PANTANAL
The Pantanal of Mato Grosso, extending 250,000 square kilometers, is the largest flooding area in South America and the world. The Pantanal is an enormous intercontinental bay, bordered by the Brazilian Highlands to the east, the Mato Grosso Plains to the north, and a chain of hills and highlands of the Andes to the west. Therefore, it might be considered a large internal delta, where waters accumulate from the higher Paraguay River and many rivers that descend from the Highlands. The Pantanal is closely linked to the large basin of the Paraná and Prata rivers via the Paraguay River. Diffused aquatic connections with Amazonian tributaries exist to the north of Pantanal, especially with the Guaporé River.

The drainage of this internal delta by the middle Paraguay, via the narrow and shallow strip of Fecho dos Morros do Sul, is done with great difficulty. The enormous quantities of stagnated water behind this barrier make the Pantanal an unpredictable labyrinth of still and running waters, temporary and permanent. In indigenous legends and early maps, the Pantanal is remembered as a great lake full of islands, the "sea of the Xaraiés."

In rainy years, such as 1984 and 1995, the Paraguay River expands into a strip up to 20 km wide, invading the great lakes on the Bolivian frontier and Caracará Island, temporarily regenerating the "sea of the Xaraiés" of the old rainy climates. The Paraguay and other swamp rivers have small declivity, on the order of 20-30 cm. per kilometer, causing the waters that accumulate during intense rainfalls to drain very slowly. Consequently, the floods that are at a maximum in the north during the months of March and April arrive in the south of Pantanal only in July and August. Meanwhile, large quantities of water, probably hundreds of cubic kilometers a year, are lost through direct evaporation into the atmosphere. The Pantanal can be considered the largest "window" of fresh water evaporation in the world.

The whole life and economy of the Pantanal is related to this inundation system. The region is an aquatic paradox in an area of semi-arid or even arid continental climate. Without the abundant and shallow subterranean water table and the alluviums left by the floods, the terrestrial vegetation would be similar to that of the "cerrado" or the Bolivian "Chaco." The rich fauna of birds and mammals depends, in the great part, on aquatic food. The Pantanal may be seen then as a large and dynamic interface between the aquatic and terrestrial worlds.

The aquatic vegetation is fundamental to Pantanal's life. The floating plants are the major primary producers in the waters of Pantanal. Huge areas are covered by
"batume," floating plants such as agápê (Eichhornia) and Salvinia. Taken by the rivers, these plants form real floating islands called "camalotes."

After the inundations, the layer of nutritious mud allows the development of rich herb vegetation. The carandá palm tree (Copernicia australis) grows in extensive formations in areas where the floods are predominant but which remain dry during winter, permeating with the termite nurseries where the "paratudal" (shrubbery) starts. The paratudais formed by the purple ipês (Tabebuia, locally called "piúva"), are typical.

In a region a little more elevated, already in flooding areas, there is a typical vegetation of "cerrado." There are also, in the Pantanal, areas of dense and shady woods (with Piptadenia, Bombax, Magonia, Guazuma). Around the highest riverbanks the acuri palm tree (Attalea principes) appears, forming a forest with other trees, such as the pau-de-novato (Triplaris formicosa), the embaúba ( Cecropia ), the genipapo ( Genipa ), and the fig trees ( Ficus ). In high points of the hills there is vegetation similar to the caatinga (a dry bush), with the bromeliaceae Dycia, the cactus cansação, and mandacaru ( Cereus ).

The geologic past has permitted the Pantanal to constitute the largest junction of exchanges between the aquatic flora and fauna of South America. Nowadays it is populated by a variety of Amazonian and southern organisms. Being mainly a corridor of exchanges, it doesn't house as rich an endemic fauna as the Amazon, and it is the quantities, not the qualities, that characterize it.

