



Burning Season: Challenges to Conserve Biodiversity and the Critical Points of a Planet Threatened by the Danger Called Global Warming

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Authors' contributions

This work was carried out in collaboration among all authors. Author DPLJ conceived and designed the scope of the review. All authors contributed to the improvement of the article, giving their opinions and carrying out a careful review. All authors read and approved the final manuscript.

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ABSTRACT

Aim: Due to their biological richness and threat levels, the Cerrado and the Atlantic Forest of Brazil, along with other regions located in different parts of the planet, are identified a global hotspots and need greater attention due to the problems generated by global warming.

Objective: This article addresses general aspects of the planet's biodiversity, the improvement of ecosystem conservation in Brazil and in the world.

Methodology: We carried out an approach on the environmental situation in relation to global warming, the problems generated to the fauna and flora and the conditions in which the biomes of the Midwest region of Brazil are found.

Results: The State of Mato Grosso, located in the heart of South America, Brazil, encompasses in its territory the biodiversity of three large biomes: the Amazon, the Cerrado and the Pantanal. The cerrado, a savanna mosaic biome with 38.9% of the state's territory, is home to 30% of Brazilian biodiversity and 5% of the planet's species. In Mato Grosso Amazonia, the main anthropic pressure is caused by exploration, deforestation, crops and livestock. In the Pantanal of Mato Grosso, one of the largest continuous wetlands on the planet, it is marked by peculiarities, such as dry and flood seasons, low fertility soils, difficult access, among others, which restricted its occupation and human interference.

Conclusion: Finally, these biomes are areas of relevant interest for conservation and for environmental and ecosystem services, these biomes in the state are under threat and need attention from civil society and government in different spheres. General aspects of the biodiversity of biomes distributed in the territory of Mato Grosso/Brazil, socio-environmental challenges, conservation units and public and private policy initiatives that affect conservation, require active conservation intervention measures to harmonize investment activities with the priorities of biodiversity conservation.

Keywords: Brazilian biomes; sustainability; global warming; loss of biodiversity; conservation challenges.

1. INTRODUCTION

There have been five mass extinctions on planet earth in the last 500 million years. From the perspective of the geological history of the planet, which experienced five episodes of extinction, at least half of the living beings were eradicated in the face of this cataclysmic event. Occurring 66 million years ago, when an asteroid collided with the earth, more than 90% of the organisms that once walked, swam, flew or crawled on this planet disappeared.

Most of the life on the planet, such as mammals, turtles, reptiles, amphibians and birds from that Cretaceous period, survived, as did the marine and aquatic life of each biome. Without catastrophic and huge dinosaurs, they proliferated, leading to the birth of *Homo sapiens*, a species that may now be responsible for a probable sixth extinction [1]. In this new cataclysmic allusion, we can say that the meteor this time; it is we, human beings, who are contributing to the extermination of species and changes in climate change on the planet. There is still time to avoid this tragedy announced and of great proportions.

The planet earth is one of the eight planets in our solar system and is awarded for presenting under its terrestrial surface a variety of plant and animal species of greater exuberance, from the gigantic whales, the trees to the tiniest microbiological agent, all the species on the

planet interact for the sustainability of the planet where they live. This rich and complex biodiversity has its days numbered, according to climate projections reported for decades, which have been alerting government officials and calling the attention of the world population to the increasingly relentless situations of conditions and actions as a result of what is being announced.

In a catastrophic analysis, almost compared to a Tsunami, researchers analyzed the decline of species on the planet, indicating that, in addition to global species extinctions, the Earth is experiencing a major episode of declines, extinctions and population extirpations in biomes, which will have cascading negative consequences on the functioning of ecosystems and services vital to the maintenance of human civilization and its natural resources [2].

These consequences were shown in anthropological studies carried out by Italian researchers [3], the climatic conditions that the planet has suffered and has been suffering from contributed to the extinction of the human species themselves. These Italian researchers found answers in the assessment of climate modulation and meteorological data from millions of years ago. These temperature fluctuations may have ended up with three different hominids that walked the earth thousands of years ago, leading to extinction the *Homo neanderthalensis*, *Homo erectus* and *Homo heidelbergensis* that suffered from the climatic consequences.

Ecological issues present their concepts defined by Willin [4], who describe genetic diversity as all the genetic information of each individual species. Species diversity refers to the frequency and variation of different organisms, and the diversity of ecosystems encompasses variation in habitat and community, as well as ecological processes in the ecosystem, that is, an operational definition of biodiversity establishes that it is the quantity and composition of living entities, at different scales, spatial and organizational. Felfilli [5] refers to the biome as a biological subdivision of the earth's surface that reflects the ecological, physiognomic character of the vegetation and environmental factors, corresponding to the climatic regions.

The biodiversity of planet Earth is being depleted, with a speed never seen by climate projections and alerted by scholars of the planet as biologists, ecologists and biodiversity scholars. The planet earth is a living organism and human beings directly impact it. The theory of Gaia an ecological hypothesis establishes that the planet Earth is an immense living organism. This fundamental concept developed by the English scientist James Lovelock (1979), teaches us that the planet is able to obtain energy for its functioning, while regulating its climate and temperature, eliminating its detritus and combating its own diseases, that is, as well as other living beings, an organism capable of self-regulation.

Would the SARS-CoV-2 pandemic be one of the results of this organization for this self-regulation? Everything indicates that it is. The exaggerated consumption of natural goods, exploitation of forests, traffic of wild animals, associated with human greed and irresponsibility, has contributed to the future of being affected by other insidious, and perhaps more lethal, viruses, as has happened since the end of 2019.

The Covid-19 pandemic brought to the world new behaviors, new acts, new attitudes, new policies, new research topics and greatly changed the choices of agents in the face of a new scenario with serious health risk. The speed of spread of cases of the disease, combined with the acceleration of lethality in the sequence in which deaths by the microbiological agent occur, generated impacts on the public and financial health policies of many countries, which left them in cases of restrictions adopting aid policies socio-economic, and often turning their attention to the environment.

Lovelock [6-7] emphasizes that according to the hypothesis, biotic organisms control abiotic organisms, so that the Earth remains in balance and in adequate conditions to sustain life, but the insidious and catastrophic action of man, comes causing the planet to take vigorous action against this devastating and aggressive action.

In 2010, leaders from 196 countries gathered in Japan and agreed on a list of goals designed to save the Earth. These goals were designated by the UN (United Nations Organizations) as the "Decade of Biodiversity", but the efforts were flawed and the consequences have caused several damages to the environment.

In 2020, the biodiversity goals of Aichi, in Nagoya, Japan will produce a Global Biodiversity Outlook 5 (GBO5) report, directed by the UN that mainly described 20 maiores transition goals that need to be accomplished to slow and halt the decline of species in the nature and the accelerated global climate change on the planet. Towards a New Post-2020 Global Biodiversity Milestone: GBO-5 synthesizes the scientific basis for urgent action to contain and halt species destruction and halt global warming [8].

In this article, we carry out a bibliometric analysis of published issues and facts about global climate change, recent records on the environment and, more specifically, we reveal temporal and categorical patterns in research on the environmental situation and climate change in Brazil with an emphasis on the region Midwest of Brazil. Addressing specific issues of the Cerrado, Amazon and Pantanal biomes, general aspects of biodiversity, socio-environmental challenges, Conservation Units and public and private policy initiatives that affect and direct conservation, showing the existing conditions on the planet and the current situation as a result of warming global that has implied environmental situations and problems, in the food chain, in climatic conditions, in the devastation of forests, in the degradation of the soils and in the survival of fauna and flora species.

2. MATERIALS AND METHODS

For data collection, bibliographical surveys were carried out in the Pubmed, Sciel, Lilacs, Science Direct and Google Scholar databases of scientific articles and technical information involving the location and identification of subjects relevant to the situation of the planet such as global

warming, glaciers, traffic of animals, attack wildlife, devastation of forests, extinction of species, protection of animals and situations of biomes, considered hotspots of biodiversity and mainly returning to information related to Brazil, focusing on the central region of the country, the State of Mato Grosso .

3. MATO GROSSO/BRAZIL: GEOGRAPHICAL CHARACTERISTICS

The state of MT is located in the west of the Center-West Region of Brazil, its capital is the city of Cuiabá, considered the third largest state in the country, behind Amazonas and Pará. Amazonas and Pará, to the south, Mato Grosso do Sul, to the east, Tocantins and Goiás and to the west, Rondônia and Bolivia. Occupying an area of 903,357.908 km², its topography is 55% slightly flat, 30% flat, 10% wavy and 5% mountainous, altitude between 400m and 800m [9].

According to the climatic classification of Köppen-Geiger, the climate of Mato Grosso, is characterized as "Aw", Tropical climate and "Cwa", Tropical of altitude, it is subtropical, dry and rainy winter in summer is characterized by the semi region-arid (semi-humid hot) [10], with an average annual rainfall of 1,500 mm and an average annual temperature of 25°C to 40°C. What defines two very characteristic seasons is a dry inversion (May to September) and a rainy summer (October to April), with an average annual temperature of 26°C; the maximum can reach 38°C and the minimum, 8°C [9].

This characterization of dry winters and rainy summers in the Center-West of Brazil, results from the stability generated by the influence of the subtropical anticyclone of the South Atlantic and of small dorsals that are formed over the South American mainland.

4. RESULTS

According to the search terms, it was possible to access 110 scientific articles, folders, books of interest to the subject proposed in this review and after consultation and evaluation, the selected articles were used as relevant results for the discussion of the review. The results presented show the action and interaction of biomes, man and the environment. The results discussed were grouped and tabulated by theme and presented below.

5. DISCUSSION

5.1 Hotspots: The Vulnerable Points of Biodiversity

In 1988, ecologist Norman Myers created the term "biodiversity hotspots" in allusion to places rich in fauna and flora diversity on the planet; this characterized term represents areas that have an exceptional concentration of endemic species and that experience exceptional habitat loss [11].

Initially, 25 global hotspots were established. Today, we can see that the distribution of hotspots across biomes is well established for tropical forests, representing 34 proposed biodiversity hotspots [12,13]. In 2011, a 35th access point was added to the Eastern Australian Woodlands [14], currently comprising 35 biodiversity hotspots distributed around the world. In Brazil, two natural domains are classified: Cerrado and Atlantic Forest (Fig. 1).

Of these 35 eco-regions presented, we observed that 23 (66%) of them are predominantly tropical forest biomes, ranging from very humid hotspots to savannah regions or pastures with predominantly sparse trees, tortuous trunks, thick bark and leaves, typical of dry climates such as those presented in the Cerrado of Mato Grosso. Still, we can observe access of temperate forests 6 (17%), ecosystems with a predominance of the Mediterranean 5 (14%) and one (3%) considered desert (Fig. 1).

On a global scale, we can see conservation priorities are well established in the 35 biodiversity hotspots [12], that is, areas with exceptional concentrations of endemic species, as well as experiencing extreme habitat loss and consequently with damage to the fauna and flora of each region [12,13].

Although many questions about the mechanisms and assessments of biodiversity hotspots are questioned by other authors based on calculations used for information such as species distribution, endemism and threats [15], many researchers still disagree about the methodologies used for biodiversity conservation calculations [16-19] each of these points of view has its priorities and its positive and negative points, what we really need is to have a precise measure and a decisive answer, we follow in this review the great thinkers who listed the prominent and preponderant role of conservation biology, even if some facts are controversial, as in any study.

