INPUT
Iniciativa para o Uso da Terra

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FIRST PARTIAL REPORT OF THE PROJECT

IDENTIFICATION OF RELATIONSHIPS BETWEEN ABNORMAL PRECIPITATION EVENTS AND CROP FAILURES IN SOYBEAN, MAIZE AND SUGARCANE HARVESTS IN BRAZIL DURING THE LAST TWO DECADES

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1. AGRICULTURAL DATA USED

Data on planted area and yield for soybeans, maize and sugarcane throughout Brazil were obtained from the Brasil Agricultural Land Use database (Available at www.biosfera.dea.ufv.br). The data are based on IBGE's the Municipal Agricultural Survey (PAM) at the micro region level and are spatially disaggregated to allow cross-linking with climate data in the following stages of the project.

The last harvest currently available in the database is 2013/14 for soybeans and maize and 2014 for sugarcane. This database includes data from the 1989/90 to 2013/14 harvests for soybeans and maize and 1990 to 2014 for sugarcane.

2. CRITERIA FOR THE DEFINITION OF SIGNIFICANT CROP FAILURES

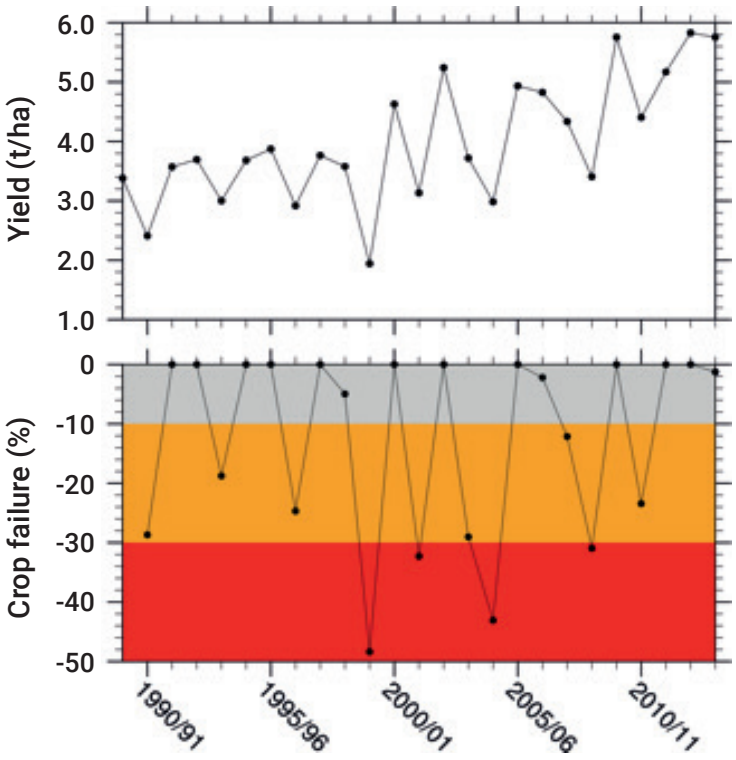
Currently, there is no explicit definition of crop failure that allows for the quantification and comparison of different events. The BNDES (Brazilian Development Bank) glossary defines crop failure simply as a "significant reduction in crop output, as a result of low production and/or low yields". Specific failure events are usually quantified as values of total production or yield in a region relative to projections for that year or, as considered in this report, relative to previous years with good harvests.

To take into consideration changes in planted area between the years, we herein defined crop failures using the yields from each region, in tons of product per hectare of planted area. The use of planted area instead of harvested area as a denominator automatically considers as crop failure the lost areas declared in each region, since it is counted as planted area, but did not contribute to the production. Considering that

new technological developments lead to yield increases throughout time, we calculated herein the percentage of crop failures relative to the last year in which the yield increased. Failures between 10 and 30% are considered medium and those greater than 30% are considered severe.

