

**Conservation Assessment  
for  
Cluster Fescue (*Festuca paradoxa*)**



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This Conservation Assessment was prepared to compile the published and unpublished information and serves as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject community, please contact the Eastern Region of the Forest Service - Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

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## **EXECUTIVE SUMMARY**

Barrens and glades occur at scattered sites on the Hoosier and Shawnee National Forests, and are found widely on the Mark Twain National Forest. Expressions of the barrens community on National Forest System lands are currently recognized on the Hoosier at a few sites within the Brown County Hills and the Crawford Escarpment, and at several sites in the Crawford Uplands. On the Shawnee, barrens are found as small remnants in the Cretaceous Hills, and the Greater Shawnee Hills, Lesser Shawnee Hills, and the Illinois Ozarks have more and somewhat larger communities. Barrens and glades are often large within most of the natural divisions found on the Mark Twain.

Barrens are characterized by species of canopy trees tolerant of xeric conditions having a stunted, open-grown appearance, the dominance of native warm-season grasses and prairie forbs, and, in glades, significant exposures of bedrock. The mix of plants and animals inhabiting these sites varies with the canopy openness, internal structure of the stands, slope, aspect, and other less tangible variables. The barrens is an ecosystem, not merely a hole in the forest filled with prairie plants.

The purpose of this assessment is to bring together the best available information about this community, provide a summary of the character and distribution of barrens across the three Forests, and provide similar information about six RFSS found in this habitat. An additional purpose is to provide the background information necessary to prepare a Conservation Strategy, including management actions to conserve species discussed in this assessment.

[\(Barrens and glades conservation assessment\)](#)

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## **NOMENCLATURE AND TAXONOMY**

*Festuca paradoxa* Desv. Opusc. 105. 1831. Fig. 149.

The only synonyms for this species are: *Festuca shortii* Kunth (P & S) and *Festuca nutans* Biehler.

One accepted common name is cluster fescue.

*Festuca paradoxa* is a member of the Poaceae, i.e., a grass. This family contains over 600 genera and over 10,000 species. Fescues are perennial grasses that typically have open panicles with 2 to 15 florets per spikelet and the rachilla (floret axis) disarticulating above the glumes (Gleason and Cronquist 1991). *Festuca paradoxa* is often confused with *Festuca subverticillata*, a.k.a. *F. obtusa*.

## **DESCRIPTION OF SPECIES**

*Festuca paradoxa* is a tufted perennial, without rhizomes. Culms are 50 to 120cm long, glabrous, and green at the base. Leaf blades are 10 to 40cm long, and 3 to 10mm wide, commonly roughened on the upper surface. Panicles are 5 to 20cm long, with the branches sometimes drooping during spikelet development but loosely ascending at maturity. Spikelets typically have 3 to 6 florets per spikelet, sharp-pointed glumes, the outermost one keeled, and small, reddish brown fruits. Awns are absent. It typically flowers from May through July (Yatskievych 1999, Mohlenbrock 2002, Rydberg 1971, Radford et al. 1968, Mohlenbrock and Voigt 1959, McGregor and Barkley 1986, Fernald 1950). For a complete description of the species, see Appendix IV.

*Festuca paradoxa* is often confused with *Festuca subverticillata*. Aiken and Leftovitch (1993) investigated the morphological characteristics used to identify these species and determined that a number of characteristics that traditionally have been used are inconsistent and unreliable for proper identification. These characteristics include the inflorescence branch length and angle, spikelet width and shape at maturity, the number of

florets per spikelet, and anther length (Aiken and Lefkovitch 1993). Instead, they have delineated the species based on the following characteristics:

*F. paradoxa*: “Inflorescence branches not reflexed at maturity; spikelets clustered, consistently overlapping each other by 1/3 to 1/2 their length on the lower inflorescence branches; spikelets clavate in bud; upper glume almost as long as or longer than the first lemma” (Aiken and Lefkovitch 1993).

*F. subverticillata*: “Inflorescence branches reflexed at maturity; spikelets often widely separated on the lower inflorescence branches, sometimes overlapping slightly towards the ends of the branches; spikelets lanceolate in bud; upper glume usually shorter than the first lemma” (Aiken and Lefkovitch 1993).

Other characteristics including glume length, lemma length, and lemma apex, among others, overlap and should also be avoided (Aiken and Leftovitch 1993).

## **HABITAT**

*Festuca paradoxa* may occupy a range of habitats that extend from wet meadows (Steyermark 1963) and wet prairies (Rydberg 1971, Small 1933, Yatskievych 1999, Gates 1936) to dry, rocky slopes, margins of glades, and ledges of bluffs (Yatskievych 1999, Steyermark 1963). Most commonly, the habitat is described as prairies and a variety of open woods (Yatskievych 1999, McGregor and Barkley 1986, Steyermark 1963, Hitchcock 1971, Gleason and Cronquist 1991, Gleason 1963, Rydberg 1971). Occasionally, there are references to “rich woods” (Mohlenbrock and Voigt 1959, Radford et al. 1968) and low, open woodlands (Deam 1940). In Missouri, the species is found in a variety of grass-dominated communities including pastures (Yatskievych 2001). Ladd (2000) indicated that in Missouri the species often is found in mesic microsites within a dry or dry-mesic habitat. This is in contrast to Mohlenbrock (1986, 2002) who indicates that in Illinois the species is more plentiful in drier sites than in more mesic conditions.

In Missouri, the species has been reported on both limestone and siliceous substrates (Ladd 2000).

