

Environmental Controls of Primary Production in Agricultural Systems of the Argentine Pampas.

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Abstract

We studied the aboveground net primary productivity (ANPP) of wheat crops in the Argentine Pampas. Our specific objectives were to determine (a) the response of ANPP to changes in water availability (b) the regional patterns of ANPP and (c) the interannual variability and environmental controls of ANPP. We used ground and satellite data to address these questions. Wheat ANPP was calculated as the ratio between grain yield and harvest index. We developed a simple model that took into account environmental and genetic improvement effects upon harvest index. We used the normalized difference vegetational index (NDVI) as a surrogate for ANPP at the county level. Straight-line regression models were fitted to single-year and average values of ANPP and precipitation to derive temporal and spatial models for wheat. For grasslands, we used spatial and temporal models already published. At any given site, there was no difference between modeled wheat and grassland average ANPP. The response of ANPP to changes in interannual water availability decreased along the precipitation gradient when vegetation structure (for example, species composition, density, and total cover) was held constant (wheat crops). Wheat ANPP and total production variability, estimated from remotely sensed data, decreased as mean annual precipitation (MAP) increased. The percentage of soils without drainage problems was the variable that explained most of the wheat ANPP spatial variability as shown by stepwise linear regression. Precipitation variability accounted for 49% of wheat ANPP variability. Remotely sensed estimates of ANPP variability showed lower and wheat ANPP higher temporal variability than annual precipitation.