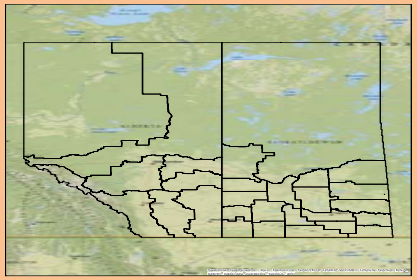
Pallister Triangle droughts mapping and their economic effect in wheat production

By Unai Miguel Andres

Abstract

The Palliser triangle is the main area of wheat production in Canada and the world, and it has been affected during the last century by several droughts, but nobody has study their impact on the grain production. This paper has the objective of analyze and show if more studies should be done in order to prevent the scarcity of wheat supply in Canada and so the world.

Introduction



The Palliser Triangle, located mainly in the Canadian provinces Alberta and Saskatchewan, is known as the driest area of the Canadian Prairie and some studies have shown that the temperature increased 0.9 C since 1900, increasing the droughts periods of this area.

This region is also where the Canadian wheat main production is located, and that make this area special area of interest for both, Canada and the World (since Canada is one of the main exporters of wheat).

As even some research show the evolution of the temperature or precipitation in this area, there are not models or predictions of how this droughts are affecting the production of wheat, what as an initial thought it will be a relation between drought periods and decreased in wheat production.

Methods

In order to track the intensity of the meteorological droughts in the Palliser Triangle I have used an SPI text file (based on NASA NLDAS) create by Dr. Munoz-Hernandez. The steps followed to map the droughts I have:

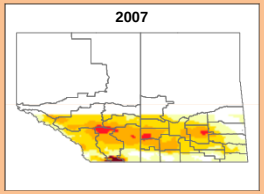
1. To create a Raster usable by ArcGIS, the text files have to be opened with Excel to introduce the cell size, the number of Rows and Columns, the location of the lower left cell and the No-data values:
   - NCOLS 464
   - NROWS 224
   - XLLCORNER -125.00050354004
   - YLLCORNER 25.000499725342
   - CELLSIZE 0.125
   - NODATA_VALUE 0.03
2. Once the text files are modified, a Raster can be created using the tool Conversion Tools>To Raster>ASCII to Raster. Float will have to be chosen from the Output data type, due to the SPI works and so is formed by numbers with decimals.
3. The just created Raster are for North America, so in order to work only with our area we will have to extract them. To do so, go to Spatial Analysis>Extraction>Extract by Mask. The mask we will use is a layer create previously of the area of interest (the Pallister Triangle).
4. The new Raster will have the data just for the area of interest but it will classify by default with stretch values (from the minimum to the maximum value) but for our analysis we will need to readjust it. To do it, we have to make right click on the layer, choose properties and chose the Symbology tab. Once we are there we will have to chose form the left box Classified, in the new menu choose classify and a new window will appear. In the new window select as Classification Method “Manual”, adjust the Classification Classes to 7 and introduce the following break value:
   - -3
   - -2.5
   - -2
   - -1.3
   - -0.5
   - 0
   - 2.7
5. After this new classification we need to know the percentage of area affected by significant droughts. In order to do that, go to Spatial Analysis Tools>Zonal>Zonal Histogram. This tool will create a new table with the total of pixels in each category, with what we will have the percentage of area affected by a drought.

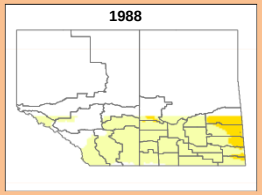
Conclusion

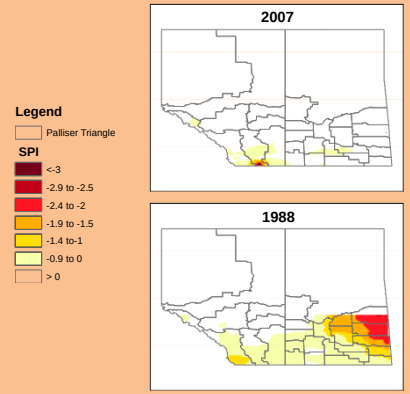
This study shows that it seems to be a relation between droughts periods (accounting them during both June and July) and the increase in price in Saskatchewan Province, with some exceptions as in 1992 (which can be due to other variables as more seeded area, or increase in the crop efficiency, etc), and that more studies should be realized about these areas (Suach as Agricultural Drought interpolations) to discover if some droughts prevention models are necessary, etc.

Results

July drought maps







June drought maps

Saskatchewan wheat price and drought relation