

**Tennessee yellow-eyed grass**  
**(*Xyris tennesseensis* Kral)**

**5-Year Review:**  
**Summary and Evaluation**



**Tennessee yellow eyed grass**  
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**Southeast Region**  
**Alabama Ecological Services Field Office**  
**Daphne, Alabama**

**5-YEAR REVIEW**  
**Tennessee yellow-eyed grass / *Xyris tennesseensis***

**I. GENERAL INFORMATION**

**A. Methodology used to complete the review:** In conducting this 5-year review, we relied on available information pertaining to historic and current distributions, life histories, and habitats of this species. We announced initiation of this review and requested information in a published *Federal Register* notice (74 FR 31972). We conducted an internet search, reviewed all information in our files, and solicited information from all knowledgeable individuals including those associated with academia and state conservation programs. Our sources include the final rule listing these species under the Act; the Recovery Plan; peer reviewed scientific publications; unpublished field observations by US Forest Service, Service, State and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists or experts. Comments received and suggestions from peer reviewers were evaluated and incorporated as appropriate (see Appendix A). We did not receive any public comments.

**B. Reviewers**

**Lead Region** – Southeast Region: Kelly Bibb, 404-679-7132

**Lead Field Office** – Alabama Ecological Services Field Office: Shannon Holbrook, 251-441-5871

**Cooperating Field Office** – Tennessee Ecological Services Field Office: Geoff Call, 931-528-6481 (x.213); Georgia Ecological Services Field Office: Jimmy Rickard, 706-613-9493

**C. Background**

- 1. Federal Register Notice citation announcing initiation of this review:** July 6, 2009 (74 FR 31972).
- 2. Species status:** Stable. A preliminary survey of all known sites in late 2008 indicated reduced numbers of plants at all sites, compared to numbers seen in the late 1990s, related to drought stress and drying of the plants preferred habitat. A more thorough survey completed in 2010 after two years of adequate rainfall indicates plants are still extant in original locations and in former abundances.
- 3. Recovery achieved:** 1= 0-25% recovery objectives achieved

**4. Listing history**

Original Listing

FR notice: 56 FR 34151

Date listed: July 26, 1991

Entity listed: Species

Classification: Endangered

**5. Review History:**

Recovery Data Call: 2013, 2012, 2011, 2010, 2009, 2008, 2007, 2006, 2005, 2004, 2003, 2002, 2001, 2000, 1999 and 1998

Recovery Plan: 1994

**6. Species' Recovery Priority Number at start of review (48 FR 43098): 8.** The "8" indicates a moderate degree of threat and high recovery potential.

**7. Recovery Plan:**

Name of plan: Tennessee Yellow-Eyed Grass Recovery Plan

Date: June 24, 1994

**II. REVIEW ANALYSIS**

**A. Application of the 1996 Distinct Population Segment (DPS) policy:**

The Endangered Species Act (ESA or Act) defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listing DPS to only vertebrate species of fish and wildlife. Because the species under review is a plant, the DPS policy is not applicable.

**B. Recovery Criteria:**

**1. Does the species have a final, approved recovery plan containing objective and measurable criteria? Yes**

**2. Adequacy of recovery criteria.**

**a. Do the recovery criteria reflect the best available (i.e., most up-to-date) information on the biology of the species and its habitat? Yes.**

Though the recovery criteria are not specific as to number of individuals/population, the recovery criteria of 15 viable, protected populations reflects the best available data.

**b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and there is no new information to**

**consider regarding existing or new threats)?** The recovery criteria address the 5 listing factors by assessing population persistence over time.

**3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information.**

This species will be considered for delisting when there are 15 adequately protected and managed, self-sustaining populations of the species distributed throughout the historical range and maintained for 10 years. A population will be considered adequately protected when it is legally protected and actively managed. A population will be considered “self-sustaining” if monitoring data support the conclusion that it is reproducing successfully and maintaining stable numbers or increasing. The minimum number of individuals necessary for a self-sustaining population should be determined by demographic studies implemented through the recovery plan.