This calculation is exemplified in **Figure 1**, which shows the data series for maize productivity of a point in Parana state and the corresponding percentage failures. In the first point of the series, yield decreased 28% between 1989/90 and 1990/91, which was the crop failure value considered for the 1990/91 harvest. From this year until 1992/93 the yield increased and there was no failure. In 1993/94, the yield once again decreased, representing a failure of 18% relative to the last harvest year with yield increases (1992/93). Similarly, yield increased between 2001/02 and 2002/03. In 2003/04, there was a crop failure of 29% relative to 2002/03. In 2004/05, yield decreased once again, and the crop failure was calculated as 43% relative to the last harvest year with increasing yield, which was, once again, 2002/03. In 2005/06, yields increased once again, becoming the reference for the crop failures during the next three years until 2009/10, when yields started to increase again, and so on.

FIGURE 1: Maize yield series for a point in Parana (24º30'S 53º30'O, top chart) and corresponding calculated percentage failures (lower chart). The regions in orange and red of the second chart correspond to the failures considered medium and severe, respectively.



3. REGIONS WITH SIGNIFICANT CROP FAILURES

Figures 2, 3 and **4** show the summarized results for the soybeans, maize and sugarcane crop failures, respectively. In these figures, the colored areas indicate where the crop was planted each year (at least 0.5% of each cell was occupied by the crop, that is, at least 6000 ha in a 1.2 million ha pixel). The grey regions indicate regions where there were no crop failures, that is, yield increased relative to the previous year, or there was a yield decrease below 10% relative to the best most recent year. The regions in orange show medium crop failures, that is, between 10 and 30% relative to the best most recent year. Finally, the regions in red show severe crop failures, greater than 30% relative to the best most recent year.

Generally, soybeans had greater crop failures in the south of Brazil and in the MATOPIBA region. In the south of Brazil, most crop failures occurred in La Niña years, such as 2007/08 and 2011/12. In the case of maize, severe crop failures were more spread throughout the territory than in the case of soybeans, but more concentrated in the Brazilian northeast, although also suffering the consequences of La Niña in the south of Brazil. Crop failures are apparently more frequent in the case of maize because it is a lower technology crop compared to soybeans, and because it is a crop commonly used for the second harvest (safrinha). Finally, in the case of sugarcane, severe crop failures are less common and occur in regions where sugarcane is not an intensive crop, that is, outside of the state of São Paulo, Triangulo Mineiro, North of Parana and Northeast coast.

FIGURE 2: Regions with occurrence of soybean crop failures considered medium (from 10 to 30% relative to the last growth year) and severe (greater than 30%) for 24 harvest-years between 1990/91 and 2013/14.