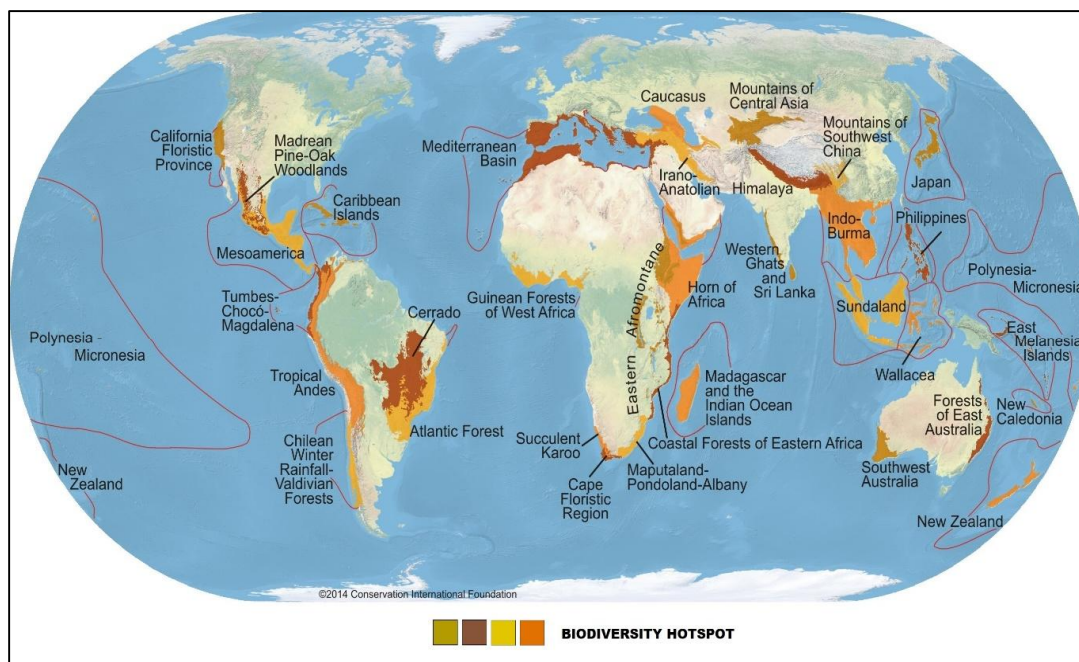


Fig. 1. Map of the Earth's biodiversity hotspots, including the Brazilian Cerrado (Brazilian savannah) and the Atlantic Forest. These reserve sites are heavily threatened by habitat loss and degradation, making their conservation crucial to protecting nature for the benefit of all life on Earth. Source: Mittermeier [13]; Conservation International Foundation

6. CERRADO AND ATLANTIC FOREST: THE HOTSPOTS OF BRAZILIAN BIODIVERSITY

Due to their biological richness and threat levels, the Cerrado and the Atlantic Forest of Brazil, along with other regions located in different parts of the planet, are identified as global hotspots, which require priority measures for the conservation of biodiversity throughout the world [12].

According to Brooks [20], in the hotspots are found more than 50% of plants and 57% of vertebrate animals threatened with extinction worldwide, according to the criteria of the International Union for the Conservation of Nature (IUCN).

In Brazil, a Biodiversity survey carried out by researchers and scientists from various areas established the country's fauna and flora. Brazilian flora records currently recognize 49,993 species for the Brazilian flora (native, cultivated and naturalized), being 4,993 of algae, 3,553 of angiosperms, 6,320 of fungi, 1,610 of bryophytes, 1,403 of ferns and lycophytes and 114 of gymnosperms [21].

Among the Brazilian fauna, estimates currently record 119,720 valid species of animals known to Brazil, with 94,000 species of arthropods, 4,400 species of osteichthyes, 3,100 species of molluscs, 3,000 species of birds, 1,600 species of annelids and more than 1,000 species of amphibians registered in the federative unit [22].

For the IBGE (Brazilian Institute of Geography and Statistics), among the 166,264 thousand species (49,168 of plants and 117,096 of animals) recognized in the country; the Atlantic Forest biome had the most threatened species with 1,989 (25%) assessed threatened species, followed by the Cerrado biome with 1,061 (19.7%) threatened species [23]. However, constant taxonomic revisions and the frequent discovery of new species keep these numbers constantly updated.

6.1 Atlantic Forest

The Atlantic Forest, despite not being part of the biomes found in the Midwest region of Brazil, is an ecosystem of biological richness and presents scenarios of threats, along with the other 34 biodiversity hotspots. Spread over more than 27 degrees of latitude in Brazil, including parts of

Argentina and Paraguay, the Atlantic Forest has great variations in relief, rainfall and mosaics of phytogeographic units, which contribute to the great biodiversity found in this hotspot [24].

The devastation of the Atlantic Forest is a reflection of territorial occupation and the disorderly exploitation of natural resources. The successive impacts resulting from different exploration cycles, population concentration and major urban and industrial center led to a drastic reduction in natural vegetation cover, which resulted in landscapes, today, strongly dominated by man [12]. A study by Bellard [25] revealed that the Atlantic forest is considered one of the biodiversity hotspots vulnerable to global changes.

According to reports by IBAMA (Brazilian Institute of Environment and Natural Resources), the number of endangered species in this biome is alarming: the Atlantic Forest is home to 383 of the 662 species of animals threatened with extinction in Brazil and 200 Brazilian plant species endangered, 117 are from this biome. In relation to aquatic and marine animals, of the total of endangered taxa, 1,013 (86%) are continental and 351 in fresh water [26].

Several aspects associated with fragmentation, become worrying in relation to the Atlantic Forest. The existing synergism between factors, associated with hunting, fire, introduction of invasive species contribute to a strong influence in the region and these events need to be documented, as they end up influencing negatively and their persistence reflect a very significant set for the range of threatened and with urgent need for protection in conservation units [24].

6.2 Brazilian Savannah (Cerrado)

The great geographic extension and diversity of climate, soil and relief provide the existence of an incomparable biological diversity, not only in relation to animals, but also in relation to vegetation. Mato Grosso, central region of Brazil, has 3 phytogeographic domains characterized by the Amazon, the Cerrado, which is called the Brazilian Savanna and considered one of the hotspots of global diversity [12] and the Pantanal, the largest wetland on the planet of South America.

Mato Grosso is a privileged state in terms of biodiversity, it is the Brazilian state to have,

alone, three of the main biomes in the country: Amazon, Cerrado and Pantanal. Among these three biomes, the Amazon is the most comprehensive, with 480,215.00 km² (50%); the Cerrado occupies 354,823.00 km² (38.9%) and the smallest area is the Pantanal, with 60,885.00 km² (7.2%) [9,27].

The cerrado *sensu lato* occupies most of central Brazil, a very important biome that is regionally present in the central portion of Brazil, considered the second largest biome in South America, after the Amazon, corresponding to 1/4 of the national territory (24%) and the largest hotspot in the Western Hemisphere. This biome, located in the center of South America, covers a total area of 2,064,301 km², with 99.30% in Brazil and the rest divided between Paraguay (0.41%) and Bolivia (0, 29%) [28].

This biome extends through the Brazilian states of Bahia, Goiás, Maranhão, Minas Gerais, Mato Grosso, Mato Grosso do Sul, Piauí, Paraná, Rondônia, São Paulo, Tocantins and the Federal District with many biogeographic limits: to the north with the Amazon biome; to the east and northeast, with the Caatinga; to the southwest, with the Pantanal; and to the southeast, with the Atlantic Forest; Home to 30% of Brazilian biodiversity and 5% of the planet's species, this species-rich biodiversity is home to around 11,627 species of native plants, of which approximately 4,400 (44%) are endemic species [28].

After the Atlantic Forest, the Cerrado is the Brazilian biome that suffered the most from human occupation. It is this combination of conditions – high biodiversity and high degree of threat from habitat loss – that made these two biomes to be considered priorities for investment in biodiversity conservation and ecosystem services [28].

Despite the great variety, the fauna of the Cerrado is little known. Many studies indicate an extraordinary variety of faunal specimens, the difficulty in obtaining information about the entomofauna, is due to the extreme richness of the species and abundance of some groups and taxonomic difficulties. The cerrado contributes by indicating that there are about 14,425 species of invertebrates, with about 194 species of mammals, 19 of which are endemic, 837 species of birds, 29 of which are endemic; 185 reptile species, 24 endemic; and 150 amphibians, 45 of which are endemic [29].

Work carried out by Cavalcanti [30] showed revealing numbers that reinforced the biological relevance and colossal status of this Biome; between 1998 and 2008, 1,300 new vertebrate species were described. Of these, 347 species found in Cerrado sites, 222 new species of fish, 40 amphibians, 57 reptiles, 27 mammals and one bird.

In this ecosystem, the following plant species stand out: Lixeira (*Curatella americana*), mamica-de-porca (*Zanthoxylum rhoifolium*), yellow-ipê (*Handroanthus albus*), pau-terra (*Qualea parviflora*), (*Qualea grandiflora*), aroeira (*Astronium fraxinifolium*) barbatimão (*Stryphnodendron barbatiman*), copaiba (*Copaifera langsdorffii*), timbó (*Magonia pubescens*), pequi (*Caryocar braziliense*), buriti (*Mauritia flexuosa*), mangaba (*Hancornia speciosa*), cagaita (*Eugenia dysenterica*), bacupari (*Salacia crassifolia*), araticum (*Annona crassifolia*), baru (*Dipteryx alata*) and herbaceous cerrado savana-grass (*Mesosetum chaseae*), lemon-grass (*Elyonurus muticus*), mimoso-grass (*Axonopus purpusii*) e capibara-grass (*Steinchisma laxum*) as the highest in values of floristic importance for the region.

The Cerrado countryside formations comprise three main phytophysiognomic types: dirty field, clear field and rupestrian field, composed of the presence of many rocks, floristic composition, which includes many endemic species. According to topographical particularities and geoforms, dirty field and clear field may have three subtypes each: dry dirty field, wet dirty field and dity field with Murundus (=elevation of terrain); and dry clean field, clean wet field and clean wet field with Murundus [31].

Due to the action of man, the Cerrado has been suffering from the great changes imposed by the human species and, consequently, may cause the extinction of various forms of life in this biome, such as: tapir (*Tapirus terrestris*), capybara (*Hydrochoerus hydrochaeris*), jaguar (*Panthera onca*), puma (*Puma concolor*), guinea pig (*Cavia aperea*), paca (*Cuniculus paca*), ocelot (*Leopardus pardalis*), wild dog (*Cerdocion thous*), calango (*Tropidurus torquato*), worm sloth (*Bradypus variegatus*), tegu (*Tupinambis teguixim*), collared peccary (*Pecari tajacu*), opossum (*Didelphis marsupialis*), giant otter (*Pteronura brasiliensis*), three-banded armadillo (*Tolypeutes tricinctus*), giant armadillo

(*Priodontes maximuseira*), anteater (*Myrmecophaga tridactyla*), peccary (*Tayassu pecari*), howler monkey (*Alouatta caraya*), various snakes and other animals from an extensive representative list.

In Mato Grosso, the area occupied by the Cerrado biome is approximately 354,823.00 km² equivalent to 38.9% of the state territory. The first impression is of a wild landscape, with short and twisted trees in apparently lifeless terrain. However, it is in this biome, considered one of the most important in Brazil, that rivers flow that divide the three main hydrographic basins in Brazil: Platina, Tocantins and Amazonia. Its flora, with 11,627 species of native plants, with approximately 4,400 endemic species, standing out for its exotic beauty and medicinal richness [32].

