

Alabama Streak-sorus Fern Recovery Plan



U.S. Fish and Wildlife Service
Southeast Region
Atlanta, Georgia

ALABAMA STREAK-SORUS FERN

(*Thelypteris pilosa* var. *alabamensis*)

RECOVERY PLAN

Prepared by

Scott C. Gunn
Millbrook, Alabama

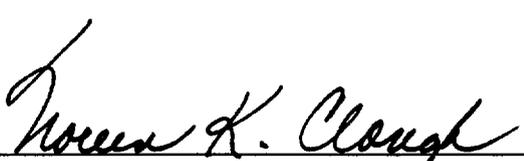
for

U.S. Fish and Wildlife Service
Jackson, Mississippi

and

U.S. Fish and Wildlife Service
Southeast Regional Office
Atlanta, Georgia

Approved: _____


Noreen K. Clough, Regional Director, Southeast Region
U.S. Fish and Wildlife Service

Date: _____



Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. Plans are prepared by the U.S. Fish and Wildlife Service, sometimes with the assistance of recovery teams, contractors, State agencies, and others. Objectives will only be attained and funds expended contingent upon appropriations, priorities, and other budgetary constraints. Recovery plans do not necessarily represent the views nor the official positions or approvals of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

By approving this document, the Regional Director certifies that the data used in its development represents the best scientific and commercial information available at the time it was written. Copies of all documents reviewed in development of the plan are available in the administrative record, located at the Jackson, Mississippi, Field Office.

Acknowledgement:

The U.S. Fish and Wildlife Service thanks Sam Beibers of Beibers Creative Arts for the cover sketch.

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 1996. Alabama Streak-sorus Fern (*Thelypteris pilosa* var. *alabamensis*) Recovery Plan. Atlanta, Georgia. 27 pp.

Additional copies may be purchased from:

Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814

Telephone: 301/492-6403 or
1/800/582-3421

EXECUTIVE SUMMARY

Current Status: *Thelypteris pilosa* var. *alabamensis* is listed as threatened without critical habitat. It is only known to occur along a 4.25 mile segment of the Sipsey Fork, a tributary of the Black Warrior River in Winston County, Alabama. The majority of the extant sites are on U.S. Forest Service land (Bankhead National Forest).

Habitat Requirements and Limiting Factors: Plants take root in crevices and on rough rock surfaces of Pottsville sandstones on bluffs along the river. Plants typically occur on ceilings of sandstone overhangs (rockhouses), on ledges beneath overhangs, and on exposed cliff faces.

Recovery Objective: Delisting.

Recovery 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.

Actions Needed:

1. Protect populations.
2. Search for new occurrences.
3. Maintain plants in cultivation.
4. Develop management plans.
5. Monitor populations.
6. Establish additional populations, if found to be necessary.

Total Estimated Cost of Recovery: It is not possible to determine costs beyond the first few years. Cost estimates for recovery actions over the next 3 years, total \$59,000.

Date of Recovery: It is not possible to determine a date of recovery at this time since the achievement of recovery depends upon the outcome of several of the recovery tasks.

TABLE OF CONTENTS

I.	INTRODUCTION.....	1
	Background.....	1
	Description and Taxonomic Status.....	1
	Distribution.....	3
	Habitat.....	5
	Life History.....	7
	Reasons for Listing.....	7
	Conservation Measures.....	8
	Strategy for Recovery.....	10
II.	RECOVERY.....	11
	A. Recovery Objective.....	11
	B. Narrative Outline.....	11
	C. Literature Cited.....	21
III.	IMPLEMENTATION SCHEDULE.....	23
IV.	APPENDIX.....	25
	List of Reviewers.....	25

I. INTRODUCTION

Background

Alabama streak-sorus fern (*Thelypteris pilosa* var. *alabamensis*) was discovered in 1949 on sandstone cliffs above the Sipsey Fork of the Black Warrior River in Winston County, Alabama (Crawford 1951). Construction of a new bridge over the river destroyed the type locality, and the taxon was believed to have been extirpated from the United States (Dean 1969) until its rediscovery approximately 8 miles upstream (Short and Freeman 1978). Field work since has documented this plant on sandstone overhangs along approximately 4 miles of the Sipsey Fork, but the species has not been found elsewhere (Gunn 1994, 1991).

