

# Identifying Remnant Grasslands and Woodlands



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Southeastern Grasslands Institute





Craig Fraiser

**Remnant Prairie – Flanagan Prairie Natural Area, Franklin County, Arkansas**

***Healthy remnant grasslands are disproportionately  
biologically diverse!***



Theo Witsell

**Dry-Mesic Tallgrass Prairie – Franklin County, Arkansas**

Switchgrass (*Panicum virgatum*)



Indian Grass (*Sorghastrum nutans*)



Big Bluestem (*Andropogon gerardii*)



Little Bluestem (*Schizachyrium scoparium*)



Prairie Gayfeather  
(*Liatriis pycnostachya*)



Indian Paintbrush  
(*Castilleja coccinea*)



Sensitive Brier (*Mimosa quadrivalvis nuttallii*)



Pale Purple Coneflower  
(*Echinacea pallida*)



Butterfly Milkweed  
(*Asclepias tuberosa*)



Compass Plant  
(*Silphium laciniatum*)



Photos by John Pelton



Arkansas Beard-tongue  
(*Penstemon arkansanus*)



Large Coneflower (*Rudbeckia grandiflora*)

Warren Montague



Meadow Beauty  
(*Rhexia mariana*)



Narrow-leaf Sunflower  
(*Helianthus angustifolius*)



Cream False Indigo  
(*Baptisia bracteata*)



Green Milkweed  
(*Asclepias viridis*)

Photos by John Pelton

***“MOST NATIVE GRASSLANDS ARE NOT REALLY EARLY SUCCESSIONAL COMMUNITIES, BUT ARE STABLE, MATURE COMMUNITIES WITH A LATE SUCCESSIONAL GROUND LAYER MAINTAINED BY PERIODIC ABOVE GROUND DISTURBANCE WITHIN A CERTAIN RANGE OF VARIATION”***



Jennifer Akin/ANHC

**Mesic Tallgrass Prairie – Franklin County, Arkansas**



***“The... vegetation is the outcome of thousands of years of sorting and modification of species and adaptations to soil and climate. Prairie is much more than land covered by grass. It is a slowly evolved, highly complex, organic entity, centuries old. Once destroyed, it can never be replaced by man.”***