The Pantanal offers to the visitor a great variety of open landscapes inhabited by large animal populations, whose feeding depends on the aquatic phase. This way, in the lakes, the microflora and microfauna allow the development of rich populations of "arua" snails (Brazilian amphibious mollusk, Pomacea, Marisa, and others) and shells ( Anodontides, Castalia, and others ), which sustain a variety of predators of these mollusks, such as birds and reptiles.

The innumerable shoals of "pitu" ( Macrobrachium ) and the various species of crabs ( Trichodactylus, Dilocarcinus, and others ) have indirect economic importance: they serve as bait for fishermen. The abundant fish include the corumbatá, pacú, cascudo (cat fish), pintado (surubim), dourado ( dorado ), and piranhas. Among the aquatic vegetation eaters, there are large populations of capybaras ( Hydrochaeris, hydrochaeris ) and buffalos. The câgado (a freshwater chelonian; Platemys) is also a vegetarian. The ariranha ( Pteronura brasiliensis ), an important piscivorous predator, formerly abundant, has been almost exterminated by hunters. The jacare ( Caiman crocodilus yacare ) might have a similar destiny, decimated by illegal hunting in recent years.

Alligators have an important role in the waters of Pantanal, functioning as predator "regulators" of the fauna of fish, and sometimes as relevant agents of the nutrients cycle. Where there are many alligators, few piranhas are found. When the alligators are decimated by the indiscriminate hunting of "coureiros" (hunters for the animal's skin),
the aggressive piranha population increases, to the detriment of other fish species. These might even be dangerous to human beings.

Another important aquatic and semi-terrestrial predator is the sucuri (anaconda; Eunectes notaeus), hunted by Pantanal inhabitants. Snakes are rare in the Pantanal, especially in the flooding areas, although there are water snakes (Liophis, Helicops), jararacas (Bothrops neuwidii), and boi-pevaçu (Hydrodynaste gigas).

Pantan al birds are one of the area's main attractions. Joined in huge concentrations, they seek aquatic food resources. Tuiuiú (Jabiru mycteriel), cabeça seca (Mycteria americana), and coleteiro (Ajaia ajaja), besides biguás (cormorants), herons, and ducks, are the most eye-catching. Many species nest in common areas, on determined trees, known as ninhais (groups of nests), which stand out in the Pantanal landscape. An admirable spectacle is to follow the birds, at nightfall or at dawn, to their dormitories on the riverside where they spend the nights.

Typical Pantanal birds include the aracuã do Pantanal (large-tailed squirrel cuckoo; Ortalis arnicollis); the blue macaw (Anodorhynchus hyacinthinus), which is risking extinction; and the black-headed parakeet (Nandayes nenday). The small cardinal bird (Paroaria capitata) is a characteristic bird of this ecosystem. A large abundance of birds of prey, especially the caracará (Polyborus) reflects the richness of animal prey. The caramujeiro hawk (Rosthramus sociabilis) feeds on mollusks.

Typical cerrado animals are also found in great number in the Pantanal, attracted by the abundance of food in flooded areas. These are species that appear sparsely in other areas of the continent. The Pantanal deer (Blastocerus dichotomus), common in the rich humid pastures, may be seen alongside two other species of "cerrado" deer and other mammals, such as the cachorro-vinagre (Speothusvinaticus), tapi (Tapirustrrestris), caitetu (peccary; Tayassutajacu), and agouti (Agoutipaca). There is also the guará wolf (chrysocyonbrachyurus) and the tamanduá bandeira (great anteater; Myrnecophaga tridactyla), which are hunted intensely.

Among primates, the macaco prego (capuchin monkey; Cebus apella) can be found here, alongside the bugio (Alouatta caraya). Montane pigs, descendants of domesticated swine, also proliferate in the dense Pantanal vegetation. Like the jaguar (Panthera onca), many other felines are attracted by the abundant prey. The predator on the high riverbanks is the spotted jaguar, together with other felines and canines. Among the birds, the emu (Rhea americana) and the siriema (crested cariama; Cariama cristata) are typical inhabitants of the cerrado. Naturally, the rich fauna offers many opportunities to birds of prey and carcass eaters.

