



Ecocide in the *Cerrados* (Brazilian Savanna): agribusiness, water spoliation and pesticide contamination

Ecócidio nos Cerrados: agronegócio, espoliação das águas e contaminação por agrotóxicos

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ABSTRACT: At 65 million years old, the Cerrados biome is constituted of wide biodiversity related to its water's abundance and hydrological cycle's dynamics, perpetuating rivers in six of eight Brazilian river basins and overflowing its waters to other countries of the South American subcontinent. The biome hosts a diverse set of traditional communities that constituted livelihoods based on their ancestral knowledge. In recent decades, the Brazilian State has been implementing development policies in these territories that are subordinated to neo-extractivism and accumulation by the plunder of large corporations. Thus, the Cerrados biome was invaded by the agribusiness accelerated expansion that results in intense conflicts, threatening or refraining the livelihood of different populations. Information and analysis were gathered to characterize the Cerrados biome Ecocide, where around 120 million hectares are destined to produce 75% of Brazilian commodities soy-cane-corn-cotton, which destroyed 52% of the native vegetation, and consumed 91.8% of surface water and groundwater in pivot irrigation systems, resulting in the migration of springs, the interruption of river flows and the reduction of aquifer volumes, as observed in the analysis of ongoing conflicts in western Bahia and the basin of the Formoso and Javaés rivers, in Tocantins State. Also, the impacts of intensive use of pesticides on all forms of life are observed: there are more than 600 million

liters of poison annually, concentrating 73.5% of the total pesticides consumed in the country in 2018, which, regarding human health, results in rates of exogenous poisoning and childhood cancer higher than the national averages. The Cerrado biome is characterized as a sacrificial zone of the Brazilian development model where nature, and populations, are plundered to guarantee the accumulation of few in an Ecocide process that is a modern-colonial racist product in this territory.

Keywords: Cerrados (Brazilian Savanna); agribusiness; traditional communities; water spoliation; pesticides poisoning.

RESUMO:

Com 65 milhões de anos, os Cerrados constituem-se de intensa biodiversidade, que tem relação com sua abundância em águas e a dinâmica do ciclo hidrológico, perenizando rios de seis das oito regiões hidrográficas do país e transbordando suas águas para outros países do subcontinente americano. O bioma abriga diversos povos e comunidades tradicionais que constituíram modos de vida e saberes ancestrais. Nas últimas décadas, o Estado vem implementando nesse território políticas de desenvolvimento subordinadas ao neoeextrativismo e à acumulação por espoliação de grandes corporações. Assim, os Cerrados têm sido invadidos pela expansão do agronegócio, que resultam em intensa conflitividade no bioma, além de tentar exterminar os modos de vida dos diferentes povos. Foram reunidas informações e análises para caracterizar o Ecocídio dos Cerrados, onde mais de 110 milhões de hectares do bioma estão ocupados pelo agronegócio – com área plantada para produzir 75% das *commodities* soja-cana-milho-algodão cultivadas no Brasil e as áreas de pastagem destinadas à produção de carne bovina. Isso implica na destruição de 52% da vegetação nativa e no consumo de 91,8% das águas superficiais e subterrâneas usadas na irrigação por pivôs centrais, resultando na migração de nascentes, na interrupção dos fluxos dos rios e na redução dos volumes dos aquíferos, como se aprofunda na análise dos conflitos em curso no oeste da Bahia e na bacia dos rios Formoso e Javaés/TO. A isso, somam-se os impactos do uso intensivo de agrotóxicos sobre todas as formas de vida – são mais de 600 milhões de litros de venenos anualmente, concentrando 73,5% do total de agrotóxicos consumidos no país em 2018, sobre a saúde humana resulta em taxas de intoxicação exógena e câncer infanto-juvenil nos Cerrados maiores que as médias nacionais. Os Cerrados caracterizam-se como zona de sacrifício do desenvolvimento brasileiro, em que natureza e povos são saqueados para garantir a acumulação de poucos, num processo de Ecocídio que é o produto moderno-colonial racista no bioma.

Palavras-chave: Cerrados; agronegócio; povos e comunidades tradicionais; espoliação das águas; contaminação por agrotóxicos.

1. Introduction

The lowering of the waters of the Arrojado River, in Correntina-BA, reached the limit of the acceptable, whose ribeirinhos population does not exist without it. Thus, with full awareness of a fundamental Human Right and the power to act for it, near one thousand of these ribeirinhos population, on November 2nd, 2017, the Day of the Dead, broke and burned the

agricultural irrigation facilities of the company that sucked their blood, that is, the water. Nine days later, a crowd of 12 thousand people went out to the streets of the city of about 12,600 inhabitants (Census 2010) to support that action: “Nobody is going to die of thirst on the banks of Arrojado”. (Ruben Siqueira, by Comissão Pastoral da Terra/Bahia e Coordenação Nacional da CPT- Pastoral Land Commission/Bahia and CPT National Coordination).

The conflict in Correntina, a municipality located in the West of Bahia, uncovers some of the impacts of the agribusiness expansion in Brazil, especially on the Cerrados. This conflict is an emblematic case, being the main one in Brazil involving water, and involve the deforestation of the Cerrado, which causes the decrease of flow and even the death of rivers.

The Cerrados¹, formed some 65 million years ago, are the oldest and the second largest Brazilian biome, covering 36% of the national territory, with 192.8 million acres of Continuous Cerrado and 114.4 million acres of transition areas (Mazzeto Silva, 2009). These areas are found in the states of Goiás, Mato Grosso, Mato Grosso do Sul, Tocantins, Maranhão, Bahia, Piauí, Minas Gerais, São Paulo, Paraná, and the Federal District. Because of its size and natural complexity, it communicates with the Amazon, the Pantanal, the Caatinga, and the Atlantic Forest, constituting ecotones of great complexity and plant and animal diversity (Barbosa, 2008). It hosts several Phyto physiognomies such as the Campos, the Cerradão, Matas, Matas Ciliares, Veredas and Ambientes Alagadiços and the Cerrado itself. There are 11,627 plant species, 250 species of mammals, 837 species of birds, 1,200 species of fish, and 150 species of amphibians (MMA, 2009).

The Cerrados terrain, usually in plateaus and lowlands, and its varied native vegetation has a close relationship with its abundance in waters and the dynamics of its hydrological cycle, which has three large aquifers, important for other biomes in Brazil and for other South American countries: Guarani, Bambuí, and Urucuia. As Altair Sales Barbosa te-

aches us: aquifers give rise to springs that, in turn, give rise to most rivers in the Cerrado. Its existence depends on precipitated waters and their attainment mainly by deep root vegetation and complex root systems (Barbosa, 2008).

These waters overflow from their cradles in the Cerrados to perpetuate rivers on the right bank of the Amazon hydrographic basin (Araguaia/Tocantins, Xingu, Madeira and Tapajós) and to the rivers: São Francisco, Paraná and Prata, Parnaíba, Jequitinhonha and Doce. The Cerrados are related to the largest and most precious continental floods of the Planet, the Pantanal, and the Araguaia.

The archaeological discovery of the *homo sapiens sapiens* skeleton in Goiás confirms that native peoples have lived in the Cerrados at least 13 thousand years ago (Barbosa, 2008), constituting knowledge and learning in close relationship with the different subsystems of the biome to withstand their social reproduction, as underpinned by Porto-Gonçalves (2019, p. 40-41):

[...] nobody lives in a region, whatever it may be, if they do not know how to hunt, crop, fish, and/or eventually farm, that is, if they cannot guarantee their food and, thus, reproduce on their own way; no one lives in a region if they do not know how to cure themselves, that is, if they are not able to develop/invent their own medicine; no one lives in a region if they do not know how to protect themselves from the weather, that is, to invent their own architecture. [...] to put it another way, nobody lives without knowledge, without learning (how to eat, heal and inhabit). Knowledge is inscribed in life, in doing.

¹ In this article, we have adopted the term Cerrados, in the plural, to refer to the Continuous Cerrado and its transition areas, as recommended by several scholars of the biome.

As a cultural successor of these first inhabitants, the Cerrados are currently inhabited by a wide diversity of traditional peoples and communities that “represent the socio-diversity of the biome and at the same time are the protectors of the region’s ecological and cultural heritage” (ActionAid, RSJ-DH, 2017, p. 24). There are more than 80 indigenous ethnic groups, totaling 44,118 people, distributed mostly in the lands of Maranhão, Tocantins, Goiás, Mato Grosso, and Mato Grosso do Sul,

[...] from the linguistic groups Jê and Macro-Jê. In the first, we find the Timbira (that include the indigenous Canela, Krinkati, Pukobyé, Krenjé, Gavião, Krahô), the Kayapó (which include the Kubenkranken, Kubenkrañoti, Mekrañoti, Kokraimoro, Gorotire, Xikrin, Txukahamãe), the Xerente, Karaente Xavante, Xakriabá, Apinayé (currently considered belonging to the Timbira group), Suyá, Kreen-Akarôre, Kaingang, and Xokleng. The largest linguistic trunk (Macro-Jê) would also include the indigenous Pataxó, Bororo, Maxakali, Botocudo, Kamakã, Kariri, Puri, Ofaié, Jeikó, Rikbatsá, Guató, and Fulniô, in addition to the Guarani Kaiowá (Silva, 2009, p. 51).

As traditional peoples and communities, the Quilombolas, ancestors of the black people captured in Africa and brought to Brazil as slaves in the sesmarias, also live in the Cerrados. Subjected to living and working conditions compatible with non-human conditions that Modernity invented for them, to rationalize the colonial project, many fled the slave quarters to try to establish communities in which they could retrieve their identity and culture - the quilombos. The Land Law, of 1850, anticipated restrictions so, with the abolition of slavery, they could not have access to land and were led to occupy unclaimed lands among the expanding landholdings.

Despite the imaginary “demographic void” created and spread around the Cerrados, several groups and traditional communities such as peasants in the region still live close interdependence with the biome:

[...] the geraizeiros (north of Minas Gerais), the geraizeiros (Gerais de Balsas/MA), retireiros (flood lands of Araguaia/MT); beiradeiros, barraqueiros and vazanteiros from the borders and islands of the São Francisco (MG); quebradeiras de coco (Cocais Zone/MA, PI and TO), pantaneiros (MT and MS), camponeses dos vãos (south of Maranhão) and other general denominations, such as varjeiros and ribeirinhos (along the São Francisco, Grande and Paraná), caipiras (Triângulo Mineiro and São Paulo) and sertanejos (north of Minas, Bahia, Maranhão and Piauí), as well as the fundo e fecho de pasto communities (traditional community of the cerrado peoples) of western Bahia (Silva, 2009 *apud* ActionAid; RSJDH, 2017, p. 26).

These people’s rich and diversified ways of life include, overall, living on unclaimed lands in the so-called baixões, at the source of the springs arrives on the chapadas, with the possibility of fishing and cultivating their yuca, rice, corn, and beans fields, besides raising chickens and pigs. Chapadas are lands regularly used for cattle breeding, hunting, and the extraction of fruits and medicinal herbs. That is, the relationship between the common lands of the Chapada and possession in the baixões is what allows to carry on the ways of life of these colonist peasants (posseiros) (Alves, 2006).

This is the rich territory that the people of Correntina (and many others) protect.

Currently, the Brazilian Cerrados, as a productive area, have been highly forced by the expansion of agribusiness, representing the largest Brazilian

region to produce grains. The agribusiness² production model, centered on extensive areas of monocultures, is established after deforestation, destroying biodiversity and compromising the hydrological cycle; it demands great volumes of water, restricting its use by local communities; and, among other socio-ecological impacts, uses chemical and pesticide fertilizers intensively - 602,303,236 liters of pesticides in 2018, in soybean, sugarcane, corn, and cotton crops - contaminating the air, soil and water and, especially, causing illness to workers and residents (Pignati *et al.*, 2017; IBGE, 2020).

We intend in this article to argue that an Ecocide process has been in progress in the Brazilian Cerrados in recent decades. According to the Permanent Peoples' Tribunal (PPT)³, based on the Universal Declaration of the Rights of Peoples, approved in Algiers on July 4th, 1976,

[...] ecocide is understood as the serious damage, destruction, or loss of one or more ecosystems, at a given area, caused either by human or other reasons, whose impact causes a severe decrease in the environmental benefits that the inhabitants of that territory were benefited from.