***- J. E. Weaver***

**Wes Knapp**

*Healthy remnant grasslands are unique!*



Jennifer Akin/ANHC

**Seepage Prairie – Franklin County, Arkansas**



Jennifer Akin/ANHC

**Seepage Prairie – Franklin County, Arkansas**

***Healthy remnant grasslands are more than just grass!***



Bill Holimon/ANHC

**Chert Prairie – Boone County, Arkansas**



Charles Mills

**Blackland Prairie – Hempstead County, Arkansas**



Photo by Jennifer Akin/ANHC

**Dry-Mesic Upland Prairie – Franklin County, Arkansas**



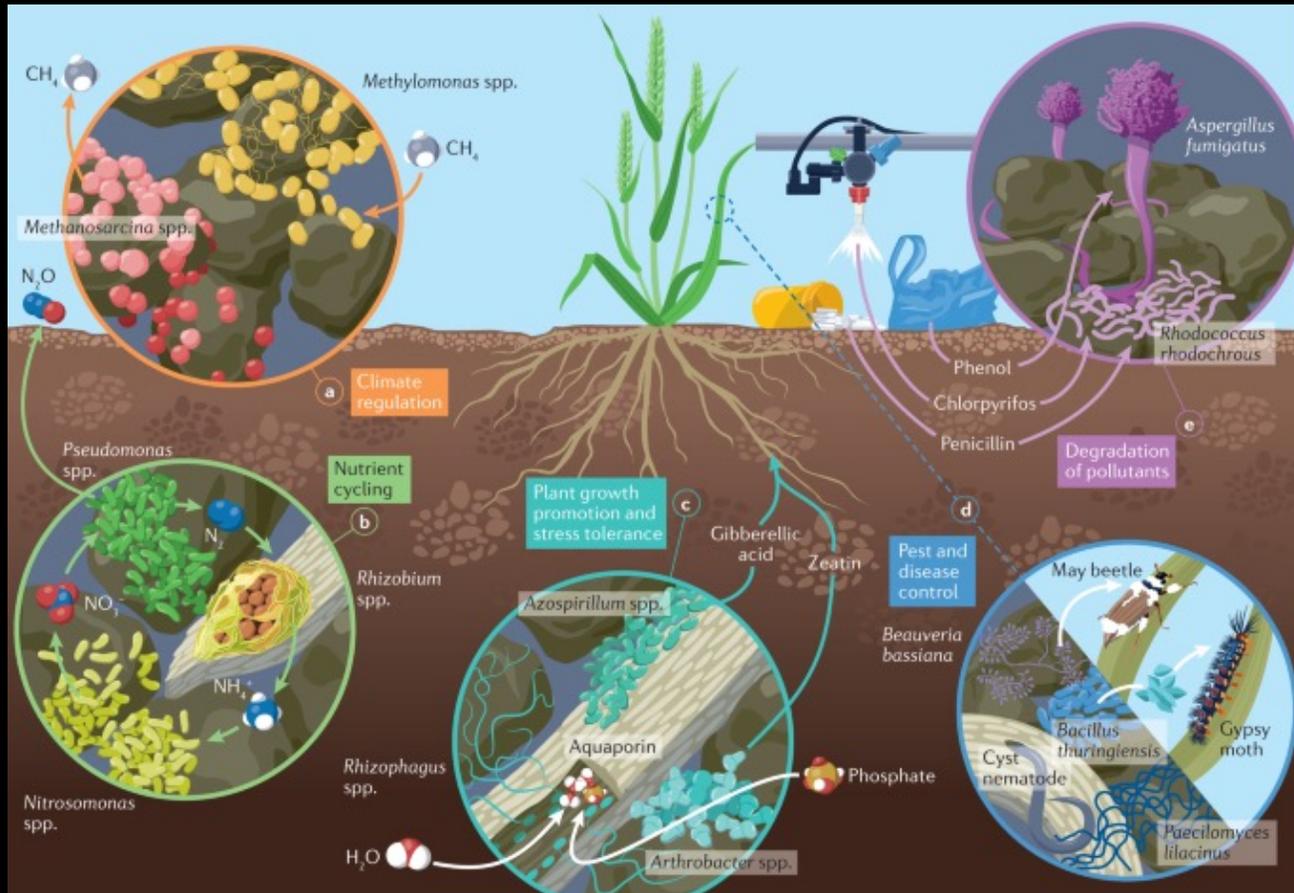
Photo by Bill Hollimon/ANHC

**Dry-Mesic Chert Prairie – Boone County, Arkansas**

***Healthy remnant grasslands are more than just plants!***



Joe Neal



Hartmann, M., Six, J. Soil structure and microbiome functions in agroecosystems. *Nat Rev Earth Environ* 4, 4–18 (2023). <https://doi.org/10.1038/s43017-022-00366-w>

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Hartnett, D. & G. Wilson. 1999. Mycorrhizae influence plant community structure & diversity in tallgrass prairie. *Ecology* 80(4): 1187-1195.

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## Nodulation of Common and Endangered Legumes by Symbiotic Nitrogen-Fixing Bacteria Present in Native Illinois Prairie Soils

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### Introduction

The legume-Rhizobium symbiosis is one of the most interesting and important plant-bacteria interactions in nature (1). Legumes are a diverse group that includes such economically important crop plants as soybeans and alfalfa and such native prairie plants as lead plant and prairie clover (2). Bacterial species in the genera *Rhizobium* or *Beijerinckia* (collectively referred to as rhizobia) are normal components of most soils and can infect the roots of leguminous plants. Infection of a given legume is highly specific, requiring a specific rhizobial species, and leads to the formation of root nodules that are capable of nitrogen fixation. In nodules, bacterial symbionts provide the plant with reduced nitrogen in the form ammonium while receiving carbon and energy from the host plant (3). Thus, symbiotic nitrogen fixation by nodulated leguminous plants is a metabolic process that is vital to both agricultural and native terrestrial ecosystems. However, to date, most research has centered on the legume-Rhizobium symbiosis in crop plants and its overall influence on crop yields.

Little, if any, information is available on the types of rhizobia that nodulate prairie legumes or the potential impact that these symbiotic nitrogen-fixing bacteria may have on the growth, reproduction, and competitiveness of common and endangered legumes in their native habitats. Research proposed in this project is aimed at studying the metabolic potentials and host-specificity of rhizobia isolated from the nodules of common and endangered leguminous prairie plants in Illinois.

