Biophysical influences on the spatial distribution of fire in the desert grassland region of the southwestern USA

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Abstract: Fire is an important driver of ecological processes in semiarid systems and serves a vital role in shrub-grass interactions. In desert grasslands of the Southwestern US, the loss of fire has been implicated as a primary cause of shrub encroachment. Where fires can currently be re-introduced and managed given past state changes and recent restoration actions, however, is unknown and controversial. Biophysical variables that influence fuel load and quality are commonly employed to model fire distributions; however, soil-landscape properties like those captured by ecological site descriptions are rarely employed to model fire probability. We predicted that, in addition to climate, soil-landscape properties would have a significant effect on fire ignition frequencies. We characterized the spatial distribution of fire in the Chihuahuan Desert and Madrean Archipelago ecoregions and investigated the influence of soil properties and ecological site groups compared to other commonly used biophysical variables using multi-model inference techniques.

A total of 4060 fires greater than 1 acre in size occurred in the desert grassland region between 1980 and 2012 and 2759 of those were in low elevation zones comprised of grassland and shrubland vegetation. Soil-landscape properties significantly influenced the spatial distribution of fire ignitions. Bottomland ecological sites (i.e., soil-landscape classes) experienced more fires than expected in contrast to ecological sites with coarse soil textures and high fragment content that experienced fewer fire ignitions than expected. Influences of mean annual precipitation, distance to road/rail, soil available water holding capacity (AWHC) and topographic variables varied between ecoregions and by political jurisdictions and differed for peak (Fig. 1) and nonpeak fire seasons. AWHC explained more variability of fire ignitions in the Madrean Archipelago compared to the Chihuahuan Desert.

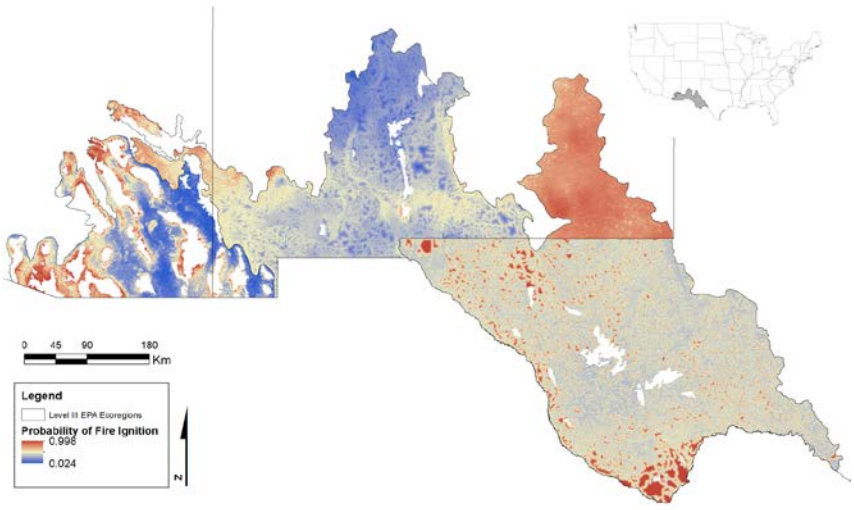

Fig 1. Ignition probability for peak fires in low elevation zones of the desert grassland region of the Southwestern USA based on data from 1980-2012.

Understanding the spatiotemporal distribution of recent fires in desert grasslands is needed to manage fire and predict responses to climate change. While climate variables have proven useful for predicting fire patterns in most systems, the use of landscape units such as ecological sites presents an opportunity to improve predictions at management scales. The application of soil property information readily available in soil survey is an important addition to the toolbox for predicting and managing fire.

Relationship with the LTER VI proposal: This poster contributes to Obj. 6 (a) of the LTER VI proposal: Broad-scale patterns and trends in drivers and changes in socio-ecological states.