The open landscapes of the Pantanal facilitate the census done by air of the populations of large vertebrates. It is estimated, for example, that today there are 10,000,000 alligators, 600,000 capybaras, and only 35,000 deer.
FLOODS
The difference in water level between the dry and rainy seasons is, on average, only four meters, but due to the small declivity, the majority of Pantanal might be flooded. In years of high rainfall, the waters surpass the six-meter level. On these occasions, the water of rivers such as the Paraguay, Cuiabá, São Lourenço, Taquari, and Miranda, as well as their tributaries, overflow and inundate enormous areas. These form a dense network of lakes, bays, and flooded lowlands, interconnected by perennial—the corixos—or ephemeral watercourses. Only high terrains, called cordilheiras (mountain chains), and a few islands escape inundation. Some isolated hills of pre-Cambrian rocks, the inselbergs, stand out in the swamps. The Morro do Azeite is one of these hills, on the banks of the Miranda River.

When the waters return to normal, many bays and lakes remain, while others are dry. Rich herbal vegetation spreads through the lowlands, taking advantage of the nutritious mud left by the flood. There are also small bays of salt water. At each precipitation/evaporation cycle the mineral salts accumulate, resulting in salting of the soils and some bays. The slow water evaporation in the lagoons is shown by the white rings of salt deposits (sodium carbonate). The salt concentration in these bays, in places like the Nhecolandia region, might be close to marine levels.

HUNTING
Difficult access has, until recently, protected the Pantanal from human impact. Only in the last decades has the area begun to be exploited by hunters for ariranha and alligator skins. Now the illegal hunting and smuggling of alligator skins is, in general, under control; alligator breeding farms are multiplying. The indiscriminate hunting of deer, capybaras, and baguás (a variety of mongrel dogs) constitutes a direct danger to the regional biological diversity.

Commercial fishing in Pantanal has become a serious environmental problem, with the arrival of boats and refrigerated trucks. Even game fishing, more and more intense, needs severe regulation. Individual quotas per amateur fisherman exist. However, the number of tourist fisherman has increased with growing access to the facilities of the Pantanal.

PANTANAL’S ECONOMY
Since the mid 1970s, there has been an intensification of agricultural and cattle breeding economies in Pantanal. Today, with around 4,000,000 cattle, the region has become a major meat producer. Cattle breeding is not considered harmful to the environment. The unpredictability of great floods controls herd sizes, maintaining them within the limits of an ecologically sustainable economy. In the absence of other pasture mammals, besides the few deer, the Nelore bulls are not in competition with the original fauna. They have become integral part of Pantanal's landscape.

The cultivation of rice, sugar cane, and soya are prejudicial to Pantanal's environment. Dams, canals and landfills, which drain the rains for agriculture, and the deforestation of the cerrado, cause the silting of rivers like the Taquari, and have interfered in the upriver
migration of fish. Recently, many exotic herbs have been spread by air sowing, the Brachiaria africana for instance, to increase pastoral productivity.

The Pantanal is a large water collection and evaporation bay, and much care must be taken to preserve it from pollution. An example is what happens to the mercury used to wash gold by prospectors of the Pocone River: its toxic salts accumulate in the bays in ever-increasing quantities; fish spread the mercury and the amount of this health-damaging metal on the skins of Pantanal fish increases each year. Pulp from alcohol distillers in Mato Grosso and pollution from the metropolis of Cuiabá also accumulate in this large sedimentation bay.

Just one of the great environmental dangers for the Pantanal is the waterway project, planned jointly by Brazil, Bolivia, Paraguay, and Argentina. To facilitate the access of marine and river navigation to Caceres, in the Upper Paraguay, the river channel will be dredged, the meanders, cut-offs, and contact between river and swamps will be restricted by dykes. In order to guarantee this ecosystem's health, it is fundamental to maintain and extend its preserved areas. Currently there is a small ecological station, the Taiamã Island Station, and Pantanal's National Park. But the regulation of these immense areas is extremely difficult, due to lack of financial resources and appropriate personnel.