Aimed at contributing to characterize the Cerrados Ecocide, we will specifically portray two of the (many) socio-ecological consequences related to the expansion of agribusiness on the biome: the plundering of the waters, with deepening of the ongoing conflicts in the west of Bahia and the Formoso and Javaés river basins in Tocantins; and

some impacts due to the intensive use of pesticides on the health of the people from the Cerrados, such as acute poisoning, congenital malformations, and cancers in children and adolescents.

2. The “development” in the Cerrados and the socioecological consequences of agribusiness

Since the 17th century, the Cerrados and their peoples have suffered and went through the violence of the colonial project, introduced by the *bandeirantes* who were after gems and metals and hunting down slaves. The pioneering of power subsists centuries and is updated in the economic and political order of *development/modernity*.

Subjected to economic agents, the State keenly takes part in the creation of the necessary conditions for the implantation and expansion of this model. In the context of the business-military dictatorship (1964-1985), in response to the growing agrarian conflicts and the need to boost the production of the agricultural sector, the State develops a set of policies that enables the expansion of agricultural limits over the Cerrados, such as the establishment of interconnected highways in the North and Northeast regions (Programa de Integração Nacional/ National Integration Program); Prodecer (Programa Nipo-Brasileiro de Desenvolvimento do Cerrado/ Japanese-Brazilian Cerrado Development Program), aimed at the Midwest in its first stage, at West Bahia in the second and currently demanding

² In this article, we will refer to the term agribusiness based on the concept proposed by Guilherme Delgado, which defines it as a “political economy agreement between industrial agriculture chains, large land ownership and the State, which increasingly imposes a private and state strategy for the pursuit of land income as the main guideline for capitalist growth for the economy as a whole” (Delgado, 2012, p. 111). 111).

³ The updated Permanent Peoples' Tribunal is available at: <<http://permanentpeopletribunal.org/estatuto/?lang=es>>, with the definition of ecocide provided in Article 5 of the Statute. Accessed on: Jan. 2021.

for the growth of commodity production on the boundaries of the Amazon; the establishment of the Industrial Agriculture Complexes (CAI) as a strategy for agricultural modernization, with the contribution of the Empresa Brasileira de Pesquisa em Agropecuária (Embrapa)/Brazilian Agricultural Research Corporation in the adaptation of soybean cultivars for exportation; and, among others, mechanisms to enable access by farmers and entrepreneurs to subsidized resources from public banks. State governments also take initiatives, as in the south of Piauí, to place a large stock of land on the market - about 2 million acres in the 1970s (Greenpeace, 2018).

In the last decades, governments considered to be “populist” in Latin America have also subject to what Gudynas (2009) called *progressive neo-extraction*, invigorating the development model based on the production of agricultural and mineral commodities for the globalized market and the exteriorization of its social and environmental impacts. Agribusiness in Brazil is systematically considered as one of the fundamental pillars of the economy, expanding agricultural frontiers over the territories of life of traditional peoples and communities, which David Harvey (2005) describes as *growth by spoliation*. This represents a violent process of appropriation and expropriation of natural properties, lands, and territories, giving rise to patterns of conflicts evidenced in systematic evictions, irregular land assignments, limited access to lands of collective and common use – namely the chapadões of Cerrados, abstraction, and plundering on an industrial scale of river waters and groundwater, deforestation with suppression of native vegetation (including the use of the so-called “*correntão*”- (use of a chain pulled by a truck along the forests to put

down the three as well as all other plant species), murders of the populations in the rural area. Thus, the *Environmental conflicts* are established, understood as:

[...] those related to access, preservation, and control of natural resources, which suppose, on the part of the actors confronted, divergent interests and ideals among them, in a context of uneven power. Divergent perspectives concerning natural resources refer to the territory (shared or to intervene) and, more generally, to the environment, regarding the need for its conservation or protection. Anyway, such conflicts express different perceptions about Nature and, finally, manifest a dispute about what is meant by “development” (Svampa, 2016, p. 143).

Such conflicts are structured on *racism*, since the values, knowledge, and ways of life of traditional peoples and communities are absolutely devalued and ineligible by hegemonic agents, considering them “outdated” and “inefficient”. Based on a “universal concept of history associated with the idea of progress, from which the classification and hierarchy of all peoples, continents and historical experiences are built” (Lander, 2005, p. 13), these peoples are not given the right to sustain and recognize other ways of existing. And yet, such conflicts impose *environmental inequalities/injustices*, since the destruction falls on vulnerable social groups, in an unequal division of the benefits and harms of development (Coletivo Brasileiro de Pesquisadores da Desigualdade Ambiental, 2013).

Moreover, the political solidification of agribusiness caused political impacts through the ruralist bench – one of the largest and most influential in the National Congress, reflecting systematically on the flexibility of the regulatory patterns of en-

vironmental, land, economic, territorial, and labor demand, among others, with repercussions on the land market, environmental conservation units, lands traditionally occupied and in common use, rural settlements.

According to Frederico (2013), the main beneficiaries of the agribusiness expansion are transnational companies or *trading* companies, which regulate logistics, marketing, and a substantial part of the financing, besides the financial speculators that invest in the agricultural commodities futures market. This is what Oliveira (2012) entitled a growing movement for the globalization of Brazilian agriculture, which explained the growth of the agribusiness transnationals control over national agriculture – either by determining the technological standard, either by purchasing/ shifting agricultural production, or by the growing acquisition of land by farmers, companies, and foreign groups. However, the meaning of this movement, with its three basic features - the production of commodities; the Goods and Future Exchanges, and the world monopolies –, is translated in the increase of the territorial control of these transnationals, acting, in regional and local spheres, the land monopoly of the territory and eviction of the traditional peoples and communities via land grabbing.

In Brazil, in 2018, the cultivation of soybeans, corn, sugar cane, and cotton totaled 62,542,022 acres of the planted area, in addition to a grass area of 169.6 million acres and a herd of 213.5 million cattle units. This production is greatly concentrated in the Cerrados, which had a planted area of 46,889,008 acres for these commodities in the same year – representing 75% of the total planted in the country (Figure 1). Further, the grass area takes up to 63,847,127 acres of the Cerrados, representing

37.6% of the entire grass area in the country, with 117,199,138 cattle units (54.9% of all cattle in Brazil), causing severe effects on greenhouse gas emissions (IBGE, 2020; LAPIG, 2020).

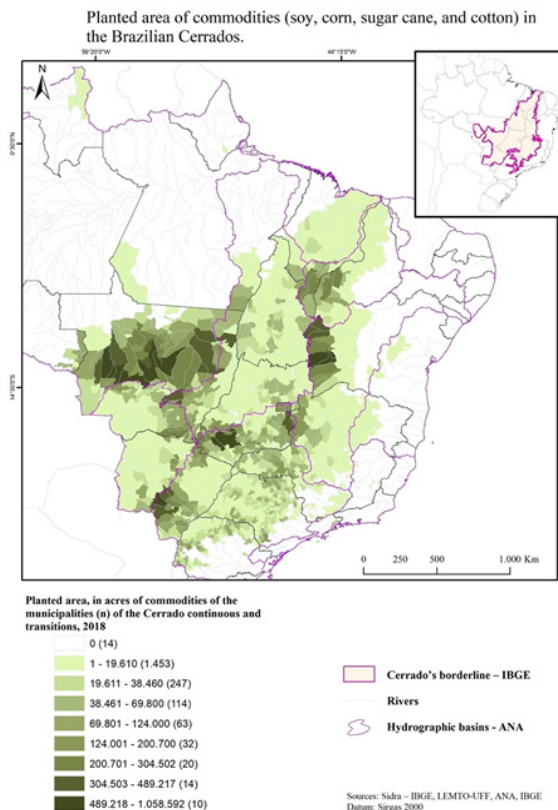


FIGURE 1 - Planted area, in acres, of commodities (soy, corn, sugar cane, and cotton) in the Cerrados and Brazilian hydrographic basins, 2018.

Among the crops of selected commodities, soy production in the Cerrados accounts for 24,627,450 acres of planted area (52.5%), followed by corn with 12,435,639 acres (26.5%), sugarcane with

8,682,674 acres (18.5%) and cotton with 1,143,245 acres (2.4%) (IBGE, 2020).

A lot of this recent expansion dynamic is because of the implementation of Matopiba in the states of Maranhão, Tocantins, Piauí, and Bahia, in the Dilma Rousseff government, when Kátia Abreu, Minister of Agriculture at the time, approves Decree No. 8,447 of May 2015, which provides for the Region's Agricultural Development Plan, relocating substantial resources through the PAC works of the federal government, especially focused to irrigation for agribusiness. In the Tocantins alone, the amounts, in cooperation with other ministries and the Banco Interamericano de Desenvolvimento (BID) (Inter-American Development Bank), totaled 650 million reais for 2016, 450 million reais for the revitalization of the Formoso River irrigation project. This decree, with the studies projected by Embrapa, delimit an area of 73 million acres. Added to arable land, there are strategic energy input from waters flowing into the basins of the Paraná, São Francisco, Tocantins, and Parnaíba rivers, and still meets the three large aquifers - Guarani, Bambu, and Urucua. Matopiba is the region in Brazil with the highest percentage growth area of planted area of soy, corn, and cotton, which, added together, grew 32% in 2000/01 crop and 193% in the 2014/15 crop (Frederico & Almeida, 2019). Parallel, the Matopiba Region had a loss of natural vegetation cover of 94,000 square kilometers between 1985 and 2017.

The biome has one of the highest deforestation percentages in the country – 52%, with the Cerrados losing 29 million acres of native vegetation between 2019/2020, while 28 million acres were intended for agricultural activities (MapBiomas, 2019/2020; Santos & Glass, 2018). Deforestation has another

negative environmental effect, which is soil erosion and the washing of sediments into water streams. In the São Francisco River basin, a study by the American Army and Codevasf (CBHSF, 2020) estimated that the São Francisco River takes about 23 million tons of sediment yearly, silting up its mainstream and its tributaries. According to this same study, this process results from the deforestation in the Cerrados plateaus due to the planting areas, contributing to the reduction of river flow, formation of islands and sand deposits, with restrictions on navigating and accelerating the degradation process of the river.

According to Barbosa (2014), the entropies resulting from deforestation cause unpredictable and irreversible processes. The eradication of vegetation cover, removing deep-rooted trees and complex root systems from the Cerrados, added to the suppression of their grasses, hinders the penetration of water into the soil, lowering the volume of aquifers, which occurs mainly in the vast areas of the plateaus. One-third of the vegetation body mass of Cerrados is on the surface and two-thirds is underground, which is crucial for the infiltration of water into the soil, due to root systems. With deforestation, the soil becomes dense and surface runoff occurs.

The plundering caused by this productive model, besides being caused due to the strong territorial expansion over areas of native vegetation, is founded on overexploitation and consumption of water, through irrigation systems that compromise the hydrological cycle. According to the Agência Nacional de Águas (ANA) (National Water Agency), in a report published in 2019, irrigated agriculture takes up to 66.1% of the water; 11.6% are used to nourish animals; 9.1% to industry and 9.1% to urban supply; 2.5% to rural supply; 0.9%

for mining and 0.3% for a thermal power station. Furthermore, irrigated agriculture is accountable for the removal of 969 thousand liters of water per second from the surface and underground water sources, which means 83 billion liters of water a day (ANA, 2019a) - while the average daily consumption of each Brazilian is 150 liters.

Brazil is among the ten countries with the largest area supplied for irrigation worldwide, totaling 4 million acres in 2016 (ANA, 2017) and reaching 7.3 million acres in 2019 (ANA, 2019b). By the year 2017, the country had 23,181 centre pivot irrigators with 1,476,101 acres supplied for irrigation (Figure 2), to which 94,000 acres were added yearly from 2012-2018, with a tendency to increase this process

until 2030 (ANA, 2019a). Such prediction signals an increase in the use of water volume in this activity, which would go from 969 thousand liters per second to 1.338 million liters per second in 2030, an estimated increase of 38% (ANA, 2019b).

This increase of the areas with irrigation is mostly located in the Cerrados, whose states concentrate 91.8% of the area supplied by pivots (ANA, 2019b). In the São Francisco Hydrographic Region, there is a concentration of these areas in the West of Bahia, especially in the basins of the rivers Grande, Correntes, Carinhanha, and Paracatu, which flows into the São Francisco and has Entre-Ribeiros and Preto as tributaries⁴.