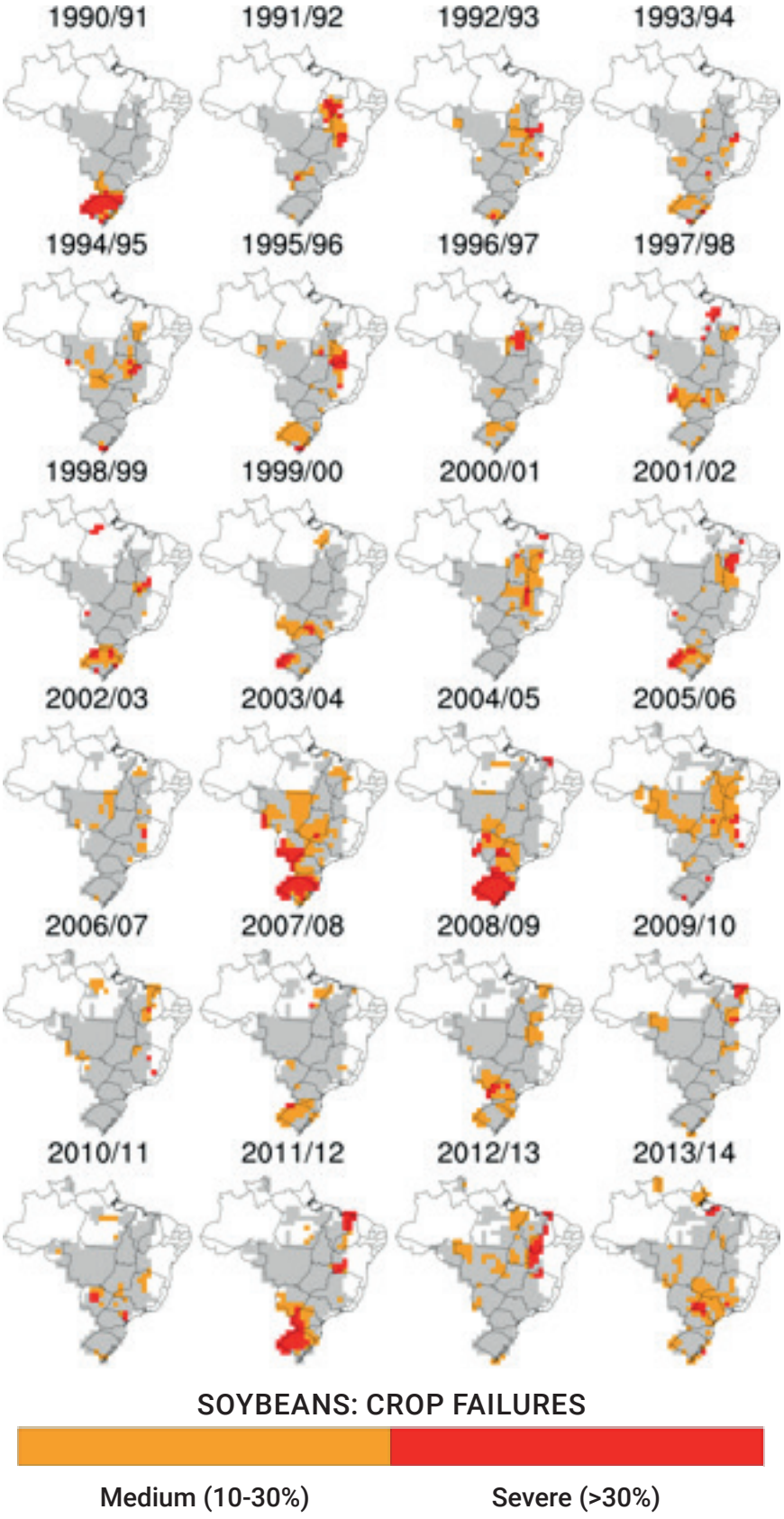
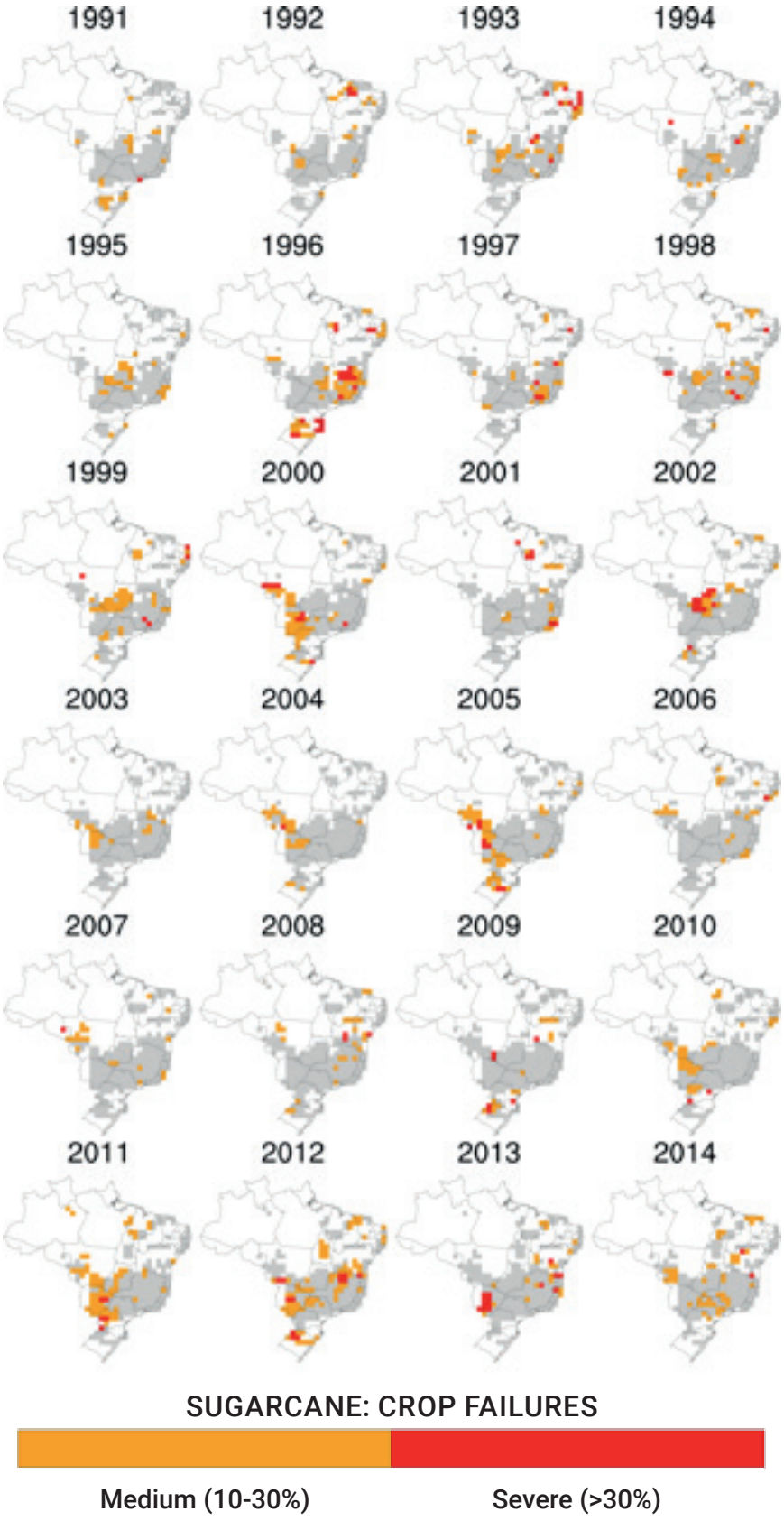


FIGURE 3: Regions with occurrence of maize crop failures considered medium (from 10 to 30% relative to the last growth year) and severe (greater than 30%) for 24 harvest-years between 1990/91 and 2013/14.

FIGURE 4: Regions with occurrence of sugarcane crop failures considered medium (from 10 to 30% relative to the last growth year) and severe (greater than 30%) for 24 harvest-years between 1990 and 2014.



ABOUT INPUT

The Land Use Initiative (INPUT) project is the result of a partnership between Agroicone and the Climate Policy Initiative (CPI) in Brazil. It counts on a dedicated team of leading economists, lawyers, mathematicians, geographers and agronomists who work at the forefront of how to increase environmental protection and food production.

INPUT engages stakeholders in Brazil's public and private sectors and maps the challenges for a better management of its natural resources. Additionally, it mobilizes agents of the productive chains in order to promote compliance with the new Forest Code. In addition, the project aims at analyzing and influencing the creation of a next generation of low-carbon economy policies in Brazil.

In this project, besides from generating information about the alternatives for restoration of native forests and compensation of Legal Reserve areas, Agroicone is responsible for engaging the private sector in the challenges for compliance and creating sectoral solutions that enable large-scale implementation.

To learn more: www.inputbrasil.org