Tropentag 2023
September 20-22, 2023
Conference on International Research on Food Security, Natural Resource Management and Rural Development
organised by the Leibniz Centre for Agricultural Landscape Research (ZALF), Germany in cooperation with Humboldt-Universität zu Berlin, Germany

# How do extreme climate events affect farm food production? An analysis from Brazil

Deise Maria Bourscheidt[a], Daniel Alberto Perozo-Suárez [b], Elder Tomassevski[c]

[a] Fronteira Sul Federal University, Brazil Email deise.bourscheidt@uffs.edu.br
[b] University of Brasilia, Email: daniel.perozo@unb.br
[c] Fronteira Sul Federal University, Brazil Email elder.tomassevski@uffs.edu.br

## Introduction

Agriculture expansion in Brazil has continuously grown for the last three decades, at least. Such expansion has affected forest areas and the environment, also increasing climate change effects. From a global perspective, there is evidence of the relevance of these effects on the agricultural sector itself: between 1991 and 2021, most damages from extreme climate events like droughts and floods were suffered by the global agricultural sector. In the same way, most of these damages took place in developing countries. Considering this view, developing countries with strong agricultural sectors were considered relevant case studies. Also, it has been found that natural disasters have affected different regions all over Brazil. In 2020 alone, there were more than 3,800 environmental disasters in Brazil, the majority of which were climatological, including droughts. They can be the result of natural processes, but also of pressure exerted by human exploitation of nature, including processes aimed at enhancing economic growth.

## Material and Methods

In this sense, this work aims at analyzing the incidence of extreme climate events and how they affect farm food production in Brazil. To do this, the losses from extreme climate events and their implications on the agricultural sector were explored, as well as the incidence of such extreme climate events all over the country, with particular attention to territories with strong agricultural activity and areas. Data was collected from the National Secretariat for Civil Protection and Defense - Sedec/MDR. This research focused on data between 1991 and 2021. Information on food production was obtained from the Brazilian Institute of Geography and Statistics (IBGE).

## Results and Discussion

Results indicate that, hydrological events at the country level (mostly floods) had a higher incidence, while climatological (referred mostly to droughts) were second, being more present in southern areas of the country. It was found that droughts were mainly related to longer dry seasons that affected crops like corn and soy. Other kinds of events like fires were present in areas with evidence of land use change for agricultural purposes.

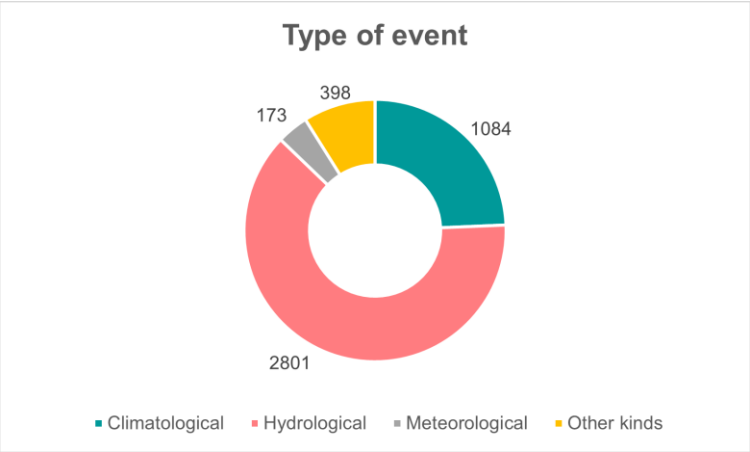


**Figure 1:** Analysed events were classified in climatological, hydrological, meteorological, and other kinds (1991-2020).

As for food production in Brazil, the monetary value of production in 2020 was R$ 372,613,449.00 in temporary crops and R$ 100,694,969.00 in permanent crops. Using temporary crops as a proxy, precisely because they are the ones with the highest production, we present the value of production resulting from them, as well as the number of disasters in Brazil between 1995 and 2021. Figure 2 shows that there was an upward trend in the monetary value of production of temporary crops when analyzing the entire period, despite slight falls, like in 2005 and 2006, for example. Natural disasters fluctuated, but there was also an upward trend between 1995 and 2021. When comparing the data on the number of disasters and the value of Brazilian crop production between 1995 and 2021, it is possible to notice a positive relation between them.

