

## PROJECT

# "MONITORING AND PROJECTING CLIMATE IMPACTS ON AGRICULTURE"

Climate change is already a reality and can be felt all over the planet. That is what the sixth report of the Intergovernmental Panel on Climate Change (IPCC), published in August 2021, has found, and what each of us can observe on a daily basis.

We have been seeing more and more extreme events, such as droughts, floods, extremely high or low temperatures. These fluctuations deeply impact all of our ecosystems, from forests to oceans.

**But what about agriculture?**



According to the IPCC, climate change also impacts agriculture, potentially lowering productivity in a context of increasing food demand by the middle of this century.

**Higher incidence of droughts, rainfall and high temperatures have a direct impact on crops.**

*That is why it has become increasingly crucial to monitor and predict extreme events to better plan production strategies and ensure food safety across the world.*

## ABOUT THE "MONITORING AND PROJECTING CLIMATE IMPACTS ON AGRICULTURE" PROJECT

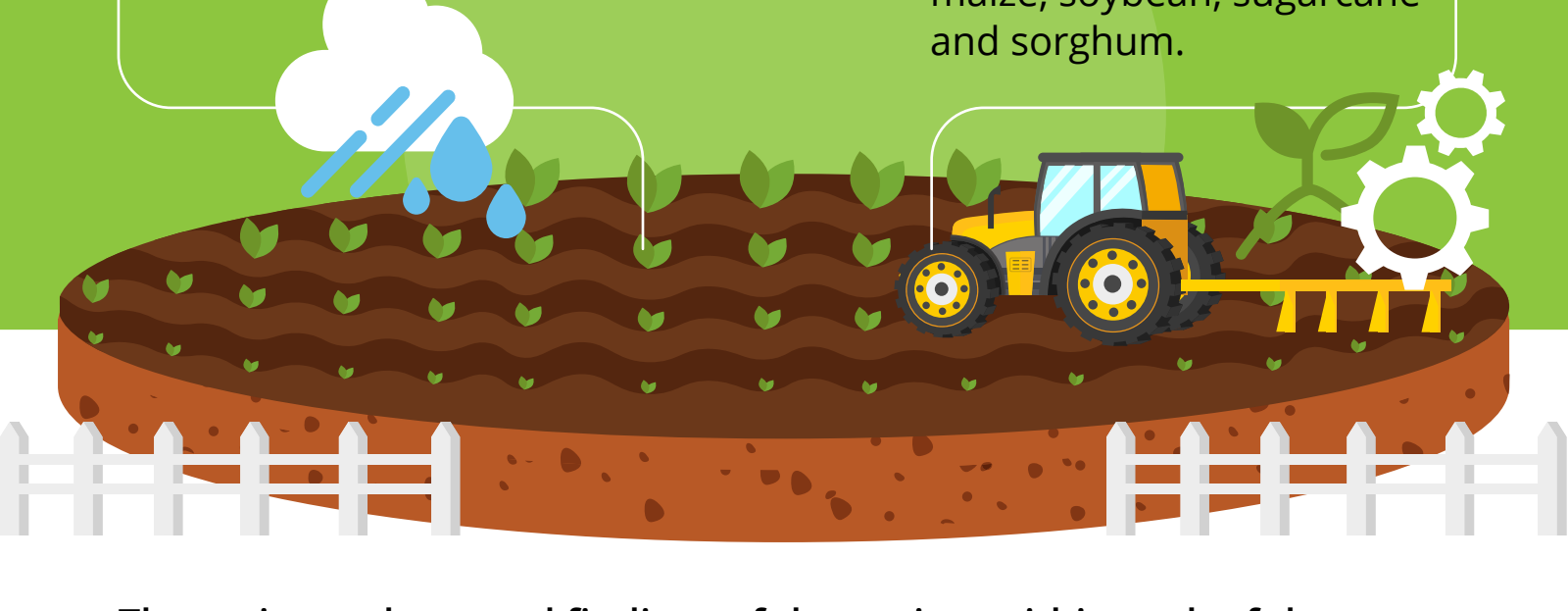


With that in mind, the Climate Science for Service Partnerships (CSSP) Brazil, – a partnership between Met Office of the UK and the Brazilian institutions National Institute for Space Research (INPE), National Institute of Amazonian Research (INPA) and National Center for Monitoring and Alerting of Natural Disasters (Cemaden) – funded the research project titled "Monitoring and Projecting Climate Impacts on Agriculture".