A promising activity, compatible to the survival of this unique environment, is so-called ecological tourism: the Transpantanal highway, partially completed, as well as the Miranda-Corumbá road, facilitate thousand of tourists' access and enables the enjoyment of the richness of Pantanal's fauna and landscape. The tourist industry is a means of awakening the Pantanal population's interest in the survival of the region's fauna and flora. The growing number of tourist farms and small hotels constitutes a good example of integration between tourism and the ecosystem's environmental preservation.

Flooded lands are always rich in fauna, all over the world. In the special case of Pantanal, the neighborhood of Amazonia and the environment's physical characteristics make it one of the areas of highest tourist and ecological value in Brazil. Activities such as cattle, capybara, and alligator breeding are compatible to preservation of the area. On the other hand, the action of prospectors and individual initiatives that alter the landscape's ecology through drainage of swamps and extensive landfills among others, makes impossible the maintenance of the abundant flora and fauna and of the tourist potential. Considered one of Earth's paradises, it is of fundamental importance to maintain and extend Pantanal's preservation areas.

PANTANAL'S BIRDS
Pantanal's fauna of aquatic birds and paludicolous (inhabitants of lagoons) is among the world's richest, with many species of ducks that filter small animals and algae, the irerê being the most common and abundant in the region. Some of the ducks belong to the typical fauna of the Paraná-Prata system. The "tachã," or "Pantanal's guard," an animal
peculiar to South America and a distant relative of the Anatideos, easily can be seen on grass fields or perched on treetops where they remain for hours.

Many species of herons and socós form large colonies in the trees of riverbank woods. The largest heron species is the maguari. Though of a solitary habit, it is common to find groups of large white herons together with small white heron groups. Each is specialized for hunting various prey, such as fish, amphibians, and small reptiles, in different zones of lagoons, during the day or at sunset. The Ajaia ajaja, the beautiful pink colhereiro, is a specialized filtration bird.

The stork, the cabeça-seca, and the tuiuíú feed on insects, crabs, snails, frogs, and fish that they collect from shallow waters and mud. The tuiuíú is one of Pantanal's symbols. Its isolated tree nests stand out in Pantanal's landscape.

These varied aquatic birds have different diet and hunting strategies. The biguá, for example, catches fish by swimming and diving; the biguatinga, with its serpent-like neck, uses its pointy beak to spear fish. The caramujeiro hawk is a specialist in catching snails, and thus dependent on the gastropods' existence, especially the aruás.

THE ATLANTIC FOREST
The Atlantic Forest is the second of the most expressive forests in South America, second only to the Amazon Forest, the largest on the planet. The Atlantic Rain Forest located in the Serra do Mar escarpment, is part of the Atlantic Tropical Forestal Domain. This Forestal Domain extends for an area relatively parallel to the Brazilian coast, from Rio Grande do Norte to Rio Grande do Sul and is constituted by "seas of hills" and "chapadões" (large tablelands) covered in forest, with deep soils of perennial drainage.

The climate in the Atlantic Rain Forests has two seasons, defined mainly by rainfall, despite being quite variable in latitude. While in the Brazilian Northeast, average annual temperatures vary around 24ºC, in the Southeast and the South, the annual averages are lower and the temperature might occasionally reach 6ºC.

The Serra do Mar, represented by a chain of coastal mountains, presents a series of interruptions where the large belt of Rain Forests is also interrupted. The average altitude in this mountain chain is 800 to 900 meters, with emerging peaks of around 1,400 meters and escarpments up to 2,000 meters. On the mountain tops there are fields of rocky outcrops and, exceptionally, over 1,700 meters the forest gives way to alpine pastures.

