

## Drought Analysis using the SPI and VCI Indices in the Bío-Bío región

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### Abstract

Drought is one of the most complex natural disasters, with severe impacts in our society, in particular in agriculture. Moreover, climate change evidence foresees that extreme events will be increasingly common and more severe in the next years. In this study we analyze evolution of agricultural drought on the Bío-Bío region (Chile). First, the standardized precipitation index (SPI) is used to describe the meteorological drought at different scales (1-36 months); second, the vegetation condition index (VCI) is computed to analyze the response of vegetation to weather; and finally the relationship between SPI and VCI is analyzed.

The aim of this study is to advance the understanding of drought in the region, and to attempt to explain the interaction between precipitation deficit and vegetation response. The SPI index was computed based on 16 meteorological stations, with 30 years of observations, from 1983 to 2013. The VCI index was derived from satellite imagery provided by the MODIS sensor and its MOD13Q1 product, with a spatial resolution of 250m and a time frequency of 16 days, from 2000 to 2013.

The SPI indices (1-36 months) were able to correctly identify wet and dry patterns in the region, with 1998 and 1999 as the driest years. From 2007 up to 2013 we observed a steady decline in SPI, mostly for time scales above 12 months (SPI-12 to SPI-36). The VCI indicates that vegetation was most affected by rainfall deficit during the growing seasons 2007/2008 and 2008/2009. The overall Pearson product-moment linear correlation coefficient ( $r$ ) between VCI and SPI was 0.57 for SPI-2 and SPI-3. At administrative unit level, the correlation was higher for SPI-3, generally with values of  $r$  higher than 0.42, indicating a short-term response of the crops to rainfall deficit.