FIGURE 2 – Centre pivot used for irrigation of monocultures.

SOURCE: Photo by João Zinclar, provided to Articulação Popular São Francisco Vivo and kindly provided by him to this publication.

⁴ SNIRH Portal – Sistema Nacional de Informação de Recursos Hídricos: (National Water Resources Information System: Water Use). Available at: <www.snirh.gov.br>. Accessed on: jul. 2020.

The fast growth of agribusiness on the Cerrados, with deforestation taking over the native forest, associated with the intensive use of water from aquifers and rivers, affects the volume of water in aquifers. Besides reducing the flow of rivers - since what keeps the perennialization of rivers are supplied by the aquifers -, it can cause the break of streams or even the death of tributaries of the main rivers, which can have consequences in the supply system of the main rivers in the country and the collapse in the hydrographic regions of the South American subcontinent.

This is the context that allows us to understand the increase in conflicts involving water in Brazil. Between 2015 and 2019, the Centro de Documentação da Comissão Pastoral da Terra (Documentation Center of the Rural Land Commission) recorded an annual average of 254 water conflicts in the country, the most emblematic of all, that of Correntina, in Western Bahia. In 2019, this number reached 489, and the involvement of 279,172 people - indicating a growth of about 77% comparing to 2018 (CPT, 2020, p. 139), and reveals the water inequality that affects traditional peoples and communities. Like the motto of the National Campaign to Fight for the Cerrado: no Cerrado, no water, no life⁵.

This growth of agribusiness is also associated, in the model recommended by the so-called agricultural modernization, the increase in the use of pesticides, in which Brazil leads among the largest consumers in the world, in the last decade. In 2018, 549,280 tons of pesticides were sold, used in a total of 78.5 million acres of the planted area or used to harvest different crops around the country - not to mention illegally traded products (illegal marketing/

products not approved in the country), which are estimated to account for around 20% of total sales. Most of these pesticides are used in the cultivation of cotton, sugar cane, corn, and soybeans, which consumed 838,478,552 liters of pesticides in 2018 (Pignati *et al.*, 2017; Fiocruz, 2018).

In the Cerrados, the crop with the highest use of pesticides is soy, which totaled 435,905,865 liters (72.4%) in formulated product, followed by corn crops with 92,023,729 liters (15.3%), sugar cane with 41,676,835 liters (6.9%), and cotton with 32,696,807 liters (5.4%). Together they amount to 602,303,236 liters of poisons applied to the municipalities of the Cerrados, combining 73.5% of the total pesticides consumed in Brazil in 2018, which characterizes an intense sacrifice zone (Figure 3).

To analyze these consequences of the modern-colonial project on the Cerrados, expressed in the last decades in a development model promoted by the State, in line with the interests of the landowning oligarchies and the transnational corporations that plunder biome's lands, waters, and peoples to expand, through agribusiness, the cultivation of agricultural commodities makes it possible to understand the conflict that takes place in the biome, in response to the inequalities and injustices imposed on its peoples, who see their traditional ways of organizing life greatly threatened, if not made unfeasible. Such consequences overflow the Cerrados, compromising other regions supplied by its waters, within the scope of the South American continent, at the same time as they represent priceless losses of knowledge, biodiversity, and expectations for the future.

⁵More information available at: <<https://semcerrado.org.br>>. Accessed on: Jul. 2020.

3. The plundering of waters affects the territories and ways of life of traditional communities in the Cerrados

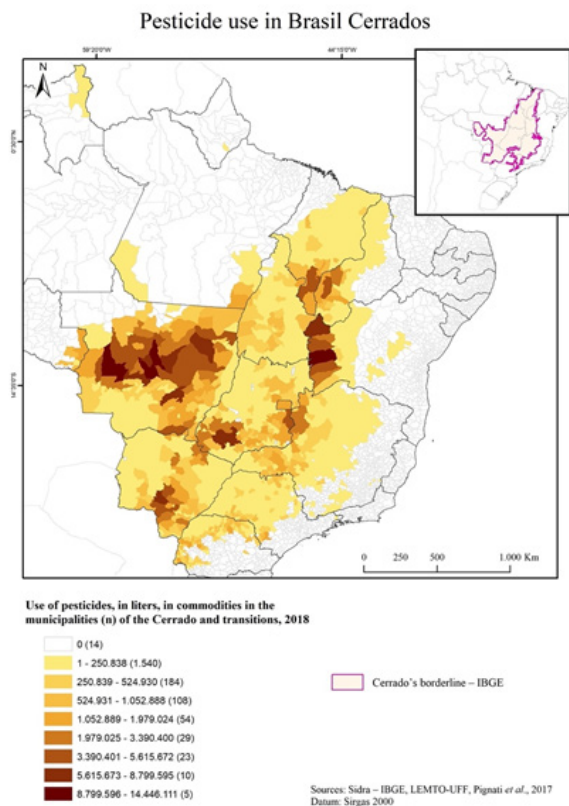


FIGURE 3 – Pesticide use, in liters, in agricultural commodities (soybeans, corn, sugar cane and cotton) in the Cerrados do Brasil, 2018.

“(…) We traveled for about fifteen days by the Tocantins River (…) at that time there were huge *gerais* with no one there, you would get there and could choose where you thought it was beautiful spot to live there and you would stay. There was nothing neither nobody living there. Nobody knew the land if it had an owner … It was really a *gerais*ção.” (Joaquim, oficina de mapas, Projeto Nova Cartografia Social da Amazônia, Manaus, 2009).

The ways of life of traditional populations are portrayed by bonds in the community and ecosystems in which they live, through production and work in agriculture, hunting, fishing, collecting, and farming, which establish values, traditions, and beliefs. These elements create the various traditional communities, in support and collective assistance for social reproduction, shaping different ways of life. According to Brandão (2010), in traditional ways of life, there is relative autonomy, that, in general, land tenure is precarious and, according to this author, there is *the presence of the other*, who may be the farmer, the land grabber (*grileiro*), the investment fund or the State. In this way of life, any action of outside power over the territories of life triggers ‘vulnerability processes⁶, which cause suffering and trigger socio-environmental conflicts’.

⁶ The concept of vulnerability was adopted in this article from a broad understanding of the injustices, inequalities, and rights violations engendered historically and constantly to certain populations. The subjects that are part of these communities suffer the consequences of being neglected by a State that does not guarantee the fulfillment of many guaranteed rights and still works to facilitate the implementation of large enterprises that plunder the territories and make people sick. Therefore, reflecting on the vulnerability processes that these communities are subjected to, is a step beyond just identifying and characterizing individual and collective vulnerabilities (Acsehrad, 2013).

Dozens of indigenous peoples used to live in Western Bahia. Currently, there are three communities in the process of resurgence, far from their original territories – the Kiriri (Barreiras), Atikun (Santa Rita de Cássia), and Xacriabá (Cocos) –, who seek to reconnect the ancestral bonds that give them an identity. Quilombola communities have been mainly in the Rio Grande basin, for about 300 years, composed of groups of slaves who left the corrals along the São Francisco and Pernambuco rivers, as well as Arraial de Canudos. Peasants make up diverse and rich identities about their origins, the ecosystems where they live, and the fruitful activities they perform. In the broad fields of the *gerais* or in the *baixões*, they can be *geraizeiros*, *fundo*, and *fecho de pasto*, *quilombolas*, *extractivists*, *ribeirinhos*, or even family farmers.

The life and propagation of traditional communities in Western Bahia are fulfilled by the *chapadas* or the *gerais*, and the *vales* or *veredas*, these being the two indivisible units of the landscape, as supported by Porto-Gonçalves (2019). With the arrival of large agribusiness companies in the 1970s, land grabbing in the *gerais* and the ways of life have been threatened. Disruptions in the nature-society process begin to deepen, producing processes of vulnerability in traditional communities, resulting from the environmental degradation imposed by big capital and the State. Recently, land grabbing has also started to take place in the *veredas* or *baixões*, to become legal reserves, necessary for agribusiness to meet the legal requirements of the maintenance of preservation areas.

The wisdom and ancestral practices that guide the diverse collective use of water are noteworthy,

involving not only their management and handling for household use, crops, cattle, and fishing activities, but also social practices of a playful and ritualistic/sacred nature. Such collective systems are compromised by the intense and conflicting process of deforestation and capture of water from rivers and aquifers for the irrigation of monocultures, mainly in *chapadões*, which, as we have seen, are the most important areas for recharging aquifers. Therefore, begins the spring migration process, water stress in the basins and sub-basins, the partial death of main rivers and the desertion of rivers of other orders in the same basin decreased flow of rivers and aquifers, among other impacts (Figure 4).

To better observe this process of water spoliation by agribusiness, the Western Bahia, and the Formoso River basin, in Tocantins, are emblematic cases, where the implementation of monoculture projects, dependent on intensive water use, has been going on since the 1970s.

The Western Bahia is a region of the development of the soy monoculture, with irrigation by centre pivots, which use water from rivers and mainly aquifers; in the case of Tocantins, an irrigation project for rice monoculture predominates - the Formoso River Project, which uses the flooding dynamics of the wetlands of this important ecotone from Cerrados, recognized as a humid area of relevance to worldwide biodiversity. Figure 5, the Water Balance Map of the basins and sub-basins, allows to observe, on the left, the Formoso River (TO), and on the right, the Western Bahia (BA), both in a very critical situation, according to the criteria established by the Agência Nacional de Águas (National Water Agency).

Such an intensive process of water spoliation is closely related to the expansion of cultivation areas for agricultural commodities of the agribusiness in the regions highlighted above. The available data from the Municipal Agricultural Production of IBGE show that, in 25 years (1993-2018), the Western Bahia went from 620,732 acres to 2,246,821 acres of total area with temporary crops, indicating an increase of more than 360 % (IBGE, 2020).

If in 1993, the four main agricultural commodities in agribusiness - soy, cotton, sugar cane,

and corn - used a total area of 483,810 acres, which was equivalent to almost 78% of the total area with temporary crops for that year, in 2018, these monocultures used 94.5% of the total area of temporary crops. It is worth mentioning the soybean planted area in the Western Bahia - the main monoculture of agribusiness expansion over the Cerrados -, which went from 381 thousand acres in 1993 to more than 1,600,000 acres in 2018, equivalent to an increase of 420% in area planted in just 25 years (IBGE, 2020).

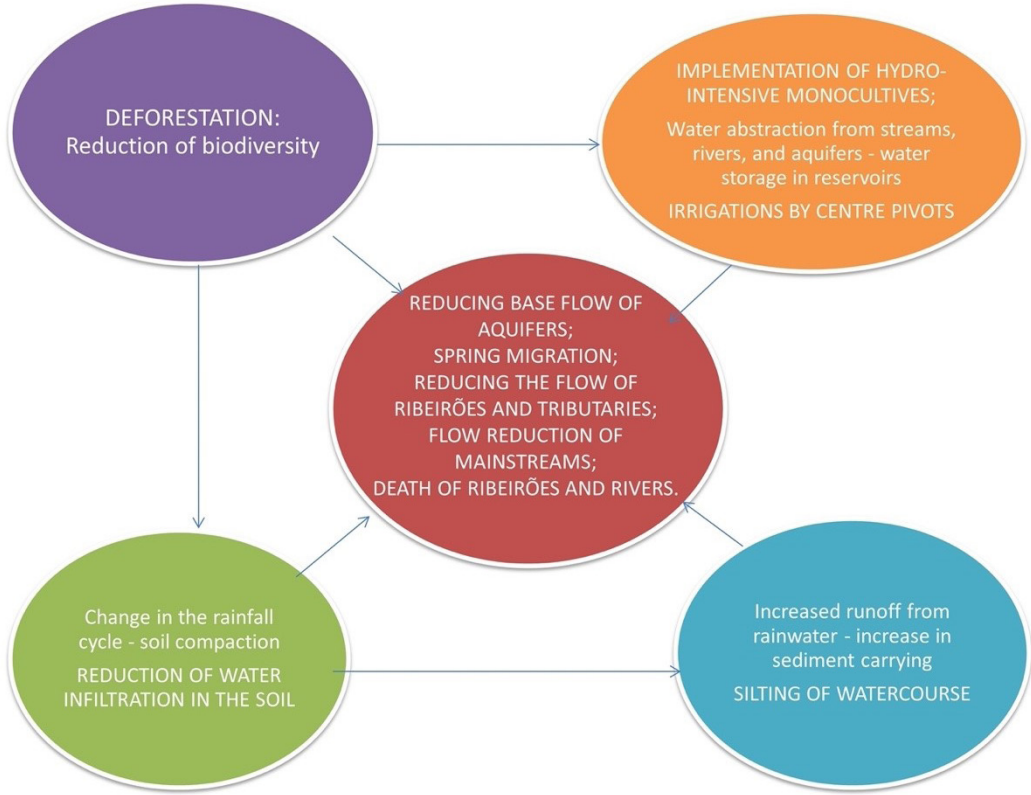


FIGURE 4 – Changes in land use and water spoliation processes in Western Bahia by agribusiness. SOURCE: Prepared by the authors.