Low numbers of individuals of Alabama streak-sorus fern and the species' extremely limited distribution, plus the combination of past, current and potential threats, prompted its listing as threatened under the Endangered Species Act on July 8, 1992 (U.S. Fish and Wildlife Service 1992).

Description and Taxonomic Status

Thelypteris pilosa var. *alabamensis* is a relatively small fern of the Thelypteridaceae family. The following brief technical description is modified from Lellinger (1985), Kral (1983), Dean (1969), and Wherry (1964).

Rhizomes are short and slender, creeping, about 1.5 to 2.5 millimeters (mm) [0.1 inch (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 usually slightly narrowed and truncate at the base. They are once-pinnate, the lower pinnae separate, short-stalked, narrowly to broadly ovate, and entire or crenate. Pinnae become sessile upward, then fused basally, the blade (lamina) gradually narrowing to a pinnatifid apex, and shallowly lobed or serrate-dentate at the very tip. Blades typically are 1.3 to 3.3 centimeters (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 more pale. 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.

The Alabama streak-sorus fern differs from other *Thelypteris* of the Southeast United States in that it has no indusia. It differs from *T. pilosa* var. *pilosa*, widespread in Mexico and Central America, by being an overall smaller plant with narrower blades, spreading (versus ascending) pinnae with rounded tips, and by having sinuses of the pinnule margins reached by one lateral vein rather than by two (Smith 1993, Kral 1983, Dean 1969, Crawford 1951).

Due to changing familial and generic concepts of *Thelypteris*-like ferns among pteridologists, a number of pertinent synonyms for both the *pilosa* species and the *alabamensis* variety exist. When he described his new taxon, Crawford (1951) created the new combination of *Thelypteris pilosa* (Mart. & Gal.) Crawford. He stated that the species properly belonged in section *Leptogramma* of the genus *Dryopteris*, "which is now best considered a section of the genus *Thelypteris*". Hence *Gymnogramme pilosa* Mart. & Gal., *Dryopteris pilosa* (Mart. & Gal.) C. Chr., and *Lastrea pilosa* (Mart. & Gal.) Copeland were relegated to synonymy. Later, Iwatsuki (1964), assigned all *pilosa* material to the new combination *Stegnogramma pilosa*, based on the structure and arrangement of the exindusiate sori. Alabama plants then became known as *Stegnogramma pilosa* (Mart. & Gal.) Iwatsuki var. *alabamensis* (Crawford) Iwatsuki. Wherry (1964) then provided the new combination *Leptogramma pilosa* (Mart. & Gal.) Underwood var. *alabamensis* (Crawford) Wherry, which became fairly widely used. However, Alabama streak-sorus fern now is once again generally referred to by the name *Thelypteris pilosa* (Mart. & Gal.) Crawford var. *alabamensis* Crawford by most recent authors (Smith 1993, Lellinger 1985, Kral 1983).

Concerning its validity as a distinct taxon, both Dr. J. T. Mickel, a pteridologist at the New York Botanical Garden, and Dr. A. R. Smith, a pteridologist at the University of California, Berkley, and an authority on the genus *Thelypteris*, agree that *T. pilosa* var. *alabamensis* is quite sufficiently distinct to maintain its varietal status. Mickel (1989) adds that it also may be distinct enough to warrant elevation to specific rank. Smith considers the material from the Mexican states of Sonora and Chihahuan, which were cited as belonging to this variety in the original description of Crawford (1951), to be different from the Alabama plants (Norquist pers. comm. 1996).