The Cerrado is also the source of 90% of the waters of the São Francisco River, one of the most important water courses in Brazil. When the Cerrado is deforested, three large Brazilian aquifers (BambuÍ (180,000 km²), Uruçua (120,000 km²) and Guarani (1.2 million km²) are recharged, as well as the water resources that are essential for millions of people living in the biome.

In the central region of Brazil, there are the sources of two of the three largest hydrographic basins in South America (the Hydrographic Region of Paraguay, with an area of 176,800 km², which covers 19.6% of the state surface; the Amazon Hydrographic Region; with 592,382 km², which occupies 65.7% of the territory, and the Tocantins-Araguaia region, with 132,238 km², which corresponds to 14.7% of the surface of the state of Mato Grosso [33] (Fig. 2).

Specifically in the Amazon portion of the state, the hydrographic basins of the rivers Teles Pires (142,600 km²), Juruena (181,367.9 km²) and Xingu (176,800.41 km²) stand out. The Juruena and Teles Pires rivers form the Tapajós river, a right bank tributary of the Amazon river [9]. This characterization results in a high potential aquifer, which favors extensive contributions to the biodiversity of the biome, its vegetation, still considered, at this level, as the second largest plant formation in Brazil and originally occupied an area of nearly two million km², and today it only occupies about 20% of the total.

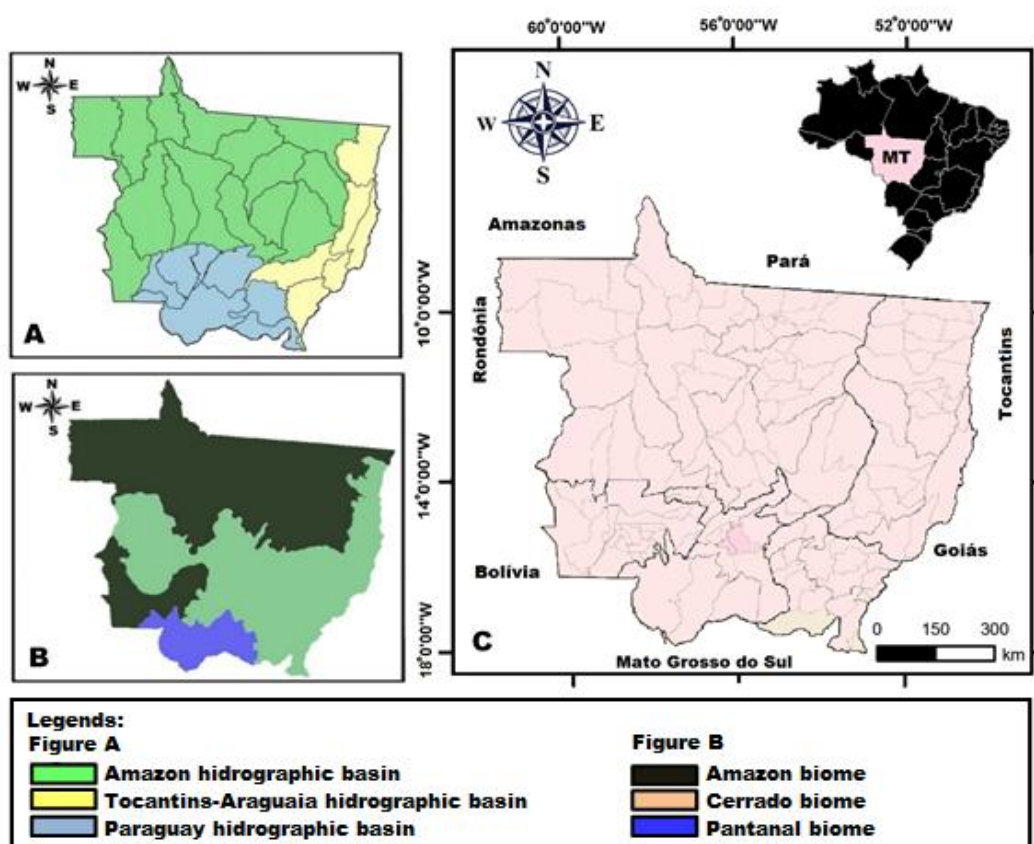


Fig. 2. Maps of the State of Mato Grosso, central region of Brazil. In the upper left (A), map showing the respective hydrographic basins of the State of Mato Grosso. At the bottom below (B), showing the respective state biomes. Right, larger image (C), map of Mato Grosso and its boundaries, smaller map (black) represents a map of Brazil

6.3 Pantanal: the Largest Floodplain in the World

Another exuberant ecosystem that is appreciated for its richness of species is the Pantanal. Due to the remarkable diversity of plant and animal species that it houses, it received the title of Biosphere Reserve from UNESCO (United Nations Educational, Scientific and Cultural Organization). Its waters nourish millions of animal, plant and human lives, supplying not only Brazil, but also Bolivia, Paraguay and flow to Argentina through the Paraguay River.

The Pantanal of Mato Grosso is considered one of the most extensive wetlands in the world and of global importance [34]. In Mato Grosso, central Brazil, a tropical country par excellence, one of the largest continuous wetlands on the planet, it is called Pantanal, an area marked by hydrophytic climatic peculiarities, where there is

a circannual succession of water phases, known as flood, full, ebb and dry, still low fertility soils, difficult to access, and characteristic vegetation, their phytophysiognomies were restricted to occupation and anthropogenic interference, and these classifications can be interpreted by the Raunkiaer biological system.

This floodplain is located in the depression of the upper Paraguay river 16–20°S and 55–58°W, presenting an upper Paraguay river catchment area covering about 496,000 km², the Pantanal about 160,000 km², of which about 140,000 km² belong to Brazil, 15,000 km² to Bolivia and 5,000 km² to Paraguay. The Pantanal climate is hot with a pronounced dry season from May to September and a rainy season from October to April. Annual precipitation decreases by 1,250 mm near Cuiabá, the monthly average temperature varies between 27.4°C and 21.4°C varying between months [34].

Due to the great interaction between biotic and abiotic factors, the result is a great heterogeneity of landscapes within the plain, thus, the Pantanal can be divided into eleven hydrographic sub-basins. As one of the main cattle breeding regions in Brazil, management must be guided by the needs of native species of fauna and flora, integrating the needs of exotic animals, when they exist, and of man, in order to preserve balance and soil quality and maintain the sustainability of the system.

The Pantanal has a vegetation composed of four main Phytoecological Regions: Cerrado, Chaco, Deciduous Forest and Semi-deciduous Forest. Floristic contacts are transitions of different regions, where species mix and are of great importance for the environmental balance and biodiversity. Plant species can be observed presenting a great variety that can be noticed in the different types of terrestrial and aquatic plants, grasses, shrubs and small, medium and large trees.

Presenting an open vegetation (different from the Atlantic Forest and Amazon Forest which are considered closed forests. Highlights for the flora: Pequi (*Caryocar brasiliensis*), Sucupira (*Bowdichia virgilioides*), Tarumarana (*Buchenavia macrophylla*), Jatobá (*Hymenaea stigonocarpa*), Gonçalves (*Astronium fraxinifolium*) and angico (*Parapiptadenia rigida*), aroeira (*Myracrodruon urundeuva*), the piúvas or ipês tree of the Bignoneaceae family; yellow-ipê (*Handroanthus albus*) medicinal tree known as para-tudo, purple-ipê (*Handroanthus impteigenosus*), white-ipê (*Handroanthus roseo-albus*) e o pink-ipê (*Handroanthus heptaphyllus*), angico (*Anadenanthera colubrina*), acuri (*Attalea phalerata*), caramdah (*Copernicia australis*), camburu (*Dipteryx alata*), many aquatic plants, varied orchids (*Praecereus saxicola*) (cacti represented in the transition areas between the Cerrado and the Pantanal).

The number of plant species occurring in the Pantanal varies according to the source considered, between 1,082 and 1,863, with estimates pointing to the possibility of occurrence of more than two thousand plant species in the region. Aquatic plants stand out in the Pantanal landscape. About 280 species of aquatic plants are listed in the Pantanal, generally called aquatic and/or hydrophilic macrophytes. Woody plants are the majority, with 756 species, of which 220 are trees. Among the species known to be endemic to the Pantanal, *Arachis diogoi*

(Fabaceae), *Euplocca pottii* (Boraginaceae), *Habranthus pantanalensis* (Amaryllidaceae), *Stilpnopappus pantanalensis* (Asteraceae), *Xanthosoma potti* (Araceae) and *Muellera sericea* (Fabaceae), among others they are known by popular names, denoting how much we still do not know about the composition of the Pantanal flora [35].

Among the animals, a large number stand out among the floodplains of the region, especially the tuiuiú (Jabiru mycteria), considered the symbol bird of the wetland, which measures 1.60 m from one end of the wing to the other; We still find the hyacinth macaw in the region (*Anodorhynchus hyacinthinus*), toucan (*Ramphastos toco*), parakeet (*Eupsittula aurea*), White-heron (*Ardea alba*), socó (*Trigrisoma lineatum*) e rhea (*Rhea americana*). Mammals, in addition to those already mentioned for the Cerrado region, we can find pampas-deer (*Ozotoceros bezoarticus*), blocket-deer (*Mazama gouazoubira*), maned-wolf (*Chrysocyon brachyurus*), capuchin monkey (*Sapajus cay*), wetland-deer (*Blastocerus dichotomus*). The reptiles species found: anaconda (*Eunectes notaeus*), jibóia (*Boa constrictor*), tortoise (*Chelonoidis carbonaria*), marsh-tortoise (*Acanthochelys macrocephala*), swamp-alligator (*Cayman yacare*), yellow-throated alligator (*Caiman latirostris*) and still huge variety of fish as brazilian tiger fish (pintado/*Pseudoplatystoma corruscan*), silver-dollar (pacu/*Colossoma mitrei*), curimbatá (*Prochilodus lineatus*), barred sorubim (cachara/*Pseudoplatistoma fasciatum*), dourado fish (*Salminus brasiliensis*), piauçu (*Leporinus macrocephalus*), piraputanga (*Brycon microlephis*), jurupoca (*Hemisorubim platyrhynchos*) and jaú (*Zungaro jahu*), which is a symbol fish of the region, and can weigh up to 120 kg and measure 1.5 m.

6.4 Amazon in the Midwest

And finally, the Amazon biome is a vast region that spans eight countries: Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, Guyana, Suriname and French Guiana, an overseas territory of France. It is one of the three large tropical forests in the world, in Brazil distributed between the states of Acre, Amazonas, Roraima, Pará, Amapá and Rondônia (Northern Region) and the northern and northwestern portion of the state of Mato Grosso (Central Region). West), representing 50% of the national territory.

The Amazon is the Brazilian biome with the greatest wealth of fauna species. There are

about 30 million animal species, many of which have not yet been catalogued, the territory is home to more than 73% of the mammal species and 80% of the bird species existing in the Brazilian national territory. There is no exact definition of the numbers of animals, as the biome spans several countries. In Brazil, there are at least 311 mammals, 1,300 birds, 273 reptiles, 232 amphibians and 1,800 continental fish [36].

The climate in the Amazon rainforest is equatorial, hot and humid (continuous to the Atlantic forest), with the temperature varying little during the year. Rains are abundant, with average annual precipitation ranging from 1,500 mm to 1,700 mm. There are two types of forests in Mato Grosso: the Amazon forest and the Seasonal forest. Concentrated in the north of the state, the Amazon is the most complex in terms of biodiversity in the world [9].