*Astragalus craticarpus*, an endangered plant species in Illinois, occurs in dry rocky prairies, glades, gravel prairies, open woods, and bluffs. This species was thought to be extirpated from Illinois until it was discovered in 1987 along a limestone bluff in

### Materials and Methods

**Field Sites, Bait Soil Collection, and Sources of Leguminous Seeds.** The main prairie field site for the collection of plants, soil, and seeds was located at Beaver Dam State Park. Soil was also collected from two other prairie sites within Illinois: Green River Conservation Area and Lona Prairie. Soil samples were collected, transferred to a plastic container, sealed, transported to the laboratory, and were stored at 4°C in the dark until subjected to analysis. Seeds of *Astragalus craticarpus* were collected from Beaver Dam State Park. Seeds of *Aescholophorus canadensis*, *Lepodolobos virginica*, and *Psoralea canadensis* were purchased from Prairie Moon Nursery (Wisconsin, MN).

**Seed Preparation and Germination.** Seed surfaces were sterilized then rinsed three times in sterile water, then scarified by nicking them with a sterile scalpel. Pots were sterilized in a bleach solution, allowed to dry, then filled 3/4 full with potting soil. Three seeds for a given plant species were added to a pot; 5 pots were used per plant species per bait soil type. Pots were watered with deionized water every other day, and N-containing 1/4 strength Hoagland's Nutrient Solution was added once a week. Four weeks after germination, pots were watered with N-free Hoagland's Nutrient Solution and was used once per week for two weeks or until the bait soil was applied.

**Bait Soil Studies.** A slurry of each prairie soil was made by mixing 10 g of soil in deionized water and applied to each pot at the rate of 5% of the volume of the pot. Plants were watered daily, and, once per week for four weeks, received the N-free Hoagland's Nutrient Solution. After four weeks, plants were removed from potting soil. Root systems were examined for the presence of nodules as well as the extent of root nodulation.

Table 1. Nodulation of Endangered (*Astragalus craticarpus*) and Common (*Aescholophorus canadensis*, *Lepodolobos virginica*, and *Psoralea canadensis*) Prairie Legumes with Soil from Different Prairies

Prairie Legume (Type: Year/Endemic)	Prairie Soil (Year/Soil)	Number of Pots Containing Nodulated Plants (total number of pots examined)	Number of Nodulated Plants (total number of plants examined)	Average Number of Nodules Per Nodulated Plant
<i>Astragalus craticarpus</i>	Control	0 (0)	0 (0)	NA <sup>a</sup>
	Beaver Dam	0 (0)	0 (1)	0
	Lona	0 (0)	0 (0)	NA
	Green River	0 (0)	0 (0)	NA
<i>Aescholophorus canadensis</i>	Control	0 (0)	0 (0)	NA
	Beaver Dam	0 (0)	0 (0)	NA
	Lona	0 (0)	0 (0)	NA
	Green River	0	0	0
<i>Lepodolobos virginica</i>	Control	-	-	-
	Beaver Dam	-	-	-
	Lona	0 (0)	0 (0)	0 (0)
	Green River	-	-	-
<i>Psoralea canadensis</i>	Control	0 (0)	0 (0)	NA
	Beaver Dam	1 (0)	1 (0)	1
	Lona	0 (0)	0 (0)	NA
	Green River	1 (0)	1 (0)	NA

<sup>a</sup> NA, not applicable. None of the plants were nodulated.

<sup>b</sup> No data was obtained because of high plant mortality. In these experiments, seeds germinated but none of them plants survived the duration of the experiment because of high temperatures which often occurred in the greenhouse during the spring.