Distribution

Alabama streak-sorus fern is currently only known to occur in Winston County, Alabama (Figure 1). The type locality for the species, now destroyed, was situated on sandstone cliffs above the Sipsey Fork of the Black Warrior River approximately 5 miles east of Double Springs in Winston County. New locations for the fern were later reported (Short and Freeman 1978). Subsequent work by the Alabama Natural Heritage Program (Gunn 1994, 1991) revealed around 17 distinct extant occurrences distributed along an estimated 4.25 mile segment of the Sipsey Fork. The minimum historical distribution of *T. pilosa* var. *alabamensis* is assumed to include this area, plus the stretch of stream, now inundated, between this 4.25-mile segment of river and the destroyed type locality. It is probable that the species also occurred downstream of the type locality and perhaps even on some tributaries such as Rockhouse Creek or Brushy Creek. The majority of extant sites are on Bankhead National Forest property. At least four sites containing an estimated 750 to 850 individuals are on private property; however, a portion of a fifth site, the site with the greatest number of plants, is also on private land (Gunn 1994).

Surveys of sandstone cliffs and rockhouses on the Sipsey Fork above the mouth of Caney Creek (Gunn 1994, 1991), and on Sandy Creek and Brushy Creek (Gunn 1994, 1991, 1990), failed to reveal any new occurrences of *T. pilosa* var. *alabamensis*. A reported occurrence at the Sipsey Recreation Area (Short and Freeman 1978) has never been verified, despite repeated searches of the area (Gunn 1994, 1991).



Figure 1. Distribution of Alabama streak-sorus fern

Habitat

All known Alabama occurrences of *Thelypteris pilosa* var. *alabamensis* are confined to Pottsville sandstone. Plants are located within crevices or fissures, or on rough surfaces of this sandstone, on ceilings and recessed walls, on ledges at the very back of these sandstone overhangs, or on rockhouses that are found at the base of massive bluffs along the river. Occasionally, a few plants may be found in moist seepage areas on exposed vertical rock faces (Gunn 1994, 1991).

Short and Freeman (1978) reported that all *T. pilosa* var. *alabamensis* occurrences they observed were growing about "10 feet above water level", but Gunn (1994) found sites ranging anywhere from 3 meters (10 feet) up to 18 meters (60 feet) above the level of the river (Gunn 1994). No plants were observed on low hanging recesses directly over water; the ceilings or walls might be subject to repeated scouring by frequent flooding in these locations.

This species' habitat "is maintained by a combination of high humidity, high substrate moisture, and shade, the humidity [being] provided by evaporation from the stream, the substrate moisture by seepage over the sandstone and bryophyte mats, the shade by overhanging branches of trees which also tend to trap the moist air" (Kral 1983). However, it also appears that adequate diffuse light must be available for the fern to occur. Rockhouses are abundant along many streams and ravines in the area where *T. pilosa* var. *alabamensis* occurs, but the species is found only in the most open of rockhouses directly along the Sipsey Fork. Most rockhouses tend to be very shaded, and thus are rendered unsuitable as habitat for Alabama streak-sorus fern (Gunn 1994). Appalachian bristle fern (*Trichomanes boschianum*), the most notable vascular associate of *Thelypteris pilosa* var. *alabamensis* (Gunn 1991, Short and Freeman 1978, Crawford 1951), is a more shade-tolerant species also confined to sheltered recesses and overhangs of Pottsville sandstone. In a study of the northern one-third of Bankhead National Forest, it was observed in about 20 percent of rockhouses investigated (Gunn 1990), but Alabama streak-sorus fern was not discovered.

Similarly, streak-sorus fern was found to occur in none of sandstone rockhouses around the Sipsey Recreation Area, or elsewhere in the Sipsey Fork valley, if they were not immediately adjacent to the river (Gunn 1994, 1991).