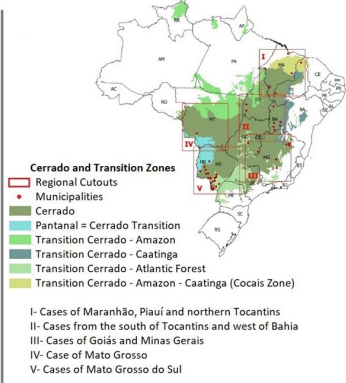
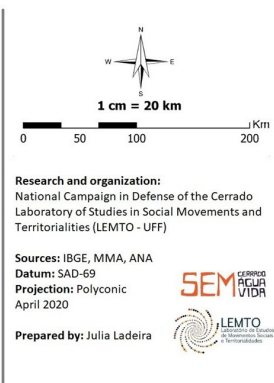
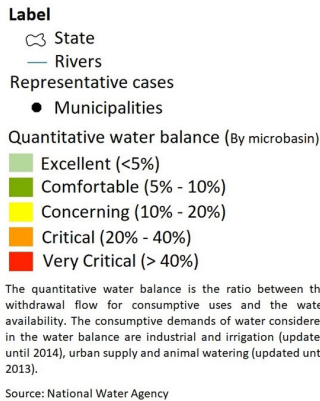
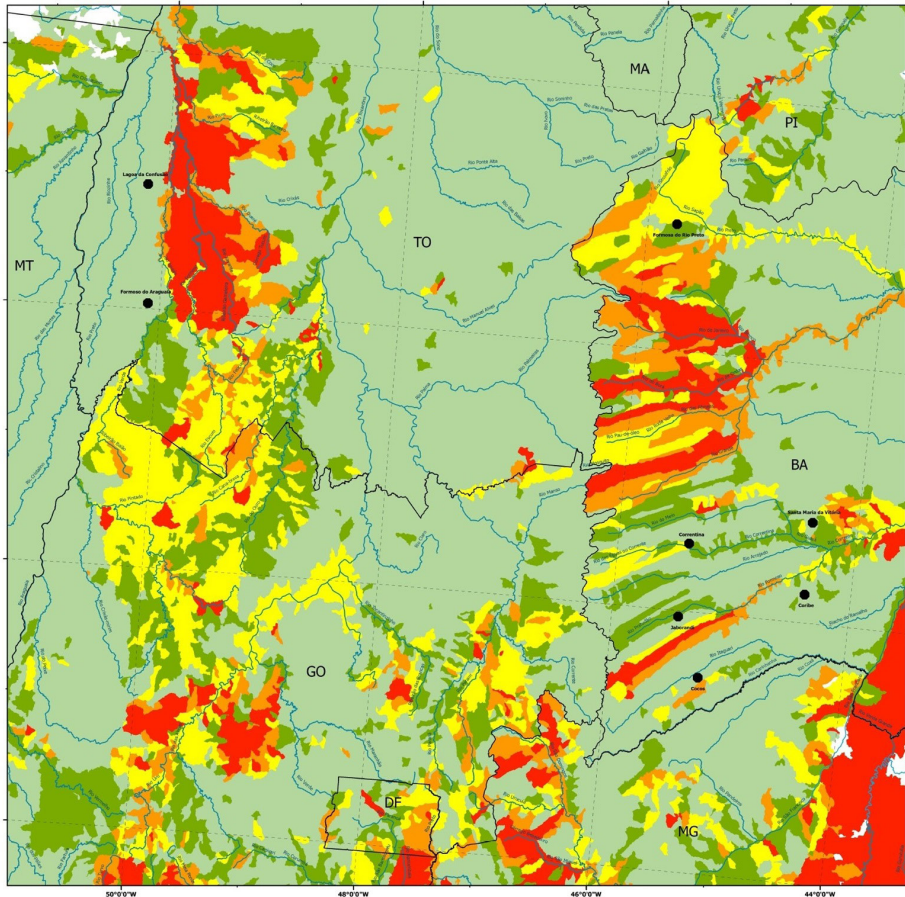


FIGURE 5 – Quantitative balance map of water spoliation in the territories of Western Bahia and Formoso-Bananal, 2014.

In the region of the Formoso River basin, in Tocantins, we highlight that the area used with temporary crops, in 1993, was 53,578 acres and, in 25 years, 2018, reached 189,200 acres, an increase of more than 350% for that scale (IBGE, 2020). This region has as a characteristic, the strong predominance of rice cultivation, mostly because of the Rio Formoso Irrigation Project, implemented since 1970. In 1993 this crop used 43,166 acres, which corresponded to 80.5% of the area with temporary crops. IBGE data show that over the last 25 years (1993-2018) the rice planted area doubled up, with a total of 87,069 acres, which was, in 2018, 46% of the total planted area (IBGE, 2020).

However, the growing process of agribusiness in this region will occur both with the constant expansion of the area of rice cultivation as well as with a great increase in the planted area of soybeans, the main agribusiness commodity in the Cerrados. In 1993, the rice and soybean cultivation areas together accounted for 80.6% of the area planted with temporary crops, but soybean represented 13% of this area, which is equivalent to less than 7,000 acres. Over the past 25 years, the area planted with soybeans now totals 76,191 acres, meaning an increase of 1,100%, while the area planted with rice has decreased, relatively. In 2018, the decrease in the relative status of rice planted area in the region is due to the advance of soybeans, where the area was 46% of the planted area, while soybeans went from 13% in 1993 to 40% in 2018 (IBGE, 2020). Furthermore, it is worth noting that the Agribusiness Projections Brazil 2016/2017 to 2026/2027 (MAPA, 2017) point to the prospect of an increase in the

planted area of 9.3 million acres over the Cerrados of the country.

The exponential expansion of agribusiness imposes processes of vulnerability for traditional peoples and communities, with material and symbolic losses. Besides environmental crimes and land grabbing, slave labor is another face of agribusiness. The 24 municipalities in Western Bahia account for about a third of slave labor in that state. According to the Observatório da Erradicação do Trabalho Escravo e do Tráfico de Pessoas (Observatory for the Eradication of Slave Labor and Human Trafficking)⁷, between 2003 and 2018, 4,146 people were rescued in slave-like working conditions in this region. In the 4 municipalities of Formoso/Araguaia, in Tocantins, in the same period, there were 132 people in the same circumstances. Exponent regions of cutting-edge technology and agricultural financial investment, reproducing outdated models of environmental degradation, plundering of waters, and the brutality of slave labor.

3.1. The case of Western Bahia

The context of state management over water in Western Bahia is tolerant to agricultural capital, for example, the opinions related to the flows granted by the State is alarming, without adequate control of the flows consumed by the management agency (Inema/BA). This was what led to the Correntina conflict, regarding the overexploitation of water by the Igarashi Group, in the Arrojado River basin. Bahia's public prosecutor unveils this tolerant context (Khoury, 2018, p. 77):

⁷ More information is available at: <<https://smartlabbr.org/trabalhoescravo>>. Accessed on: Nov. 2020.

[...] The large abstractions that are granted by the management division, without the updating of flow measurement data, without the monitoring of the impacts of that concession granted to the ecosystem and the ecological preservation of the river, without interpretation of the synergistic effects of other works in the same basin, without analyzing the negative impacts on neighboring communities in the region, it can be concluded that the grant has been a notary instrument, without the power to effectively control water use.

The Corrente River basin is one of the main ones affected by agribusiness in Western Bahia. Survey of the Núcleo da Diocese de Bom Jesus da Lapa/Arquivo (Nucleus of the Diocese of Bom Jesus da Lapa/CPT Archive) – Midwest of Bahia points out that, in this basin, of 45 analyzed rivers, only 05 are perennial, 02 are dead (dry in the drought, without vegetation in the spring), 02 are semi-perennials (they have vegetation and water, but they do not reach the final course in the dry period) and 36 are dry (they dry during the drought season, but keep the vegetation in the spring).

A study by Gonçalves *et al.* (2018) points to a decrease in the base flow of the Urucuia Aquifer System (UAS) to the São Francisco River. The most intense historical cycle of decrease in this base flow of the UAS occurred after 1980 when the flow rate was 792 cubic meters per second and dropped to 402 cubic meters per second in 2015 - a 49.2% drop in the supply of the São Francisco River (corresponding to 390 cubic meters per second) in 35 years. According to the authors, the context that determined the reduction of water is composed of five processes: the change in the rainfall regime, the exploitation of groundwater, the capture of surface water, the damming of rivers, and the irrigation

and compaction of the soil in recharge areas. Silva (2020) relates the first process - the change of the rainfall regime, presenting “trends in the fall of average rainfall between 67% and 88%” - with the changes in land use and cover triggered by deforestation (Silva, 2020, p.106).

In figure 5, it is observed that the water balance in the region was already a concern in 2014, due to the volume consumed, essentially, by agribusiness. The worst flows occur in the northern part of this region, in the tributaries of the right bank of the Rio Preto - sub-basins of the Rivers Ribeirão, Riachão, and do Ouro –, in which the situation is *critical* (where consumption by agribusiness was between 20% – 40% of the river flow). In the affluent basins of Rio Grande and around its mainstream, notably in the micro basin of the Rivers de Janeiro, de Ondas, and in the upper Rio Grande, red spots show that the water balance is very critical, that is, agribusiness consumes above 40% of river flow. In the lower Rio Grande, the situation is *critical*. In the southern part of Western Bahia, in the upper Formoso River, a tributary of the Corrente River, and in the lower stretch of that river, the situation is also *very critical*.

The plundering of the waters and their depletion are potentialized with the “reservoirs” (piscinões) built in Western Bahia to find solutions to keep the production when the flow of the rivers is no longer sufficient to feed the centre pivots. They are huge reservoirs dug into the ground and sealed, fed by underground water intake, to store and supply the daily flow required for irrigation. Iremar Barbosa, an important leader in the region of the Corrente River basin, describes this process (Cunha, 2017, p. 38):

A technology called centre pivot based on reservoirs

(piscinões) is spreading in Western Bahia. A reservoir(piscinão) built in Correntina, for example, has a capacity of 200 million liters of water. There is a property there that has ten reservoirs(piscinões) dug and the Court of Justice – TJ of Bahia has authorized this procedure now... that is, it is absurd what is happening in Western Bahia.

These plundering processes make traditional centenary communities vulnerable, affecting their ways of life and compelling them to abandon their territories of life, as accused by Jamilton Magalhães, the Carreirinha (Mota & Motoki, 2020, n.p.), the leadership of the Corrente River basin:

After [19]70-80, there was a need to encircle, because land grabbing had begun. Then people had to come together, in communities, in kinship, acquaintances, and establish their territory. That way the enclosing of their territory to protect and fight to preserve the way of life was made... it was not easy to face these people who come from outside to take advantage. To be fecho de pasto is to be a community that has its independence.

Proud of the autonomy achieved in the past, Carreirinha says that “in our community, the only thing that came from outside, was the salt, which had to be bought in the store. Other than that, everything was produced in the community” (Mota & Motoki, 2020, n.p.). Or: “this way of life I want to be respected by the government. It is in the fechos that the territories are preserved, that the forests have their Cerrado together” (Mota & Motoki, 2020, n.p.).

This traditional way of life is rejected and the presence of the other is imposed, which may be the land grabber, the henchman, the investment fund, business condominiums, and slave labor, which deny the legitimacy of their existence and generate vulnerability, as Carreirinha states: “[...] with the arrival of these people from the south of the country and even from other countries as well, they began to take possession of this land bringing fake documents, forged certificates and with henchmen, handgun” (Mota & Motoki, 2020, np).

