Ecosystem-Level Soil Dynamics following Woody Plant Encroachment from Rough-Leaf Dogwood into Grasslands

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**Objectives**
Assess belowground characteristics of native grasslands and sites with encroaching Comus drummondii. Belowground characteristics included: root biomass, mycorrhizal fungal production, soil organic carbon, and aggregate stability.

**Introduction**
The tallgrass prairie ecosystem once occupied much of the central Great Plains of North America. However, primarily due to extensive conversion to row-crop agriculture since the 1830s an estimated 82-99% of this highly productive, floristically diverse ecosystem has been lost. Today, the last remaining tracts of tallgrass prairie in Kansas, Oklahoma, and Texas are threatened by a variety of global change phenomena. The encroachment of woody plant species into the remaining grasslands, due primarily to the anthropogenic removal of fire, is possibly the greatest current threat to the remainder of this endangered ecosystem. An important woody species encroaching into these grasslands is Comus drummondii (dogwood) with multi-scale effects including loss of plant and animal biodiversity and loss of habitat for wildlife species. These grasslands provide primary resources for livestock production in North America and habitat for a wide variety of wildlife. Therefore, conservation of the remaining tallgrass prairie is essential.

**Methods**
We selected six areas on Konza Prairie Biological Station, Manhattan, KS that are dominated by C. drummondii shrub islands, and six corresponding areas dominated by native warm-season grasses (e.g. Andropogon gerardii and Sorghastrum nutans). We collected soil (0-10 cm deep) in the center of each C. drummondii shrub island, at the edge of each island, and in the center of the adjacent native grass communities. The soil cores were transported to Oklahoma State University and processed to assess plant root biomass, soil carbon, soil aggregates, and arbuscular mycorrhizal (AM) fungal production. To determine the annual production of AM hyphae, we used hyphal in-growth bags made from nylon mesh (50-µm mesh) that allows hyphae to grow into the bag but excludes roots. These were placed into the soil at the beginning of the field season, collected at the end of the season, and the hyphae was carefully extracted using 53 µm- and 38 µm-diameter nested sieves. The hyphae of each in-growth bag was then dried and weighed.

**Results**

![Mycorrhizal Fungi Abundance](image)

**Discussion**
Our results indicate that C. drummondii has fewer roots per m², yet is associated with greater abundance of AM fungi compared to the native grasses (Figures 1 and 2). Soil aggregate stability and soil organic carbon was greater in soil collected from rhizosphere of C. drummondii compared to native grass, possibly due, at least in part, to the greater AM fungal abundance (Figures 3 and 4). Our lab’s previous work has shown a strong correlation between AM fungi and soil aggregate stability, as well as soil organic carbon. While these results may indicate C. drummondii has a positive effect on grassland soils, the loss of important ecosystem services must also be taken into account.

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