**Status:** Criteria have not been met. Currently the species is known from 23 sites with only 4 of these sites occurring on federally owned land. These 4 sites are protected and managed under the Fort McClellan INRMP but the remaining sites are in private ownership not subject to take provisions of the ESA. Status surveys conducted in 1998-1999 listed 17 sites with plants (Moffett 2008). A resurvey of several of these sites in the summer and fall of 2008 revealed a decline in populations following several years of drought (Boyd and Moffett 2010). A population survey conducted in the summer and fall of 2009 by Auburn University concluded that the known population size has been relatively stable during the past decade. The 2009 study (Boyd and Moffett 2010) found known occurrences from 23 sites, an increase from the 17 known sites from 1998-1999 surveys. This most recent published study of the species indicates that the seedlings appear to need relatively well-lit moist soil to become established and grow to maturity. Further, this species tends to be disturbance dependent and needs active management to maintain populations for long-term survival. Although currently there are more than the 15 required populations and generally the population has been relatively stable during the past decade (Boyd and Moffett 2010), the majority of these are not adequately protected and managed.

Fort McClellan, under their 2007 Integrated Natural Resource Management Plan (INRMP), has a number of protection measures in place to protect this species and other rare species. The Alabama Army National Guard (ALARNG) has coordinated with the USFWS to determine the most appropriate course of action in the management of populations of Tennessee yellow-eyed grass located on the Fort McClellan Army National Guard Training Center (FM-ARNGTC). In the June 2007

INRMP, management actions for the species are outlined that include monthly and annual monitoring of the sites and maintenance activities to control competing vegetation based on recommendations by USFWS.

Annual monitoring of TYG will be conducted between the 1st and 15th of August for consistent comparisons among years. Field surveys will involve a plant inventory and a qualitative assessment of habitat. The habitat assessment identifies impacts that may benefit or adversely affect the populations. The populations will also be visited on a monthly basis throughout the year to monitor potential changes in the general area. The ALARNG continues to coordinate with the USFWS to determine the best management and monitoring techniques for these populations.

Surveys were conducted in 1998, 1999, and 2000 in Tennessee by Division of Natural Areas (DNA) with the help of section 6 funding from the US Fish and Wildlife Service under the ESA. These surveys located 11 new occurrences within the seep communities and along stream banks. DNA again conducted a survey in Tennessee in 2008 and located two new occurrences in Tennessee.

## **C. Updated Information and Current Species Status**

### **1. Biology and Habitat**

*Xyris tennesseensis* is a rare perennial monocot that is an obligate wetland plant that prefers relatively high pH seeps and streambanks. The plant ranges from 7-10 decimeter (2.3 to 3.3 ft) in height. Plants typically occur in clumps where they arise from fleshy bulbous bases. Leaves are basal, the outermost scale-like, the larger one linear, twisted, deep green and 14 to 45 centimeters (5.5 to 17.7 in) long. The inflorescence consists of brown conelike spikes, 1 to 1.5 cm (0.4 to 0.6 in) in length, which occur singly at the tips of long slender stalks from 30 to 70 (12 to 28 in) long. The flowers, which are pale yellow in color and 4.5 millimeters (0.2 in) long, unfold in the late morning and wither by mid-afternoon. Fruits are thin walled capsules containing numerous seeds 0.5 to 0.6 mm (0.02 in) in length. Flowering occurs from August through September.

*Xyris tennesseensis* is an obligate wetland plant that is restricted to calcareous seeps, fens, and spring runs in Alabama, Georgia, and Tennessee. *Xyris tennesseensis* is not only at risk as a wetland plant, but is also extremely rare due to its unusual habitat requirement among North American xyrids for circum-neutral pH soils overlying calcareous substrates. In addition, it has been shown to be a poor competitor and quickly succumbs to ecological succession without periodic disturbance.

Plant conservation efforts aimed at this species have included habitat and population surveys, as well as critical habitat management and restoration.

The known current and historic distribution of *Xyris tennesseensis* is restricted to the states of Alabama, Georgia, and Tennessee almost exclusively within the Interior Plateau and Ridge and Valley ecoregions. Tennessee yellow-eyed grass was known from only seven sites, five in Tennessee, one in Georgia and one in Alabama, at the time of listing in 1991 (USFWS 1991). However, surveys since its listing have resulted in the location of 16 additional populations. Currently, a total of 23 populations are known to be extant including three in Bibb County, four in Calhoun County, and one each in Shelby and Franklin Counties, Alabama; four in Bartow County, one in Floyd County, and one in Whitfield County, Georgia; and seven in Lewis County, Tennessee.