Communities that have been in the baixões or brejos for hundreds of years have been prohibited, by environmental laws from Inema/BA, to plant their crops, to produce their own food, with their “multiple practices of appropriating the natural conditions necessary for the reproduction of life – land-soil-terrain-subsoil-climate-water-plants-animals” (Porto-Gonçalves & Chagas, 2019, p. 41), as we see in the report by Andreia Neiva, of the Movimento dos Atingidos por Barragem (2017 *apud* Porto-Gonçalves & Chagas, 2019, p. 33):

We are victims of a development process that does not consider us, that does not respect us. May our children, and the children we will still have, have access to the geraís, can go for a walk and see the veredas, pick up pequi⁸, eat mangaba, eat puçá, may they have the life we had, the childhood we had.

The denial of the legitimacy of the existence of the other, this other undesirable to agribusiness – an expression of racism –, has triggered socio-environmental conflicts in Western Bahia since the

⁸ Pequi is a typical fruit from the Cerrados in Brazil. Its traditional management is through extractivism and is widely used in food and medicinal form by traditional peoples.

1980s, especially because traditional peoples and communities have the strength and determination to protect their territories. and ways of life.

The conflict over water in Correntina/BA, involving the capture of water by agribusiness, started in 1982. With conflicting episodes in 2002, and restarted in 2015, with a large protest, counting on 6 thousand people, and, in 2017, the capture of the waters of the Arrojado River by the Higarashi Group had national repercussions in November 2017 (Porto-Gonçalves & Chagas, 2019).

On November 2nd, 2017, several appliances were damaged on two farms belonging to this Group, led by about a thousand farmers, tired of the partiality of the State's action and flustered by the threat of their crops being unviable due to the lack of access to water. With the entitled murderers, farmers and residents held a protest estimated at 12 thousand people, on the 11th of the same month (Porto-Gonçalves & Chagas, 2019). According to these authors, *such anger* is legitimate, as shown by Andreia Neiva (Tatemoto, 2017, n.p.):

[...] They are plundering our waters, they are stealing. It may be legal, but it is not legitimate. We have tried to dialogue several times. Nothing was dispatched. There comes a time when it takes an act of rebellion to be heard. [...]

The relationship between water capture by agribusiness and socio-environmental conflicts is significant for understanding these processes in territories. A study carried out by Carvalho (2019) found that in the case of Correntina changes in watercourses with extreme reduction of flow, as the peasants refer, are related to changes in the soil and the demands of irrigated soy, cotton, and corn

production. Its high blue water footprint – that is, surface or underground water used to produce something - allows estimating “theft” over to the volume granted:

the great magnitude of the blue water footprint found suggests that the water consumption scenario indicated by the expansion and intensification of agricultural commodity production in the Corrente river basin shows an increase in water demand about twice the amount currently granted (Carvalho, 2019, p.158).

Another relevant socio-environmental conflict arises from the land grabbing of a massive extension of land - 43 thousand acres, by Agronegócio Condomínio Cachoeira do Estrondo, since 1999, aimed at the acquisition of land and water in the baixões of Formosa do Rio Preto, to transform it into a legal reserve. The geraizeiras communities have faced violence and threats for about 20 years:

They shot my husband, arrested my brother-in-law, assaulted me; our territory is not a condominium reserve, we have been there for over 300 years. Gerais is a sacred place for us. Western Bahia may have high agricultural potential, but before being a region of grain production, it is a region of water production (Divanice das Chagas, 2019).

In this conflict, the Bahia Court of Justice ruled in favor of the grizeiros, in July 2020. For Samuel Brito, pastoral agent of CPT, this is “a milestone in the fight against agribusiness... knowing that black and poor communities won this fight is extremely relevant” (Brasil de Fato, 2020).

The socio-environmental conflict between grizeiros and the Estrondo farm is an example of what Bonfim and Vicente (2017, p. 15) affirm: “the

expropriation of water and land, which combines violence and institutionality, and is based on an extractive, colonialist and racist rationality of plundering and social deconstruction of territories, is one of the central motivators of capitalist growth”.

The conflicts of Correntina and Fazenda Estrondo are milestones of battle and resistance, through the participation of social movements and pastoralists that contributed to their prominence on a national scale, enhancing political achievements. These social processes in native land are mediated by unequal power relations marked by environmental racism, of modern-colonial cause. The strength of these networks and collective actions brought a differential in winning power in confronting agribusiness and in conquests, as suggested by Acselrad (2002).

In the context of socio-environmental conflict, “the disproportionate exposure of the socially most disadvantaged to the risks of technical-productive networks of wealth or their environmental dispossession by concentrating the benefits of development in the hands of a few” (Acselrad, 2013, p. 109) reflects the agribusiness spoliative character in its racist dimension. Neoextractivism is founded on denying the legitimacy of culture and the traditional way of life and in the violation of the systemic processes of nature, centered on a utilitarian reason.

3.2. *The case of Tocantins*

“(…) we, the cerradeira women, stand against any process of destruction of the sources, contamination,

and privatization of the waters” (Letter of the First Meeting of Women from Cerrado, June, 2019).

In the Letter of the First Meeting of Women from Cerrado⁹, they recognize themselves as guardians of the popular knowledge that comes from past generations, their ancestors, from which women fight and build and reconstruct their different ways of life from their territories. They are black (negras), indigenous (indígenas), quilombolas, feminists, peasants (camponesas), settled and encamped (assentadas and acampadas), landless (sem-terra), affected by mining and dams (mineração and barragens), babassu coconut breakers (quebradeiras de coco babaçu), countrywomen (sertanejas) fisherwomen (pescadoras), vazanteiras, LGBTQ+, rural wage workers, of fundo and fecho de pasto, raizeiras, healers (benzedeiras), family farmers, grizeiras, ribeirinhas (Carta, 2019).

“No one will die of thirst on our riversides”, they say, calling attention to the value of the waters in their territories, which have been suffering strong impacts from the expansion of agribusiness. They accuse the destruction of vegetation, the eviction of peoples and communities, the contamination of water and people.

This delicacy of reproducing life through rivers; flooding such as swamps, marshes, lakes, ponds, and wetlands; varjões; ipucas; interconnected in the Cerrados, is the regulating environment of the waters of the southern side of the continent, including the three large aquifers that feed this biome, namely the Urucuia, Guarani, and Bambuá.

⁹Letter from the Meeting promoted by the Campanha Nacional em Defesa do Cerrado (National Campaign to Fight for the Cerrado) in June 2019. More information on the Letter from the First Meeting of the Women from Cerrado is available at: <<https://www.cptnacional.org.br/publicacoes/noticias/articulacao-cpt-s-do-Cerrados/4775-carta-do-i-encontro-nacional-das-mulheres-Cerrados>>. Accessed on: aug. 2020.

According to Barbosa (2020a), these waters constitute, primarily, the oldest environment in the recent geological history of the Planet (Cenozoic period).

The ecotones or transition areas of the Cerrados hold great significance for the sequence and durability of the landscape in a mosaic of traditional peoples and communities interacting in the territories, establishing a great diversity. In the transition between the Amazon and the Cerrado, the wetland regions stand out as ecotones that are recognized as areas of world biological heritage (Sales, 2018).

In the Araguaia-Tocantins hydrographic region, the flooded forests, known as ipucas, are natural forest fragments in an ecotone region between the Cerrado and the Amazon Forest. The term comes from Tupi – ipuka – and means “water resort”. In these forests are many animal and vegetable species, as there usually is water and moisture in their soil for the consumption of animals. Ipucas are areas of the floodplain of Bananal Island that is periodically swamped by river floods, whose function, in the periods of floods, is to make the connection between the various rivers in the region (Rodrigues, 2013). According to the Convention on Biological Diversity, signed by Brazil during the Conferência das Nações Unidas sobre Meio Ambiente e Desenvolvimento (CNUMAD) (United Nations Conference on Environment and Development), in 1992, Bananal Island – the largest river island in the world – makes up the Ramsar System for wetlands with other areas of international interest¹⁰, being an important lowland system of the Araguaia River with medium to high navigable rivers, seasonal ponds, swamps, and many other islands.

We see that the movement of the waters in this region – the dynamics of the floods and droughts of the rivers - influences the ways of life and defines the collective space of the communities’ lives, in a collective regime, in a social relationship of respectful living with the floodplains and rivers (Porto-Gonçalves, 2000). This traditional way of life constitutes a diversity of traditional territories in their most varied practices:

That is the people of Araguaia nowadays, it is the mixture [...], it is the ribeirinho people, we are impregnated with the ribeirinho people of our region, we are impregnated with the squatters in our region, because there Kanela’s son married to squatters, Kanela’s son married to a retireiro. So, nowadays the Kanelas do Araguaia live mixed with these communities in the Araguaia region [...]. (Lenimar, oficina de mapas, Projeto Nova Cartografia Social da Amazônia, map workshop, Projeto Nova Cartografia Social da Amazônia, Manaus, 2009).

Thus, the flooded forests, on the margins of these rivers and tributaries, are territories of life for indigenous peoples, ribeirinho peoples, retireiras and retireiros and several peoples who developed and develop knowledge and practices based on common local use (Porto-Gonçalves, 2000), with varied traditions of management and production of waters, resources, and their ways of living.

What do we call a retiro here in the region? People who have some cattle; retireiros are those people who have little cattle and take them there. That area is swampy, in winter, in the flood season it fills up ev-

¹⁰ More information is available at: <<https://rsis.ramsar.org/es/rs/624?language=es>>. Accessed on: Aug. 2020.

everything, and then they take the cattle to the dry land, where there is no water. When it is in the summer, that place dries up and it is very beautiful, there is a lake, there is a beach [...] so those retireiros gather everyone together, take their cattle to that retiro... As it is low, in the summer that beautiful grass is grows, when it dries, it is humid, in summer it keeps that field, so they take the cattle back, then bring the cattle back, then they stay. This is what we call a retireiro. Just like in my case, I go from Bananal island, so I am a retireiro from Bananal island. (Lenimar, map workshop, Projeto Nova Cartografia Social da Amazônia, Manaus, 2009).

In the state of Tocantins, overall, we can say that the predominance of its territory corresponds to the Cerrado biome with an area of more than 60% and the rest comprises forest fragments, such as the Ipucas, which keep a lot of diversity and can be identified almost always in the Tocantins, Araguaia, Paranã Basins, and tributaries. The Araguaia-Tocantins hydrographic basin is the largest basin located within the Brazilian national territory, with approximately 2,500 kilometers from its origin, at the joining of the Maranhão and Rio das Almas rivers, in Goiás, up to its estuary in the Marajó bay, in Pará. This region has 11 aquifer systems: Alter do Chão; Bambuí; Barreiras; Cabeças, Corda, Furnas; Guarani; Itapecuru; Motuca; Ponta Grossa and Urucua-Areado, which add up to a reserve of 9,254 million cubic meters of water per year (MMA, 2006). The rivers Araguaia and Tocantins make up this large and important hydrographic region with their basins. Araguaia, although little considered in studies on the great rivers of the Planet, ranks the eleventh river in flux worldwide (Seplan, 2016).

This region of flowing and overflowing waters was an area for the implementation of large irrigation projects and dams, especially for the cultivation

of rice and other grains such as corn and soybeans. The water for irrigating the rice monoculture in this region corresponds to 66% of the total demand and is concentrated in the sub-basin of Araguaia and its tributaries (MMA, 2006).

In this sense, it is imperative to highlight the region of the middle Araguaia-Tocantins, whose characteristic of lowland (planície), systemically, presents seasonal floods in the dry and rainy seasons. This movement of waters is responsible for controlling variations in discharge from rivers, which, in the case of the Araguaia River, is about 2,644 cubic meters per second per year, with an average overflow discharge of 6,654 cubic meters per second (Seplan, 2016). Furthermore, this region, due to its hydrogeological characteristics, is a large reservoir of groundwater that is seen by agribusiness as ideal for the expansion of irrigation projects. In this sense, it is important to highlight the headwaters (cabeceiras) of the Araguaia River, in the municipalities of Formoso do Araguaia and Lagoa da Confusão, for the areas of expansion of agribusiness with their large-scale projects.

We highlight here the Rio Formoso Project, implemented in 1979, linked to the state development program Prodecer, as irrigated agricultural areas in medium and large properties, with public and private investments, revealing how agribusiness is territorialized and produces water spoliation in the region (Rodrigues, 2013). The advancement of the agricultural boundaries in this region has always used and uses the abundance of water resources, with hydromorphic soils, located on the várzeas and ipucas, which allow accomplishing two different crops of grains per year, rice, and soybeans, with high production volumes, in a production model

based on mechanization, genetic manipulation of seeds and use of large amounts of pesticides.