Short and Freeman (1978) noted that *T. pilosa* var. *alabamensis*, along with *Trichomanes boschianum*, also grew in close association with various bryophytes, and Kral (1983) stated that *T. pilosa* var. *alabamensis* was found "usually scattered in moss and liverwort mats," though none of these non-vascular species are identified specifically by these authors. In addition to *Trichomanes boschianum*, the other most frequently noted pteridophyte associates are *Osmunda regalis* (royal fern) and *O. cinnamomea* (cinnamon fern) (Gunn 1991, Mickel 1989, Short and Freeman 1978, Crawford 1951). These species, however, generally occur in the more exposed, rather than in the darker portions of the overhangs. Other reported associates of *Thelypteris pilosa* var. *alabamensis* include *Asplenium* (= *Asplenosorus*) *pinnatifidum* (lobed spleenwort), *Athyrium filix-femina* (lady fern), *A. thelypteroides* (silvery-spleenwort), *Botrychium virginianum* (grape fern), *Dryopteris marginalis* (marginal wood fern), *Polystichum acrostichoides* (Christmas fern), *Thelypteris palustris* (marsh fern), *T. normalis* (= *T. kunthii*) (maiden fern), *T. novaboracensis* (New York fern), *Woodwardia areolata* (chain fern), *Selaginella apoda* (spike moss), *Decumaria barbara* (climbing hydrangea), *Thalictrum clavatum* (meadow rue), and *Heuchera parviflora* (alum root) (Gunn 1991, Mickel 1989, Short and Freeman 1978, Crawford 1951).

The herbaceous species assemblage of the sandstone overhangs is part of the river gorge's well developed Hemlock-Hardwood Forest Association, a bluff-ravine forest that is dominated by hemlock (*Tsuga canadensis*) and various cove hardwood species, including northern red oak (*Quercus rubra*), white oak (*Q. alba*), ash (*Fraxinus* spp.), tulip poplar (*Liriodendron tulipifera*), elm (*Ulmus* spp.), maple (*Acer* spp.) and sweet birch (*Betula lenta*) (Kral 1983, Short and Freeman 1978).

Life History

Virtually nothing is known about the life history of *Thelypteris pilosa* var. *alabamensis*. Live plants were observed during visits to the type locality in the late fall of 1949 and the early spring of 1950, suggesting that the species is evergreen. Further observations revealed that the species produces spores year-round.

Lellinger (1985) and Wherry (1964) reported that *T. pilosa* var. *alabamensis* is not cultivated, but Dr. Robert Burks, of Birmingham, Alabama, is reported to have grown plants from spores and maintained them for about 5 years which suggests that the species might be cultivated should research or conservation objectives require it.

Reasons for Listing

The first documented impact to *T. pilosa* var. *alabamensis* was the destruction of the type locality during bridge construction and subsequent inundation from stream impoundment (Short and Freeman 1978). Knowledge of fern habitat and distribution suggests impoundment destroyed a large number of colonies of *T. pilosa* var. *alabamensis* (i.e., greater numbers of plants than now exist) as a result of flooding an undetermined number of sandstone rockhouses. The river distance between the farthest extant downstream occurrence of *T. pilosa* var. *alabamensis* and the site of the type locality is approximately 5 miles, which is at least three-quarters of a mile longer than the presently known occupied length of the Sipsey Fork. The rediscovery site of *T. pilosa* var. *alabamensis* is near a bridge which was built prior to the discovery of this species there. Some plants may have been destroyed with the bridge construction. Future road construction or stream impoundment along the portion of the Sipsey Fork supporting *T. pilosa* var. *alabamensis* could potentially adversely impact plants; however, such developments do not appear likely at this time (Gunn 1991).

