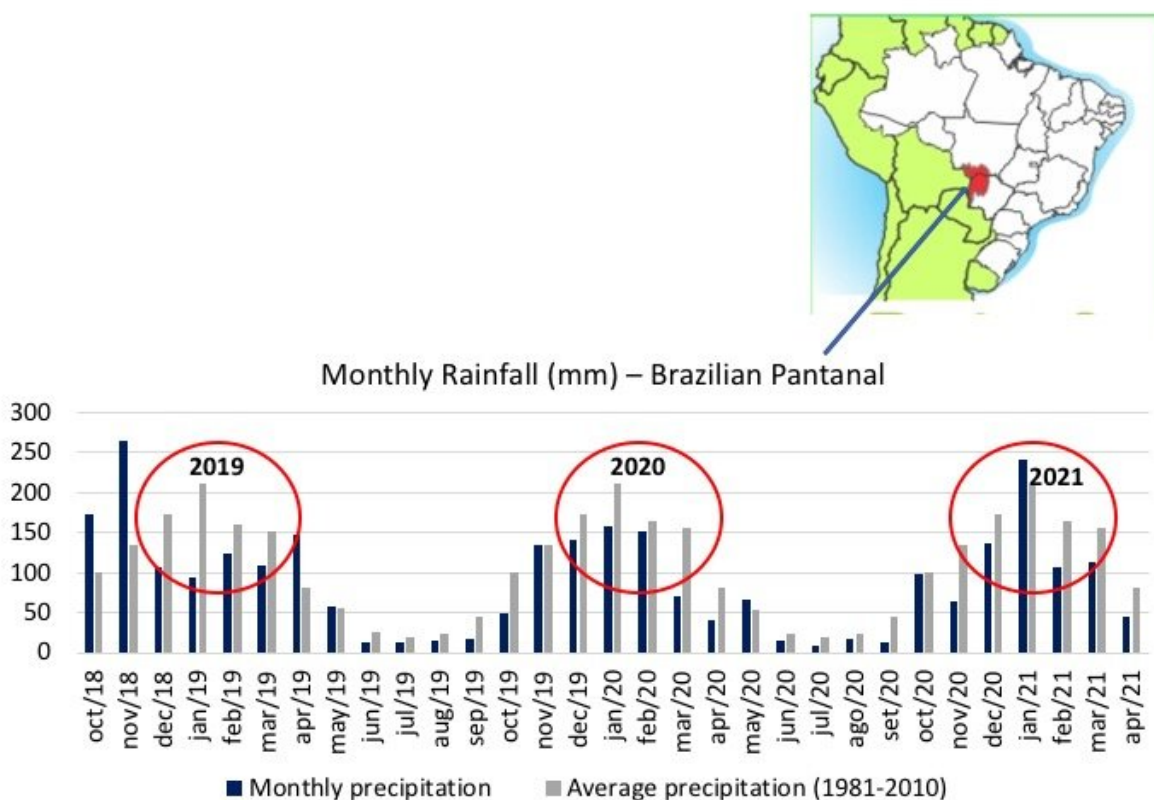


Researchers identify the causes of the extreme drought that affected the Pantanal

May 24 2021, by Elton Alisson



The study shows that the 2019-20 drought resulted from a natural meteorological phenomenon similar to the one that caused the 2014-16 critical water shortage in São Paulo state, Southeast Brazil. Credit: José Marengo

The extreme drought suffered by the Pantanal in 2019-20, considered the worst in the last 50 years, was caused by natural climate conditions similar to those underlying the 2014-16 water crisis in São Paulo state. The Pantanal is one of the world's largest wetlands. The Brazilian portion is located in the Center-West region, mainly Mato Grosso do Sul state.

The 2019-20 extreme [drought](#) was studied by researchers affiliated with the Natural Disaster Surveillance and Early Warning Center (CEMADEN), the National Space Research Institute (INPE) and São Paulo State University (UNESP) as part of a project supported by FAPESP under the aegis of its Research Program on Global Climate Change (RPGCC).

The results of the study are published in the journal *Frontiers in Water*.

"The recent drought in the Pantanal was caused by a meteorological phenomenon we call atmospheric blocking. A high-pressure area prevented the formation of rainclouds throughout the central-western portion of South America. Temperatures were very high and [relative humidity](#) very low," José Marengo, a researcher at CEMADEN and principal investigator for the study, told Agência FAPESP.

"Lack of rain combined with high temperatures and very low humidity led to a heightened risk of fire, which extended to agricultural areas as well as natural parts of the biome."

Deliberate burning of vegetation to clear land for cattle ranching contributed to the spread of wildfires throughout the region, and these were harder to control owing to the long period of drought. "Fires caused on one hand by warmer air and lack of rain in the Pantanal, and on the other by the burning of areas to clear the vegetation for cattle to graze, resulted in environmental disaster," Marengo said.

Sources of observational data

To investigate the hydroclimatic causes of drought in the Pantanal, the researchers used an array of sources of observational hydrological data (on the level of the Paraguay River) as well as data on rainfall and hydroclimatic teleconnections (links between hydrological events and atmospheric circulation patterns causing weather phenomena). They also used information on [land use](#) and remote sensing data to characterize water stress and drought in the Pantanal.

Based on an analysis of all these datasets they were able to provide a clear description of the interannual variability of rainfall, river streamflow, and drought-related factors, concluding that the drought was caused by a complex combination of hydroclimatic teleconnections.

"The lack of rain during the summer in 2019 and 2020 in the Pantanal was due to a decrease in the flow of warm humid air from the Amazon," Marengo said.

Part of the rain that falls on the Pantanal is brought by winds blowing from the North Atlantic to the Amazon, and from there to the Pantanal in Brazil's Center-West region. The humidity coming down from the Amazon and [cold fronts](#) coming up from the South were prevented from reaching the Pantanal by a high-pressure bubble. As a result, masses of warmer and drier air contributed to the scarcity of rain during the summer at the peak of the monsoon season, typically characterized by changes in atmospheric circulation and precipitation in tropical and subtropical coastal regions due to asymmetric heating of land and sea.

The result was a prolonged [extreme drought](#) throughout the Pantanal, with severely adverse effects on the biome. "This phenomenon is natural and occurred in a similar manner in São Paulo during the 2014-16 drought," Marengo said.

Amplified impact

According to Marengo, it is not yet possible to foresee whether the Pantanal will face more severe droughts in the years ahead. The problem can only be avoided if there is the right amount of rain at the right time. "It's no use getting rain now, in March, at the end of the rainy season, and then between December this year and February 2022, for example," he said. "This compromises the rainy season and increases the risk of more wildfires in the Pantanal."

Drought in the Pantanal cannot be blamed solely on [global climate change](#) because it is a natural event and climate change is a long-term process. The recent drought differed from those seen in the 1950s and 1960s when the planet was cooler. "What's happening now is that these natural droughts are suffering the effects of climate instability, and the effects are worse because back then there was a lot less human occupancy in the region. Its population is now more vulnerable to the impact of drought," Marengo said.

More information: Jose A. Marengo et al, Extreme Drought in the Brazilian Pantanal in 2019–2020: Characterization, Causes, and Impacts, *Frontiers in Water* (2021). [DOI: 10.3389/frwa.2021.639204](https://doi.org/10.3389/frwa.2021.639204)

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