This Irrigation Project was the pioneer in using flood-type irrigation systems in an initial area of 27 thousand acres for the cultivation of irrigated rice, in the rainy season, and soybean (to produce seeds) in the dry season. The infrastructure of this project included the construction of floodbanks, adduction and irrigation, and drainage channels, all directly linked to strong impacts on rivers. The works were carried out in stages in the years of 1979; 1980 and 2003, expanding each area by 11,900 acres (Rodrigues, 2013). Figure 6 shows well these irrigation channels whose main purpose is, through barriers, to capture and redirect a large amount of water from the original course of the river to large-scale monocultures, directly impacting the flow and output of river waters and the contamination of these waters.

The implantation of this enterprise resulted in intense conflicts between the farmers and the peoples and communities that traditionally lived and live in the region, causing great impacts in the territories of the indigenous populations such as the Bororo and the Xavante, in the rivers Araguaia and Mortes; the Inã and Karajá, who together with the Javaé, live by the Araguaia River and its tributaries. These peoples are also joined by the Tapirapé, and, in the Tocantins valley, there are the Xerente, Krahô, Apinajé and Krikati (Porto-Gonçalves, 2000).

Data surveyed in 2006 point to the expansion of an additional 33,000 acres of irrigated area on the Formoso River, of which 28,000 acres are intended for rice and soybeans; and in its tributaries: 22,000 acres on the Urubú River and 160,000 acres for rice on the Javaés River (MMA, 2006).



FIGURE 6 – Far-reaching channels for capturing the waters of the Formoso River in the irrigation area, Formoso do Araguaia.
PHOTO: Angélica Mendonça / Secom / Seagro-TO (2011).

These recent Sub-Projects are in sub-basins of the Formoso River – such as that of the following rivers: Escuro, Pau Seco, Lago Verde, Taboca, Urubu, Dueré, and Xavante – and in its main sub-basin, that of the Javaés river, which corresponds to 5.6% of the Araguaia basin (Seplan, 2016). The Javaés sub-basin is bordered by the Araguaia river, rises in the Serra dos Caiapós and in the north it joins the Tocantins river, making in this center the great Bananal island, 350 kilometers long and 60 kilometers wide, mostly flooded. Figure 7 illustrates the irrigated fields with their irrigation channels bordering the Formoso River.

This image accuses what the traditional communities that live on the banks of this river

repeatedly accuse about the major impacts of the intense process of damming and capture of the waters for the irrigation of the rice monoculture on the rivers: silting, decrease of the volume of the water flow and even drought or death of sections of the river, as illustrated in Figure 8.

The Rio Formoso Project is also bordering the Parque Indígena do Araguaia (PIA) (Araguaia Indigenous Park) and near to the Parque Nacional do Araguaia (PARNA) (Araguaia National Park), where the advancement of agribusiness has contributed to systematic spoliations of huge volumes of water from the Formoso river and its affluent Javaés, which are an essential part of the living and ways of life of the region's traditional populations,



FIGURE 7 – Satellite image comparing the irrigated areas bordering the riverbed with silting spots and intense deforestation of its banks (galleries). PHOTO: Jornal Conexão Tocantins (2018).

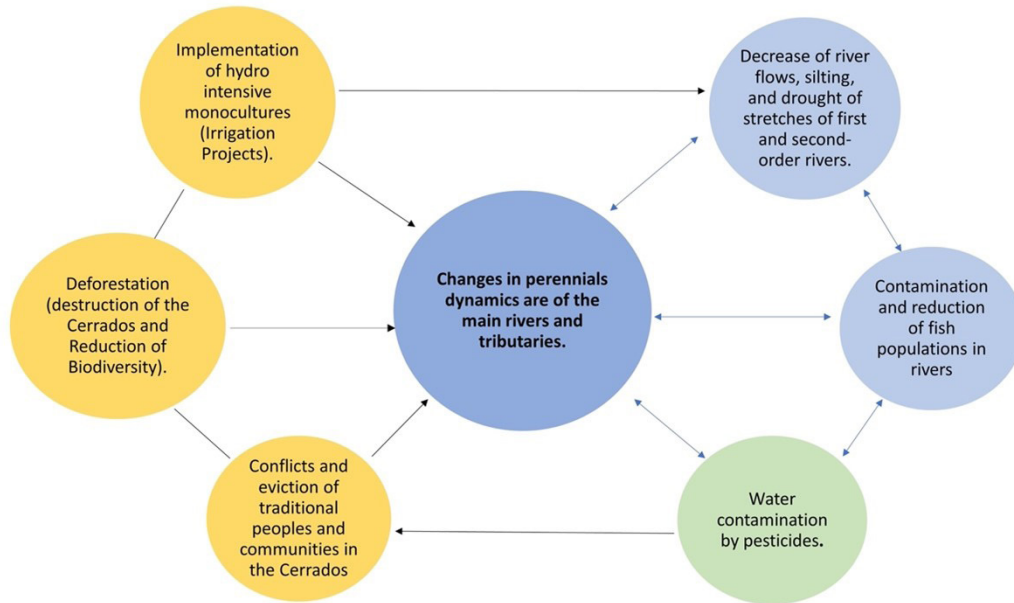


FIGURE 8 – Processes of Water Spoliation by Agribusiness in Tocantins.
SOURCE: Prepared by the authors

besides taking a symbolic and cultural value. The ways of life of the Javaés and Karajás indigenous peoples, directly linked to these waters, suffer continuous impacts. However, it should be observed that this region also refers to the territory of other ethnic groups, such as the Avá-Canoeiros, Xavante, Xambioás and Xerente, who gradually lost part of their territories to the advancement of agribusiness (Rodrigues, 2013).

In the last two decades, multinational companies related to the grain production sector have created yet another important and serious stage in the process of expanding agribusiness. These companies have taken advantage of the region in

a predatory way, appropriating their good quality waters and soils for irrigated planting, making the floodplains (várzeas) and ipuca around Bananal Island one of the largest producers of transgenic soybean seeds in Brazil (Rodrigues, 2013).

Even more recently we can consider the process of “revitalization” of the Rio Formoso Project as another stage of grain production expansion, implemented by the federal government in 2011, as one of the biggest investments made by the PAC (Growth Acceleration Plan) in irrigated agriculture throughout the country. This phase makes the Formoso River the largest in number of water grants for irrigation in the state of Tocantins.

Ipucas, varjões, rivers, populations, and the entire lowland (planície) ecosystem are severely affected by the plundering of waters promoted by agribusiness. In 2016, a severe drought on the Javaés river showed one of the serious impacts of the expansion of this type of irrigation - the water crisis¹¹ characterized by the low volume of rivers and the consequent drought of kilometers of the Javaés river, as we can see in Figure 9.

The intense and ancestral resistance of the traditional peoples and communities, indigenous, peasants, vazanteiros, and ribeirinhos on this island, in the defense of their territories and ways of life, works as a barrier to the powerful advance of

agricultural frontiers towards PIA and PARNA on Bananal Island, causing, however, several conflicts. The traditional communities of this region end up having their ways of life affected by agribusiness and being brutally forced to abandon common community practices and the organization and management of their territories in a collective regime. The expansion of agribusiness and the plundering of waters prevent communities from participating in the dynamics of waters, which demarcates the pace of their lives in the territories. Furthermore, another extremely important conflict, also related to the “uses” of water by agribusiness within the Formoso River basin, concerns the major use of pesticides,



FIGURA 9 – Aldeia Boto Velho, do povo Javaé, na Terra Indígena Inãwébohona, Ilha do Bananal sob os impactos da seca do rio Javaés.
FONTE: Cimi Regional Goiás/Tocantins (2016).

¹¹ Many news is broadcast in the media showing the water crisis of the Javaés river, showing the destruction of the river, as well as the Formoso river basin, with the direct participation of the Public Ministry of Tocantins in the suspension of water grants. More information available at: <<https://conexaoto.com.br/2018/06/13/atuacao-do-ministerio-publico-na-protecao-da-bacia-hidrografica-do-rio-formoso-e-destaque-em-revista-nacional-sobre-sustentabilidade>> and <<http://www.oprogreso.net/tocantins/justica-proibe-captacao-de-agua-na-bacia-do-rio-formoso-decisao-atinge-18-propriedades/118225.html>>. Accessed on: Sep. 2020.

which pollute the riverbed, reaching communities located around the irrigated agriculture project, the case of the Javaés and Karajá indigenous communities whose food is based, among other foods, on fish taken from rivers and lakes.

4. The productive model of agribusiness: pesticides, illness, and death

In addition to the issues related to land and water use, which make up the territorial transformations carried out by agribusiness in the Cerrados, there is yet another dimension of its productive model that causes conflicts and contributes to the biome's ecocide, namely the intensive use of pesticides.

The use of pesticides and their consequences for health and the environment are themes discussed worldwide. In the last few decades, publications in Brazil have shown repeated results showing the relationship between environmental and human contamination by pesticides, exposure to these substances, and the occurrence of several diseases. The methods to detect pesticides in the environment, food, water, and exposed populations, in most cases, are not available for the Health Surveillance systems of Brazilian municipalities, despite the systematization of data on the use of pesticides and the illness of people is essential to foster discussions that produce protective actions in the territories that suffer from the major use of pesticides.

One of the ways to obtain information on agricultural production is through the Banco de Produção Agrícola Municipal – PAM (Municipal Agricultural Production Bank), the Sistema de Recuperação Automática (SIDRA) (Automatic

Recovery System) of the Instituto Brasileiro de Geografia e Estatística IBGE (Brazilian Institute of Geography and Statistics) (IBGE, 2020). The data for estimating the use of pesticides can be obtained through the methodology by Pignati *et al.* (2017), which multiplies the number of pesticides used per acre of plantation, in 21 crops (which were selected by the information on the quantity of pesticide use per acre). In this work, data from four crops were considered, namely cotton, sugar cane, corn, and soy.

The main criterion for selecting these crops was their predominance as the most relevant agricultural commodities in economic matters for Brazilian agribusiness, which is expanding in the Cerrados region. Besides the information on these crops, it was also decided to systematize the data on pasture, given the vast presence of the agricultural production sector in the Brazilian economy, and, consequently, the large land exploitation that this activity requires. Data on the pasture were obtained through the pasture information platform of the Laboratório de Processamento de Imagens e Geoprocessamento da Universidade de Goiás - Lapig/UFG (Image Processing and Geoprocessing Laboratory of the University of Goiás) (LAPIG, 2020).

The selection of municipalities characterized as belonging to the Cerrados biome considered the concept of transition regions of the Cerrados elaborated by the Laboratório de Estudos de Movimentos Sociais e Territorialidades da Universidade Federal Fluminense (LEMTO/UFF) (Laboratory of Studies of Social Movements and Territorialities of the Universidade Federal Fluminense), which increased the number of municipalities in the Cerrados from 1,112, according to the traditional IBGE classification, to 1,967 municipalities, by including the

transition zones of the Cerrados biome with other biomes (Amazon, Pantanal, Caatinga and Atlantic Forest).

Besides the systematization of the main information on the extent of planted areas and the use of pesticides in the selected municipalities, concerning the listed crops and pasture, a bibliographic review was carried out, on basis that gather research from the health area, which involved three groups of grievances related to exposure to pesticides: acute grievances (exogenous pesticide poisoning), subacute grievances (congenital malformations) and chronic injuries (children and youth cancer). Data on health grievances were retrieved from the Departamento de Informática do SUS – DATASUS (SUS Department of Informatics) (MS, 2020), from the Ministry of Health, from the Sistema de Informação de Agravos e Notificação (SINAN) (Diseases Information and Reporting System), from the Sistema de Informação sobre Nascidos Vivos (SINASC) (Live Births Information System) and the Sistema de Informação sobre Mortalidade (SIM) (Mortality Information System). The choice of working with these three groups of diseases aimed to present and discuss the variety of health consequences caused by the time of exposure to pesticides.