Alabama streak-sorus fern microhabitat is maintained by surface moisture seepage over the sandstone on which the fern grows, as well as by local high humidity (Kral 1983). Logging, particularly clear-cutting, around and opposite

T. pilosa var. *alabamensis* sites, and along the stream corridor in general, is considered a threat to this microhabitat. Removal of timber could change the area's hydrology and dehydrate the microhabitat. Timbering along the stream corridor would lead to an increase in both the ambient light in the corridor (leading to warming of the corridor and a subsequent reduction in local humidity) and in the direct light reaching into certain overhangs, especially at south and west-facing sites (Gunn 1991, Kral 1983).

Incidental impacts, or acts of vandalism from recreational users of some of the rockhouses where the fern grows, have been noted as potential threats, including heat and smoke from campfires built under some of these natural shelters (Gunn 1991).

The overall greatest threat to *T. pilosa* var. *alabamensis* is its vulnerability due to its extremely restricted range and the relatively small number of plants comprising its population (U.S. Fish and Wildlife Service 1992). One natural, or human-induced catastrophic disturbance, could eliminate or seriously reduce the size of the known population. 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 even 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.

Conservation Measures

Federal listing of *T. pilosa* var. *alabamensis* as threatened (U.S. Fish and Wildlife Service 1992) and its inclusion on the National Forests in Alabama sensitive species list (U.S. Forest Service 1986) provide official recognition of rarity and vulnerability and thus the need for protection.

Federal Wild and Scenic River designation of the Sipsey Fork as scenic, including that segment in the range of *T. pilosa* var. *alabamensis*, provides some mechanisms for conserving the fern. The stream may not be impounded and permitted activities are restricted to some development of road access, certain

recreational activities, and limited development on the shoreline (U.S. Forest Service 1986). These limitations will reduce some impacts but will not totally eliminate them.

The *Sipsey Fork, West Fork Wild and Scenic River Implementation Schedule* anticipates increased recreation on Sipsey Fork within the fern's range. Certain proposals (e.g. installation of a small watercraft access site, a parking and picnic area, and a portage trail) may encourage that increase (Malone 1992). The kinds of recreation that would be encouraged by construction of the access site are not necessarily incompatible with conservation of Alabama streak-sorus fern, provided that recreational users can be satisfactorily managed. In discussing cultural resources of the wild and scenic corridor, the Implementation Schedule specifically acknowledges that increased use of the river likely will result in increased impacts, both intentional (e.g., illegal archeological excavating) and unintentional (e.g., campfires), to the rockshelters where many of these resources are found (Malone 1992).

The *Sipsey Fork, West Fork Wild and Scenic River Implementation Schedule* provides an additional internal framework on which a management strategy for the fern can be constructed and implemented. Any management mandated by National Forests in Alabama internal guidelines, or by the *Implementation Schedule* for the scenic part of the river, will apply only to those *T. pilosa* var. *alabamensis* sites that occur on National Forest property. Private inholdings in the Wild and Scenic River corridor are inside both the Bankhead National Forest proclamation boundary, as well as the National Forest's administrative land adjustment boundary. Such tracts generally are regarded as high priorities for acquisition, with acquisitions attempted as tracts come available. Three such tracts on Sipsey Fork, including one in the range of the streak-sorus fern, have been acquired by the Forest Service since 1986 (Bill Fadden, National Forests in Alabama, pers. comm. 1995).

Presently, formal guidelines for management of *T. pilosa* var. *alabamensis* are yet to be developed by National Forests in Alabama (Suzanne D. Oberholster, Botanist, National Forests in Alabama, pers. comm. 1995), but they have committed to performing annual monitoring of sites and to providing assistance in

surveying for additional populations (Overbay *in litt.* 1992). Personnel from the National Forests in Alabama in Montgomery and/or the Bankhead Ranger District in Double Springs have assisted Alabama Natural Heritage Program in visiting *T. pilosa* var. *alabamensis* sites, in making population counts, and in searching for additional sites each year from 1989 through 1993.

