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

SENAR
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DECISION MAKING SUPPORT SYSTEM FOR THE ADAPTATION AND COEXISTENCE OF EXTENSIVE LIVESTOCK FARMING IN THE DYNAMICS OF PANTANAL FLOODS AND DROUGHTS IN FACE OF CLIMATE CHANGE

Carlos Roberto Padovani[1]; Alex Fernando de Araújo[2]; Renato Porfírio Ishii[3]; Edson Takashi Matsubara[3]; Júlio César Dalla Mora Esquerdo[4]; Rogério Alves dos Santos Antoniassi[2]

1 Empresa Brasileira de Pesquisa Agropecuária – Pantanal. 2 Instituto Federal de Educação de Mato Grosso do Sul. 3 Universidade Federal de Mato Grosso do Sul. 4 Empresa Brasileira de Pesquisa Agropecuária – Informática Agropecuária

According to the Intergovernmental Panel on Climate Change, the extreme events that have been observed in recent decades and those predicted for the future are a consequence of climate change due to human activities. Regardless of the cause, be it climate change or natural climatic variability, extreme events eventually occur and cause societies to become concerned, due to the risk of loss of human life, property and economic losses. Measures for adapting to climate change are essential to minimize risks.

The Pantanal is an extensive sedimentary plain, with seasonal flooding and where extensive livestock farming is the main economic activity. Flood seasonality is a natural process in wetlands, it naturally fertilizes native pastures that occur in large areas in the Pantanal, being the basis of cattle feed. In regions that flood by overflowing rivers or those that flood directly because of rain, large areas of native pasture are submerged from time to time with critical depths and durations, and in extreme events, there may be a drastic reduction in the supply of food and even an increase of cattle mortality due to starvation or drowning. Over more than 200 years of coexisting with floods, management strategies such as the removal of cattle from low, floodable areas, to higher areas in the Pantanal or in the adjacent plateaus, allowed livestock to adapt to floods, being characterized as a very effective non-structural measure. In this context, the question that is asked every year is: what will the magnitude of the flood and flooded areas be and will the removal of cattle be necessary?

Because the Pantanal was considered an area of restricted use according to article 10 of the New Forest Code, structural measures to contain floods such as dikes and channels, are not recommended or are considered illegal, based on current legislation. Dykes, by changing the hydrological dynamics, can convert seasonally flooded environments into permanently flooded environments or generate water deficit, negatively impacting livestock and other system components. The channels drain the seasonally flooded areas, increasing the magnitude of drought events, which can generate water deficit in the soil, lowering the groundwater table, which then reduces the production of pastures, and can lead to losses in the areas.

severe and prolonged droughts. Therefore, coexisting with floods, based on non-structural measures, has been shown to be more effective and sustainable for Pantanal livestock and for the conservation of hydrological processes, biodiversity and distribution and abundance of native vegetation and wild fauna.

All these extrinsic and intrinsic factors point to the need for a decision-making system for adapting extensive livestock to floods and droughts in the Pantanal (Figure 1). The system will consist of three main components: 1 - Mapping and modeling the dynamics of flooding in the Pantanal using remote sensors, 2 - Flood risk modeling for the dissemination of an early warning system and 3 - Communication of flood alerts and flooded areas using Internet communication tools, in addition to media such as television and radio interviews.

RESULTS

- Flood alert system for the Pantanal rivers. Since 2013, we have been making forecast alerts on river levels available to the interested audiences. We are currently using statistical models of linear and non-linear regression with river level data in upstream and downstream stations, with a good margin of accuracy;
- Providing hydrometeorological information to all audiences from the Hydrological Information Portal for the Upper Paraguay-Pantanal basin on Facebook, since 2013;
- Interviews on television, radio and internet media, on the general aspects of each flood and flood event; and
- Preparing technical reports for the Civil Defense and Rural Unions in the event of above-average events.

NEXT STEPS AND RECOMMENDATIONS

We are developing and hope to achieve the following goals in the next two years:

- Improve current processing methods satellite images for flood detection and monitoring;

- Improve the current automation of processing large volumes of satellite imagery data in a computer cluster to accelerate the production of real time results;
- Evaluate new statistical methods for the treatment of time-stamped data of river flow and levels;
- Search for new precipitation data and other environmental variables, by satellite, on global and national data platforms; and
- Evaluate the Monitoring, Analysis and Alert Platform for Environmental Extremes - TerraMA to integrate environmental data, develop a model based on artificial intelligence to forecast floods and droughts in the Pantanal and make such information available to those interested on the internet and other communication platforms.

DATA PUBLISHED IN:

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PROJECT COORDINATORS

Dr. Carlos Roberto Padovani

Empresa Brasileira de Pesquisa Agropecuária – Pantanal

e-mail: carlos.padovani@embrapa.br

Dr. Renato Porfírio Ishii

Universidade Federal de Mato Grosso do Sul

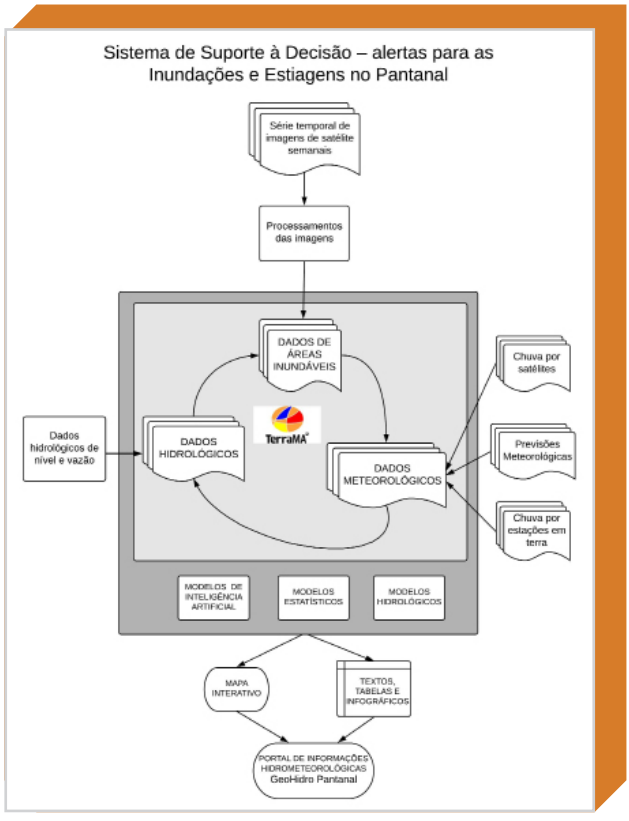
e-mail: renato@facom.ufms.br

Dr. Alex Araújo

Instituto Federal de Educação

e-mail: alex.araujo@ifms.edu.br

Figure 1: Diagram of the compartments and processes of the Decision Support and Alert System for floods and drought in the Pantanal



Crédit: Carlos Padovani. Alex Araújo e Renato Ishii.