



## Research Brief for Resource Managers

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**Contact:**  
Tracy L. Hmielowski

**Phone:**  
608-890-4713

**Email:**  
thmielowski.tpos.firescience@gmail.com

### Expansion of woody species in tallgrass prairie

Ratajczak, Zak, Jesse B. Nippert, Jeffery C. Hartman, and Troy W. Ocheltree. 2011. Positive feedbacks amplify rates of woody encroachment in mesic tallgrass prairie. *Ecosphere* 2(11):121.

<http://dx.doi.org/10.1890/ES11-00212.1>

Woody encroachment is a problem in grasslands worldwide, and the tallgrass prairie ecosystems of the upper Midwest are no exception. Tallgrass prairie occurs in a region that can support forests, but it is theorized that a combination of fire, occasional drought, and competition with grasses maintains grass dominance over deciduous woody species

The authors of this study used a combination of long term demographic data and field measurements to **investigate what traits allow native woody species to outcompete grasses**, even when fire is used as a management tool.

The study was conducted at Konza Prairie Biological Station in the Flint Hills of Kansas. Twenty six years of data from permanent plots established in 1983 were used to examine changes in woody species cover. Sites were classified as upland or lowland, and this analysis focused on sites which were managed with fire on a 3-4 year return interval and not grazed.

The authors found that the five most common native deciduous woody species (*Cornus drummondii*, *Rhus glabra*, *Prunus americana*, *Ceanothus americanus*, *Amorpha canescens*), made up 85% of the woody cover. Of these five woody species, *C. drummondii* was determined to

#### Management Implications

- Woody cover can increase in tallgrass prairie managed with relatively frequent fire
- Determining the mechanisms that enable wood species to expand is critical for management (e.g., species with clonal growth more likely to survive fire or mowing)

be the most abundant, and the study focuses on this species.

Woody expansion was more prevalent in lowland sites. In the lowlands *C. drummondii* increased from 0% to 19% cover, while uplands remained at close to 0% cover throughout the period covered by the dataset. This **pattern of greater expansion by species with deep roots and clonal growth in lowlands** was consistent when all species were pooled.

In general, the authors found evidence that a **positive feedback loop contributed to the ability of *C. drummondii* to encroach tallgrass prairie**. Once established, this shrub has a deep root system, spreads via clonal growth, and reduces fine fuels needed to carry fire. These clonal resprouts are more likely to survive fires, and thus able to expand across the landscape at a higher rate. Understanding the specific life history traits that enable woody species to establish and expand will inform management efforts to control their spread on the landscape.



Example of landscape at Konza Prairie post burn. This watershed is burned on 3-4 year fire return interval. Green patches are unburned shrubs. Photo provided by Z. Ratajczak

Additional reading based on this data set:

Ratajczak et al. 2014. Abrupt transition of mesic grassland to shrubland: evidence for thresholds, alternative attractors, and regime shifts. *Ecology* 95(9): 2633-2645.

Ratajczak et al. *In press*. Fire dynamics distinguish grasslands, shrublands and woodlands as alternative attractors in the Central Great Plains of North America. *Journal of Ecology* doi: 10.1111/1365-2745.12311