Alabama streak-sorus fern
Thelypteris burksiorum

5-Year Review:
Summary and Evaluation

USFS photo

U.S. Fish and Wildlife Service
Southeast Region
Alabama Ecological Services Field Office
Daphne, Alabama

5-YEAR REVIEW
Alabama Streak-sorus Fern
Thelypteris burksiorum J.E. Watkins and D.R. Farrar

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 on September 8, 2006 (71 FR 53127). 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include the final rule listing these species under the Act; the recovery plan; peer reviewed scientific publications; unpublished field observations by U.S. Forest Service, U.S. Fish and Wildlife Service, State and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists or experts. During the comment period, we did not receive any additional information about this fern other than responses to specific requests for information from biologists familiar with the species (see Appendix A).

B. Reviewers

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

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

Cooperating Field Office – Jackson, Mississippi Ecological Services Field Office: Cary Norquist, 601-321-1128

C. Background

1. **Federal Register Notice citation announcing initiation of this review:** September 8, 2006: 71 FR 53127

2. **Species status:** Stable (2013 Recovery Data Call) Surveys indicate the fern continues to be found in the same locations it was a decade ago.

3. **Recovery achieved:** 1 **(**1= 0-25% recovery objectives achieved)

4. Listing history
Original Listing
FR notice: 57 FR 30164
Date listed: July 8, 1992
Entity listed: subspecies
Classification: Threatened

5. Review History:
Recovery Plan: 1996
Recovery Data Call: 2013, 2012, 2011, 2010, 2009, 2008, 2007, 2006, 2005, 2004, 2003, 2002, 2001, 2000, 1999, and 1998

6. Species' Recovery Priority Number at start of review (48 FR 43098)*:* 9. Degree of threat is moderate; recovery potential is high.

7. Recovery Plan:
Name of plan: Alabama Streak-sorus Fern Recovery Plan
Date issued: October 25, 1996

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy:
The 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 DPSs to only vertebrate species of fish and wildlife. Because the species under review is a plant, the DPS policy is not applicable.

B. Recovery Plan and Criteria:

1. Does the species have a final, approved recovery plan containing objective, 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 3 viable, protected populations is appropriate.

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 are not linked to specific threats but 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.

Criteria: This species will be considered for delisting when the population on the Sipsey Fork, and at least two other populations in different drainages, are protected and determined to be viable. A protected population is one which is secure from any present or foreseeable threats and is being appropriately managed (if management is needed). A viable population is one which is stable or increasing in size as determined through long-term monitoring for at least a 10-year period.

Status: Currently, the Alabama streak-sorus fern is only known from one drainage, the Sipsey Fork. Status surveys in the 1990s by the Alabama Natural Heritage Program did not discover any additional populations of the fern in adjacent drainages, nor have additional populations been reported by other botanical surveys in the Bankhead National Forest or surrounding area. U.S. Forest Service biologists have revisited some of the original 17 locations as well as sites in between known sites but found no new occurrences. However, the Forest Service is currently engage through a Participating Agreement with ALNHP to conduct surveys for this and other rare species. During flattened musk turtle surveys associated with this agreement, one additional location (within the Sipsey Fork) was discovered in the Spring of 2013 with identification confirmed by Dan Spaulding. More species-specific and monitoring via the Participating Agreement for this species are planned for the next few years (Ryan Shurette, USFS, February 2014, pers. comm.). Survey information provided by Alabama Power Company by Dr. David Whetstone (2008) confirmed that 5 of the previously known sites were all still present.

We provide the main recovery tasks from the species' recovery plan here and discuss the progress on each task.