Strategy for Recovery

To ensure the long-term survival of *T. pilosa* var. *alabamensis*, it is necessary to develop a strategy that affords sufficient protection, and proper management as necessary, for all the known extant sites. The Fish and Wildlife Service and the Forest Service should quickly undertake the development and implementation of a Memorandum of Understanding (MOU) regarding the fern's conservation.

Recovery strategies should also include plans on how best to protect *T. pilosa* var. *alabamensis* sites on private property, as well as those potentially suitable sites on private property within the fern's range. It is necessary to consider the latter because suitable unoccupied habitat may be required for establishment of additional colonies to decrease the species' vulnerability. However, before initiating any establishment efforts, searches for new natural populations should be completed.

II. RECOVERY

A. Recovery Objective

Thelypteris pilosa var. *alabamensis* will be considered for delisting when the population on the Sipsey Fork and, at least two other populations on 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.

These recovery criteria are preliminary and may be revised on the basis of new information.

B. Narrative Outline

1. Protect known occurrences. Because of the extremely restricted distribution of *T. pilosa* var. *alabamensis*, and the relatively small number of individuals comprising the population, it is critical that all extant known occurrences be protected from any foreseeable threats. Ownership of the majority of sites supporting *T. pilosa* var. *alabamensis* by the U.S. Forest Service facilitates their protection, as enhanced by Federal Endangered Species Act mandates. To achieve that protection, certain appropriate conditions and actions regarding the conservation of *T. pilosa* var. *alabamensis* on public lands should be implemented. Protection for those populations on private land should also be sought.

1.1. Protect occurrences on public lands or those potentially affected by public actions. The Fish and Wildlife Service should work with the Forest Service and other public agencies to ensure protection of plants on public land or those potentially affected by public actions.

1.1.1. Develop a Memorandum of Understanding between the U.S. Fish and Wildlife Service and the U.S. Forest Service. The Fish and Wildlife Service and the Forest Service should develop a Memorandum of Understanding (MOU) to provide for the protection of the species on Federal lands. The MOU should acknowledge each agency's respective responsibilities in the protection of *T. pilosa* var. *alabamensis* and address such issues as biological field work needed; monitoring programs; management strategies (if needed); and surveys for new occurrences.

1.1.2. Contact other governmental agencies. There are other agencies, including the Alabama Department of Transportation, the Winston County Highway Department, and the Alabama Power Company, whose actions may have a bearing on the success of recovery actions. The Alabama Department of Transportation maintains the Alabama Highway 33 bridge, which extends directly over two *T. pilosa* var. *alabamensis* sites. This agency should be involved in recovery actions because of the potential for impact to those sites resulting from bridge/road maintenance. The local county highway authority is responsible for maintenance of Winston County Road 60 which is several miles upstream of the nearest fern site. Possible impacts to the fern sites downstream from maintenance of this roadway should be investigated, as well as any role the county may have in the maintenance of Highway 33.

Finally, the need for inclusion of Alabama Power Company as a part of recovery actions should be examined. Alabama Power Company created, operates and maintains Lewis Smith Reservoir. This impoundment

inundated the site of the type locality of *T. pilosa* var. *alabamensis*. Its backwaters now reach upstream on the Sipsey Fork nearly to the Alabama Highway 33 bridge, through most of the extant range of the fern. Future regulation and management of the waters of the reservoir have the potential to result in impacts to both the species and its management. Cooperation from Alabama Power Company in Alabama streak-sorus fern recovery actions, as well as from the State and local highway departments, may be secured through an MOU, a letter of agreement, or some other formal means.

1.2. Protect populations on private property. Several *T. pilosa* var. *alabamensis* occurrences are on private property, including a portion of the largest site. Efforts directed at conservation of the species on private lands should be initiated after establishment of satisfactory monitoring and management goals for the species on public lands.