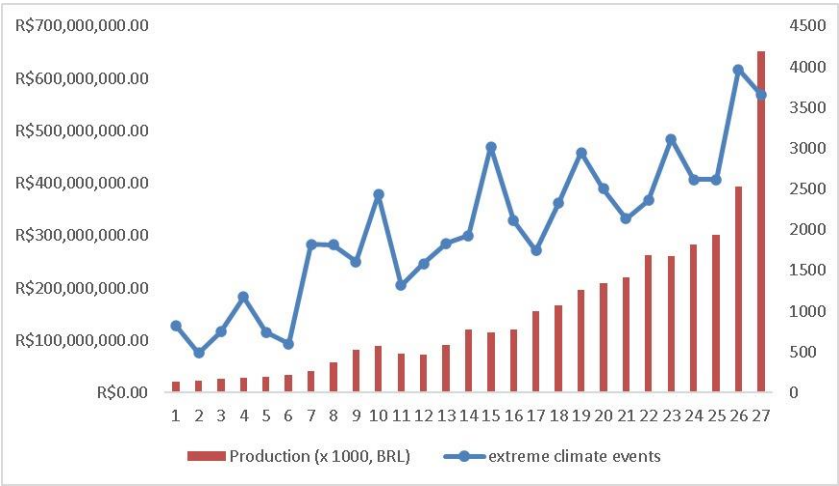


**Figure 2:** Incidence of extreme climate events and monetary production between 1995 and 2021 in Brazil

When looking at the data by states that are part of the Legal Amazon area, it is possible to distinguish the differences in the number of disasters in each state, considering the period between 1991 and 2020 (see Figure 3).

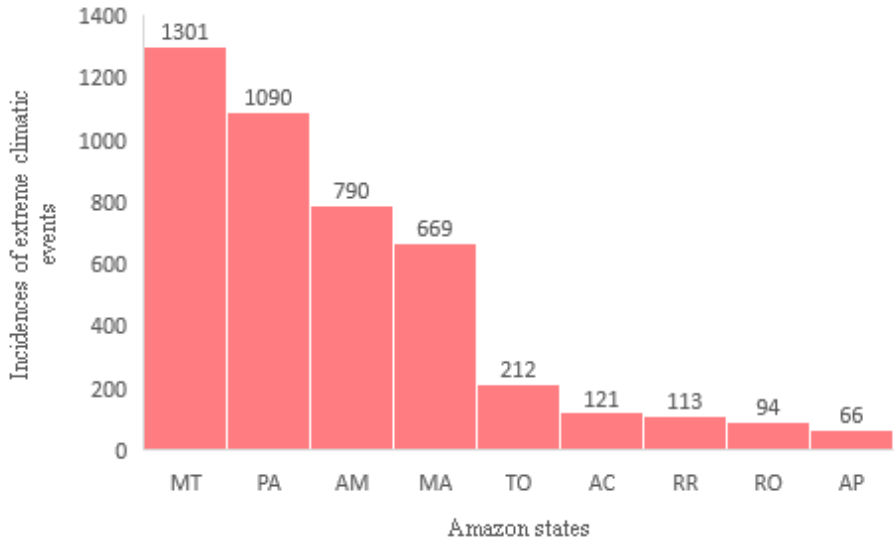


**Figure 3**: Incidence of extreme climate events in different states of the Amazon (1991-2020).

According to data, "ecosystems are being rapidly degraded by human industrial activities. A cumulative total of 17% of the original forest have already been cleared, and 14% replaced by agricultural land use" (Albert *et al*., 2023). This research found that the number of extreme climate events were increasing in the same way that the crop area has increased over the years, particularly in the states of Mato Grosso and Pará. In this sense, changes generated by agricultural expansion at the country level have had a positive economic outcome but with strong impacts on traditional communities and the environment. In addition, negative effects resulting from natural disasters and extreme climate events showed greater losses in economic and infrastructural terms in the last years of the study. When measured in a seasonal basis, the size of the losses in areas dedicated to agriculture, were higher than the gains from this activity.