(1) Protect known occurrences.
Status: The U.S. Forest Service in Alabama, under their 2004 Revised Land and Resource Management Plan, has a number of protection measures in place to protect the fern and other rare species. This includes protection of riparian corridors (chapter 3:11), rare communities (chapter 3:9), and Wild and Scenic Rivers (chapter 3:2). In addition to the protections specified in the Forest Plan, no timber operations or other disturbances occur in or adjacent to the sites of known locations of the species. A recent Environmental Assessment that would allow the Bankhead National Forest to treat individual groves of hemlocks for the hemlock wooly adelgid included the benefits to the Alabama streak-sorus fern of maintaining the shaded habitat conditions and high humidity levels. Due to the location of the species in the canyons, the Forest Service is not doing active management besides protecting the existing populations from disturbance. There is no written management plan or specific population growth objectives other than

language within the Forest plan to that states the species will be protected and populations will be maintained and expanded.

Approximately, seventeen sites of the known *T. pilosa var. alabamensis* locations, four sites, and a portion of a fifth site containing the greatest number of plants, are located on privately owned inholdings within Bankhead National Forest that are not subject to U.S. Forest Service management. No specific coordination with private landowners has occurred to date; however, the Forest Service plans to initiate this in the near future.

(2) Search for new occurrences.
Status: The area was thoroughly searched from 1989 to 1993 and no occurrences outside of the Sipsey Fork were discovered. The U.S. Forest Service biologists have revisited some of the original 17 locations as well as sites in between known sites but found no new occurrences. The Forest Service is currently engage through a Participating Agreement with ALNHP to conduct surveys for this and other rare species. During flattened musk turtle surveys associated with this agreement, one additional location was discovered in the Spring of 2013 with identification confirmed by Dan Spaulding. More species-specific and monitoring via the Participating Agreement for this species are planned for the next few years (Ryan Shurette, USFS, February 2014, pers. comm.).

(3) Establish new occurrences, if found to be necessary.
Status: There has been no effort to date to determine the efficacy or necessity of establishing new populations. The Forest Service is interested in expanding the population into new suitable locations if needed.

(4) Develop management plan(s).
Status: The Forest Service's Revised Land and Resource Management Plan addresses management of rare species, riparian corridors, recreation, timber harvest, Wild and Scenic Rivers and other factors that may affect the fern; at this time there is not a specific management plan for *T. pilosa* var. *alabamensis.* Some evidence of recreational activity (i.e., campfires in rock shelters) have been observed in the vicinity of the fern locations but no direct evidence has been observed that would indicate significant negative impacts are occurring to the species. Informal public outreach and education aimed at preventing damage from both trampling and impacts from fires and smoke to other rare fern species on the Forest has occurred with the past few years through word of mouth and signage to recreation users and groups. Because illegal ATV use in the area is a potential threat, the District implemented an emergency temporary closure of a road near a known population after finding evidence of ATV/OHV use in the Sipsey River. An MOU has not been completed; however, the Forest Service is open to completing an MOU that includes conservation measures protective of the species (Ryan Shurette, USFS, February 2014, pers. comm.)

(5) Conduct long-term site and population monitoring.
Status: U.S. Forest Service biologists have revisited some of the original 17 locations as well as sites in between known sites but found no new occurrences. However, the Forest Service is currently engage through a Participating Agreement with ALNHP to conduct surveys for this and other rare species. During flattened musk turtle surveys associated with this agreement, one additional location was discovered in the Spring of 2013 with identification confirmed by Dan Spaulding. More species-specific and monitoring via the Participating Agreement for this species are planned for the next few years (Ryan Shurette, USFS, February 2014, pers. comm.). Survey information provided by Alabama Power Company (Dr. David Whetstone 2008) confirmed that 5 of the previously known sites within the operational boundaries of Lewis Smith reservoir were all still present.