## **LIFE HISTORY**

Rabinowitz has conducted extensive research on *F. paradoxa* including both field and greenhouse experiments. The fieldwork was conducted on an undisturbed prairie, Tucker Prairie, in Calloway County, Missouri. In much of her work she contrasted four “sparse” grass species, one of which was *Festuca paradoxa*, with the “common” species of *Schizachyrium scoparium*, *Andropogon gerardii*, *Sorghastrum nutans*, and *Sporobolus heterolepis*. The terminology of sparse and common used below is in reference to these species.

In contrast to many of the native grasses found on midwestern prairies, *F. paradoxa* is a cool-season species (Navarrete-Tindall et al. in press). When grown in greenhouse conditions, intraspecific competition decreased the biomass of seedlings in dense plantings

in comparison to isolated individuals (Rabinowitz 1979, Turner and Rabinowitz 1983). Although fertilized seedlings had greater biomass than unfertilized seedlings, crowding had a greater impact on seedling biomass than nutrient levels (Turner and Rabinowitz 1983).

Also, it appears that in greenhouse experiments sparse species, including *F. paradoxa*, are better competitors than common species (Rabinowitz et al. 1984). When grown in competition with common species, seedlings of sparse species outproduced the common species. The sparse species grew best under conditions that mimicked natural conditions, i.e. in low concentration and in mixture with common species; however, the common species grew better without sparse species (Rabinowitz et al. 1984). These results may be due in part to earlier germination of the sparse species, which gave them an approximate 5-day advantage, and the rapid growth rate of sparse species that occurred before the  $C_4$  grasses reached maximum growth (Rabinowitz et al. 1984).

Flowering culms of the sparse species are more widely separated than common species and the low density of the sparse species results in less air-borne pollen (Rabinowitz et al. 1979). Although the sparse species are within the range that wind-dispersed grass pollen may travel, Rabinowitz et al. (1979) suggested that the sparse species may not receive sufficient pollen to ensure complete fertilization.

At Tucker Prairie, reproduction of grasses and forbs was monitored for four years to determine if rare or common species were more likely to colonize and survive (Rabinowitz and Rapp 1985). *Festuca paradoxa* was by far the most common seedling sampled. Although the species only comprised 2.1 percent of the aboveground biomass, it accounted for 43 percent of the seedlings sampled (Rabinowitz and Rapp 1985). In contrast, only 10 vegetative shoots (0.57 percent) emerged with only one surviving four years. Although there was a high germination of seeds, the *F. paradoxa* seedlings were rather ephemeral, surviving an average of 125 days in comparison to *Andropogon gerardii*, which survived an average of 249 days (Rabinowitz and Rapp 1985).

In another study, Rabinowitz, et al. (1989), determined that sparse species were more consistent in reproduction from year to year than the common species, which varied between high seed production to no seed production. The difference in reproduction for the two groups appeared to be related to moisture, which is more consistent in spring when the sparse species are growing and flowering than in late summer when the common species reproduce (Rabinowitz et al. 1989). *Festuca paradoxa* seeds may either germinate in fall of the year they are produced and overwinter as seedlings or they may germinate in spring (Rabinowitz and Rapp 1981).

Many grasses are infested with fungi, which are presumed to form a mutualistic relationship with the grass (Spyreas et al. 2001). In southern Illinois, 100 percent of the *F. paradoxa* plants sampled were infested with an asexual endophytic fungus (Spyreas et al. 2001). It is thought that the fungus benefits the plant by decreasing grazing, insect herbivory, and nematode predation; increasing the plants' resistance to microbial and fungal pathogens; making the plant allelopathic; increasing resistance to both heat and drought; and increasing overall plant vigor (Spyreas et al. 2001).

## **DISTRIBUTION AND ABUNDANCE**

*Festuca paradoxa* is found throughout much of the eastern U.S., from Minnesota to Pennsylvania and south to Texas and Georgia (Figure 46).

There are six known extant populations and one known extirpated site in Indiana (Figure 47). In Illinois, *Festuca paradoxa* is found in approximately 20 counties in southern and central Illinois (Figure 48). The species has been described as occasional in the southern ¾ of the state (Mohlenbrock 2002). Although *F. paradoxa* has been extirpated from a number of locations in Missouri, it remains in approximately 40 counties (Figure 49). The majority of the sites are in the unglaciated portion of the state, which is probably a result of the northern portion being heavily impacted by agricultural practices (Ladd 2000). Rabinowitz et al. (1989) describes the species as “sparse” because although its abundance is somewhat variable it is never a dominant component of the vegetation. In Missouri, it has been assigned a coefficient of conservatism of 6 indicating that is not highly indicative of presettlement conditions (Ladd 2000).

## **PROTECTION STATUS**

Globally the species is ranked as G5, but it does not have a U.S. Heritage Status Rank (NatureServe 2001, Indiana Department of Natural Resources 2002). The species is critically imperiled in Indiana, Pennsylvania, and Tennessee (NatureServe 2001).

Ranking by individual states is: Alabama (SR), Arkansas (SR), Delaware (SR), Georgia (SR), Illinois (S3S4), Indiana (S1), Iowa (S3), Kansas (SR), Kentucky (SR), Louisiana (SR), Maryland (SH), Minnesota (SU), Mississippi (SR), Missouri (SR), Nebraska (SH), North Carolina (S4), Oklahoma (SR), Pennsylvania (S1), South Carolina (SR), Tennessee (S1), Texas (SR), Virginia (SR), and Wisconsin (SH).

In Indiana, *F. paradoxa* is state endangered (Indiana Department of Natural Resources 2002). The species is not state listed in Illinois or in Missouri.

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