For data on Exogenous Poisoning, data on pesticides (agricultural, domestic, public health, and rodenticide) were selected in the population aged between 15 and 59 years, as they are economically active, between the years 2016 and 2017. Regarding data on congenital formations, births by mother's place of residence were selected, between the years 2017 and 2018. Data on children and youth cancer refer to deaths by place of residence, in the age group between 0 and 19 years, in the years of 2017 and 2018. The calculation of the average rates of

each disease was performed based on the following reason: in the numerator, the mean number of death cases, according to the period studied for each municipality, divided by the mean of the years studied; in the denominator, the population average of the municipality in the years studied. Subsequently, the values were multiplied by a constant, which represents the number of inhabitants.

Acute exogenous poisoning (short-term effects) by pesticides were selected because they represent the group of grievances that, despite all the limitations of the information systems, offer a reporting consistency far better than chronic diseases (long-term effects). Although there is a severe process of underdiagnosis and underreporting of subacute and chronic conditions related to exposure to pesticides, which makes analysis and systematization of information about these groups of diseases extremely difficult, we chose to discuss them in this article due to their relevance in terms of public health and the abundance of studies and research that relate these diseases to exposure to pesticides.

Congenital malformations were selected from the group of subacute conditions (medium-term effects) both because there is reliable scientific evidence that corroborates the relationships between them and exposure to pesticides, as well as the complaints and statements of populations affected by agribusiness regarding the perception that the prevalence of these diseases has grown considerably in their territories in recent years (Aguiar, 2017).

Children and youth cancer were selected as a representative of chronic diseases also because of the strong scientific evidence on exposure to pesticides as an important element responsible for the development of neoplasms. Furthermore, as it is a multifactorial disease, it was decided to make a

clipping on the children and youths' age group since that environmental factors are recognized for being very relevant in triggering cancer in this population (Belpomme *et al.*, 2007).

4.1. Agribusiness, exposure to pesticides, and adverse health effects

The use of pesticides in crops is applied in all Brazilian states and has brought negative consequences to the environment and people's health. In recent decades, there have been plenty of scientific evidence and pronouncements from public institutions regarding the impacts of the agribusiness production model and the use of pesticides. Some regions of the country are particularly threatened and affected by major agribusiness activities in their territories, such as the Brazilian Cerrados, which have been systematically invaded by projects aimed at the production of commodities.

Even though the whole Brazilian population, is potentially exposed to pesticides to a greater or lesser degree, the great vulnerability of specific sectors of society is recognized, such as the workers who directly or indirectly manage these substances and the communities that live in the region near the crops where pesticides are sprayed or produced. These populations, which have historically suffered human rights violations and are deprived of access to protective public policies, have become the most affected by the growth of agribusiness and the use

of pesticides in Brazil. In 2018, an important report produced by the Human Rights Watch organization, entitled "You don't want to breathe poison anymore – Brazil's flaws to protect rural communities exposed to the spraying of pesticides"¹², was published, which systematized various information regarding the suffering and illness of rural communities exposed to pesticides in Brazil.

The populations most vulnerable to the spraying of pesticides in Brazil are composed of native peoples and traditional communities, such as indigenous, quilombolas, and family farmers. The situation is aggravated by the practice, still approved by Brazilian legislation, of aerial spraying of pesticides. Many communities have accused the criminal use of this activity. In recent years, there have been major "accidents" involving aerial spraying of pesticides in Brazil, one of the most unfortunate occurred in the city of Rio Verde (GO)¹³.

Acute poisoning caused by pesticides denotes a serious public health problem in Brazil. The official data obtained by the main health information systems in the country (Toxicological Information Center, SIM, and SINAN) show that for every 100 pesticide poisonings, four evolve to death, suicide attempts prevailing among the circumstances of these exogenous poisoning. Furthermore, there is a higher incidence of exogenous poisoning caused by pesticides in rural male workers (Magalhães & Caldas, 2019; Bochner & Freire, 2020; Okuyama *et al.*, 2020). Other studies also show that the risk of death from poisoning is 2.5 times higher in men than in women, with the highest mortality rate in

¹² The report is available at: <https://www.hrw.org/sites/default/files/report_pdf/brazil0718port_web2.pdf>. Accessed on: Nov. 2020.

¹³ Aerial spraying over the rural school São José do Pontal, intoxicating 90 people, most of them children who studied at the school. A documentary on this case entitled "Pontal do Buriti - Playing in the poison rain" is available at: <<https://youtu.be/qHQdWwZcGlg>>. Accessed on: Jan. 2021.

the Midwest region (Bochner & Freire, 2020). It is also possible to verify that the incidence of poisoning follows an increasing trend, mainly in the South and Center-West region, however, the biggest average annual increase is in the Center-West region (Queiroz *et al.*, 2019).

In Goiás, Neves *et al.* (2020) identified that there is an increase in poisoning due to suicide attempts. The regions that most report pesticide poisoning are areas where the agribusiness production model stands out, in which there has been an increase in reporting of poisoning caused by herbicides (Roundup, Furadan, 2,4-D, Regent, Aldrin, and Furazin, respectively). In the state of Mato Grosso, Silva *et al.* (2019) found positive correlations between residents whose homes are located close to corn and cotton crops and a higher incidence of acute poisonings, almost twice as high as residents of other regions.

Concerning exogenous poisoning by pesticides as potential causes of suicides, a recent study conducted by the Federal University of Bahia (UFBA) showed that, between the years 2007 and 2015, the highest mortality from suicides in Brazil occurred among rural workers¹⁴. Therefore, to understand this significant finding, it is necessary, besides assessing the growing process of precariousness in rural life, to also consider the random use of pesticides, encouraged by public policies, as one of the factors that may be involved in this high rate of suicides among rural workers.

The average of exogenous poisoning, in the years 2016 and 2017, in Brazil, was 6.8 per 100,000 inhabitants. In the Cerrados, this rate was 8.5 per 100,000 inhabitants, as shown in Figure 10.

¹⁴Epidemiological notice available at: <http://www.ccvisat.ufba.br/wp-content/uploads/2019/08/SUICIDIO_BOLETIM_CCVISATfinalFINAL.pdf>. Accessed on: Jan. 2021.

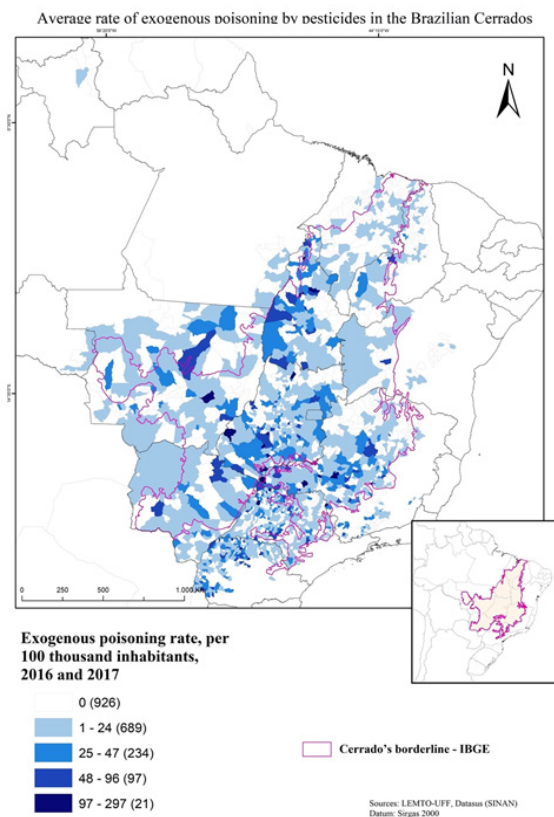


FIGURE 10 – Average rate of exogenous poisoning by pesticides, in municipalities of the Brazilian Cerrados, year 2017.

Regarding congenital malformations, Mostafalou and Abdollahi (2016) conducted a broad systematic review of the literature, internationally, and selected scientific studies with a high level of evidence concerning exposure to pesticides and the triggering of congenital malformations, such as reduced cranial circumference (Chevrier *et al.*, 2011; Gemmillet *et al.*, 2013); congenital malformations (Siqueira *et al.*, 2010); neural tube malformations

(Brender *et al.*, 2010; Ren *et al.*, 2011); and increased risk of spina bifida (Makelarski *et al.*, 2014).

An ecological study conducted in the state of Paraná, which analyzed the rates of congenital malformations between the years 1994 to 2003 and from 2004 to 2014, showed an increasing trend in the rates of congenital malformations in the state of Paraná, most prominent in the municipalities with greater use of pesticides (Dutra & Ferreira, 2019). Still in Paraná, a study by Freire *et al.* (2020), to analyze the correlations between births with congenital malformations, between the years 2008 and 2015, and some social, economic, health care and environmental indicators, showed a significant association ($p < 0.05$) between congenital malformations and the use of pesticides in the state.

Another ecological study carried out in the states of the South and Southeast of Brazil investigated the relationships between infant mortality rates caused by congenital malformations of the central nervous system and cardiovascular diseases, in infants under 1-year-old (between the years 1986-1990 and 1997-2001, respectively) and the *per capita* use of pesticides (between the years 1985 and 1996), in the micro-regions of these states. The research revealed significant and positive correlations between the use of pesticides *per capita* and the mortality rates due to central nervous system and cardiovascular malformations in rural micro-regions, but not in urban areas (Cremonese *et al.*, 2014).

Dutra and Ferreira (2019) estimated the use of pesticides in four Brazilian states that rank first places in the production of agricultural commodities (São Paulo, Mato Grosso, Paraná, and Rio Grande do Sul) and their micro-regions and compared this information with the prevalence of congenital malformations in these states and their micro-regions,

through an ecological study of temporal analysis on the prevalence of congenital malformations, between the years 2000 and 2016. The study analyzed agricultural production and the consumption of pesticides in these states in four main crops (cotton, sugar cane, corn, and soybeans) and concluded that the rates of congenital malformations were higher in the microregions of the states that had higher grain crops.

Concerning research on congenital malformations and exposure to pesticides in the municipalities that are part of the Cerrados Biome, a case-control study conducted in the state of Mato Grosso, to research the relationship between paternal exposure to pesticides and the occurrence of congenital malformations in children under 5 years old treated in hospitals in the city of Cuiabá (public and private), in 2011, found a positive association between the father's work related to agriculture (OR = 4.65, CI 95%: 1.03-20.98) and previous paternal exposure to pesticides (OR = 4.15, 95% CI: 1.24-13.66) with the occurrence of congenital malformations (Ueker *et al.*, 2016).

Data on congenital malformations show that the average rate of congenital malformations, in the years 2017 and 2018, in Brazil, was 8.7 for every 1,000 live births. In the Cerrados, it was 7.4 for every 1,000 live births, as shown in Figure 11.

We must analyze these congenital malformations rates, as well as the others mentioned here, from a critical perspective. They are elaborated from data on the macro-regions, with the prevalence of the disease being considered over the denominator of the total population. However, such indicators may not reflect what is occurring in the illness profile of workers in agricultural enterprises or of the populations in their immediate neighboring,

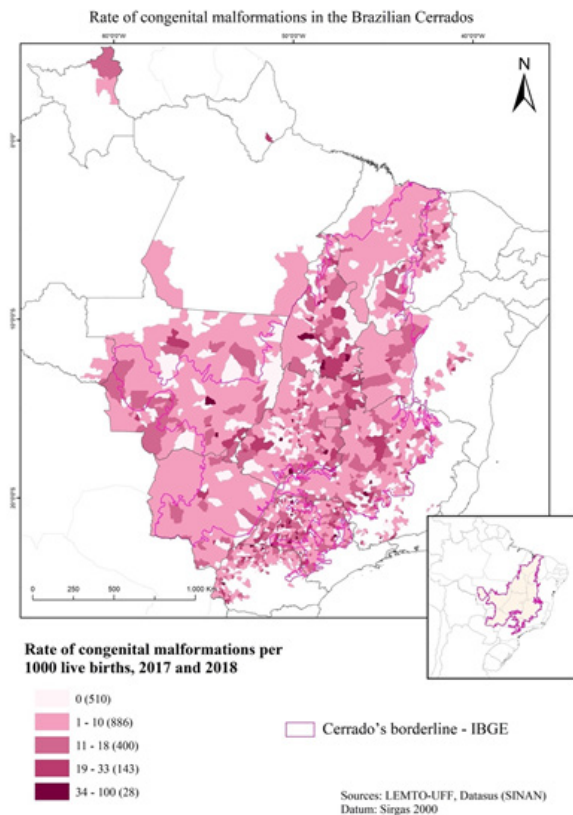


FIGURE 11 – Average rate of congenital malformations, in municipalities of the Brazilian Cerrados, year 2018.

where the risk of contamination is concentrated, characterizing true sacrifice zones. This is confirmed by many studies that investigate these diseases and their relationship with pesticide exposure using the micro-regions as a source of information, as it is known that the spraying of pesticides is concentrated in some specific territories, according to

the spatial distribution of commodity plantations. For this reason, analyzing health indicators from a municipal or regional perspective may often mitigate this information and corroborate the process of making these diseases invisible.

