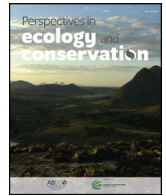




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### Opinion Paper

# Sugarcane: Brazilian public policies threaten the Amazon and Pantanal biomes

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### HIGHLIGHTS

- Brazilian government liberates the sugarcane plantations in the Pantanal and the Amazon.
- This non-sanctioned crop is likely to become the newest driver of deforestation in these biomes.
- Direct and indirect conversion of forests can create a carbon balance debt that could take centuries to offset.

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### ABSTRACT

The Brazilian government once again threatens its natural heritage by issuing a decree that liberates the sugarcane plantations in the Pantanal and the Amazon regions. The production of a non-sanctioned crop is likely to become the newest driver of deforestation in these biomes. Direct conversion of forests, migration of livestock to new forested areas, rising land values, the danger of forest fires spreading and of carbon emissions from burning sugarcane during harvesting can all create a carbon balance debt and impact on water balance that could take centuries to offset and will compromise the sustainability of the Brazilian ethanol sector.

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The Brazilian society has been concerned with the return of deforestation in Brazil, following the speeches made during the presidential campaign and, as of now, as a direct result of the environmental policies adopted by the Brazilian government in the first year of the mandate of Mr. Jair Messias Bolsonaro (2019–2022). In addition to the dismantling of oversight bodies and other actions that could facilitate the exploitation of the Amazon (Ferrante and Fearnside, 2019), Mr. Bolsonaro once again surprised environmentalists with the issue of Decree 10,084, on November 5, 2019. The Decree cancels a 10-year ban on sugarcane cultivation in the Amazon rainforest, the largest rainforest on the planet, as well as in the Pantanal, the Earth's largest floodplain recognized by United Nations Educational, Scientific and Cultural Organization (UNESCO) as a World Natural Heritage Site and a Biosphere Reserve. These biomes were previously protected by a 2009 decree that respected

the vulnerabilities of each region through agro-ecological zoning (AEZ). With the issuance of the new decree, the Brazilian government expands the areas for ethanol production in order to support the policy of increasing the production of sustainable biofuels in the energy mix to up to 18% by 2030, which is one of the country's greenhouse gas (GHG) emission reduction targets agreed in the Paris Agreement (Andrade-Junior et al., 2019). This could be another questionable environmental policy of President Bolsonaro especially if sugarcane directly or indirectly occupies forested areas, with the land use change causing a carbon debt that would take more than two centuries to be repaid using biofuels instead of fossil fuels (Lapola et al., 2010).

Brazil is the world's largest producer of sugarcane, with an area of 10,123.5 million hectares (Mha) planted with the crop in the 2018/2019, both for sugar and ethanol production (CONAB, 2019). The main destination for ethanol is the biofuel industry supplying the Brazilian vehicle fleet with the mixture of anhydrous ethanol for gasoline and for the engines with flex fuel technology which make up an increasingly emerging market in Brazil and worldwide. Due to the need to lower GHG emissions via reducing the country's

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dependence on fossil fuels, there is an expectation of rising demand for the biofuels. The International Energy Agency (IEA) forecasts a 200% increase in the Brazilian biofuels production, from a total of 1.3 to 4.1 million barrels by 2035 (APLA, 2019). This increase in production will be a direct consequence of the anticipated increase in sugarcane production, with the opening of the Amazon and Pantanal borders expected to provide the new planting areas necessary for the expansion of the sector. This development comes at a delicate time in these biomes, which have already experienced a substantial increase in fire foci and deforestation in this first year of Mr. Bolsonaro's term. There is a clear danger that sugarcane might become the newest driver of environmental degradation in these regions. In the Pantanal, the sugarcane will compete for space with the forest areas and livestock. In the Amazon, livestock, soybean cultivation and forested areas already compete for space.