There are more than 2,000 species of plants identified as useful in food and medicine, as well as in the production of oils, greases, waxes, etc. The Amazon forest stands out for its forest with monumental and large trees such as: Vitória-régia (*Victoria amazonica*), the symbol flower of the Amazon, Samaúma (*Ceiba pentandra*), red angelim (*Dinizia excelsa*), Brazil nut tree (*Bertholetia excelsa*), açai palm (*Euterpe oleracea*), rubber tree (*Hevea brasiliensis*), andiroba (*Carapa guianensis*), peach palm (*Bactris gasipaes*), mahogany (*Swietenia macrophylla*), cedar (*Cedrela odorata*), cocoa (*Theobroma cocoa*), cupuaçu (*Theobroma grandiflorum*), guarana (*Paullinia cupana*) and tucumã (*Astrocarium aluleatum*), plants used by indigenous and local peoples, from food, income generation, use of wood, resins and latex, use in medicinal and ritual preparations [36].

In Amazonian rivers, mammals such as the pink dolphin (*Inia geoffrensis*) and the tucux (*Sotalia fluviatilis*), the Amazonian manatee (*Trichechus inunguis*), giant otters (*Pteronura brasiliensis*) and otters (*Lontra longicaudis*) can be found in Amazonian rivers, in the middle of the forest, you can find jaguars, anteaters, birds, armadillos and deers. According to ICMBIO, the Amazon biome is home to a huge number of primates such as capuchin monkeys (*Spajus nigritus*), spider monkeys (*Ateles belzebul*), and potbellied monkeys (*Lagothrix lagotricha*). Brazil is the country with the greatest diversity of primates in the world, with 16% of known species found on Brazilian soil, and the Amazon has 10% of the

world's primate species [37]. The species of black cuxiú (*Chiropotes satanas*), caiarara-kaapor (*Cebus kaapori*) and brazilian bare-faced tamarin (*Saguinus bicolor*) are "critically endangered", included by ICMBIO in the Red Book of Threatened Brazilian Fauna of Extinction.

An international study [38] highlighted that 25 species of primates cataloged and distributed around the planet are at serious risk of extinction. Three of them occur in Brazil, the dark tamarin (*Callithrix aurita*), brazilian bare-faced tamarin (*Saguinus bicolor*) and the brown bugiu (*Alouatta guariba*) running serious risks of extinction and three other Latin American species; 12 from the African continent, five of which are endemic to the island of Madagascar; and seven that occur in different countries in Asia.

Most of the Amazon fauna is made up of animals that inhabit the treetops. There are no large animals in the biome, as in the Cerrado. Among the birds in the canopy are parrots, toucans and woodpeckers and among mammals are bats, rodents, monkeys and marsupials [9,34].

With a vast natural wealth of fauna and flora species that support the appreciation of the Amazon, this biome also houses a fantastic cultural diversity, indigenous peoples, remnants of former quilombolas and thousands of communities of chestnut collectors, riverine, babassu collectors, artisanal fishermen, among others. This fantastic Brazilian socio-environmental heritage maintains its original characteristics relatively well preserved [39].

7. MAIN MOTIVATING PRESSURES FOR CHANGE IN BIODIVERSITY

Degraded conditions on planet earth affect ecosystems and humans across the planet and are influenced by anthropogenic climate changes that contribute to a negative trend caused by direct or indirect human processes.

Global warming is an intensification of the so-called greenhouse effect. A natural and important phenomenon for the Earth, however, its intensification is harmful, as there is an increase in the atmosphere of greenhouse gases, which ensure that part of the heat that reaches the planet is retained. When we talk about global warming we are referring to an abnormal increase in the average temperature of our planet and this relationship is closely linked to

the existence of living beings and the growth of the human species.

The exponential growth of the world population over the last century puts us at a crossroads. Scientific records show that from the 1960s to the 2000s, the planet's population doubled from 3 billion to 6 billion inhabitants; estimates report that by 2050 we will be 9 billion inhabitants [40] on a planet that is suffocated by the consumerism of its human inhabitants and the price to be paid is increasing every day.

The UN also predicts that the world population could reach close to 11.2 billion by 2100. However, recent studies contradict this information, projecting a more hopeful future with 8.8 billion inhabitants for 195 countries [41].

The main threats to the diversity of plant and wildlife species include land conversion, deforestation causing desertification, climate change and changes in rainfall patterns, excessive and uncontrolled exploitation of plant and soil products, pollution by domestic sewage, siltation in aquatic environments, production of waste without reuse, wildfires and wildfires that threaten the loss of local and world biodiversity, and that directly result in damage to human, animal and plant health and well-being.

Forest biodiversity is threatened by the state of the countries' development process and their needs associated with the consumption of forest products, infrastructure development, population growth and living space requirements, rapid urbanization, agricultural expansion, grazing pressures, specific threats to biodiversity, soil degradation, including unsustainable farming practices, conversion of agricultural lands, exotic cultivation of agricultural crops and the consequent emergence of lethal spreading diseases.

Likewise, the pressure on water resources, devastating invasion of seas and oceans, and an increase as a result of urbanization and industrialization, including the growing increase in the world population, has led to an erosion of natural resources, taking these resources to fail to recover in time.

8. BIODIVERSITY LOSSES, SPECIES AT RISK OF EXTINCTION

Brazil is considered one of the countries with the greatest biodiversity in the world, it is estimated that no less than 10% of all terrestrial biota are

found in the country [12]. The universe of known species and the different taxonomic groups are enough to place the country in the world ranking in terms of species, even if richness estimates vary enormously.

In 2020, probably more than in others, forest fires in Brazil were in evidence, devastating and destroying forest heritage and killing local fauna. Some of our largest ecosystems have suffered major losses in area and biodiversity. Seeing the increase in fires up close, or rather, their persistence, makes us question the reasons, origins and consequences of these fires in our biomes.

Since the last UN conference on the environment, which took place in 1972 in Stocolm/Sweden, where heads of state, scientists, researchers and environmentalists gathered to address the abuses and degradation of the planet promoted by human activity, since that time 50 years ago in the past, little or nothing was done in relation to nature, which is showing alarming signs of the attack on man promoted by environmental impacts, disorderly use of the soil and attack on fauna and flora.

The planet's response comes in the form of meteorological catastrophes, extreme heat, reduced rainfall, melting glaciers, floods and fires of biblical proportions, such as those that occurred in 2020, in the central west region of Brazil, affecting the main biomes of that Cerrado region, Pantanal and Amazon, destroying fauna and flora, caused mainly by global warming and all this provided in response to default caused by man and the anachronistic immediate irresponsibility of rulers and their counterproductive and inappropriate thoughts.

In 2007, the IPCC - Intergovernmental Panel on Climate Change, organized by the WWF, held in the Paris agreement, where countries pledged to limit the rise in world temperature, the panel presented warned that up to 30% of the planet's species face a risk to disappear if the global temperature increases by 1.50C. and 2°C. even warning about what would happen if these goals were not achieved [42].

Nowadays, we observe that these goals promised by far have not materialized, putting the planet on alert and we are feeling the impacts generated by global warming, with harmful actions caused by nature in disregard of human inconsequence. In order for these goals to be achieved, the human mindset needs changes

and demands, and these changes need to be rapid, long range, and unprecedented in all aspects of society and with a cosmopolitan reach.

Research carried out by the WWF shows that many species are not immune to the effects of climate generated by global warming, and that, in the near future, these consequences could lead to the extinction of species on the planet. The situation is aggravated mainly for species that suffer heavily from anthropogenic action, representatives of fauna such as jaguars, polar bears, penguins, turtles, elephants, tigers etc... and plant species such as jequitibá, imbuia, ipe, among others [42], including in this list of plant species that one was of great economic importance for Brazil, the jacaranda (*Jacaranda copaia*) and the tree that gave the country its name, the pau-brasil (*Paubrasilia echinata*), recently renamed, in a phylogenetic analysis of the genus *Caesalpinia* [43]. These trees were the main targets of timber activity, a fact that led to their reduction, leading plant specimens to suffer a risk of near extinction.

The global living planet index, provided by the WWF, indicates the continued decline of species. The results show an average reduction of 68% in the size of populations of mammals, birds, amphibians, reptiles and fish between 1970 and 2016. A 94% drop in the index for the tropical subregions of the Americas is the largest drop observed in any part of the world. The conversion of grasslands, savannas, forests and wetlands, the overexploitation of species, climate change and the introduction of exotic species are the main drivers [44].

Among scientists there is a consensus that the most direct result of climate change is an increase in the planet's temperature between 1.5°C and 5.8°C. The surveys registered by NASA (<https://data.giss.nasa.gov/gistemp/>) [45] show surveys that prove that the ten hottest years in history, since these records were started, more than 130 years ago, were all from 1980 onwards. The increase in the Earth's temperature tends to cause the sea level to rise because the heat will cause the thermal expansion of the water molecules (Fig. 3).

Global climate indicators (average temperature, atmospheric, greenhouse gases, ocean heat, global sea level, ocean acidification, extent of sea ice and the mass balance of glaciers and ice sheets), established in the report of the WMO (World Meteorological Organization) in 2020 indicated that the global mean temperature for

2019 was around $1.1 \pm 0.1^\circ\text{C}$ above the baseline of 1850–1900, used as an approximation of pre-industrial levels. 2019 was the second warmest year on record. The year 2016, which featured strong El Niño records, remains the warmest on record. The report states that since the 1980s, each successive decade has been warmer than any previous one [46].

Another study related to mean sea surface temperature changes verified the influence of these precipitation changes related to the El Niño-Southern Oscillation (ENOS) phenomenon. According to experts, they were verified in the last 130 years, what they called "Super El Niño" recorded in 1982, 1997-1998 and 2015-2016. Extreme El Niño occurred more frequently, which in turn significantly increased precipitation than observed for the historical simulation (1980-2019) by increasing ocean temperature by 3°C or 4°C, and they had one responsible for all of this: a human action, say the researchers [47].

Many authors consider Antarctica a great polar desert, due to its low precipitation rate in the interior of the continent. For about 35 million years, part of planet Earth has been immersed in this ice world, which presents environmental conditions that affect the growth and reproduction of the animals that live there [48].

The polar regions of our planet are not free from our influence and we are unwittingly modifying this frozen world and consequently bringing modifications to the entire planet. For thousands of years, the continuous advance and retreat of glaciers in the icy universe of Antarctica, followed its flow, but nowadays, estimates of ice cover during the warmer periods in the region indicate that it is 40% smaller than 1980 ice. Data revealed by the Living Planet 2020 report directed by the World Wide Fund for Nature (WWF) indicate that 75% of the Earth's surface is free of ice, only 25% of which can still be considered wild areas [44].

One of the most aggravating facts related to global warming is happening with the ambassadors of climate change, the polar bears and that they are dying of hunger due to the melting of the glaciers in their habitats. According to the study, melting occurs regardless of how quickly the world reduces emissions that cause global warming. A study by scientists who studied data from 234 glaciers across the Arctic over 34 years, through 2018, found that annual snow was no longer sufficient to replenish glaciers with snow and ice lost in the summer melt [49].