Status surveys conducted in 1998-1999 listed 17 sites with plants (Moffett 2008). A resurvey of several of these sites in the summer and fall of 2008 revealed a decline in populations following several years of drought (Boyd and Moffett 2010). A population survey conducted in the summer and fall of 2009 by Auburn University concluded that the known population size has been relatively stable during the past decade. The 2009 study (Boyd and Moffett 2010) found known occurrences from 23 sites, an increase from the 17 known sites from 1998-1999 surveys. This most recent published study of the species indicates that the seedlings appear to need relatively well-lit moist soil to become established and grow to maturity. Further, this species tends to be disturbance dependent and needs active management to maintain populations for long-term survival

A population survey conducted across the range in Alabama, Georgia and Tennessee in the summer and fall of 2009 by Auburn University found occurrences from 23 sites. Three additional sites were discovered in Georgia during the 2009 surveys.

Current research on *X. tennesseensis* indicates that flower production and (perhaps) seedling recruitment are most extensive in locations that are relatively sunny and lack an overstory of shrub or tree canopies. The species does best in relatively open moist sites. According to Moffett (2008), woody competition that shades out the species and herbaceous competition that shades and competes with the species can suppress *Xyris tennesseensis* growth and reproduction. The tiny seedlings appear to need relatively well-lit moist soil to become established and grow to maturity. Thus the species is likely disturbance dependent and needs active management to main sites in suitable conditions for long-term viability (Boyd and Moffett 2010). This management strategy reveals that conservation of the species requires a more hands-on management approach than some endangered plant species.

**2. Five Factor Analysis (threats, conservation measures and regulatory mechanisms)**

**a. Present or threatened destruction, modification or curtailment of its habitat or range:**

The research indicates that the species and its habitat rely on active management to keep sites open and well-lit to ensure the success of the future of the population. Most of the occurrences of *Xyris tennesseensis* are found on private land making active management difficult for the majority of the populations. Even on government land, active management may only be successful with the encouragement and assistance from USFWS.

Because this species depends on open well-lit sites for establishment, modification of habitat through natural succession or lack of disturbance is still considered a major threat to the success of *Xyris tennesseensis*. Due to the level of destruction and degradation of habitat associated with human population growth in the southeastern U.S., active conservation and management for this species are critical to its continued existence. In situ efforts focus on habitat protection, acquisition, and/or the restoration and management of critical habitat for rare taxa.

This species continues to be threatened by habitat destruction including stream impoundment, habitat conversion for agriculture and residential development, and poor management practices of the few wild populations (Johnson et al 2012).

**b. Overutilization for commercial, recreational, scientific, or educational purposes:**

At the time of listing, overutilization was not believed to be a threat. We have no new documentation of this threat occurring and continue to believe it is not a threat to this plant.

**c. Disease or predation:**

At the time of listing, disease or predation were not believed to be a threat. We have no new information concerning this factor and continue to believe it is not a threat to this plant.

**d. Inadequacy of existing regulatory mechanisms:**

There are no State laws in Alabama protecting the Tennessee yellow-eyed grass and its habitat. State protections are in place for the species in Tennessee and Georgia but do not provide for the protection against habitat destruction. Tennessee legislation prohibits taking of the plant without the permission of the landowner and regulates commercial sale and export. In Georgia, listed plants or those proposed for listing are protected by the Wildflower Preservation Act of 1973. This legislation prohibits taking of plants from public lands without a permit and regulates the sale and transport of plants within the State. Neither of these statutes provides protection against habitat destruction, which is the principal threat.

**e. Other natural or manmade factors affecting its continued existence:**

Current research indicates that *X. tennesseensis* continues to face the threat of extinction. The future of the remaining locations of the species is greatly dependent on their management.

Current research on *X. tennesseensis* indicates that flower production and (perhaps) seedling recruitment are most extensive in locations that are relatively sunny and lack an overstory of shrub or tree canopies. The species does best in relatively open well-lit moist sites. According to Moffett (2008), woody competition that shades out the species and herbaceous competition that shades and competes with the species can suppress *Xyris tennesseensis* growth and reproduction.

