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## Evaluating Spatio-Temporal Relationships between Climate Variables and NDVI in Humid Grasslands of Northeastern Argentina

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### Abstract

In northeastern Argentina, subtropical grasslands occupy over 50,000 km<sup>2</sup> and are mainly devoted to raising cattle, representing the main economic resource for the inhabitants. Some evidence have shown that precipitation and temperature in this region are changing according to global change forecasts. Therefore, our objective was to confirm the existence of such patterns and evaluate if vegetation is responding to it. For this purpose, a 11-year series of biweekly NDVI (MODIS, 2000–2011) were used. Integrated NDVI values for early, middle, late and the entire growing season were calculated. For the same period, information about temperature, amount of precipitation and days with precipitation was considered. Trends of NDVI and its correlation with climate variables were analysed for five different grassland types identified in the study region. The annual precipitation and temperature did not show a significant negative trend (slope was -0.105 and -0.041,  $p > 0.05$  respectively). However, the number of days with precipitation during the current growing season showed a significant negative trend along the years (slope = -0.550,  $p < 0.001$ ). This indicates that, despite the total amount of precipitation remains unchanged, it is concentrated in less frequent and bigger events. Indeed, this variable was strongly correlated with the NDVI ( $r=0.78$ ,  $p < 0.001$ ), which also decreased significantly over the analysed period (slope ranged from -0.144 to -0.253,  $p < 0.001$ ). The amount of precipitation was strongly correlated with NDVI late in the growing season and there was a weak correlation in the early season ( $r=0.85$  and  $0.38$ , respectively). In conclusion, the trend of climate variables in the study region is mainly represented by changes in the frequency and intensity of the precipitation, which is affecting negatively the grassland productivity. As a consequence, implementation of management practices tending to optimise the water fluxes is necessary to minimise the impact of climate change on this ecosystem. Moreover, given that NDVI and its related variables are good indicators of the vegetation attributes, understanding their relationship with climate variables would allow predicting changes on productivity under different climatic scenarios, being also a key when looking for adaptive responses of grassland and livestock production systems.

**Keywords:** Argentina, climate change, grassland productivity, NDVI, subtropical humid grasslands