# Glades and Barrens



Photo: Theo Witsell

**Limestone Glade and Woodland – Ozark Highlands Ecoregion**

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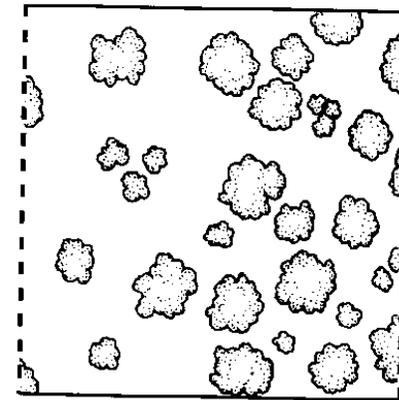
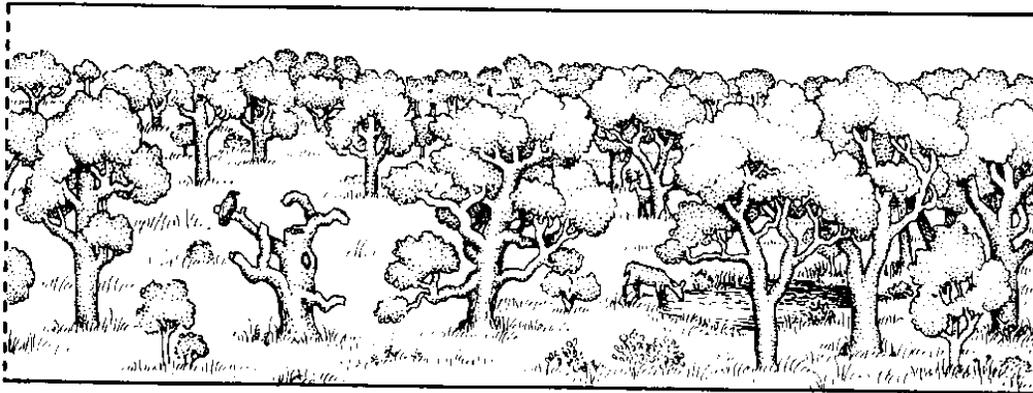


**“Bald Knobs” - Dolomite Glades and Barrens, White River Hills (Baxter County, Arkansas)**



**Dolomite Glade, Barrens, and Woodland – Ripley County, Missouri**

# Woodlands



C. Woodland: An open forest with a vigorous turf of grasses and flowers throughout the growing seasons. Depends on frequent fire. Many trees have spreading lower limbs. Bright enough for oak or pine regeneration (i.e. less than 80% canopy cover).

Illustration by Paul Nelson, from *The Tallgrass Restoration Handbook*, Island Press