Research shows that *X. tennesseensis* is not tolerant of extensive shading and has declined in sites experiencing encroachment from trees and shrubs (Kral 1983). The tiny seedlings appear to need relatively well-lit moist soil to become established and grow to maturity. Thus the species is likely disturbance dependent and needs active management to main sites in suitable conditions for long-term viability (Boyd and Moffett 2010). This management strategy reveals that conservation of the species requires a more hands-on management approach than some endangered plant species.

Competition from woody plant encroachment including overcrowding and overshading are factors affecting the specialized habitat requirements of this species. Also, because this species relies on well-lit moist soils to become established, it is vulnerable to diversions of seep or ground water. A decline in number of three populations in Georgia and Alabama was attributed to alteration of disturbance regimes, competition with other plants at each site and recent devastating droughts (Boyd and Moffett 2010).



**D. Synthesis**

The existence of Tennessee yellow-eyed grass continues to be threatened because of its specialized habitat needs, small population size, and continued impacts to its habitat. The potential development of private land, changes in moisture, shade and overcrowding from woody plant encroachment and disturbance events, including severe drought, present continuing threats to the species.

Habitat destruction or modification is presently the largest threat to this species. Because the species relies on active management to keep sites open and well-lit, partnerships with private landowners and government agencies to implement active management and easements on their properties are vital to the continued existence of the Tennessee yellow-eyed grass.

Based on the preceding information in this review, we believe that the Tennessee yellow-eyed grass continues to meet the definition of an endangered species. This assessment is based on our limited knowledge of the species' life history, its limited distribution, and potential threats to its habitat.

Summaries of verified populations of *Xyris tennesseensis* in each State are found in Tables 1-3.

<b>Table 1. Extant Tennessee yellow-eyed grass populations known from Alabama.</b> (Boyd and Moffett 2010)				
<b>Site Name</b>	<b>County</b>	<b>Last Observed</b>	<b>Size and/or Vigor 1999/2010</b>	<b>Ownership</b>
Alligator Glades East	Bibb	2009	0/ 1,088 spikes	Private
Alligator Glades West	Bibb	1999	1,332 / 0 spikes	Private
Burning Ground Seep	Calhoun	2009	3,415 / 37 spikes	Federal – Anniston Army Depot
Ebenezer Swamp	Shelby	2009	0 / 11,366 spikes	Private
Little Schulz Creek	Bibb	2009	2,511 / 8,064 spikes	Private
Lloyd's Chapel Swale	Calhoun	2009	11,370 / 22 spikes	Federal – Pelham Range
Red Bay Highway	Franklin	2009	2,117 / 2822 spikes	Private
Wesley Chapel	Bibb	2009	0 / 263 spikes	Private
Willett Springs	Calhoun	2009	2,637 / 4,121 spikes	Federal – Pelham Range
The Sinks	Bibb	2009	38 / 263 spikes	Private
Firing Fan Creek	Calhoun	2009	1,173 / 72 spikes	Federal – Pelham Range

**Table 2. Extant Tennessee yellow-eyed grass populations known from Georgia.**  
(Boyd and Moffett 2010)

Site Name	County	Last Observed	Size and/or Vigor 1999/2010	Ownership
Clear Creek Spring	Bartow	2009	684 / 1,360 spikes	Private
Clear Creek Lake	Bartow	2009	0 spikes (had been mowed)	Private
Colbertson Spring	Floyd	2009 (discovered in 2009)	252 spikes	Private
Deep Springs	Whitfield	Access denied		Private
Interstate Hypericum Springs	Bartow	2009	1,230 / 771 spikes	Private
Mosteller Springs	Bartow	2009	20,878 / 9,793 spikes	Private
Mull Farm Pond	Floyd	1999	1,594 / 0 spikes	Private
Petit Creek/Wofford's Crossroads Swale	Bartow	1999	119 / 0 spikes	Private
Pine Log Springs	Bartow	2009	(no 1999 survey) /127 spikes	Private
Soggy Bottom Fen	Bartow	2003	3,000 (2003) / 0 spikes	Private
Whiskey Barrel Springs	Bartow	2009	5 spikes (new in 2009)	Private