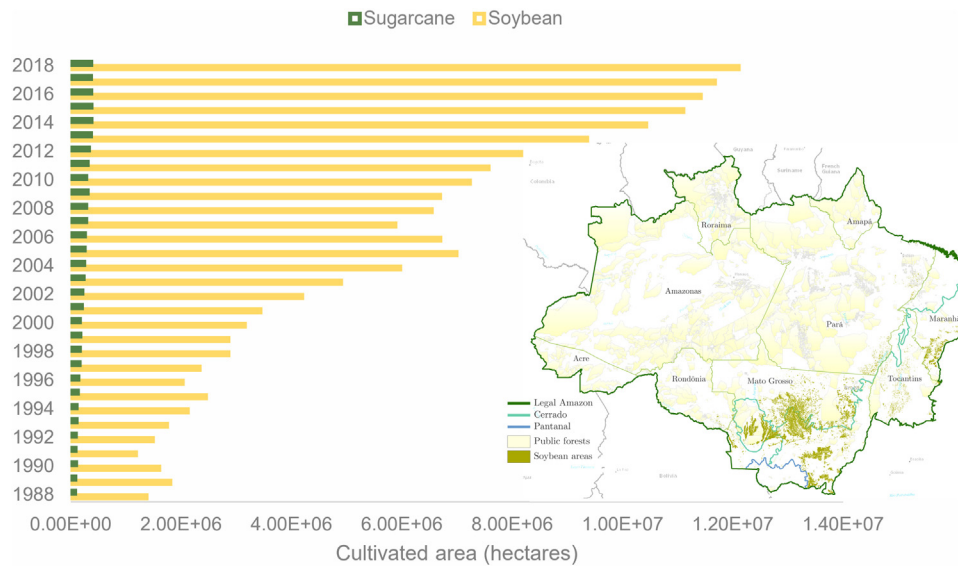
We evaluated municipalities located in the Brazilian Legal Amazon, where there is significant sugarcane and soy production (Fig. 1). We found that these crops can coexist and have a similar growth pattern. The state of Mato Grosso, due to its location, will be sugarcane's gateway to the Amazon and Pantanal. This state, which has areas of Pantanal, Amazon and Cerrado in its territory, is the largest Brazilian soybean producer, with a total area of 10.6 Mha planted with the crop in 2018/2019. The Amazon part of the state accounted for 4.2 Mha of this total, the Cerrado part accounted for 6.3 Mha, and the Pantanal part accounted for 6104 ha. In Mato Grosso, there has been an increase of 282,499 ha of planted area in the last three years, with 92% (259,976 ha) of that increase having occurred in the Amazonian part of the state (SOJAMAPS, 2019). This shows that the Cerrado part is already saturated in terms of soybean production, and the new areas which will allow for the high degree of mechanization required for soybean production would only be available in the Amazon region. This also means that sugarcane, which is also a highly mechanized crop very similar to soybean plants, will have to compete for space with soybeans and will hardly occupy areas already consolidated with this culture.

Mato Grosso is a universe apart from Brazilian agriculture. In this area, a soybean producer with up to 2500 ha of planted area is considered a small producer. The producers with planted areas of between 2500 and 5000 ha are the medium-sized producers, and only the producers with planted areas above 5000 are considered to be large producers. The farms have huge capital in machinery for the entire soybean growing season, barracks to accommodate machinery and inputs, and silos to accommodate production. It is very unlikely that soybean farmers will give up this capital to lease their land or start sugarcane planting themselves. No less important in this context is the production of corn-based ethanol. Mato Grosso has 12 ethanol plants. Of these, seven use sugarcane as a raw material, two use maize and three use flex (a mixture of sugarcane and maize). By 2021, five more corn plants are expected to become operational (G1, 2019). Mato Grosso is the largest maize producer in Brazil where it is planted as a second crop (following the soybean crop), thus allowing producers to have two harvests a year. The opening of these plants implies a higher demand for the product and, consequently, a greater financial return for the producer and a greater value of soybean productive lands.

Excluding areas already occupied by soybeans, in the Amazon sugarcane will have to compete with areas that are occupied with livestock, or with forested areas. The use of both soybean and livestock have environmental restrictions that aim to limit their advance on forests, such as the Soy Moratorium (SoyM) and the Cattle Agreement (CA). SoyM is an agreement in which the major exporters of this commodity have pledged neither to buy nor to finance soybeans produced in deforested areas in the Amazon since July 2008 (Gibbs et al., 2015). Following the SoyM example, the CA was negotiated in 2009 in order to suppress deforestation in the beef trade chain, where buyers from the slaughterhouses com-