The Atlantic Forest extends along the mountains and slopes facing the sea, as well as along the coastal plains. It owes its existence to the elevated atmospheric humidity brought by maritime winds. When climbing to cold areas of higher altitude, humid winds condense by the coast in the form of rains. Besides high rainfall, on mountaintops water condenses in the form of fog. This occurs even in summer and spring months, during the hot hours of the day. The entire coast of Brazil, however, does not present identical climate conditions and pluviometric indexes compatible with the existence of Rain
Forests. For this reason, there are natural interruptions of the forests along the Serra do Mar.

Today, the Brazilian Atlantic forests are almost completely devastated. Only approximately 5% of preserved areas from their original extension remain. The most representative section of what remains is found in the South and Southeast regions, where the landscape of steep escarpments makes access difficult.

The robust Atlantic Forest, with an arboreal vegetation of around 30 meters and trees that surpass the canopy, reaching 40 meters in height, presents an intense shrubby vegetation on the inferior stratum. It is a forest of diverse vegetation with many ferns, including arborescents, terrestrial orchids, and palm trees, among which the Euterpes edulis can be found. Around 10 meters high, it is from their trunks that palm hearts are extracted for food consumption. Besides moss carpets and innumerable fungi, the Atlantic Forest is rich in lianas and epiphytes, such as ferns, orchids, and bromeliads. Varieties with their leaves formed in rosettes always retain a certain amount of water, creating a favorable habitat for the development of a particular fauna, such as various larvae and adult species of arthropods and amphibians.

In general, the fauna in this forest is predominantly adapted to shade, and it is little tolerant of humidity and temperature variations. As a direct or indirect consequence of the devastation of the forest, many species have been affected. Besides terrestrial fauna, the Atlantic Forest also boasts a rich fauna of fish that inhabit the small streams that permeate forested areas. Many of these fish orient themselves by vision, to locate food or reproductive partners, as well as for social behavior reasons. They are incapable of surviving in cloudy or clear waters, or to be subjected to intense luminosity, as when the removal of the forest occurs. Further, the maintenance of mild temperatures in the stream and soil is only possible thanks to intense vegetative covering.

The Atlantic Forest has, in addition to a richness of invertebrates, especially arthropods, an important fauna of vertebrates. However, many species are still unknown to science and risk not being discovered if forest destruction continues.

One of the main characteristics of the fauna living in the Atlantic Forest, as in other tropical forests of the world, is diversity and the presence of many endemic species. With many species having a low population density, there is a great number of rare species.

The preservation of endemic species of the Atlantic Forest is extremely worrying, in face of the current situation of devastation. Even the endemic species that have not yet had their populations reduced to critical numbers, deserve special attention to survive. For example, there are a great number of endemic species in the avifauna which have the evolution center of the Serra do Mar, and together with an extremely limited geographic distribution, are in a vulnerable situation. This is the case with the pintor-verdadeiro (Tangara fastuosa) in the forests of the states of Pernanbuco and Alagoas.
There are approximately 25 species at risk of extinction listed among the Brazilian primates, and some of them are endemic to the Atlantic Forest. This is the case of four species of capuchin monkeys (Leontopithecus spp) and spider monkeys (Brachyteles aracnoides), the largest of neotropical monkeys.

The most affected areas of the Atlantic Forest are precisely the most important from the conservationist point of view. These are the remaining forests of South Bahia and Espírito Santo, which house the last examples of genus and species of plants and animals threatened by extinction. In the Southeast region, where great cities like São Paulo and Rio de Janeiro were developed in former areas of the Atlantic Forest, there remain relatively large stretches where areas of environmental protection have recently been created and even turned into the Reserve of the Atlantic Forest Biosphera. These are the last refuges of one of the richest ecosystems in the world.