Figure 4 shows the variation in the number of natural disasters over the years, as well as the variation in the area harvested from temporary crops in the same region, over the period 1995-2020. As it is evident, increases in the harvested area is followed by increases in the number of natural disasters.

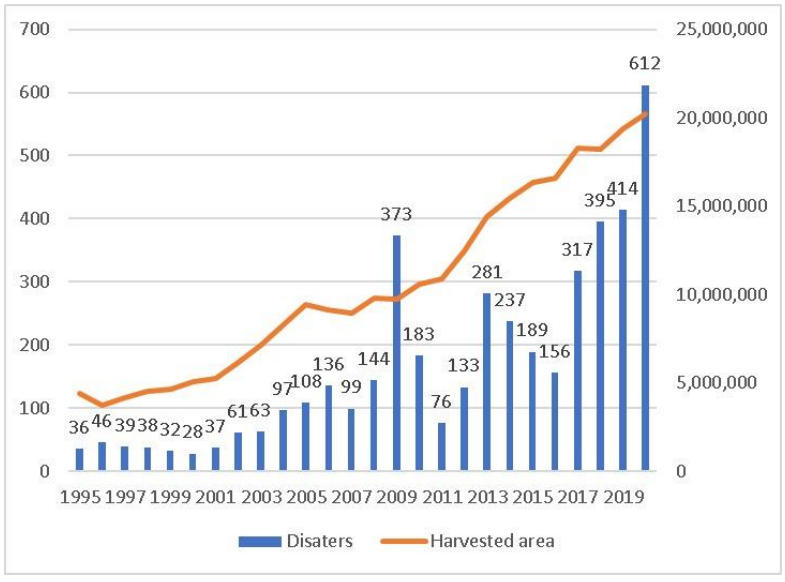


**Figure 4:** Incidence of natural disasters and harvested area in different states of the Amazon (1991-2020).

> "The importance of Amazon moisture for Brazilian agriculture south of the Amazon is complex but not trivial. Perhaps most important is the partial contribution of dry season Amazon evapotranspiration to rainfall in southeastern South America. Forests maintain an evapotranspiration rate year-round, whereas evapotranspiration in pastures is dramatically lower in the dry season. As a consequence, models suggest a longer dry season after deforestation" (Lovejoy & Nobre, 2018).

According to Albert *et al*. (2023), "the main drivers of Amazonian habitat destruction and degradation are land-use changes (such as land clearing, wildfires, and soil erosion), water-use changes (such as damming and fragmenting rivers and increased sedimentation from deforestation), and aridification from global climate change". These factors are typical from anthropogenic movements before the transformation of spaces for agriculture. In fact, the number of extreme climate events were higher in states with wider agricultural areas, which suggests a counterproductive effect of extensive farming.

## Conclusions and Outlook

In sum, the economic trade-off between the increasing agricultural expansion and the corresponding long-term environmental and economic impacts is negative, which suggests a counterproductive effect of agricultural expansion for the future of agriculture itself. The study suggests the adoption of solutions based on technology for productivity growth instead of the adoption of policies and the use of subsidies that enhance the expansion of agriculture in forest areas, and the adoption of risk management strategies as policy recommendations.

## References


Albert J. *et al*. (2023). Human impacts outpace natural processes in the Amazon. *Science*. Vol. 379. https://doi.org/10.1126/science.abo5003

IBGE (2020). Produção agrícola municipal Available at: Culturas temporárias e permanentes | IBGE Accessed 25 jul. 2023.

Lovejoy, T. E., Nobre, C. (2018). Amazon Tipping Point. *Science Advances*. 4.º EAAT2340 https://doi.org/10.1126/sciadv.aat2340

SEDEC/MDR (2022). Atlas Digital de Desastres do Brasil. Available at: Atlas (mdr.gov.br) Accessed 20 jun. 2023.