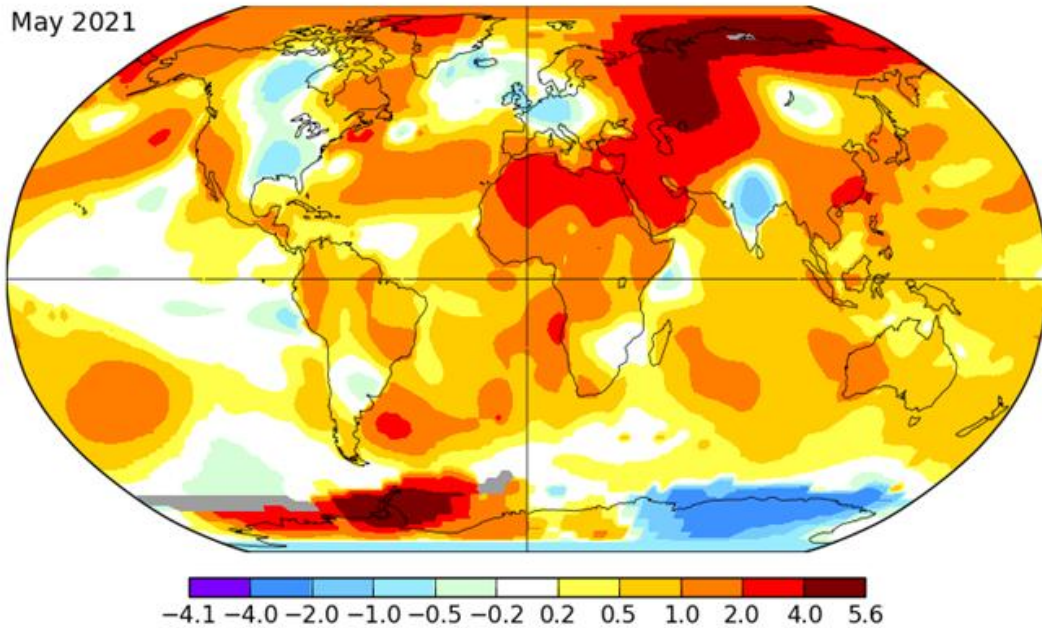


Fig. 3. Surface Temperature Analysis. Temperature changes are most pronounced in northern latitudes and over land masses. The top image shows that heat waves and temperature changes in 2021 provide a history of temperature changes on the planet. The image uses long-term averages of at least a decade to smooth out climate variability due to climatic factors such as El Niño. Source: Giss/NASA [45]. <https://data.giss.nasa.gov/gistemp/>

When we talk about cold regions, another major concern is the plight of the Arctic region, where the Brooks Range is currently seen as one of the most likely onshore USA oil and gas prospects. It is extremely important to point out that, for many, the Arctic National Wildlife Refuge (ANWR) sanctuary, which consists of a wild refuge in that part of the planet, is one of the last regions not to be devastated by man. Contrary to the idea of occupation, they express concern that development is harmful and will impact the Refuge's exclusive biological resources [50,51].

Among the species that inhabit the region are the three North American species of polar bears (*Ursus maritimus*), black bears (*Ursus americanus*) and brown bears (*Ursus arctus*), as well as wolves, caribou and migratory birds that remain in one state undisturbed and that can be harmed by the search for oil.

Other environmental records show that Antarctica's penguin populations are threatened by climate change. A study has shown that four different penguin species are under increasing threat, Adelle penguins (*Pygoscelis adeliae*), emperor penguins (*Aptenodytes forsteri*),

chinstrap penguins (*Pygoscelis antarcticus*) and gentoo penguins (*Pygoscelis papua*), with global warming, their nesting areas are decreasing, making it difficult to take care of their offspring [52,53].

These factors and others related to the physiognomic characteristics of the earth's sea currents were addressed in studies on climate dynamics, essentially encompassing phenomena that occur in the atmosphere, at different altitudes and proportions.

Data collected on the Florida Current, called the first part of the Gulf Stream, suggests changes in the Earth's climate. The terrestrial climate system involves transformations that encompass plant formations, oceans, ice and snow on the planet, transformations in seas and oceans have a great impact on the distribution of heat and moisture across the globe [54].

The hot Gulf Streams are one of the great heat and humidity distribution systems due to the reach of their effects to the North Atlantic, where the warm waters promote heating, providing evaporation, contributing to the formation of wet

masses; on the other hand, cold water currents represent the movement of these waters, contributing to fish attraction and a higher concentration of phytoplankton [54].

According to Piecuch [54], using mathematical and physical models, he conducted research on direct measurements in the Gulf streams and concluded that it has constantly weakened and over the years he has established this observation that these currents are weaker by analyzing the past 110 years.

Allied to the situation of global warming and climate change that has been observed around the world; Animal trafficking markets contribute to the spread of extinction of many animal species distributed across the planet. By mere human ostentation, many animals trafficked around the world are cruelly disseminated from the planet.

A classic example, despite being a remarkable animal, few people have heard about the pangolin, except in the face of the pandemic record that its name became evident and known. When SARS-CoV-2 was highlighted in China, these animals were considered potential transmitters of the lethal virus that caused and still causes the pandemic on the planet, because a coronavirus strain very similar to SARS-CoV-2 was detected in Malayan Pangolin (*Manis javanica*) [55]. Researchers from the "International Union for the Conservation of Nature (IUCN) SSC Pangolins Expert Group" (<https://www.pangolinsg.org/>) [56], estimate that around 900,000 pangolins were trafficked around the globe this year 2000 until the end of 2019.

The pangolin, the only mammalian animal of the Pholidota family, presents its meat as a delicacy in China, Indonesia and Vietnam, and the animal's keratinized scales are targets of being considered by many people, of having medicinal properties, without even scientific confirmation. An animal that presents symbolic, mythological and ritualistic practices throughout Africa, Asia and Europe in its history, its docility makes it easy targets for human hunters and traffickers, who can simply pick them up and carry them [57].

The pangolins, which have four Asian species chinese pangolin (*Manis pentadactyla*), indian pangolin (*Manis crassicaudata*), filipino pangolin (*Manis culionensis*) and malay pangolin (*Manis javanica*) and four African species white-bellied pangolin (*Phataginus tricuspis*), black-bellied pangolin (*Phataginus tetradactyla*), giant

pangolin (*Smutisia gigantea*) and cape pangolin (*Smutisia temminckii*) are victims of cruelty and at risk of extinction as these mammals feed the market trafficking in animals [56,57].

Another very worrying situation, which exposes the threat of animal trafficking, is what has been happening with amphibian species in Brazil. An unexpected pathogenic microorganism, a fungus called *Batrachochytrium dendrobatidis*, a chytridiomycosis originated in Asia [58] has become an exterminator for Brazilian amphibians, the fungus has become ubiquitous and is rapidly diversifying, and their trafficking animals contribute substantially to the spread of this type of infection to other species [59] as well as the trafficking, in 2018, of arrowhead toads, these tiny, poisonous and colorful amphibians of the genus *Adelphobates*, have become objects of collectors, but the specimens that are distributed throughout the east of the Brazilian Amazon and with large aposematic signs [60], have already been returned to Brazil.

With the continuing crisis of global biodiversity loss and limited resources for conservation, the concept of biodiversity hotspots has been useful in determining priority conservation areas. A market that has been contributing to the great loss of species on the planet is the predatory fishing of marine animals, fishing has been spread alarmingly and uncontrollably throughout all seas. Industrial fishing and trawling have been contributing to the unsatisfactory repopulation of species, contributing en masse, so that larger species fall into a degrading process of hunger.

There are few records of marine species in Brazil, Zamboni [61] developed by the NGO Oceana, a tool of digital maps on board, to modernize fisheries management in the country and end the lack of information about these resources and quotas on fishing national; using the data will allow the identification of inconsistencies, triggering a growing capacity and awareness to strengthen marine ecosystems.

9. GLOBAL WARMING AND THE EPIDEMICS

Climate change destabilizes the environmental conditions to which many species of animals and plants are accustomed and acclimatized, these changes causing changes in the diet, behavior, reproduction and migration routes of many species. The constant attacks on nature and its

biomes, which occur across the planet, have been contributing in an alarming way to the wear and, consequently, to these unpredictable changes. Studies show that 75% of the earth's surface was transformed by the invasion of man to the environment, giving rise to these transformations, mainly with the emergence of new diseases.

Jones [62] states that more than 60% of events involving emerging infectious diseases distributed around the world can be traced, and the vast majority of these zoonoses have, in their counterpart, involvement with wildlife.

Infectious diseases that were once confined to wildlife are now spreading to areas that are being rapidly deforested, this chain creates conditions for the spread among humans of a wide range of deadly pathogens such as Ebola, Rabies, Nipah and Lassa, including these package the parasites causing malaria and Lyme disease [63], as well as the continuous transmission of endemic pathogens such as salmonella, leptospira, trypanosoma, mycobacterium and West Nile virus [62,64,65] that infect thousands of people every year.

This influence has been supporting new microorganisms to adapt and develop their machinery in their hosts, as is currently happening with mutations and the emergence of new variants, becoming new strains of SARS-CoV 2, highly concerning, causing the Brazil becomes a granary for new bloodlines.

In this sense, we can also report those that present high plasticity, such as the case of the arthropod *Aedes aegypti*, in the history of Brazil, a vector originating in Egypt, in Africa, introduced in the New World, in the colonial period, through ships that trafficked slaves and that currently harbors four viral types: dengue (DENV), Zika (ZIKV) and urban yellow fever (FAV) representatives of the family Flaviviridae and chicungunya (CHICK) an Alphavirus, which are no longer epidemics and have become endemic. It is not surprising when you look at the path taken by the dengue, chicungunya and Zika viruses to reach America and how climate change triggered by global warming makes El Niño contribute to the intensification of their cases.

A projection made by New Zealand researchers [66] predicts that by the year 2,085 about 50-60% of the world population (or 6 billion people)

will live in areas with conditions of high risk of dengue transmission.

Studies carried out on cholera, a disease caused by the bacterium *Vibrio cholerae*, also reinforce the projection that there is a clear relationship between high temperatures and diseases. Researchers from the University of Maryland (USA), used the city of Bangladesh, in Asia, and verified the increase in temperature in the Pacific caused by El Niño, and that this has a close direct relationship with the incidence of cholera epidemics in that region. The influence has become intense in recent decades, and the El Niño effect has been intensified by the increase in the planet's average temperature [67].

According to MacDonald & Mordecari [63] the removal of forest areas contributes to the creation of ideal habitat on the edges of the forest for the proliferation of *Anopheles darlingi* — the most important transmitter of malaria in the Brazilian Amazon, and another worrying pathogen in Brazil. Reports of this infectious disease were registered on the island of Borneo (Malaysia), where researchers detected that the outbreaks of malaria identified in that region occurred simultaneously with peaks of forest devastation for cultivation and plantation for the extraction of palm oils and derived products, as described [68].

This epidemic manifestation in Brazil, were recorded in studies carried out by Oliveira-Padilha [69] that showed the relationships between the incidence rates of malaria and the proportion of deforestation in the southwest of the Brazilian Amazon, concluded that the modification of the landscape caused by deforestation is an important driver of the population dynamics of malaria in the Amazon.

Olson [70] also report in research carried out that deforestation significantly affects the risk of malaria, which suggests that land use measures can be a method to be used to control malaria in the Amazon region.

Illegal gold mining, associated with deforestation and malaria were the key words of the work carried out by Castro [71] on the increase in the occurrence of malaria in Indigenous Lands in the Amazon region of Brazil, where wells are abandoned after the illegal extraction of gold.