mitted to boycott any producer whose pastures were the result of forest conversion since October 2009 (Nepstad et al., 2014). Even with these restrictions in place, soybeans were still responsible for 29.49% of deforestation in the 10 largest Amazonian soybean municipalities in Mato Grosso during the SoyM period (Silva Junior and Lima, 2018), and CA was not effective, with failures (Gibbs et al., 2016). Unlike soybean and livestock production, there are no sanctions imposed on sugarcane production which means it could become a vector of deforestation in the Amazon. This is even more worrying in the Pantanal region, as Brazilian law, through its 2012 New Forest Code (NFC), requires only 35% of its native vegetation to be conserved as Legal Reserve (LR), while this applies to 80% of the native vegetation in the Amazon. Nevertheless, the NFC requirements were not sufficient to prevent the deforestation in the Amazon. According to the National Institute for Space Research (INPE), deforestation rates in the Amazon have increased from 5088.61 km<sup>2</sup> in 2013 to a total of 7033.05 km<sup>2</sup> of deforested areas in 2018. In 2019, 10,123.17 km<sup>2</sup> have been deforested so far. In the last two years (2018 and 2019), deforestation increased by 43.93% (INPE, 2019). It is estimated that the sugarcane sector will need 1.2–5 Mha of land over the next decade, with the increase occurring primarily through pasture replacement (72 %) and natural vegetation mosaics (19%) (Andrade-Junior et al., 2019). The authors based all their projections for sugarcane AEZ by the ethanol sector, which previously prohibited the expansion of this crop in the Pantanal and the Amazon; however, this prohibition has just been repealed by President Bolsonaro. Planting is now allowed in these biomes, the production of sugarcane will not be sanctioned and hence, as mentioned above, it will have to compete for land with agricultural land used for soybean production and cattle rearing. These factors provide a fertile ground for breaking environmental laws. Even in an optimistic but unrealistic scenario where sugarcane only occupies already available pasture areas, a land use change is expected to lead to indirect deforestation, with livestock migrating and occupying forested areas (Lapola et al., 2010).

For instance, the Alta Floresta, a municipality of Mato Grosso founded in the middle of the Amazon rainforest in 1976 with a livestock-based economy, 10 years ago had less than 1000 ha under soybean production. It also had only two agricultural companies and two silos for rice storage. The value of the land at the time was around \$ 800/ha. Today, with the development of soybean production in the state of Mato Grosso, and mainly focused on its Amazonian area, there are 14 agricultural companies in the Alta Floresta, plus four commercial companies and three private silos for soy storage. The acreage under soybean production is still relatively small, with 13,902 ha in the crop year 2018/2019 (SOJAMAPS, 2019). However, this was enough to raise the value of the land to \$ 5000/ha. As it was the case with the soybean production, sugarcane production in the area will lead to a rise in the land value, with a greater pressure being applied to the conversion of forested areas to agricultural land. For farmers, a hectare of forest is worthless, while a hectare of productive land with a high potential for soybean and sugarcane production is valuable. Sugarcane may also occupy Indigenous Lands (ILs), which are recognized by the United Nations as biodiversity conservation areas. Although illegal, soybean production already exists in the Mato Grosso ILs. The soybean is planted as a lease or partnership between farmers and indigenous people. One of President Bolsonaro's proposals is the empowerment of the indigenous people, giving them the right to economically exploit their lands and open these to capital. As with soybean production, indigenous people will be able to lease their land for ethanol production as they have no cultural restrictions on the exploitation of natural resources available in their territories (Lima et al., 2020). Another factor of concern is the sugarcane harvesting method, as sugarcane can be harvested with or without the use of fire. When sugarcane is burned and harvested manually, it releases around



**Fig. 1.** Areas in hectares cultivated with soybean and sugarcane in the Brazilian Legal Amazon in 30 years according to the Brazilian Institute of Geography and Statistics (IBGE, 2019). Soybean areas used in the map are from the base of SojaMaps (2019).

7.591 t of CO<sub>2</sub>eq/ha (Mendoza, 2017). In addition to contributing to GHG emissions, there is a possibility that fires may get out of control and spread to adjacent forests affecting their biodiversity.

All the above shows the unsustainability of ethanol production in these biomes, although the Brazilian government argues that the expansion of ethanol production and use of ethanol will contribute to climate change mitigation. However, when opening the borders of the Pantanal and the Amazon, the government did not assess the indirect environmental costs of ethanol production and the possibility of creating a negative carbon balance and impact on water balance by directly or indirectly modifying land use with the sugarcane crop. In addition, the government did not assess a very long-term sustainability of ethanol production in its largest offshore producing regions which are climatically dependent from Amazon. The warning about the dangers of the sugarcane advance in the Pantanal and Amazon had already been given (Ferrante and Fearnside, 2018), where the authors pointed out that the loss of forests could compromise Brazilian agriculture and biofuel production, since the largest areas of agricultural production are in the south and southeast of the country, which are in turn dependent on water vapor from the Amazon. It remains to be seen whether the Brazilian ethanol sector will compromise its future production as well as its current sustainability image by supporting President Bolsonaro's environmental misconceptions.

### Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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