1.2.1. Fee acquisition. The most desirable means of ensuring the protection of those occurrences of *Thelypteris pilosa* var. *alabamensis* on private lands is through land acquisition by the chief management agency. Since the majority of sites are owned by the U.S. Forest Service as part of Bankhead National Forest, future conservation-oriented acquisitions of fern habitat should be in Forest Service ownership as well. All *T. pilosa* var. *alabamensis* sites occur within the Wild and Scenic River corridor on the Sipsey Fork and all privately held *T. pilosa* var. *alabamensis* sites lie within the land adjustment boundary of Bankhead National

Forest. Each of these circumstances enhances the desirability of these privately held properties and should be used in making a case for their highest priority acquisition.

Other government agencies or private organizations may be able to acquire important privately owned lands along the Sipsey Fork which become available, if, the chief management agency is unable to acquire them. For example, the State of Alabama's "Forever Wild" program, or non-profit land-conservation organizations, such as The Nature Conservancy or The Conservation Fund, may be recruited for assistance.

- 1.2.2. Conservation easements. If fern habitat cannot be purchased in fee, purchase of conservation easements may prove an adequate alternative.

If easements are pursued, their boundaries should, at a minimum, conform to the Wild and Scenic River corridor boundaries. (They also should be minimally compatible with U.S. Forest Service land ownership goals within their land adjustment boundary.)

- 1.2.3. Cooperative management agreements. Cooperative management agreements may be used to garner support for the protection of *T. pilosa* var. *alabamensis*, when other more permanent means of protection are not available. Cooperative management agreements facilitate access to the resource, cost less than either fee or easement acquisition, and, like the conservation easement, they can place the managing agency (or appropriate designate) in a position of advantage should the

opportunity to pursue fee or easement acquisition present itself later. However, cooperative management agreements must be continually renewed and typically there is no assurance of their long-term continuance.

2. Search for new occurrences. Since its rediscovery on the Sipsey Fork (Short and Freeman 1978), searches for additional occurrences of *T. pilosa* var. *alabamensis* have been conducted several times in Bankhead National Forest (Gunn 1994, 1991, 1990). The Forest Service has expressed a commitment to continue those searches. The segment of Brushy Creek downstream of Brushy Lake and upstream of U.S. Highway 278 remains unsearched. This portion of Brushy Creek, particularly that segment below the mouth of Capsey Creek, appears to possess the best possibility of occurrence of a yet undiscovered population of *T. pilosa* var. *alabamensis*. Searches of rockhouses along this segment of stream should be undertaken at the earliest possible opportunity. Even if no new occurrences are discovered, the surveys may reveal suitable habitat for the establishment of new occurrences of *T. pilosa* var. *alabamensis*, if this task is found to be necessary.
3. Establish new occurrences, if found to be necessary. The establishment of new populations should be considered if no additional natural populations are located and an assessment of the status of the known population at that time indicates that such is needed to decrease the vulnerability of the species.
 - 3.1. Maintain plants ex situ. Maintenance of material of *T. pilosa* var. *alabamensis* will serve as a buffer against the catastrophic loss of the wild population. *Ex situ* material could also be used for research, education purposes, and for creating new *T. pilosa* var. *alabamensis* occurrences in suitable unoccupied habitat. No techniques on the cultivation of *T. pilosa* var. *alabamensis* are published, but Mickel (1989) reported that Robert Burks (of Birmingham, Alabama) has successfully cultivated streak-sorus ferns from spores.