A group of researchers Loh [72] report that infectious diseases distributed around the world suggest that approximately one in three new and

emerging disease outbreaks are linked to change and uncontrolled land use, such as deforestation, agriculture, etc. The researchers report that these zoonoses can be transmitted from wildlife to humans through a series of routes or pathways, about 31% of new diseases have emerged from deforestation.

These changes have been causing consequences for the human species and *Homo sapiens* is not even aware of these consequences, or knows, and doesn't care. As an example, we mention the case of HIV, which historically arose from the immersion and exposure of humans in the forests, keeping in touch with the wild life that was found in a reserved environment. There are many microorganisms that circulate in animals that are restricted to forest ecosystems and the more their habitats are destroyed and these animals are invaded and disturbed, this pathogenic load is released, these questions also imply the practice of wildlife trafficking.

Covid-19 is a disease of zoonotic origin, so the infective agent Sars-CoV-2 comes from wild animals, but this disease has shown itself capable, acquiring the ability to jump between different species and animals, including the ability to infect humans, through a process called spillover, a breach and/or crossing of specific barriers [73].

Drastic changes are behind the Covid-19 pandemic that is plaguing planet Earth. Studies carried out by researchers in the United Kingdom indicated that different types of coronaviruses carried by bat species have changed their routes over the years as a result of changes in the planet's climate. Emissions of greenhouse gases contributed to bats moving from regions of the planet. Using data such as temperature, precipitation, cloud cover, incidence of sunlight and carbon dioxide concentrations since 1900; the researchers analyzing these records provided a possible mechanistic link between climate change and the emergence of the two viruses SARS-CoV-1 and SARS-CoV-2 [74].

According to Beyer [74], there are also several patches spread over regions such as Central and South America, a large spatial cluster located in the south of the Chinese province of Yunnan (China) and neighboring regions in Myanmar and Laos, in Southeast Asia.

These global hotspots would be considered increased bat wealth driven by climate change as

being most likely sites of origin for the ancestors of SARS-CoV-1 and SARS-CoV-2 [75]. This information only allows us to show that the influence of man's action on the environment, contributes to the leaps of coronaviruses or other diseases to new species, these events happen all the time in nature, and are part of the evolutionary process of species and conditions of ecosystems, and that these facts will continue to happen, and the frequency of spillover will depend on the proximity between susceptible and contaminated individuals, since about 8% of the human genome consists of retroviral fragments [73,76,77].

Many of the emerging infectious diseases often originate from spillovers of pathogens from wildlife to humans [62]. Why are these pandemic outbreaks happening? Can climate and environmental changes be related to these events? These questions can be crucial for the interpretation of contagion and spread of environmental pathogens.

In this sense, we observe that a recent study carried out by Italian researchers [78] indicates that environmental degradation and global changes in land use, such as forest fragmentation, agricultural and livestock expansion are concentrated in points where there is a presence horse-shoe bats (*Rhinolophus* spp.) from the globe; these actions may be contributing to the proliferation of these winged mammals and contributing to the spread of viral microorganisms, favoring the transmission of the coronavirus, indicating that these sites are hot spots for SARS-CoV.

Just as we attacked nature, promoting the extinction of species, often not yet studied by science, we ended up destroying an immense genetic and knowledge reserve that are hidden in the forests and in these immense natural hotspots and that could someday serve to cure Diseases like many diseases such as Cancer and AIDS, in this way we illustrate recent research in the treatment of malaria, where researchers used parts of a plant known for millennia, *Artemisia* (*Artemisia annua*) and its compounds based on the treatment of the disease [79].

10. THE CLIMATE SITUATION: DRY AND BURNS IN BRAZIL

Recent reports on the pandemic caused by the SARS-CoV-2 virus and the disease known as

COVID-19 have raised questions about the situation of deforestation, global climate change and damage to the environment.

In regions where endangered species are concentrated, regional biodiversity collapses are likely. These results expose the extreme importance and urgency of taking massive and immediate global actions to save humanity's crucial life support systems [1].

Preventing certain species from becoming extinct on the planet still seems like a herculean job as some endangered candidate species are rapidly declining. Many concepts about the conservation of species show that activities and good conservation practices indicate excellent results, that is, investigating the impact of conservation efforts is extremely and fundamentally important to assess whether we have knowledge and techniques to reverse harmful actions.

In a study carried out in 2020, researchers characterized and indicated that the extinction of at least 28 to 48 species of birds and mammals were avoided between 1993 to 2020, and 11 to 25 species of birds and mammals between 2010 and 2020, and further described some 15 confirmed or strongly suspected extinctions of birds and mammals documented since 1993 [80] as well as explicit assessments that new extinctions are likely, but that conservation measures are critical to avoid extinction of some species [8].

Studies carried out by Bolam [80] show that only in Brazil 5 species of birds were no longer extinct in the period 1993 to 2020, of the 32 species of birds identified whose extinction was an evident fact. Regarding mammals, six in New Zealand and three in Mexico were investigated in the Study of the 16 species evaluated, which occur in 23 countries, including five in China and three in Vietnam and the United States, respectively. The biggest threats indicated in the study were habitat loss through agriculture, aquaculture and indiscriminate hunting.

Although we know that many political commitments have been fostered and applied to direct significant achievements in the conservation of species and climate conditions on the planet, future biodiversity actions still need to be structured and these urgently need to be scaled to avoid further extinctions.

In Brazil, specifically in the year 2020, in addition to the country being on alert with COVID-19 in

many capitals; the effect of the fires that devastated the vegetation and are directly related to deforestation in the three biomes of Brazil, Cerrado, Amazon and Pantanal, promoting, in addition to respiratory difficulty, the excessive death of wild animals and the destruction of the vegetation that inhabit the regions.

Due to its geographical position and environmental complexity associated with various climatic, water, geomorphological, geological and phytoecological factors; among the Brazilian states, Mato Grosso, in the Midwest region of Brazil, stands out for its large territorial extension, presenting in its insertion areas of occurrence of the Brazilian Cerrado biomes, the humid tropical forest, the Amazon region and the Pantanal plain, which provide a great diversity of ecological situations, involving local animals and vegetation, social, economic, cultural events and mainly the source of development in the region, which are the production processes and rural and agro-industrial development.

Using the Central-West region of Brazil, to illustrate our discussion, we can observe that in the Pantanal, fire is characteristic of the region in the dry months, around the month of September, which precedes the rainy season. However, human presence causes ignition sources that often go out of control, especially motivated by the deliberate burning for cleaning and appropriation of land for the creation of pastures and crops. This situation is also seen in the Cerrado, a biome that has fires every year.

All types of vegetation present in Brazilian territory have already suffered a burning process in Brazil. Fires in the Brazilian Amazon are responsible for the emission of large amounts of greenhouse gases by several different processes, including forest burning in areas that are being deforested for agriculture and livestock, forest fires and burning of brushwood, pastures, and different types of savannas [81].

The main cause of forest fires in Brazil continues to be agricultural pressure on land. The climatic factor, specifically the dry climate, is also of great relevance in the burning issue, and climate change may be related as the drought conditions intensify. However, the large number of fires in Brazil cannot be credited solely to the climate.

Fearnside [81] reports that the fires that accompany deforestation determine the amounts

of gases emitted not only from the part of the biomass that burns, but also from the part that does not burn. When there is a fire, in addition to the release of carbon dioxide (CO₂), methane (CH₄), carbon monoxide (CO) and oxygen nitrous (N₂O) are released.

Mato Grosso has a very different rainy period and often difficult for the region, rain is a random phenomenon, and its spatial distribution and exact periodicity values are not relevant, although it presents similar trends. In this way, the distribution of rainfall occurs irregularly over time during the annual and territorial spatial cycle [82].

The second biome of drought is the Brazilian Cerrado, which historically occurs in the period between the months of June and October, when rainfall rates reduce so much that they can reach zero. Due to these factors, the low humidity of the air, strong winds and the heat at that time cause a great incidence of fires in the vegetation, which spread and threaten the local biodiversity.

These and other factors greatly contribute to other incidents that generate threats to the population, health risks, reduced air quality, increased pollutants, increased incidence of respiratory diseases; in addition to generating infrastructural and economic problems. These factors can be seen in the characteristics of the vegetation in the Amazon, this biome has a very humid forest, and the Amazon forest does not have a biome with a self-combustion characteristic. In other words, the forest only catches fire in dry areas, where trees were cut down and the fire was caused by human action.

These measures of containment and preservation of biomes are being taken, but at a slow pace. Recent data from the data platform of the National Institute for Space Research (INPE) indicate a large number of fires in the first half of this year, not only in the Amazon, but also in other biomes, such as the Pantanal and the Cerrado, what the mapbiomabrazil report points out [83].

The current situation of the Pantanal in the Midwest region of Brazil, considered the largest continental wetland area on the planet, has become a concern for Brazilians and environmentalists, it has the worst burning period since the late 1990s. August and September/2020 more than 2 million hectares were burned.

The plains and wetlands of Mato Grosso are characterized as an extensive water accumulation plain, configured as a huge floodable amphitheater [84] where a very flat topography is observed, regularly subjected to flooding, whose drainage network is commanded by the Paraguay river, and known for its wide and complex floodplain [85].

Due to this characterization, the Pantanal region is located in a zone of climatic instability called the circumglobal belt, which causes dramatic climate change, leading the floodplain to intermittent periods of flooding and at other times to a large-scale severe drought (as observed in 2020), which leads to disastrous fires, destroying vegetation, with episodes that are not yet fully understood.

In fact, one of the main reasons for the fires is the weather: the Pantanal experienced the worst drought in 60 years recorded by the National Center for Monitoring and Alerting of Natural Disasters (CEMADEN). Many questions were related to the activity of these disasters, especially the fires that occurred in the region being highlighted, and taking advantage of this situation, many opinions and fallacies are evidenced in order to try to minimize the real situation caused by the fires.

The wetland suffered from the biggest fire that occurred in 2020, the biggest tragedy that the Pantanal biome has faced with fires, with drastic deaths of animals and droughts of their water sources, such as “*corichos*” (ducts connecting bays, lakes with rivers) so important for the livelihood of animals, studies are increasingly needed to recognize the species and survival of the flora and fauna of the Pantanal, and which biological diversity were impacted with the focus, especially the life of aquatic biota such as crustaceans, microinvertebrates, insects and even the microbial life in these waters.

Many outbreaks of fires that have occurred repeatedly over the years, very recurrent, are compromising the biotic balance of the entire system. Trees and plants suffer from the consequences of fires in the Pantanal, despite the resistance many plants are able to replenish their energy. About more than 2,500 plant species have already been cataloged in the Pantanal biome, but this diversity could become a concern if fires persist for more years to come.

A worrying factor in relation to these fires and that have been contributing to the loss of habitat,

together with illegal hunting, pushing one of the most iconic animals of the Pantanal, the pampas deer (*Ozotoceros bezoarticus*) to extinction, a typical species of natural formations farms in the Cerrado of Mato Grosso, southern Brazil and in the Pantanal, where the largest populations of this specimen of deer are located.

Studies indicate population decline, due to the accelerated process of habitat loss by pastures and crops [44] currently the species is on the red list as Near Threatened (NT) to extinction [86]. Fire contributes to reducing the availability of food for wildlife, in addition to polluting the air and harming waterways.

Fires would be a range of multifactorial factors, related to anthropic actions, climate change and environmental balance, which drives the Pantanal is the hydrological cycle that governs the entire system in that region, and we are currently experiencing extreme weather events, which have aggravated including the situation in the Pantanal region.