There is growing and numerous scientific evidence on the relationship between exposure to pesticides and the onset of different types of cancer. In 2015, the National Cancer Institute (INCA), the main Brazilian institution dedicated to the production of academic information on this theme, published a technical note entitled *Posicionamento do Instituto Nacional de Câncer José Alencar Gomes da Silva acerca dos Agrotóxicos* (Opinion of the National Cancer Institute José Alencar Gomes da Silva on Pesticides), in which brings together a series of evidences on the use of pesticides in Brazil as an important environmental factor for the emergence of several neoplasms¹⁵.

One of the most used pesticides in Brazil and worldwide, the herbicide glyphosate, was classified by the International Agência Internacional de Pesquisas em Câncer (IARC) (Agency for Research on Cancer), of the World Health Organization (WHO), as a possible human carcinogen (group 2A) (WHO, 2015). Since 2019, glyphosate has been undergoing a reassessment process in Brazil, led by the Agência Nacional de Vigilância Sanitária (ANVISA) (National Health Surveillance Agency), from the Ministry of Health. As a technical contribution to the reassessment process, the Associação Brasileira de Saúde Coletiva (ABRASCO) (Brazilian Association of Public Health) produced a document entitled *Parecer Técnico sobre processo*

¹⁵ INCA's Opinion on pesticides available at: <<https://www.inca.gov.br/publicacoes/notas-tecnicas/posicionamento-do-inca-acerca-dos-agrotoxicos>>. Accessed on: Jan. 2021.

de reavaliação do ingrediente ativo de agrotóxico glifosato utilizado na agricultura e como produto domissanitário (Technical Opinion on the process of reassessment of the active ingredient of pesticide glyphosate used in agriculture and as a household product)¹⁶.

An integrative review by Costa *et al.* (2017) systematized the main studies regarding the carcinogenicity of certain active ingredients of pesticides concerning the non-Hodgkin's lymphoma (NHL) and concluded that there is sufficient evidence that associate the active ingredients dichlorophenoxyacetic acid (2,4-D), diazinone, glyphosate and malation to the appearance of NHL.

Another systematic review of the international scientific literature on hematological neoplasms and occupational exposure to organophosphate pesticides found that the risk of hematological cancers increases with occupational exposure to organophosphates, especially in workers with a history of exposure for long periods. (Moura *et al.*, 2020).

Research conducted through an integrative review on exposure to pesticides and their relationship to certain types of cancer found strong evidence between prostate cancer, non-Hodgkin's lymphoma, leukemia, multiple myeloma, bladder cancer, and colon cancer, and exposure to pesticides, with the risk being increased for people who live close to plantations or in considerable agricultural areas, and for farmers (Pluth *et al.*, 2019).

Concerning children and youth cancer, research conducted by Silva *et al.* (2018), at an irrigated fruit pole in Northeastern Brazil to assess trends in morbidity and mortality from childhood

cancer, concluded that, in the municipalities under study (Petrolina and Juazeiro, Pernambuco), there was a trend for a significant increase in hospitalization rates and an increase without the statistical significance of mortality rates, which may be related to environmental exposure to pesticides.

Still on exposure to pesticides in Brazilian Northeastern regions, a study conducted in Ceará analyzed data referring to morbidity and mortality from children cancer, between the years 2000 and 2012 and concluded that there is a coincidence between the largest number of cases of children and youth cancer and the micro-regions in which the agricultural irrigation centers were implemented, in which there is a major use of pesticides (Barbosa *et al.*, 2019).

Regarding the average rate of children and youth cancer, in the years 2017 and 2018, in Brazil, the proportions found were 43 per 1,000,000 inhabitants. In the Cerrados, it was 45.2 per 1,000,000 inhabitants, as shown in Figure 12.

Despite the growing number of acute and chronic poisonings by pesticides in Brazil, the inefficiency of the Brazilian government is evidenced, mainly through public policies in health, to face this critical issue. The Sistema Único de Saúde (SUS) (National Health System) has not implemented effective actions, within the scope of health surveillance, to prevent the emergence of new cases of poisoning, and regarding assistance, to guarantee to the sick people adequate monitoring. On the other hand, due to dimensions that go from the unpreparedness of health professionals to deal with these specific needs; the precariousness of health; the underfunding of the

¹⁶ ABRASCO's opinion on the glyphosate herbicide available at: <https://www.abrasco.org.br/site/wp-content/uploads/2019/06/Parecer-tecnico-glifosato-GTSA-26_06_2019-1.pdf>. Accessed on: Jan. 2021

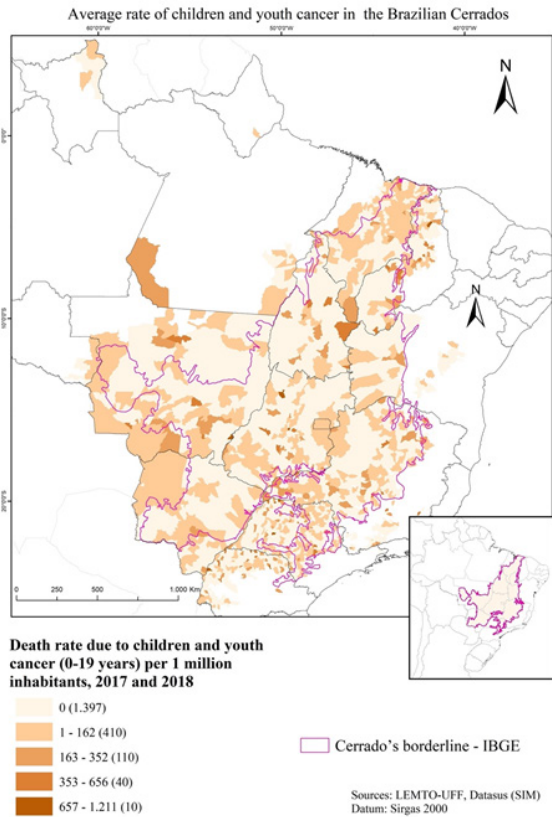


FIGURE 12 – Average rate of children and youth cancer, in municipalities of the Brazilian Cerrados, year 2018.

health system, mainly in the area of Atenção Primária à Saúde (APS) (Primary Health Care); to the regional and local contexts where violence engendered by agribusiness is perpetuated in the territories where they have an important political and economic influence, many of these cases are completely invisible, spreading a cruel cycle of the absence of mistrust, absence of diagnosis and, consequently, absence of reporting (Rigotto & Aguiar, 2015).

5. Final considerations

Despite the denialists, there is sufficient evidence that we are facing an event for which we cannot ignore and turn our backs: capitalist modernity has put the steadiness of the global ecosystem at risk, imposing a borderline situation for humanity, in which Life’s most fundamental support - water, air, soil, climate, biodiversity, seeds - is already deeply compromised. We were able to outline a new geological era, the *Anthropocene*, for those who give essence to human action, or the *Capitalocene*, which emphasizes “exchange in the ongoing historical process of capitalism, which incorporated the conditions of nature in a specific project to reorganize the material world” (Barcelos, 2019).

The ideology of progress, with its postulates of controlling nature, spoliation of the colonies and exploitation of human and women’s work for the unlimited growth of production and consumption, offered us this tragic legacy without having fulfilled its promises of well-being, and on the contrary, producing deep disparities and injustices, articulated by class, race/ethnicity, and gender oppressions.

In the Cerrados - this precious biome, which should receive all our *attention* in times of socio-environmental collapse -, five decades of “development” are causing Ecocide. As we have seen, more than 110 million acres of the biome are occupied by agribusiness, when the area planted to produce 75% of the soybean-cane-corn-cotton commodities in Brazil and the pasture areas to produce beef are added together. Besides destroying more than half of the rich and diversified native vegetation – 29 million acres deforested in 2019/20 alone – irrigated agriculture depletes surface and groundwater to feed areas

equipped with centre pivots, which are concentrated in the Cerrados (91.8%), resulting, for example, to a 49.2% reduction in the supply of the São Francisco River by the base flow of the Urucuia Aquifer System in 35 years. Not to mention the increasing number of rivers with water balance in a very critical situation, that is, with more than 40% of their flow compromised, besides the growing number of dead rivers.

Additionally, more than 600 million liters of poisons are spilled yearly on the land – often occupied by squatters –, concentrating 73.5% of the total pesticides used in the country in 2018, with serious impacts on people's health. If the national average rate of exogenous poisoning in 2016 and 2017 was 6.8 cases per 100,000 inhabitants (including underdiagnosis and underreporting), for the municipalities of the Cerrados, it was 8.5. There are also more cases of children and youth cancer in the Cerrados (45.2 per 1 million inhabitants) than in the country (43 per 1 million inhabitants). Likely, all these health grievances will also include problems of unsafe health and water, such as malnutrition and diabetes, resulting from the loss of land and/or the conditions to cultivate it. And the clinical manifestations of psychosocial suffering originated from deterritorialization and uncertainty about the future. And the repercussions of the violence on the health-disease process, whether accidents at work in mechanized agriculture, or the violence found in cities by those who were subjected to the processes of compulsory migration, or violence against women, assigned to the de-structuring of families, sexual exploitation, work overload.

Therefore, the information and analysis provided in this text provide a foundation for understanding the

Cerrados as a *sacrifice zone for Brazilian development*, in which Nature and People are plundered to guarantee the growth of a few, very few. If ecocide is “the serious damage, destruction or loss of one or more ecosystems, in a given territory, whether by human or other causes, whose impact causes a severe decrease in the environmental benefits that the inhabitants of that territory made good use of”¹⁷, we consider that the information and analysis gathered here on the consequences of the expansion of agribusiness for the biome and its peoples, especially concerning waters and pesticides, characterize dimensions of the ongoing *Ecocide*, expressed as a modern-colonial racist product in the Cerrados.

Considering that it is not possible, neither ethical nor fair, to continue this path that runs over the possibilities for the future of human and non-humankind in the Cerrados and in the biomes of the South American subcontinent that interact with them, it is necessary to look for a way out. Look and see the peoples of the Cerrados as guardians of the immense wealth of this vast territory. At least since 1730, when Quilombo Quariterê, in Mato Grosso, where Tereza de Benguela lived, already sheltered blacks and indigenous people to live in their way, planting corn, yuca, beans, and bananas, making their decisions in a community parliament, transforming weapons thrown at them in tools for cultivating the land and resisting soldiers until 1770¹⁸.

Tereza's descendants nowadays continue to care for the Cerrados, sharing their ancestral knowledge, looking for ways to keep their ways of living, and fighting in defense of their territories, despite the 32 murders in 2019 (CPT, 2020).

¹⁷ Statute of the Permanent Peoples' Tribunal (2018), available at: <<http://permanentpeoplestribunal.org/estatuto/?lang=es>>. Accessed on: jan. 2021.

¹⁸ More information available at: <<https://www.ufrb.edu.br/bibliotecacecult/noticias/220-tereza-de-benguela-a-escrava-que-virou-rainha-e-li>>.

To them and they are added movements, entities, and networks such as the Campanha Nacional em Defesa do Cerrado (National Campaign to Fight for the Cerrado), the Campanha Permanente contra os Agrotóxicos (Permanent Campaign against Pesticides) and for Life¹⁹, the Comissão Pastoral da Terra (Pastoral Land Commission)²⁰, the Greenpeace²¹, the ActionAid²², the Fase²³ and many others.

Also, researchers such as Altair Sales Barbosa, Carlos Eduardo Mazzetto Silva, Carlos Walter Porto-Gonçalves, Wanderlei Pignati and Débora Fernandes Calheiros contribute – inspirations for all and all of us in the academic field, in the perspective of a supportive and emancipatory science.

And we should not forget the power of art, expressed in the creation of the one who universalized the sertão and its veredas, Guimarães Rosa:

You see sir: there is a waterfall; so? But a waterfall is a breach on the ground, and water is falling through it, flowing; you use that water, or spoil the breach, is there any waterfall left? Living is a very dangerous thing [...].

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