Photo: John Andre/USFS

**Post Oak Woodland (Ozark National Forest, Pope County)**

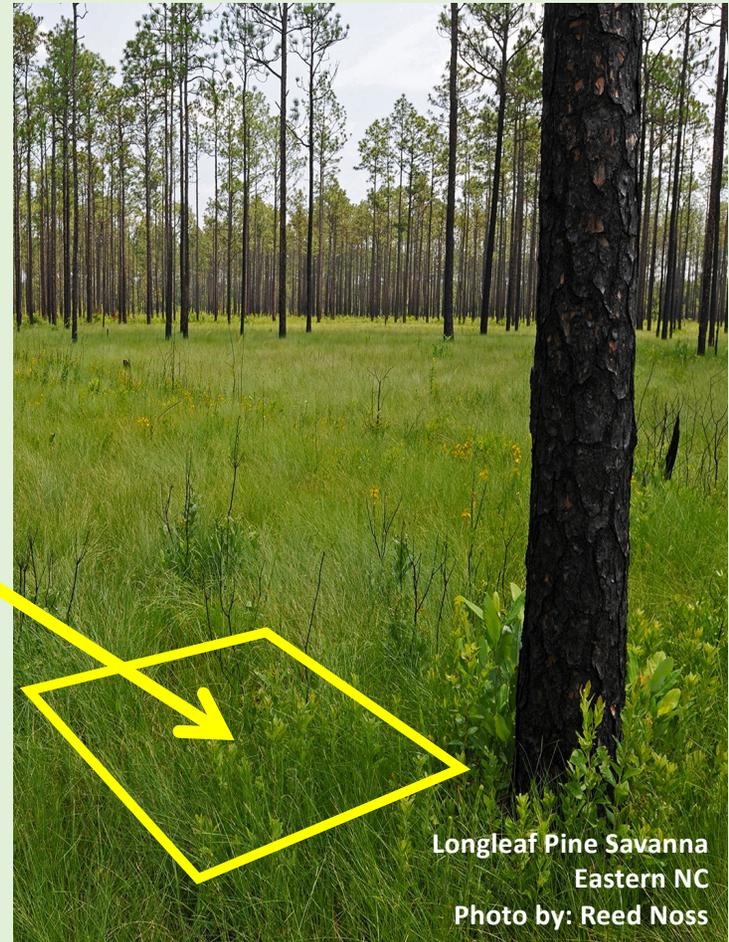




# The Herbaceous Layer Matters



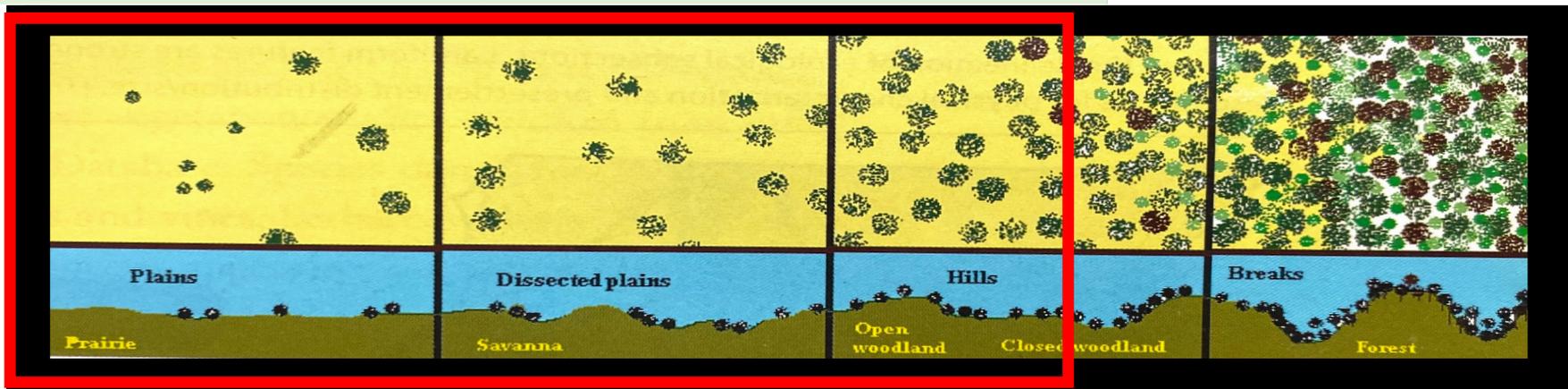
**52 species in 1 m<sup>2</sup>**



Longleaf Pine Savanna  
Eastern NC  
Photo by: Reed Noss

# Grassland Fidelity Index

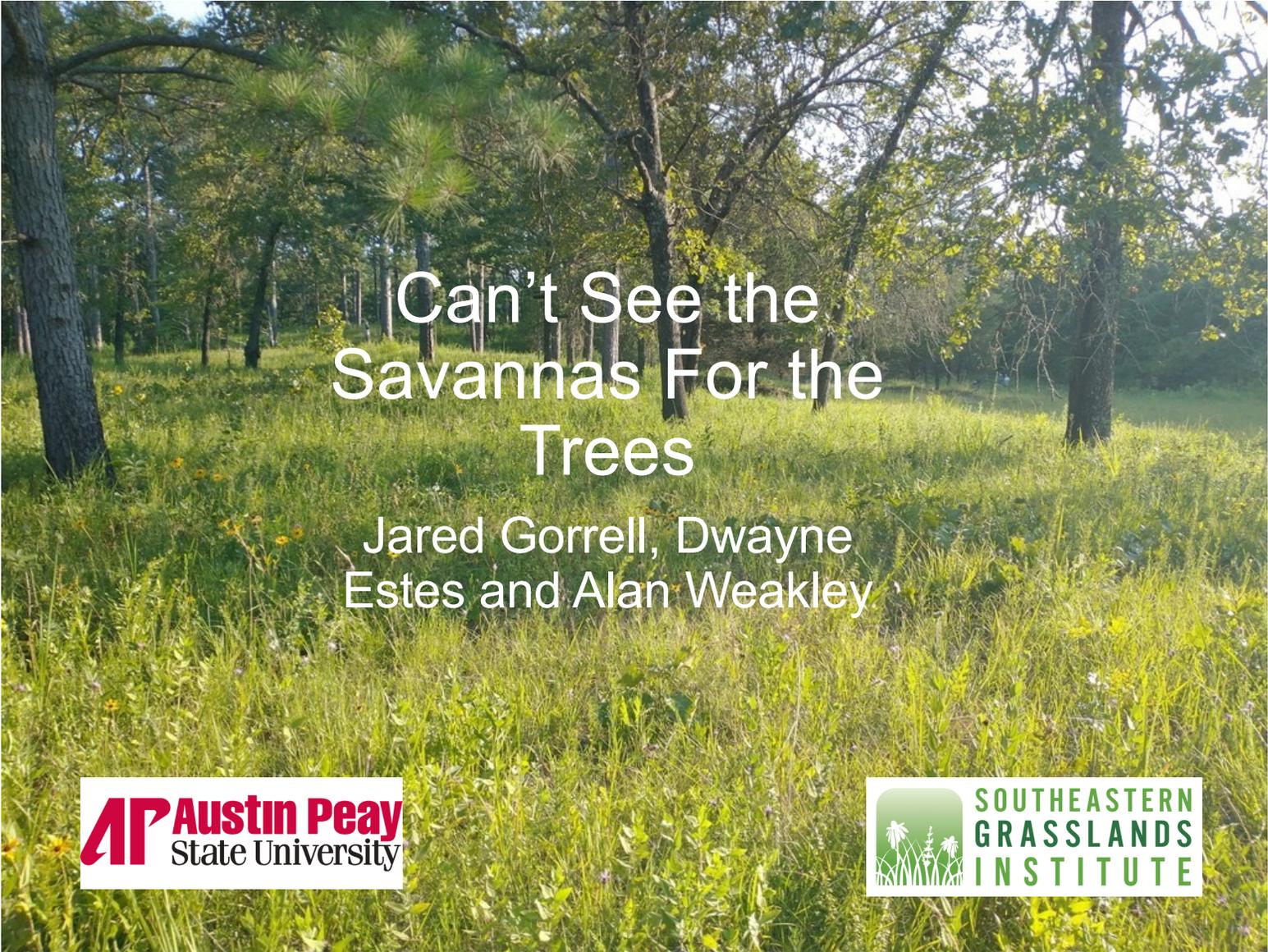