The rainfall regime is a fundamental factor for the existence of the Pantanal, which spreads between Mato Grosso, Mato Grosso do Sul in Brazil and enters through Bolivia and Paraguay. In the largest flooded plain in the world live about 4.7 thousand species of plants and animals.

The volume of rain that occurred in early 2021 was not enough, and is not being enough, so far for the filling and ebb of water to the bays that are so important for the development of animal species and the maintenance of biodiversity in the region, get lost.

Extensive fish mortality occurs occasionally in the Pantanal wetland and the phenomenon is called *dequada* by local inhabitants. The phenomenon originates by deterioration water quality in rivers and lakes, and the depletion of dissolved oxygen (DO) is the major indicator [87]. The rains bring hope to the wetland region, but some questions demonstrate the interests of researchers working with the wetland area and the flow of river waters, perhaps the lower volume of rain this year will unsatisfactorily contribute to the “*dequada*” or “*decoada*”, a natural phenomenon that consists of the flow of particulate matter from previous fires descend, carry to water courses, and fish nurseries in rivers, contributing to the possibility of increased pH and fish mortality in rivers.

This phenomenon, according to Calheiros and Ferreira [88] is natural, related to the decomposition of the great mass of submerged organic matter at the beginning of the flooding process. This event occurs more frequently in the Pantanal Mato-Grossense, resulting in biochemical oxygen demand, resulting from the oxidation processes of organic matter, both in flooded fields and in the water column of rivers, leading to changes in aquatic and plant aspects, consequently an impact on the fish community.

The Pantanal is considered a large ecotone, and for this reason when the water returns to these areas, it will find a soil with ash and other deposited organic matter. This will increase the turbidity of the water and drastically reduce the percentage of dissolved oxygen in the river, essential to aquatic organisms, including fish [88].

All over the world, several reports of the effects of eutrophication on aquatic communities related to global climate change are being discussed and highlighting the importance of these phenomena for aquatic communities. In studies carried out in the Gulf of Mexico and the Mississippi River, they were reported by Rabalais [89,90] and Rowe [91] and, more recently, the reports by Breitburg [92] warning of the decline of oxygen in the oceans.

A historical analysis of ocean-related data performed by Schmidtko [93] reveal that the planet's oceanic waters have lost about 2% of their oxygen since 1960. In addition, the volume of ocean waters is becoming anoxic, becoming deprived of oxygen and this event has been quadrupling in recent decades (Fig. 4).

The power of the movement of marine life in the oceans may be related to this event. The decimation of marine life may be interfering with this process and contributing to the increase in temperatures in the seas, according to the studies listed by Breitburg [92] (Fig. 4). The result is clear, the aquatic lives of the oceans play a very significant role in the planet's living conditions, than many imagine them to be. The problems related to the aquatic communities and the planet's atmosphere are not only based on climate problems or ocean pollution, but mainly on the conditions of predatory fishing and the disposal of the volume of fishing material, which are discarded in a disorderly way into the oceans.

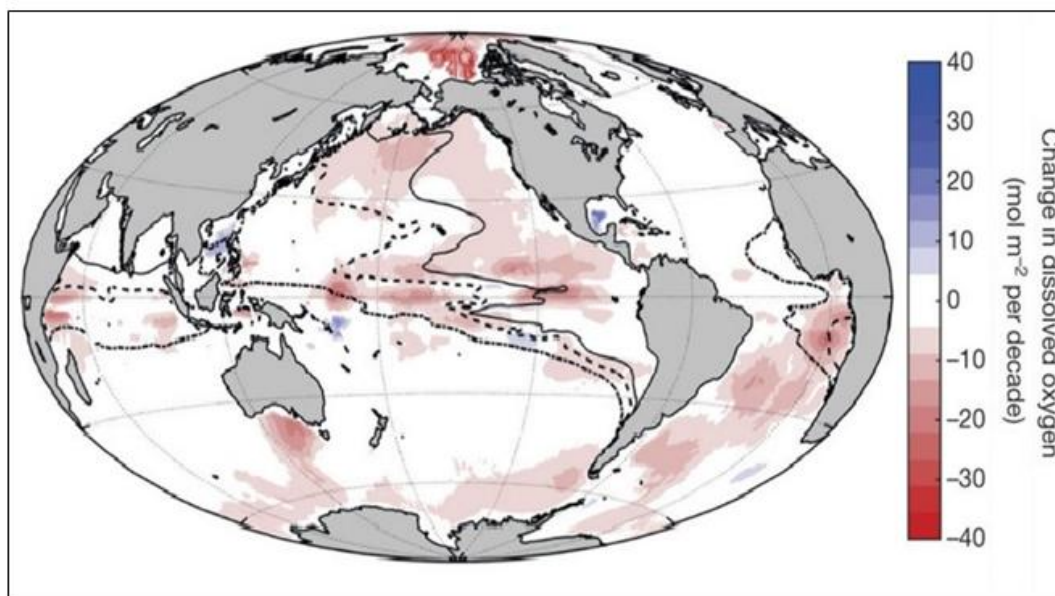


Fig. 4. Figure representing the decrease in oxygen in the oceans. Change in global ocean oxygen content in mol O₂ m⁻² decade⁻¹. Most of the coastal systems shown report first incidence of low oxygen levels after 1960. Dashed, dotted, and solid lines delineate boundaries with oxygen concentrations <math>< 80</math>, 40, and 20 mmol kg⁻¹, respectively, at any depth within the column of water. Sources: Breitburg [92], Schimidtko [93].

The expansion of anoxic waters not only represents a loss of habitat for oxygen-dependent marine life, but also implies the production and efflux rates of nitrous oxide (N₂O) into the atmosphere due to the action of microorganisms living in the peripheries of anoxic waters and participate in the production of this potent gas, which will consequently contribute to the increase in the greenhouse effect [94].

The seas are also responsible for balancing the Earth's temperature and fundamental for the continuity of life on the planet. The oceans and all the marine life that lives below and above water play a central role in stabilizing the Earth's climate. They provide a vital food source for a large number of terrestrial and aquatic species and regulate the amount of CO₂ that remains in the atmosphere, absorbing 30% of global emissions, which is called Blue Carbon [95]. Bought that the oceans are the biggest carbon sinks on the planet.

It's not just the Midwest region that suffers from the flames. And it is not just Brazil that has been consumed by great fires. In California, Australia, Indonesia, Canada and even Siberia, Russia's famous frozen territory, the summer of 2020 was the hottest in 130 years. Devastating fires were recorded, attacking the local flora and fauna, and

destabilizing people and their homes. The fires that devastated the Pantanal, the Minas mountains, the interior of São Paulo and the Brazilian Amazon, since 2019, we have seen and felt the fires in a dramatic way and that we are all together on a planet in suffering, studies confirm that of the last 20 years of great fires took place in the Amazon region.

11. SITUATION OF DEFORESTATION IN THE CENTER WEST REGION AND IN BRAZIL

The pace of deforestation in the Amazon forest is worrying, in March 2020, 256 km² of forest were devastated, affecting the states of Mato Grosso, Para and Amazonas, the lack of land title regularization and land grabbing would be the biggest events that generate these disastrous situations.

In January 2020, the SAD (Deforestation Alert System) developed by IMAZON (Institute of Man and Environment of the Amazon) detected 188 square kilometers of deforestation in the Legal Amazon, an increase of 74% compared to January 2019, when deforestation totaled 108 square kilometers. In January 2020, deforestation occurred in Pará (28%), Mato

Grosso (26%), Rondônia (15%), Amazonas (13%), Roraima (13%), Acre (4%) and Amapá (1%) [96].

When we make the comparison between 2020 and 2021, in January 2021, we can see that SAD detected 196 square kilometers of deforestation in the Amazon. New records reported by SAD indicate that, in April 2021, deforestation in the Legal Amazon reached 778 km², presenting a high historical series for the last 10 years. Deforestation estimates in the ranking of states with the largest deforested area, Amazonas leads the list with the most percentage (28%), followed by Pará (26%), Mato Grosso (22%), Rondônia (16%), Roraima (5%), Maranhão (2%) and Acre (1%), representing an increase of 45% compared to April 2020, when deforestation totaled 536 km². The records provided show that in April/2021, 68% of deforestation occurred in private areas or under various stages of ownership and also records in Settlements (19%), Conservation Units (11%) and Indigenous Lands (2%) [96].

From August 2018 to July 2019, the deforestation mapped in the Amazon and in the Cerrado of Mato Grosso by the National Institute for Space Research (INPE) was 2,560 km². This means a 10% increase in the deforested area compared to the same period last year. The destruction of native vegetation in the state is still marked by illegality. In 2019, 87% of deforestation was illegal, according to an analysis by the Instituto Centro de Vida (ICV) [97] (Fig. 5).

In 2021, mapbiomasbrasil released the annual deforestation report for Brazilian biomes and records that in 2020 showed more than 14% of green areas in Brazil were affected by deforestation. Since 2015, the control agency has been carrying out a survey of deforestation in Brazil, and the Brazilian national territory presented, in 2020, a loss of 13,853 km² with an incalculable speed of loss of plant mass. Most of the deforestation occurred in 6 states Pará, Acre, Amazonas, Rondônia, Mato Grosso and Bahia. The Amazon, the largest tropical forest on the planet, contributed 61% of deforestation, the state of Pará contributed 26% of this deforestation and the city of Altamira 99.8% of illegal deforestation records, according to the agency 2% of the alerts registered for that period had actions carried out by IBAMA. Together, the Amazon and Cerrado Biomes response for 92.1% of what was deforestation (Fig. 5) [83].

A study carried out in 2020 reflects the concern of researchers with the juvenile Atlantic Forest. The native forest cover in the Atlantic Forest since 2000 hides a strong and worrying dynamic of loss of mature natural forest, especially in some regions of the biome, which impacts the survival of species and the provision of ecosystem services, such as those involved in mitigating changes climate. The continuous deforestation of the oldest and most mature native forests, with greater biodiversity and stored carbon, felled mainly for the expansion of agriculture, leaves the forests unarmed, as the juvenile vegetation cover of the forest can be extremely harmful for the conservation of this very important biome for Brazil [98].

The Amazon is one of the least disturbed regions that still exist on Earth, constitutes a major carbon sink, regulates critical hydrological and climate systems, and provides habitat for countless species. The Cerrado savannah is also of critical importance it is a global biodiversity hotspot. Ecosystems such as the Pantanal constitute an important continuous extension of natural vegetation, one of the largest remnants in South America [99].

According to reports by Ljjasz-Vasques [100] the areas with remaining original vegetation cover, about 35% and 42% of the original vegetation cover area in Mato Grosso, 27% are within protected areas such as Conservation Units (UCs) and Indigenous Lands. Indigenous peoples are the best guardians of the forest; where they have strong rights, more forests remain standing and biodiversity is protected. Studies carried out by Piperno et al. [101] show how important the participation of indigenous peoples and their knowledge can be for the establishment of a vast Amazon forest conservation plan, regarding crops and the preservation of forest biodiversity.

Although we are now officially on the Sixth Mass Extinction, World Bank research in 2016 showed that indigenous peoples constitute 5% of the world's population but protect 80% of the world's biodiversity. As nations struggle to comply with the Paris Climate Change Agreement to limit the global average temperature rise to 1.5 degrees Celsius, indigenous peoples and the forests they protect are a ready-made solution to climate change [100].