C. Updated Information and Current Species Status

1. Biology and Habitat

In 1992, when the Alabama streak-sorus fern was listed, 17 distinct populations were known along a 4.25 mile segment of the Sipsey Fork, a tributary of the Black Warrior River, in the Bankhead National Forest, in Winston County, Alabama. The preferred habitat was on semi-shaded, moist ceilings of sandstone overhangs (rockhouses), and sandstone ledges and rockfaces. Plants can be found growing between 3 and 18 meters (10 to 60 feet) above the elevation of the river. The fern occurs on both private and federal lands upstream of Lewis Smith reservoir. The majority of the sites are located on Bankhead National Forest; however, at least four sites containing an estimated 750 to 850 individuals are on private property. A portion of a fifth site, which maybe the best population of the seventeen, is also located on private land (Gunn 1994). In 2013, one additional population was discovered during flattened musk turtle surveys with identification confirmed by Dan Spaulding (Ryan Shurette, USFS, February 14, 2014, pers. comm.).

The Alabama streak-sorus fern is a small evergreen fern that grows only on exposed rock surfaces and in crevices of Pottsville sandstone along a 4.25 mile reach of the Sipsey Fork in the Warrior River Basin. The type locale (location where the species was first described) was located approximately 5 miles downstream of the closest extant population, but was destroyed during construction of a bridge in 1960. The fern's historical range is thought to have extended from the current extant range of the species to at least the type locale and possibly father downstream. Although historical population data is not available, the USFWS has suggested that some populations of Alabama streaksorus fern may have been extirpated when Smith Lake was impounded (USFWS 1996).

All known Alabama occurrences of the Alabama streak-sorus fern are found on Pottsville sandstone, where plants grow in crevices and rough surfaces on the roofs and floors of sandstone rockhouses formed along these cliffs (Watkins and Farrar 2002). The plants typically occur on moist, shady sites such as ceilings of rockhouses, ledges beneath sandstone overhangs, and on exposed cliff faces (USFWS 1996). Locations vary in slope aspect and shade coverage, from completely shaded to partially sunny on exposed bluff faces. Sites are usually directly above or a short distance from the river, are shaded to partially sunny, and have substrates that are kept moist by water vapor from the river and up-slope runoff over the sandstone (USFWS 1996). No critical habitat has been designated for this species.

Alabama streak-sorus fern (*Thelypteris pilosa* var. *alabamensis*) is a relatively small fern of the Thelypteridaceae family. The rhizomes of this fern are short and slender, creeping, about 1.5 to 2.5 millimeters (0.1 in) in diameter, and covered with reddish-brown scales. Laminae are close-set on the rhizome, narrowly elliptic-lanceolate or ovate-lanceolate in shape, and once-oinnate, the lower pinnae separate, short-stalked, narrowly to broadly ovate, and entire or crenate. Pinnae become sessile narrowing to a pinnatifid apex, and shallowly lobed or serrate-dentate at the very tip. Blades typically are 1.3 to 3.3 cm (0.5 to 1.3 in) wide and 3.5 to 10 cm (1.4 to 4 in) long, though Crawford (1951) reports fronds up to 20 cm (8 in) in length.

Stipes are slender, erect to spreading or ascending, generally straw-colored, though darker and brownish toward the base. The upper surface of the blade tissue is yellow-green, dull, and the lower surface is slightly paler. Both surfaces of the laminae are covered with many scattered acicular hairs, especially on the axes and veins. Sori are elongate, linear, somewhat irregular and about 5 mm (0.2 in) long. The sporangia, also covered with acicular hairs, are rather loosely and medially arranged along the branch veins of the pinnae. Indusia are absent.

Little new research on the biology and habitat of the species has been conducted since the recovery plan was signed in 1996. Watkins and Farrar (2000) re-affirmed its genetic and morphological differences from other *T. pilosa* populations found in Mexico, and suggested elevating *T. pilosa* var. *alabamensis* to full species status, rather than continuing to classify it as a variety.

Data on ecology, spore morphology, gametophyte biology, and the gross frond morphology support the elevation of *T. pilosa* var. *alabamensis* to specific status under the proposed name of *T. burksiorum*. This species is characterized by its much smaller fronds and obtuse pinna apices, exhibiting spore morphology outside the range of variation of the Mexican varieties of T. pilosa, exhibiting strikingly different gameophytes and exhibiting a unique habitat selection (Watkins and Farrar 2005).