Led by Brazilian researcher Marcelo Galdos (University of Leeds), with the participation of Marcelo Zeri and Ana Cunha (Cemaden), Fabio Marin (ESALQ-USP) and Murilo Vianna (University of Leeds), among several British researchers, the project had two main objectives:

**MONITORING the incidence of droughts in agriculture both currently and in the recent past,** combining different indicators to help farmers better prepare for these events.

**DEVELOPING applications in agricultural modeling,** a system that simulates the effects of gradual changes and extreme climate events across the main Brazilian crops, such as maize, soybean, sugarcane and sorghum.



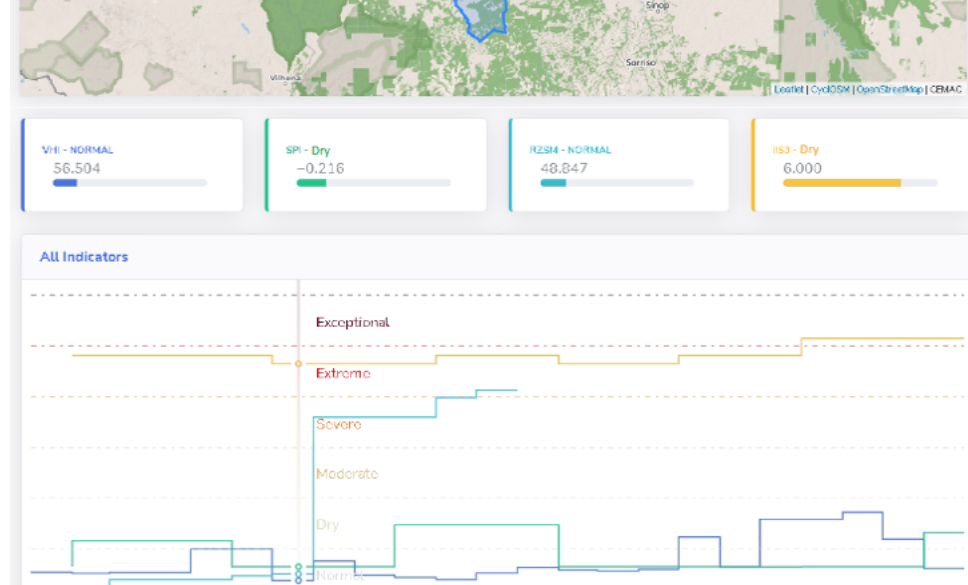
The main products and findings of the project within each of these objectives, as well as their relevance for Brazilian agriculture, are detailed below.

They provide evidence about the impacts of climate change on crops, helping adapt to this new climate context and increase resilience to such impacts. Check out the details below:

## AGROCLIMATIC MONITOR PLATFORM

DROUGHT DATA FOR FARMERS AND MANAGERS TO DEVELOP BETTER PLANTING STRATEGIES

One of the outcomes of the project was a new platform that provides soil moisture indicators and offers an innovative approach, combining two other indicators on rainfall variability and vegetation health to enhance monitoring accuracy. The indicators can be viewed separately or as a whole, sorted by Brazilian municipality in an easy and user-friendly interface for everyone: from farmers to managers. This enabled the creation of a complete platform that allows:



• **Evaluating potential drought impacts in a more accurate and interactive manner:** identifying these episodes in specific phases of the crop calendar allows farmers to better prepare ahead of time for difficult periods, ultimately avoiding losses in their crops. If the soil is still dry, plantation will likely have to be postponed.

