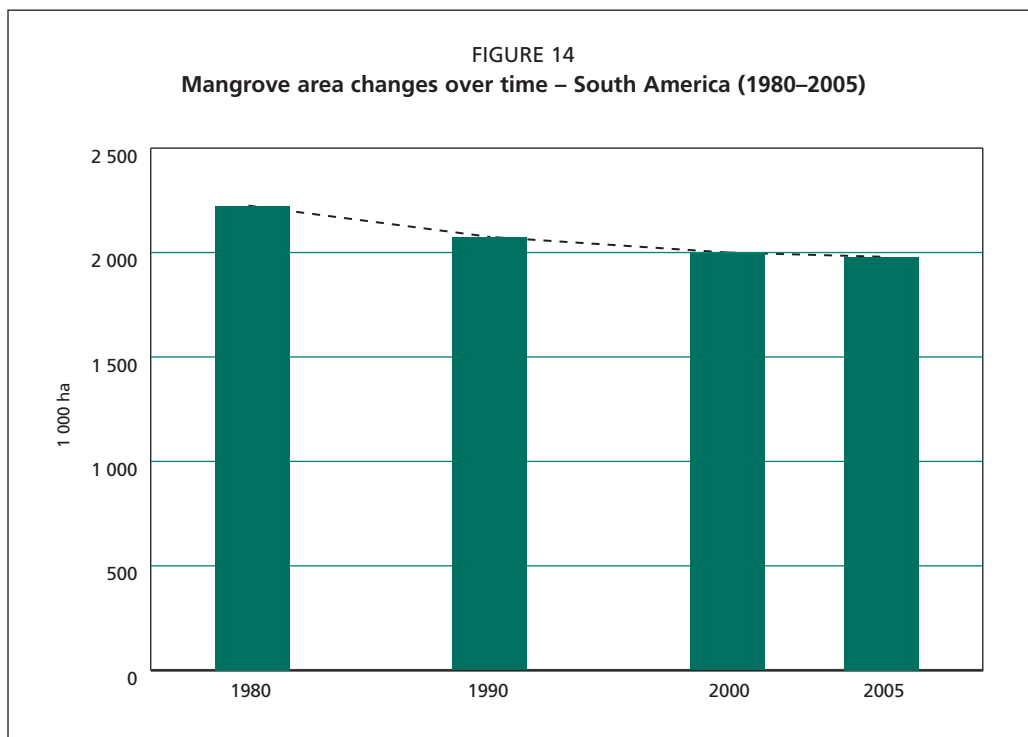
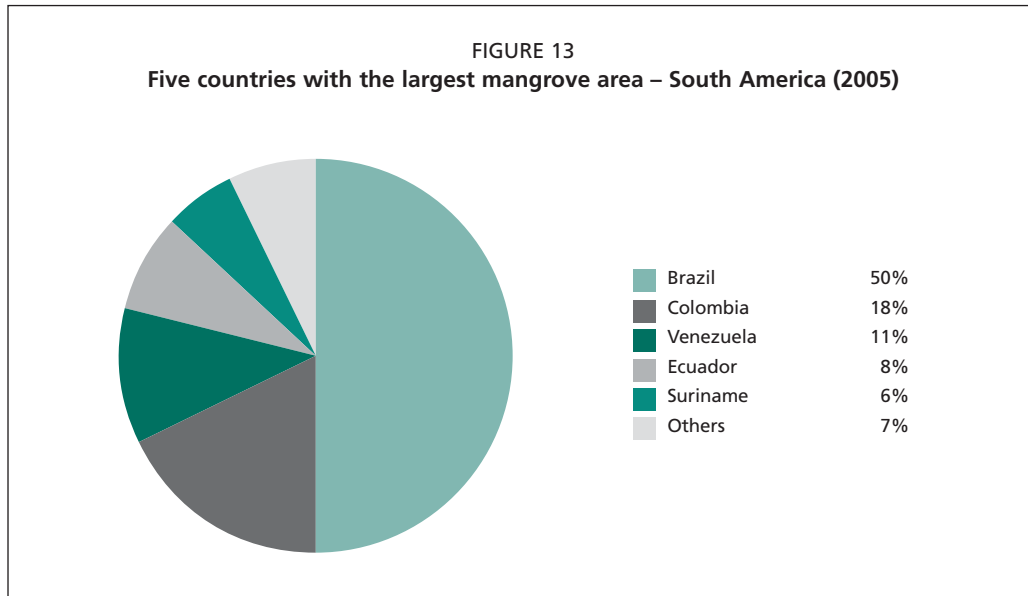
TABLE 14
Status and trends in mangrove area – South America (1980–2005)