This species has been shown to produce dwarfed viable sporophytes, but also undergoes a highly unusual form of gametophytic proliferation, indicating that it has distinct gametophyte morphology (Watkins and Farrar 2002). The unique rockhouse habitat selection of this species has separated this species from the other T. pilosa populations and driven it away from its normal life cycle to a partial or complete reliance on the gametophyte generation (Watkins and Farrar 2005).

According to information in the Flora of the Southern and Mid-Atlantic States (Weakley 2012), Watkins & Farrar (2002, 2005) present evidence for its recognition as a species distinct from *Thelypteris pilosa* and discuss its likely evolution as an ancient relictual taxon. The appropriate combination for its recognition at the species level in *Stegnogramma* has not been made. Based on the research and scientific evidence, the species is currently recognized as *Thelypteris burksiorum.*

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

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

The Alabama streak-sorus fern is endemic to the Sipsey Fork of the Black Warrior River in Bankhead National Forest. Plants are located within crevices or fissures, or on rough surfaces of this sandstone, located on ceilings and/or the recessed walls, on ledges at the very back of these sandstone overhangs, or rockhouses that are found at the base of massive bluffs along the river. The type locality of this species, which was approximately 5 miles downstream of extant populations, was destroyed in 1960 during the construction of a bridge. Additionally, when the Lewis Smith Dam was completed several miles downstream, suitable habitat upstream and downstream of the type locality was flooded, potentially destroying plants (Gunn 1991). This species continues to be threatened by future road or dam construction projects, and rises in the downstream reservoir; however, long term changes in reservoir pool levels are not possible without significant structural modifications to Lewis Smith Dam.

The ferns microhabitat is maintained by surface moisture seepage over the sandstone where the fern grows, as well as by local high humidity (Kral 1983). Logging above the occupied sites could adversely affect the microhabitat needed by the species by removing the canopy cover and thereby reducing the shaded conditions and humidity levels. Additionally, the forest is currently faced with an infestation of hemlock wooly adelgid, an invasive insect that seriously damages hemlock ecosystems. Losing hemlock trees in the vicinity of the ferns locations could reduce shaded conditions and high humidity levels needed by the species.

The species also continues to be threatened by recreational use of the river corridor, loss of forest cover from fire, timbering on the slopes overlooking the river, or loss of hemlock trees leading to changes in shade, humidity, and moisture gradients in fern habitat, and development of private inholdings.

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 Alabama streak-sorus fern and its habitat. Otherwise, protection is afforded to this species on federal land under Section 7 of the ESA. Bankhead National Forest has a Forest Plan that contains standards and protective measures including the Canyon Corridor prescription that provides protection for the species. Bankhead National Forest management practices do not apply to the potential development of private inholdings within the Forest. ESA take provisions also do not apply to plants on private lands, where a significant portion of the fern population is found.

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

The greatest threat to the Alabama streak-sorus fern is its vulnerability due to its extremely restricted range and the relatively small number of plants comprising its population. Because the fern is located in a linear stretch of the Sipsey Fork, a single, natural or human-induced catastrophic disturbance could eliminate or seriously reduce the size of the existing populations. Natural threats, such as severe flooding or drought, or erosional collapse of sandstone overhangs, could dramatically reduce the number of plants throughout the range, or completely eliminate some sites.

Negative effects of flooding and drought have already been observed (Gunn 1991) and an impoundment has already permanently inundated over half of the known historic range (Short and Freeman 1978). Although the effects of climate change, including an increase, or decrease, in drought or flood frequency and duration, are unknown, any habitat- or climate-related altering events could seriously impact the species.