MANGUE

The Brazilian coast has, in a surface of around 20,000 km, from the Orange Cape in Amapá, to Laguna in Santa Catarina, a narrow strip of forest called "Manguezal" or "mangue" (mangrove swamp). This is composed of a small number of tree species and develops mainly in estuaries and river mouths, where there is saltwater and places semi-protected from wave action, but open to receive sea waters. This is an environment with an ample supply of nutrients, where under the muddy soils there is a texture of roots and vegetable matter partially decomposed, called peat. In the estuaries, the muddy beds are crossed by tide channels (gamboas) used by fauna for their movements between the sea, rivers, and the "Manguezal."

Brazil has one of the largest extensions of manguezal in the world. Underrated in the past because the presence of the mangue was intimately associated to yellow fever and malaria illnesses already under control-the word "mangue" has, unfortunately, acquired a meaning of disorder, dirtiness, or suspicious place. The Manguezal long has been considered an inhospitable environment, due to the constant presence of different species of mosquitoes such as borrachudos, pólvora, and mutucas. The dark, muddy, unattractive forests, infested with irritant insects, caused people to think, until the mid 1970s, that the progress of the marine coast was equivalent to clean beaches, landfills with sanitation, ports confined by concrete, and cultivation experiments to use the lands of the old manguezais. Despite the great economic and social importance of the Manguezal this approach was in part responsible for the construction of ports, bathing resorts, and coastal roads in its areas, reducing the extension of the mangues.

Contrary to other forests, the manguezais are not rich in species, but stand out for the great abundance of populations living in them. For that reason they may be considered one of the most productive natural environments in Brazil.

Only three trees constitute the mangue forests: the red or bravo mangrove, the white mangrove, and the seriba or seriuba mangrove. They live in the tidal zone and have a series of adaptations: buttress roots (which supply with oxygen the other buried roots
and reduce the impact of the waves from the tides), capacity for ultra-filtration of saltwater, and development of plantules in the maternal plant, to be later dispersed by sea water. A few species can be added to the flora of Manguezal, such as the fern of the mangue, Spartina grass, bromelia Tillandsia usneoides, lichen Usnea barbata (the last species are known as old man’s beard, and very similar to one other) and hibiscus. In the North of the country, the thick mangue forests have trees that can reach 20 meters high. In the Northeast region, there is a kind of Manguezal known as dry mangue, with small trees in a sub-stratum of high salinity. In the Southeast of Brazil, the mangue has the aspect of a shrub forest.

The mangue’s dark ground is covered by water at high tide. Rich algae communities grow over the buttress roots of trees, in the area covered by the tide, including red, green, and blue algae. The trunks permanently exposed and the treetops are poor in epiphytal plants. Bacteria and fungi decompose the Manguezal leaves and the food chain is based on the use of the dregs resulting from this decomposition.

The fauna includes various species of crabs, forming enormous populations in the muddy beds. The oysters, mussels, and barnacles feed by filtering small fragments of vegetable dregs from water, rich in bacteria. There are also species of mollusks that perforate the wood of tree trunks, building in them their calciferous tubes and feeding on micro-organisms which decompose the trunks’ lignin, helping the natural renovation of the ecosystem through the fall of old trees, heavily perforated.

Prawns also enter the mangues, during high tide, to feed. Many fish species of the Brazilian coast depend on the food sources of the Manguezal, at least in their young phase. They include bagre (catfish), robalo, manjuba (fish of the family Engraulidae), and mullet. The richness of fish attracts predators such as shark and dolphins. The yellow chin alligator and the frog Bufo marinus might occasionally be found there.

Typical birds are few, due to the small diversity of flora, however, some species use the mangue trees as points of observation, rest, and nesting. These birds feed on fish, crustaceans, and mollusks, especially at low tide, when the muddy beds are exposed. Among mammals, the coati (a tropical raccoon-like mammal) is a specialist in feeding on crabs. The otter, an agile fisherman, is frequently found, as is the guaxinim (crab-eating raccoon).

The manguezais, used by the sambaqui (tribes which inhabited the Brazilian coast during the prehistoric period) more than 7,000 years ago, and by succeeding populations, provide protein-rich food for the Brazilian coastal population. The fishing of prawns, crabs, mollusks, and fish is a survival source for coastal inhabitants.