Country/ area	Most recent reliable estimate		1980 ha	1990 ha	Annual change 1980–1990		2000 ha	Annual change 1990–2000		2005 ha	Annual change 2000–2005	
	ha	Ref. year			ha	%		ha	%		ha	%
Brazil	1 012 376	1991	1 050 000	1 015 000	-3 500	-0.3	1 000 000	-1 500	-0.1	1 000 000	0	0
Colombia	371 250	1997	440 000	393 000	-4 700	-1.1	360 300	-3 270	-0.9	350 000	-2 060	-0.6
Ecuador	149 556	1999	203 000	163 000	-4 000	-2.2	150 200	-1 280	-0.8	150 500	60	n.s.
French Guiana	55 000	1980	55 000	55 000	0	0	55 000	0	0	55 000	0	0
Guyana	80 432	1992	91 000	82 200	-880	-1	80 000	-220	-0.3	80 000	0	0
Peru	4 550	1995	8 300	5 800	-250	-3.5	4 500	-130	-2.5	4 500	0	0
Suriname	114 600	1998	115 000	114 800	-20	n.s.	114 600	-20	n.s.	114 400	-40	n.s.
Venezuela (Bolivarian Rep. of)	250 000	1986	260 000	244 500	-1 550	-0.6	231 000	-1 350	-0.6	223 500	-1 500	-0.7
South America	2 037 764	1992	2 222 300	2 073 300	-14 900	-0.69	1 995 600	-7 770	-0.38	1 977 900	-3 540	-0.18

Note: n.a. = not available; n.s. = not significant.

During the 1980s and 1990s, mangrove lands were often considered unproductive and unhealthy. This attitude and the resultant activities caused a loss of some 250 000 ha of mangroves in the region (11 percent of the 1980 extent) (Figure 14). This loss is low in comparison with other regions, but can be significant at the national and local levels, where rural populations often depend on mangroves for subsistence and for commercial fishing.

In absolute terms, the countries that experienced the highest losses of mangroves were Colombia, Ecuador, Brazil and the Bolivarian Republic of Venezuela, all of them with more than 30 000 ha of mangroves lost since the 1980s. In Colombia the extent of mangroves has continued to decline over the past 25 years, even though the annual change rate has decreased from -1.12 percent (1980–1990), to -0.86 percent (1990–2000) and finally to -0.58 percent in the last five years. Extensive conversion for shrimp ponds, development of urban, industrial and tourist infrastructures and reclamation of land for agricultural crops and pasture led to the loss of 90 000 ha since the 1980s. Awareness of



the importance of this coastal ecosystem is now slowly increasing and some efforts in reforestation and/or afforestation have been undertaken (2000) as a joint initiative by the Ministry of the Environment (Ministerio del Ambiente), the Corporación Nacional de Investigación y Fomento Forestal (CONIF), ITTO and local communities.