Incidental impact or acts of disturbance from recreational users of the rockhouses are also potential threats, including heat and smoke from campfires built under some of these natural shelters (Gunn 1991, Ryan Shurette, USFS, February 14, 2014, pers. comm.).

D. Synthesis

At the time of listing, this species was only known from 17 distinct sites along a single 4 mile reach of the Sipsey Fork within the Bankhead National Forest, in Winston County, Alabama. There has been one additional site documented and no loss of sites since the species was listed. Most of this reach is protected under Forest Service management, but some of the stream bank is in private ownership not subject to Forest Service management guidelines or take provisions of the ESA. Most of the sites are located in Bankhead National Forest; however, at least four sites and a portion of a fifth site, are located on private inholdings.

Although the Bankhead National Forest provides for standards and protective measures for the fern, this species could be threatened by a rise in impoundment level of the downstream reservoir, loss of forest cover from fire, timbering on the slopes overlooking the river, or loss of hemlock trees leading to changes in shade, humidity, and moisture gradients in fern habitat, development of private inholdings, and recreational use of the river corridor.

At this time, the Alabama streak-sorus fern continues to meet the definition of a threatened species under the Act since it is not in imminent danger of extinction. However, the species could become vulnerable to extinction due to its highly restricted range.

III. RESULTS

A. Recommended Classification:

No change is needed. Recovery criteria have not been met. Additional populations may need to be located to ensure their protection into perpetuity.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Initiate at least semi-annual long-term monitoring on sites located on the Sipsey Fork.
2. Attempt to locate additional populations in nearby drainages.
3. Work to obtain protection for sites on privately-owned lands.
4. Research life history parameters and propagation techniques.

5. Continue to work cooperatively with the Bankhead National Forest to evaluate potential impacts to the plant from recreational use and implement corrective measures;
6. Enter into an MOU to work toward the recovery of this plant through the development of conservation measures.

V. REFERENCES

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Watkins, Jr., James E., and Donald R. Farrar. 2005. Origin and Taxonomic Affinities of Thelypteris (Subgen. Stenogramma) burksiorum (Thelypteridaceae). Brittonia, Vol. 57, No. 2. Pp. 183-201.

U.S. FISH AND WILDLIFE SERVICE
5-year Review of Alabama streak sorus fern (*Thelypteris burksiorum)*

Current Classification: Threatened
Recommendation resulting from the 5-Year Review

____ **Downlist to Threatened**
____ **Uplist to Endangered**
____ **Delist**
__X__ **No change is needed**

Review Conducted By: Dan Everson and Shannon Holbrook, Alabama Ecological Services Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date 3/19/2014

REGIONAL OFFICE APPROVAL:

The Regional Director or the Assistant Regional Director, if authority has been delegated to the Assistant Regional Director, must sign all 5-year reviews.

for
Lead Regional Director, Fish and Wildlife Service

Approve _____ Date 3-31-14

The Lead Region must ensure that other regions within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. If a change in classification is recommended, written concurrence from other regions is required.

APPENDIX A: Peer Review
Summary of peer review for the 5-year review of
Alabama streak-sorus fern (*Thelypteris burksiorum*)

A. Peer Review Method:
A draft copy of the five-year review was emailed to biologists at the Jackson FWS field office. In addition, the document was also sent to four independent peer reviewers including Al Shotz, botanist with the Alabama Natural Heritage Program, Wayne Barger, Botanist/Curator of the Alabama Natural Heritage Section Herbarium (ALNHS) with the Alabama Department of Conservation and Natural Resources, and Ryan Shurette, botanist with the National Forests in Alabama, and Jim Godwin, biologist 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 peer reviewers which were mostly editorial in nature with a few specific comments. One reviewer from the National Forests in Alabama provided updated status survey information as well as conservation measures for the species. This reviewer also provided information on ongoing threats to the populations in Bankhead National Forest.

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 and concerns received from the peer reviewers and tried to address every comment as appropriate.