

The Cerrado biome

1. A unique set of ecosystems in the heart of South America



Figure 1. Diagram showing different physiognomies of the Cerrado, with more or less trees and shrubs. Be aware that it represents the different physiognomies of the Cerrado and not a question of representing an ecological succession. The physiognomies depend among other things on the nutrients, the depth of the soil and the frequency of fires. [Source: authors' diagram, all rights reserved ©]

The term Cerrado, in the broadest sense, refers to the Cerrado biome*. It covers about 2 million km² of central Brazil, *i.e.* about 23% of the country's land surface (about 3.6 times that of mainland France). Small areas of the Cerrado are also found in Bolivia and Paraguay. In terms of surface area, it is the second most important formation in Brazil after the Amazonian forest (48% of Brazil).

A biome being a set of ecosystems, the Cerrado biome is composed of different ecosystems, sometimes forests like gallery forests along rivers or dry forests (*mata seca*) but the predominant vegetation is savannas and tropical grasslands. The Cerrado is usually referred to as the Brazilian savanna. It presents different physiognomies defined according to tree cover (Figure 1):

- Ecosystems with very open vegetation: the *campos limpos*, *rocky campos* ;
- Ecosystems with more tree and shrub cover: *campos sujos*, *campo cerrado*, *cerrado sensu stricto*;
- the *Cerradão*, which is considered a forest devoid of a continuous herbaceous cover.

Several reasons have been put forward to explain this variation in physiognomy, including nutrient availability and access to water, fire regimes, and soil aluminum content. It is likely that the interactions between the different factors play a role in defining the different physiognomies.

2. Biodiversity: the richest savanna in the world



Figure 2. Some examples of the Cerrado fauna. A, Jaguar (*Panthera onca*); B, Maned wolf (*Chrysocyon brachyurus*); C, Giant anteater (*Myrmecophaga tridactyla*); D, Yellow armadillo (*Euphractus sexcinctus*); E, American rhea (*Rhea americana*). [Source: A: Cburnett / CC BY-SA 3.0] / B: Calle Eklund/V-wolf / CC BY-SA 3.0 / C: Wallpaper Flare / D: Charles J Sharp / CC BY-SA 4.0 / D: Charles J Sharp / CC BY-SA 4.0]

The Cerrado is the richest savanna in the world, with more than 160,000 species of plants, animals and fungi, including 12,000 plant species at present. It is considered that 5% of the world's biodiversity is found in the Cerrado, and about 30% of Brazil's biodiversity. It is now considered a biodiversity hot-spot: that is, a region very rich in biodiversity and a priority for conservation because of the level of degradation it faces. Emblematic animals include the Jaguar (*Panthera onca*), the puma (*Puma concolor*), the giant anteater (*Myrmecophaga tridactyla*), the yellow armadillo (*Euphractus sexcinctus*), the armadillo-ball (*Tolypeutes tricinctus*), the maned wolf (*Chrysocyon brachyurus*) and the American rhea (*Rhea americana*) (Figure 2).

3. Water from the Cerrado

The Cerrado plays a major role in Brazil in water supply and water quality control, and is sometimes referred to as the "water box of Brazil", the "cradle of Brazil's waters" or the "arc of springs". The vegetation of the Cerrado avoids too much water interception by foliage (as is often the case in forests), allows efficient water retention and infiltration into the soil and filtration of the water that feeds aquifers and rivers.



Figure 3. Itaipu hydroelectric plant on Rio Paraná, on the border between Brazil and Paraguay. [Source: CC BY 2.0]

Many of Brazil's river basin heads are concentrated in the Cerrado, and it is also the source and feeder of many of South America's major rivers, such as Rio Xingu, a tributary of the Amazon, Rio São Francisco (90% of its tributaries originate in the Cerrado) or Rio Tocantins and its tributary the Rio Araguaia, Rio Paraguai and Rio Paraná. The waters of its rivers and their tributaries feed many hydroelectric plants in Brazil, such as the Itaipu hydroelectric plant (Figure 3) on Rio Paraná, one of the largest hydroelectric plants in the world, the Tucuruí dam on Rio Tocantins, and the Belo Monte plant on Rio Xingu.

In addition, the vegetation of the Cerrado also plays an important role recharging the Guarani aquifer, one of the largest aquifers on the planet. It is understood that the waters of the Cerrado are also very important for agriculture.

4. Threats to the Cerrado

Although it hosts incredible biodiversity, the Cerrado is one of the most threatened biomes in South America, as the main conservation efforts are focused on the Amazonian forest (4.2 million km²) and the Atlantic forest (1.1 million km²). Today only a small area of the Cerrado is under legal protection, about 2.2%, although it is facing drastic changes in land use. Between 1990 and 2010, the Cerrado lost 265,595 km² (about half of France); between 2002 and 2009 alone, 92,712 km² (15% of France) of natural ecosystems were converted into agricultural land, a decrease of 8.1% compared to 3.1% in the Amazon [11],[2]. Over the past four decades, the development of livestock farming and intensive agriculture has exacerbated social inequalities, biodiversity losses, landscape fragmentation, biological invasions, soil erosion, water pollution and land degradation. Currently, some policies designed to sequester carbon, such as REDD+ payment schemes, threaten the open landscapes of Cerrado through afforestation projects.

Notes and References

Cover. Ipê-amarelo, Ipê do Cerrado, *Handroanthus ochraceus*, or golden trumpet tree, tree with yellow flowers emblematic of the Cerrado of Brazil. [Source : Photo © S. Le Stradic]

[1] Beuchle, R., Grecchi, R.C., Shimabukuro, Y.E., Seliger, R., Eva, H.D., Sano, E., & Achard, F. 2015. Land cover changes in the Brazilian Cerrado and Caatinga biomes from 1990 to 2010 based on a systematic remote sensing sampling approach. *Applied Geography* 58: 116-127.

[2] Espírito-Santo, M.M., Leite, M.E., Silva, J.O., Barbosa, R.S., Rocha, A.M., Anaya, F.C., & Dupin, M.G. V. 2016. Understanding patterns of land-cover change in the Brazilian Cerrado from 2000 to 2015. *Philosophical Transactions of the Royal Society B: Biological Sciences* 371: 20150435.

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