One success story comes from Ecuador, where the significant losses of the 1980s and 1990s (some 40 000 ha) are slowly being recovered and the mangrove area now seems to be stable. The main cause of loss of mangroves was the unsustainable development of shrimp ponds, which started in 1966 as a small-scale activity. However, high international demand converted shrimp into a major trade item, and Ecuador rapidly became one of the largest producers in South America. The industry brought significant gains to the country and to local populations, becoming one of the economic activities with the most growth nationally and in the region. The outbreak in Ecuador of the white-spot syndrome virus (WSSV) had a tremendous impact on the shrimp-

farming industry. This impact, together with the activities of several environmental organizations, the consequent abandoning of the ponds, the ban on mangrove cutting implemented in 1994 and the increase in field controls, favoured the natural recolonization of mangroves in several places. The combination of these factors led to a slight increase in the extent of mangroves from 2000 to 2005.

Brazil lost at least 50 000 ha of mangroves over the last 25 years, mainly along the southern coast. The country still possesses significant and relatively pristine mangrove forests, because most mangrove areas are located in the less urbanized northern states. No recent quantitative national data are available (other than the 1991 figures reported in Table 14). However, the relatively low population pressure on the northern states and government efforts to protect and rehabilitate damaged forests seem to have contributed to a major reduction in the loss of mangrove area, which is estimated at zero in the period 2000–2005. New and updated inventories are needed to provide more detailed estimates for this country. It is hoped that a recently approved Global Environment Facility (GEF) project (Conservation and Sustainable Use of the Biodiversity of the Globally Important Brazilian Mangrove) will contribute to filling current information gaps.

Among the most significant causes of past losses and conversions are the intensive use for timber production, urban development (southeastern states) and to a lesser extent for fuelwood. Mariculture (mainly shrimp farming) began in Brazil in the 1970s and it is now widely practised – primarily along the coast of the northeastern states (e.g. Ceará, Rio Grande do Norte) – and still represents a significant threat to mangroves. The impact of this activity is a national concern, mostly because of the consequent eutrophication of the waters caused by the high emission of nitrogen and phosphorus and the widespread illegal cutting of mangroves. In 2003 shrimp farms covered approximately 13 000 ha, many of these adjacent to mangrove forests, which has generally resulted in eutrophication of mangrove creeks and tidal channels.

Intensive use of mangrove forests as a source of fuelwood, development of urban and tourist infrastructures and conversion of land use to agriculture appear to be the main causes of mangrove area changes in the Bolivarian Republic of Venezuela, where more than 35 000 ha disappeared in the past 25 years. Some additional losses and degradation have been caused by oil spills. In this country, as well, the government is now making efforts to protect these coastal ecosystems.

In relative terms, the country that experienced the largest loss was Peru (annual change rate 1980–2005: –2.42 percent), followed by Ecuador (–1.19 percent), Colombia (–0.91 percent) and the Bolivarian Republic of Venezuela (–0.60 percent). Mangroves in Peru have traditionally been used for the production of fuelwood, charcoal and poles. However, the main cause of their loss is uncontrolled clearing for conversion of the land into shrimp ponds. This activity began in the 1970s and soon became a major source of employment for many farmers. For example, the industry led to the expansion of the city of Tumbes, which has nearly doubled its population since the 1960s. The logging of mangroves is now banned and this, together with the increasing protection and control of the major mangrove forest in the country (Santuario Nacional Los Manglares de Tumbes), may have led to the reduction of the annual rate of loss, which appears to be close to zero in the last five years (2000–2005).

French Guiana is the only country in the region that did not experience major changes in mangrove area over the past two decades. In this country, other forest types are used as the principal source of timber/fuelwood, and no serious threats seem to pressure the mangroves. Unfortunately, however, the area estimates for this country had to be based on qualitative information, because no reliable data were available since 1980 (Table 14). New inventories are needed in order to have a clearer picture of the current extent of mangroves.

In Guyana, as well, updated inventories would contribute greatly to a better estimate of the extent of the mangroves.