Conservatism + Heliophytism



Prairies

Savannas-Woodlands

Forests



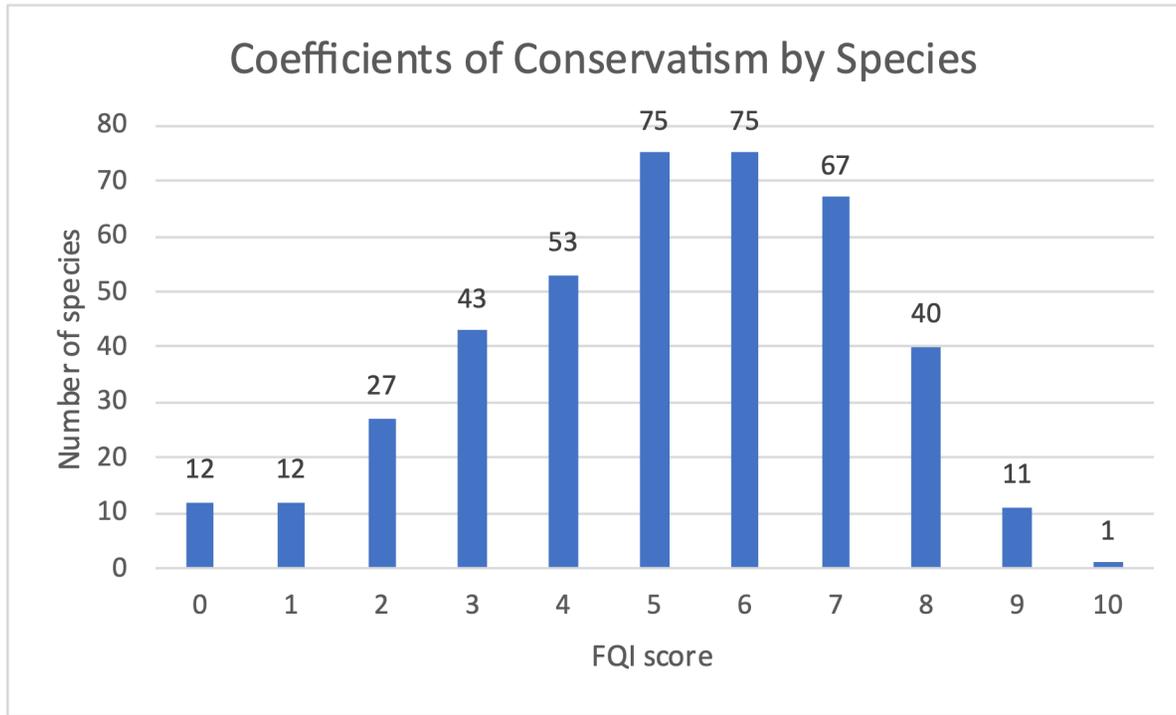
# Can't See the Savannas For the Trees

Jared Gorrell, Dwayne  
Estes and Alan Weakley

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 SOUTHEASTERN  
GRASSLANDS  
INSTITUTE

# CoC Results



# Heliophily Results