**Table 3. Extant Tennessee yellow-eyed grass populations known from Tennessee.**  
(Boyd and Moffett 2010)

Site Name	County	Last Observed	Size and/or Vigor 1999/2010	Ownership
Auntney Hollow	Lewis	2009	733 / 361 spikes	Private (state holds conservation easement)
Dry Branch	Lewis	2009	1,459 spikes	State owned
Langford Branch	Lewis	2009	1,231 / 159 spikes	Private land trust (state holds conservation easement)
Little Grinders Creek	Lewis	2009	3,432 / 2,997 spikes	Private
Little Swan Creek	Lewis			
Sandy Mitchell Hollow	Lewis	2009	Access denied in 1999 / 52 spikes	Private
Twin Falls Hollow	Lewis	2009	8,741 / 14,184 spikes	Private

### III. RESULTS

#### A. Recommended Classification:

No change is needed. Recovery criteria have not been met. Management and protection of populations on private land should be a priority.

### IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Initiate periodic monitoring on sites with robust occurrences of the species.
2. Attempt to locate additional populations.
3. Work to obtain protection for sites on privately-owned lands.
4. Actively manage on occupied sites to include woody plant competition control at staggered intervals.
5. Explore well-guided safeguarding opportunities for the species on protected public lands.

### V. REFERENCES

- Boyd, R.S, and Moffett, J.M. 2010. Population Survey of the Federally Endangered Tennessee Yellow-Eyed Grass (*Xyris tennesseensis*). Auburn University, Alabama. 12pp.
- Division of Natural Areas. 2000. Survey for New Populations of Tennessee Yellow-eyed grass *Xyris tennesseensis*. Report submitted to USFWS, Section 6, Segment 14.
- Kral, R. 1978. A new species of *Xyris tennesseensis* (sect. *Xyris*) from Tennessee and northwestern Georgia. *Rhodora* 80 (823): 444-447.
- Moffett, J.M. Jr. 2008. *Xyris tennesseensis*: Status survey, habitat restoration/management concerns, and relation to a new xyrid, *Xyris spathifolia*. Ph.D. dissertation, Auburn University, 196 pp.
- Tennessee Department of Environment and Conservation Resource Management Division. 2009. 2008 Search for New Populations of *Xyris tennesseensis*, Kral, Tennessee yellow-eyed grass. Report submitted to USFWS, Section 6, E-4, Segment 22.
- U.S. Fish and Wildlife Service. 1994. Recovery Plan for the Tennessee yellow-eyed grass (*Xyris tennesseensis* Kral). Jackson, Mississippi. 24 pp.

**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of Tennessee yellow-eyed grass (*Xyris tennesseensis*)**

**Current Classification:** Endangered


**Recommendation resulting from the 5-Year Review:**

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

**Review Conducted By:** Shannon Holbrook, Alabama Ecological Services Field Office

**FIELD OFFICE APPROVAL:**

**Lead Field Supervisor, Fish and Wildlife Service**

Approve  Date 5/3/2013

**REGIONAL OFFICE APPROVAL:**

*for*  
**Lead Regional Director, Fish and Wildlife Service**

Approve  Date 3-12-14

**APPENDIX A**  
**Summary of peer review for the five-year review of**  
**Tennessee yellow-eyed grass (*Xyris tennesseensis*)**

**A. Peer Review Method:**

A draft copy of the five-year review was emailed to biologists at affected FWS field offices (Athens, GA and Cookeville, TN). In addition, the document was also sent to two independent peer reviewers including Mincy Moffett, botanist with the Georgia Department of Natural Resources/ Natural Heritage Inventory and Dr. Robert Boyd, botanist/ ecologist on staff at Auburn University, AL.

**B. Peer Review Charge:**

Reviewers were asked to review and provide comments on the underlying science and overall assessment of the data in the document. Reviewers were not asked to provide recommendations on the legal status of the species.

**C. Summary of Peer Review Comments/Report:**

We received comments from three of the reviewers which were mostly editorial in nature with a few specific comments. One reviewer from the GA Natural Heritage Program provided updated status survey information as well as conservation measures for the species. One reviewer from the Athens, GA FWS field office provided information on ongoing threats to one population in Georgia.

Comments were considered and incorporated into the final document as appropriate

**D. Response to Peer Review:**

The primary author was in agreement with all comments received from the peer reviewers and tried to address every comment as appropriate.