MAIN USES AND THREATS

Mangrove forests in South America have traditionally been used for a wide range of purposes, and the local population still often rely on them for their livelihood. The collection of wood forest products is a common practice. Timber and fuelwood are harvested from mangroves in Brazil, Colombia, Ecuador, Guyana, Peru and the Bolivarian Republic of Venezuela. Production of charcoal from these forests seems to be less widespread, but it is a traditional practice in Colombia, Ecuador, Guyana and Peru. Extraction of tannin from the bark of mangrove trees (especially of *Rhizophora mangle*) was previously a common activity in Brazil, Colombia, Ecuador and Guyana, and contributed substantially to supplying national industries.

Rural communities often rely on mangroves as a source of food and additional income through the collection of non-wood forest products. Molluscs, crabs and other crustaceans are collected for local use or for national consumption. In Ecuador, for example, 2.0–2.5 million molluscs are collected every month from mangrove forests (Spalding *et al.*, 1997). In Guyana, *Avicennia germinans* seeds are used as food. Mangrove forests also indirectly influence the local economy by aiding commercial and small-scale fishing activities, which in the Bolivarian Republic of Venezuela, for example, have an important role in the national economy.

Mangrove forests have been converted to other land uses, such as the production of salt (Ecuador) or reclaimed for agriculture (especially in Colombia, Ecuador and Guyana) or for urban and tourism development (e.g. in Colombia and the Bolivarian Republic of Venezuela). In addition, as was described in the previous section, the conversion of mangrove lands for shrimp ponds was a major cause of mangrove destruction in past years, and even though this activity has been reduced, it still represents a significant threat.

Awareness of the importance of these coastal ecosystems is growing, but limited understanding of their services and benefits and lack of harmonization and implementation of existing laws still represent threats to mangroves. These forests continue to be under serious threat also from increasing urban and industrial pollution (e.g. Peru), the flow of pesticides to coastal zones (e.g. Suriname) and oil spills (particularly in the Bolivarian Republic of Venezuela). The planning and construction of dams or changes in river flows upstream are also current threats. These decrease the freshwater input, consequently increasing salinity and reducing nutrients and sediments transported to the coast.

Mangroves have a significant role in erosion and accretion along the coastline. An interesting case comes from French Guiana. The entire coast of this country is affected by the load dispersal system associated with the mouth of the Amazon River (located some 500 km east of the country), from which some 1 billion tonnes of sediment are poured into the ocean every year. It is estimated that 10 percent reaches the coasts as suspended load (Rudant, 1994). The mangroves assist in trapping these sediments.

MANGROVE CONSERVATION AND MANAGEMENT

Awareness of the importance of these forests is slowly but steadily increasing, and mangroves are under some form of protection in most countries of South America. However, illegal cutting and use is unfortunately continuing. Legal protection of mangroves has a long history in Brazil, where the earliest record dates from 1760. The King of Portugal, concerned about the loss of potential sources of tannin, issued an edict to restrict the cutting of mangroves for fuelwood unless their bark was also used. More recently, the government has published laws to conserve mangroves and to establish 12 new protected areas. In addition, projects for the conservation and sustainable use of mangroves in protected areas are being prepared, which could help reduce pressure on these forests.

Afforestation and reforestation activities have been undertaken (e.g. in Colombia and Guyana). All South American countries with the exception of Guyana have at

least one Ramsar mangrove site, indicating added political will to **protect these habitats** and their environmental richness. However, more efforts could be undertaken at the national and regional levels to implement appropriate strategies and effectively protect these ecosystems.

In Ecuador, after extensive mangrove clearing during the 1970s, the government declared mangroves protected forests in 1986 and prohibited cutting of mangrove trees in 1994. Forest protection policies and legislation exist in Guyana, as well, although **not dealing directly with mangroves**. **In Suriname mangroves are protected together with other** swamp forests in multiple-use management areas, and **in Peru, where mangrove clearing** is now prohibited, most mangroves have been protected since 1980 in the Santuario Nacional Los Manglares de Tumbes, which was declared a Ramsar site in 1997.