

Ministry of Agriculture, Livestock and Food Supply

**Adapting to climate change: Strategies for
Brazilian agricultural and livestock systems**

MAPA'S Mission

To promote the sustainable
development of agriculture
and livestock

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AGRICULTURAL CLIMATE RISK ZONING (ZARC)

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Agricultural Climate Risk Zoning (ZARC) was implemented in 1996 with the objective of delineating municipalities and planting times based on agroclimatic risk. At its base is, a network of researchers and technicians from Embrapa and several other state institutions and an elaborate construction of agrometeorological data analysis systems and mathematical simulations, which quantify the production risk in the normal climatic conditions of each region, in order to allow an adequate assessment of the variability of each location, season and its consequences for agricultural crops (Figure 1).

The ZARC methodology is based on the determination of the water needs satisfaction index (ISNA) and, based on it, on the frequency of occurrence of adverse events that seriously affect or impede the development, growth or satisfactory productivity of agricultural crops.

ZARC provided relevant results for reducing crop losses, reducing deficit balances and fraud frequency at Proagro. It is estimated that the country will save approximately R\$ 1 billion per year.

Currently, the results of ZARC are used in the Program of Guarantees for Agricultural Activity (Proagro), in Proagro mais, aimed at small producers linked to the National Program for Strengthening Family Agriculture (Pronaf) and in the Subsidy Program for the Rural Insurance Premium (PSR) and also as conditions for the approval of agricultural credit for credit lines independent of the programs mentioned above.

In another way of using technological development promoted by ZARC, its mathematical models and databases are used in the simulation of future agricultural scenarios. These simulations are the basis for assessing vulnerability and alternatives for increasing the adaptive capacity and resilience of agricultural systems.

The ZARC also contributes to the adaptation of agricultural systems by imposing conditions for the approval of credit, inducing good practices and adaptive technologies that are adopted directly by the farmer during the harvest.

RESULTS

- ZARC itself, with its guidelines and use within the scope of national agricultural policy, as well as in the financial sector in the granting of credit, is the main result of the project. ZARC, coordinated by Embrapa in conjunction with MAPA, held, from 2016 to 2018, about fifteen national zonings, 70 validation meetings, in the various Brazilian states, with more than 1,400 participants. Latest developments and specific results:
- CONPREES System - Digital Platform for quality control, filling in the gaps and spatial meteorological data;
- Better spatial detailing of the results;
- More accurate estimates of atmospheric water demand, water consumption of crops and periods of water deficit and surplus;
- More detailed crop models with more simulation resources, including future scenarios of vulnerability;
- Better temporal consistency and larger sample universe, allowing a greater number of events to be evaluated;
- Better assessment of the level of associated uncertainty; and
- Less uncertainty in the results generated, an essential factor in making decisions about adaptation actions.

NEXT STEPS AND RECOMMENDATIONS

As next steps and/or challenges, we consider it necessary to:

- Increase the current execution scale, from 4 to 5 crops per year, to 15 to 20 crops per year;
- Expand zoning studies for crops and systems not yet covered;
- Develop and adapt modeling methodologies for the systematic quantification of risk by productivity range;
- Develop and apply methodologies for the evaluation of resilient production systems, that are less susceptible to adverse weather events;
- Develop a system for monitoring climate claims;
- Specific and predictable budget allocation for the maintenance of ZARC studies, or risk assessment and monitoring systems; and
- More appropriate resource management model.

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Figure 1: Climatic Risk Agricultural Zoning (ZARC) for corn cultivated in the Brachiaria corn system, early cycle cultivars and soils with medium water storage capacity, with sowing taking place in the first ten days of October