Although protected by law, the Manguezal still suffers from gratuitous destruction, domestic and chemical water pollution, petrol spillages, and poorly planned landfills.

RESTINGA
Restinga is a term used to designate the coastal plains covered by marine deposits,
resulting from the retreat of ocean levels 5,000 years ago, during the Quaternary. Following the retreat, there have been lacustrine and fluvial deposits containing, in part, material originating from the Crystalline Complex escarpments, characteristic in the South and Southeast coasts of Brazil, or from the sandstone of the Formação Barreiras. These plains are situated within a humid tropical climate, with no dry season and average annual rainfalls of around 1,700 to 2,000 mm. The largest quantity of nutrients in the coastal plains comes from atmospheric precipitation, being fixated mainly in the vegetable biomass.

The coastal plains might present themselves with quite varied extensions, depending on the retreat of the Crystalline's escarpments. Past marine levels have oscillated in such a way as to cause sedimentation in different terraces, which are testimony to this alternating depositing. By the action of the tides, the deposit of marine sediments has occurred in the form of sandy strips, with some older terraces. Behind these deposits, and between the strips, depressions forming freshwater marshes or swamps might occur.

In the coastal plains' beach line, vegetation is adapted to the salty and sandy conditions under the tidal influences, and named halofila-psamofila, with reptilious herbaceous species of ample root systems. After this zone, over more stable strips, there is dense arboreal bushy vegetation, called jundu, with many terrestrial bromeliads. Its angular form is due to the abrasive action of sand particles on the buds facing the beach. It has an organic layer little developed, with the ground bromeliads performing the role of stabilizers of the sub-stratum and of retention of water and nutrients in the system. On the coast of Rio de Janeiro and Espírito Santo there are thickets formed by arboreal and shrubby species, intercalated by uncovered soil.

Over the sandy strips, depending on their age, there might be an established forest that is less exuberant than the Atlantic Forest, with similar flora, penetration of cerrado elements, few characteristic species, and many epiphytes. There are forests that are similar to the mountaintop forests in coastal escarpments, usually over more recent strips, with many Myrtaceae and terrestrial bromeliads.

In marine terraces, the occurrence of temporarily flooded areas supporting marsh forests is common. Between the strips there are depressions that might be permanently humid, sustaining paludal forests, with few adapted arboreal species and many bromeliads over the drenched soil. In the bays of organic soil, both the paludal forest and mono-specific fields of taboa or water lily appear. This group of formations over the coastal plains establishes a mosaic of variable granulation, which enlarges its biological diversity. The fauna of mammals and birds that occur in the forests over restingas is similar to the Atlantic Forest, indicating interactions associated with the temporal and spatial alternatives of nourishing, sheltering, and nesting resources. Especially due to the urban nature of coastal plains, rain forests associated with the Atlantic domain remain in only small areas, preserved in Conservation Units.
CAATINGA
Right on the sub-equatorial zone, between the Amazon Forest and the Atlantic Forest, the caatingas of the Brazilian Northeast are found. They cover roughly 700,000 thousand km², approximately 10% of the national territory. The climate is semi-arid, with average annual temperatures between 27°C and 29°C, and with pluviometrical averages less than 800 mm. The caatingas' climatic rigidity is conferred especially by the irregular distribution of those rains in time and space. The superficial drainage is intense, since the soils are shallow and situated over crystalline rocks. The rivers are intermittent, that is, they run only during the rainy season, having their courses interrupted during the dry season. The vegetation is xerophytic, deciduous and open, well adapted to withstand the lack of water.

The caatinga's most common landscape is the one it presents during drought. Despite the dry aspect of the plants, they are all alive, they have only lost their leaves in order to endure the lack of water. Even during drought, animal life is also rich and diversified. However, after the rains the animal and vegetable diversity of the caatingas becomes evident. The plants flower and the animals reproduce, leaving descendants that have already adapted to endure the next long drought.