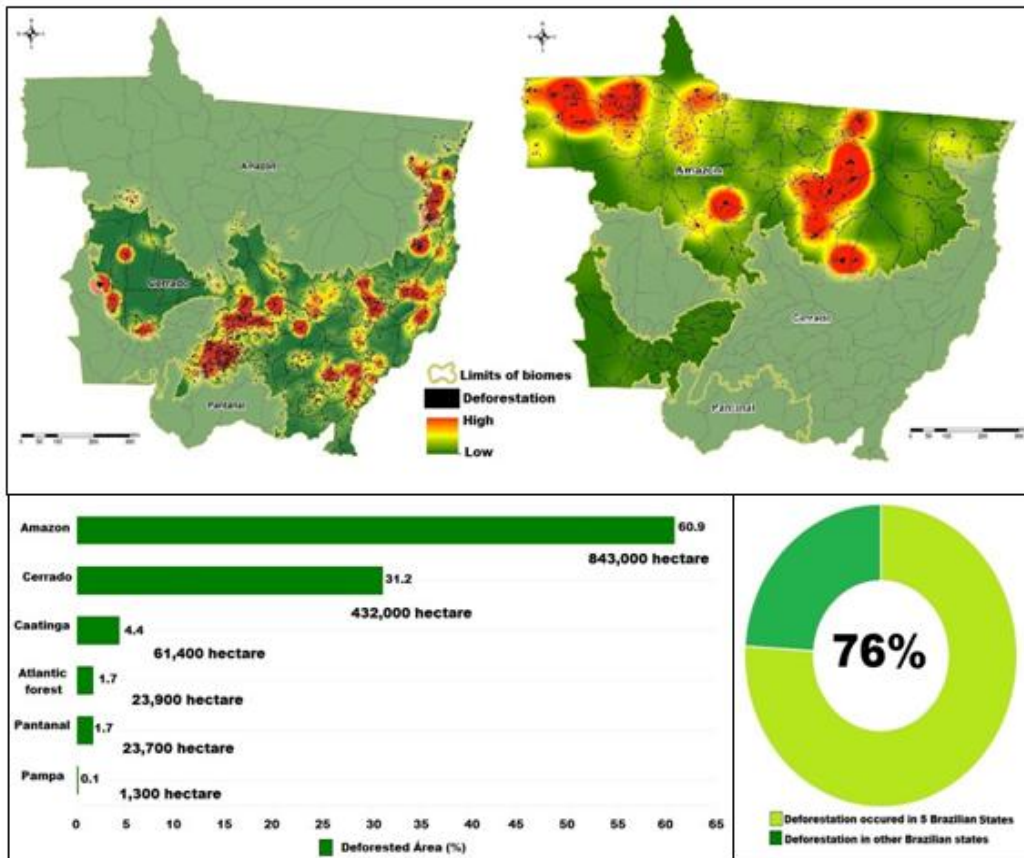


Fig. 5. Figures at the top, map of Mato Grosso/Brazil, showing the deforestation areas in the Cerrado regions (figure A) and in the Amazon region (figure B) registered in 2020, by INPE. Source: ICV Institute [92]. Figures at the bottom. Pie chart showing the 6 Brazilian states with the most deforestation and on the side a chart representing the deforestation of Brazilian biomes in 2020. Source: Azevedo et al. (Mapbiomasbrasil) [83]

Humans have been changing environments markedly through the conversion of natural vegetation pastures, unsustainable tillage, inadequately managed agriculture and other land uses, as well as the degradation of natural vegetation by cutting wood, fire and other types of environmental disturbances.

A study by Zalles [99] showed results of human land occupation across South America, the expansion of land uses as commodities sustaining economic development at the expense of deforestation, felling of natural land cover and of associated ecosystem services, promoting climate change, showing that the impact caused by the human species on the continent's land surface, uncontrolled use, and natural modification of land cover, has expanded by 268 million hectares, or 60% of this total between 1985 to 2018.

Brazil has a total of 1,544,833 square kilometers of protected areas, or 2,029 conservation units across the country, 325 of which are managed by the Chico Mendes Institute for Biodiversity Conservation (ICMBIO). Of the species threatened with extinction, 732 are registered in protected areas, of the categories provided for in the National System of Conservation Units (SNUC) [26].

We turn our eyes to the central region of Brazil, currently, the State of Mato Grosso has 111 Conservation Units. Of this total, 23 are federal units, 43 are state and 45 municipalities, in accordance with art. 2 of Federal Law No. 9,985, of June 18, 2000. Despite being the third largest state in the federative unit of Brazil, in territorial extension, occupying 6.39% of the instance units in Brazil [27], we can observe that in relation to the existing conservation units in the State, these

still have a smaller number of protected areas for the State, when compared to other Amazonian states.

These questions bring light to the recognition of the Cerrado biome that despite its biological importance, this biome has a low percentage of areas with full protection. Only 8.3% of its territory has any legal protection. Of this total, 3.1% are fully protected by conservation units and 5.2% are areas of sustainable use, including private reserves (0.09%) [28].

These questions were observed by Verissimo [102] who point out that part of the Conservation Units in the Midwest region of Brazil are protected only "on paper", which can compromise the integrity of the attributes that justified their protection.

Due to the lack of communication and transfer of information between the different levels of the Executive Branch and the conservation units themselves, it is possible to observe the inefficiency of this management network, where many have a lack of management plan, reaching almost zero management [103].

For this reason, analyzing the risks and challenges to the conservation and preservation of these areas presupposes identifying the main social and environmental problems that these biomes affect and, eventually, prevent them from achieving their protection objectives and, in the central region of the country, the lack of management plans, can create disturbances for the conservation of local biodiversity.

These opinions in relation to the existing conservation units in Mato Grosso often show us that some considerations and work carried out have acted as barriers to the advance of deforestation and that some actions focused on the most threatened units aim to solve conflicting problems between land tenure limits and regularization in the region, aiming to improve the efficiency of the state system of conservation units, protection of river sources, fauna and flora.

12. ENVIRONMENTAL PROJECTS AND STUDIES THAT AGREE WITH CONSERVATION

Several studies show the importance of tropical forests for the Earth's climate and reveal that large-scale deforestation, mainly related to the Amazon, can significantly alter regional climates.

Anthropogenic activities, when carried out disorderly, without taking into account the conservation aspects, lead to the degradation of ecosystems. Conservation studies aim to improve the conditions imposed by man on nature, the adoption of conservation practices, as an example of the adoption of the no-tillage system, integrated production systems, and forms of cultivation that enable the sustainable use of the soil and that increase the entry of sequestration of carbon, through the residues, are presented as an essential measure for the mitigation of greenhouse gases, as long as they are correctly managed.

The discovery of four new species of fish in the Fernando de Noronha region of Brazil emphasizes the importance of conservation studies. Faced with the devastation caused by man to the environment, nature renews itself showing its adaptability and resilience. Oceanographers and divers discovered four species: stone fish (*Scorpaena* sp.), lizard fish (*Synodus* sp.), aphrodite fish (*Tosanoides* sp.) and the fourth new species discovered was the gobidid fish (*Psilotris* sp.), a genus classified as "rare" [104]. The results emphasize the need for protection and attention to this unique ichthyofauna found in these deep ecosystems.

The jaguar (*Panthera onca*) or jaguetê (from Tupi, "true jaguar"), the largest terrestrial predator in the Americas, as well as all felids are, to varying degrees, threatened with extinction in all or parts of their natural area due to, mainly, the destruction and fragmentation of habitat and hunting. Jaguars have been found in jungles from North America, in the southwestern United States, covering Central America to South America, in Argentina.

Most of the specimens today are found in Brazil, however, deforestation and the pressures of illegal hunting have caused an urgent need for conservation. The destruction of habitats and the consequent isolation of reserve areas, jaguars, which used to roam thousands of kilometers, only mate between individuals of the same group, which reduces genetic variability and tends to drive populations to extinction. A group of researchers created a genetic bank, with embryos, semen and other biological materials, with the aim of preserving the species' DNA for posterity [105].

This work reflects the importance and is in line with activities carried out by other researchers,

for contributing positively to the appalling devastation scenario that occurred in Brazil, in the Pantanal region during the 2020 fires. The decrease in genetic exchange, in the long term, it leads to loss of genetic variability and reduced reproductive potential, as reported by environmental researchers, in cheetahs (*Acinonyx jubatus*), lions (*Panthera leo*) and Florida cougar (*Puma concolor coryi*) [106,107].

In Brazil, the work directed to this technique is also advanced with other wild cats such as: ocelot (*Leopardus pardalis*), margay cat (*Leopardus weidii*) and small wild cat (*Felis tigrina*) and other cats [108].

In Brazil, in the central region of Mato Grosso, environmental awareness and protection projects emerge and are adapted to preserve environmental conditions and improve the quality of life of populations, data from the Water for the Future project, by the State Public Ministry from Mato Grosso, in partnership with Instituto Green Action Institute and Federal University of Mato Grosso (UFMT), show that 215 springs have been identified in the capital of Mato Grosso, of which 78% are degraded and 22% are preserved. The survey also points out that there are about 300 unconfirmed springs due to environmental degradation [109].

The surroundings of the springs are generally humid areas, which, as such, have characteristic soils and plants adapted to periodic flooding. The Water for the future project identified 140 species of these plants in the various springs.

An ambitious project, it aims to create an ecological corridor on the banks of the Araguaia and Tocantins rivers in Brazil, connecting the Amazon rainforest and the Cerrado. The forest network will extend through the states of Goiás, Mato Grosso, Mato Grosso do Sul, Tocantins, Pará and Maranhão, covering 112 municipalities, despite the setbacks and resistance, the project aims to preserve and recover part of the area to comply with the code standards forestry in Brazil, vegetation recovery, tree planting, soil erosion, economic benefits and many other advantages that will provide a great quality and improvement for the vegetation in these worked regions [110].

13. CONCLUSION

Biodiversity integrates the impacts of all types of environmental change. Any effort of science will not be enough without a plan with real

preservation strategies. The climate crisis, the toxicification of the environment and the indiscriminate attack on forests and the animals that exist in them, represent an existential threat to civilization.

Studies and results reveal that they will only be compensatory if deforestation of forests is stopped, as these deforestation significantly contributes to the greenhouse effect, and it seems that this emission of gases shows the high priority that should be given to improving the estimates of these emissions and the uncertainties contained therein.

The viral disease SARS-CoV 2 (Covid-19) pandemic that we have been experiencing since 2019, of which we still do not understand its full functioning and its connection with animals and wildlife; what we know at the moment is that the likely global economic, social and political impacts linked to this pandemic virus and that it is closely linked to wildlife.

So many species distributed around the planet will only have a safe destination if different conservation fronts are put into practice. Changes in awareness and management of the deforested landscape can only contribute to a small fraction of this impact.

Exact measures and with greater potential for reducing greenhouse gases would be changes in policies in order to reduce deforestation rates, environmental preservation, ensuring that forests remain standing, establishing ecological corridors, restoring degraded areas; allied to awareness activities and the effect of ending the fight against hunting and illegal trade, curbing trafficking and biopiracy, banning the consumption of wild species meat in countries that use this practice as a cultural standard, sustainable agriculture and greater attention to biodiversity and improving the quality of life of human populations, especially investing in awareness of environmental education to reduce conflicts with humans.

These are initial steps for the transmission of scientific knowledge to society, which will only be able to understand the need for biodiversity conservation if it knows and understands its importance.

INTEREST CONFLICTS

The authors declared that there were no conflicts of interest. The retracts used for this research are

based on articles, manuscripts and news predominant in the research area and in the country of origin.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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