Primary production dynamics and climate variability: ecological consequences in semiarid Chile

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Abstract

Increase in rainfall variability has important consequences for organisms in arid and semiarid regions around the world. In South American and Australian deserts, the El Niño/Southern Oscillation (ENSO) phenomenon greatly influences rainfall patterns, and therefore the dynamics of plant communities. However, the field data needed to assess the effect of climate change on vegetational patterns is difficult to obtain because of the large spatial scale required for such studies. Normalized Difference Vegetation Index (NDVI) characteristics allow the use of several indexes related to vegetational structure. Due to its direct relationship with primary productivity, it is possible to obtain several measures of annual productivity. These include annual plant yield, annual maximum yield, onset of 'greening-up' and senescence phases, length of the 'green' season, vegetation peak, and therefore, the periods when more or less food is available for herbivores. After verification with ground-truth measures, we used NDVI data from two semiarid localities in north-central Chile (Fray Jorge and Aucó) to determine the relationship between rainfall patterns and vegetation cover and productivity related to El Niño phenomenon. With this information we gauge the influence of climatic processes on primary productivity in western South America, an area subject to strong climate variability. We predict significant variation in Chilean semiarid regions due to climate change, affecting mainly the extent and timing of annual growth season of vegetation, and also including a shorter and delayed greening-up season. Also, we predict that important decreases in rainfall levels will not have strong effects on primary production in these semiarid ecosystems.