CERRADO
Cerrado is the regional name given to the Brazilian savannas. Approximately 85% of the great plateau that occupies Central Brazil was originally dominated by the cerrado landscape, representing around 1.5 to 2 million km², or approximately 20% of the country's surface. The cerrado region's typical climate is hot, semi-humid, and notably seasonal, with rainy summers and wet winters. The annual rainfall is around 800 to 1600 mm. The soils are generally very old, chemically poor, and deep.

The "cerrado" landscape characterizes itself by extensive savanna formations intercepted by woods along the rivers, at the bottom of valleys. However, other types of vegetation appear in the cerrado region, such as humid fields or buriti palm paths, where the water table is superficial. Alpine pastures may occur at higher altitudes and the mesospheric forests are situated on more fertile soils. Even the exclusive savanna formations are not homogenous; there is a great variation in the balance between the quantities of trees and herbaceous vegetation, forming a structural gradient that goes from the completely open cerrado-the clean field, predominant vegetation of grasses, without the presence of trees and shrubs-to the close cerrado, with a great quantity of trees and a forestal aspect.

Cerrado trees are peculiar, with twisted trunks, covered by a thick bark and leaves that are usually broad and rigid. Many herbaceous plants have subterranean organs to store water and nutrients. Thick barks and subterranean structures can be interpreted as adaptations of this vegetation to the periodic burnings to which it is submitted, in order protect the plants from destruction and making them capable of sprouting again after fire. It is believed that, as in many savannas in the world, cerrado ecosystems have coexisted with fire since ancient times; initially as natural fires caused by lightening or volcanic activity, and later caused by humans. Taking advantage of the sprouting of
herbaceous stratum that follows a burning in the cerrado, inhabitants of these regions have learned to use the fire as a tool, to increase the fodder offer to their domesticated animals (herbivorous).

The great habitat variability in the different types of cerrado supports an enormous diversity of plant and animals species. Recent studies, such as the one presented by J. A. Ratter and other authors in "Avanços no Estudo da Biodiversidade da Flora Lenhosa do Bioma Cerrado" (Advances in the Study of the Biodiversity of the Ligneous Flora of the Cerrado Bioma) in 1995, estimate the number of vascular plants at around 5,000; more than 1,600 species of mammals, birds, and reptiles have already been identified in the cerrado's ecosystems. Among the diversity of invertebrates, the most notable are termites and leaf-cutter ants (saúvas). They are the main herbivores of the cerrado, having a great importance in consuming and decomposition of organic matter, as well as constituting an important food source for other animal species.

Urban pressure and the rapid establishment of agricultural activities in the region have reduced the bio-diversity of the ecosystems. Until the mid 1960s, agricultural activities in the cerrados were quite limited, directed mainly at the extensive production of beef cattle for subsistence or local markets, since cerrado soils are naturally infertile for agricultural production.

After this period, however, the urban and industrial development of the Southeast Region has forced agriculture to the Central-West Region. The transfer of the country's capital to Brasilia has also attracted population to the central region. From 1975 until the beginning of the 1980s, many government programs have been launched with the intent of stimulating the development of the cerrado region, through agriculture subsidies. As a result, there has been a significant increase in agricultural and cattle production.

Nowadays the cerrado region contributes more than 70% of the beef cattle production in the country and thanks to irrigation and soil correcting techniques, it is also an important production center of grains, mainly soya, beans, maize, and rice. Great extensions of cerrado are also used to produce cellulose pulp for the paper industry, with the cultivation of several species of Eucalyptos and Pinus, but still as a secondary activity.

The conservation of the cerrados natural resources is represented by different categories of conservation units, according to specific objectives: eight national parks, various state parks and ecological stations, comprising around 6.5% of the total cerrado area.

However, this extension is still insufficient and more conservation units need to be created for the protection of existing biodiversity.

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Correa, Beef Cattle Production in Central Brazil, 1989.