• **Selecting specific data based on users needs:** users can choose the city, region, period and indicator to be monitored. Results are shown on the map and can be downloaded as well.



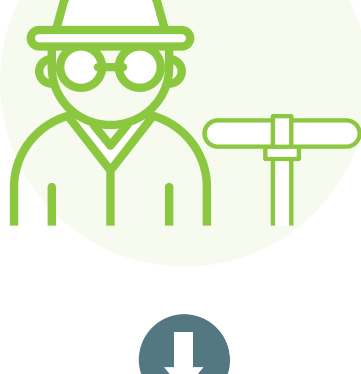
• **Identifying drought regions and episodes more accurately compared to conventional monitoring methods:** that was only possible because the platform combines more than one drought indicator. For example: the plant may be green (indicating vegetation health), but the soil might be dry (moisture indicator). The tool lists municipalities where droughts have been more severe, already evidencing the impacts of extreme climate events.

## MODELING TO PREDICT IMPACTS OF CLIMATE CHANGE AND ASSIST IN ADAPTING TO SUCH CHANGES

The researchers improved the performance of the JULES (Joint UK Land Environment Simulator) ecosystem model, which simulates the flow of water, carbon and nutrients between vegetation and the atmosphere, to more accurately predict the impact of future climate changes in Brazil, and how this affects agriculture.

To achieve this goal, JULES's **soil moisture simulations** were compared to climate and agriculture indicators, and adjusted based on measurements made during field tests. The model was then adapted and evaluated for crops such as sugarcane and maize.

The modeling process allows simulating climate impacts on crops, anticipating the potential impacts of future climate conditions, and outlining adaptation strategies.



## EFFECTS OF CLIMATE CHANGES IN THE FARMING

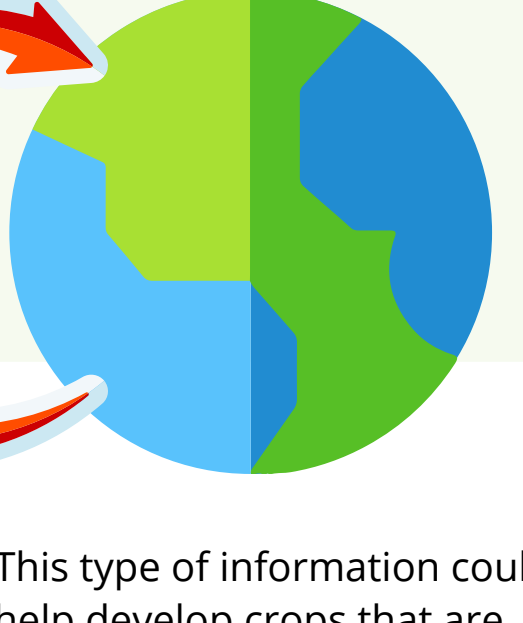


For example, what will happen to sugarcane production considering the rising temperatures and CO<sub>2</sub> concentration in the atmosphere over the next few decades?

**Researchers already have that answer.**

In temperatures below 35 degrees, production would increase. But above this threshold, a sharp drop in productivity is expected.

## EFFECTS OF AGRICULTURE IN CLIMATE CHANGE



This type of information could help develop crops that are more resistant to drought or make changes in plantation areas, for example.

**Another feature of JULES** is that it allows investigating not only climate impacts on agriculture, but also the impacts of agriculture on the climate, including the effects of land use change and different crop management systems.

*Enhancing this model for Brazilian agriculture, responsible for a large portion of the world's food supply, is a major contribution of Brazilian science to the entire world.*

WANT TO KNOW MORE ABOUT THE TOOLS DEVELOPED BY THE "MONITORING AND MODELING OF CLIMATE IMPACTS ON AGRICULTURE" PROJECT?

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