- 3.2. Search for suitable potential establishment sites. Searches for potential establishment sites can be conducted while surveying for new natural populations (Task 2) and implementing monitoring activities (Task 5). The presence of suitable habitat should be noted during all surveys. Efforts should be made to survey in different drainages for suitable habitat. It will also be important to note whether sites are in public or private ownership. Populations should be established on lands where protection of the site is assured.
- 3.3 Establish additional populations. The number of populations to be established will be determined at the time the need for this task is assessed. Information gained from Task 3.1. will aid in determining the appropriate method for creating new populations. Established populations will require long-term monitoring to assess the success of these efforts. A successful established occurrence would be one which is shown to be increasing, or to have increased then sufficiently stabilized, over a period of at least 5 to 10 years.
4. Develop management plan(s). This species is potentially threatened from recreational overuse of its habitat. An investigation of threats to the fern and its habitat, associated with recreational use, should be initiated and guidelines to avoid impacts should be developed. Protected measures may include limiting access to, and use of, areas near sites with this species or posting signs to instruct individuals not to disturb a nearby rare species. Indirect approaches to management that educate recreational users to treat the entire river resource with respect without drawing attention to the fern or its habitat may be preferable. Using such approaches, all accesses to the river could be confined to selected points, such as road contacts, trail junctions, or boat landings. At these points, recreational users would be routed by posted rules and available educational

literature. In addition, litter, old campfires and non-natural flood debris should be regularly removed from the rockhouses. Evidence of human use, if allowed to remain, often serves as an invitation for further use. Presently, no posted rules or educational literature are available at traditional Forest Service accesses, and other important access sites are on private property, and therefore beyond public control (e.g., the site of the Low Water Bridge). There also are little or no restrictions to access by some Forest Service roads, and there may be no realistic way to control access by boaters coming from downstream.

The *Sipsey Fork, West Fork Wild and Scenic River Implementation Schedule* (Malone 1992) anticipates many of the threats, and consequently management needs, of *T. pilosa* var. *alabamensis*. It predicts increased recreational use on the river that will likely produce greater impact to cultural and natural resources, including threatened and endangered species. The *Implementation Schedule* proposes the development of a "Limits of Acceptable Change Monitoring System" that will consider the impacts of the various recreational activities in the river corridor on the river's natural and other resources. It also promises to implement management actions as needed. This monitoring system specifically proposes to address the need to prohibit campfires in the river corridor, except in designated areas, to restrict camping to designated areas, and to require mandatory launch times and issue boater permits, if necessary. One or more of these management tools could be used effectively to manage for the fern, while permitting people to make use of the rockhouses. If feasible, management of *T. pilosa* var. *alabamensis* should be incorporated into the "Limits of Acceptable Change Monitoring System" proposed in the *Sipsey Fork Wild and Scenic River Implementation Schedule*. Management activities for *T. pilosa* var. *alabamensis*, with or apart from the "Limits of Acceptable Change Management System," can be combined successfully and efficiently with the population monitoring activities.

5. Conduct long-term site and population monitoring. The "Limits of Acceptable Change Monitoring System" proposed in the *Sipsey Fork, West Fork Wild and Scenic River Implementation Schedule* (Malone 1992), and discussed in Task 4, deals primarily with the management of human impacts to all of the Wild and Scenic River corridor resources. The monitoring detailed in this recovery plan refers only to populations of *T. pilosa* var. *alabamensis*, and its habitat.

5.1. Monitor conditions of all occurrences. All natural occurrences of *T. pilosa* var. *alabamensis* should be observed on a regular basis and locations should be precisely mapped. Observations on human impacts to the fern and its habitats, changes in occurrence size, health, etc., and any changes in environmental conditions or associated species should be noted. General baseline maps should be developed for each occurrence and may include information on habitat dimensions (e.g., length, height of ceiling, depth of recess of the back wall), aspect, whether habitat is over water or land, vertical distance of the floor of the shelter (if over land) above the surface of the water, and distance of the rockhouse front from the river margin. Environmental characters, such as the amount and type of vegetation in, or in front of the habitats, the presence of seepage moisture in the habitats, plus seepage location, may also be useful information. Local seasonal data or observations (e.g., rainfall and temperature readings, the presence of local drought, evidence and impacts of recent flooding) should also be noted. Evidence of human use and impact, such as the presence of old campfires, the presence and amount of litter (plus the nature of that litter; i.e., old fishing line, beer cans, clothing, etc.) should be recorded as well. Photographs should be made of each of the fern sites, recording as many of their various features as possible.

Distribution of *T. pilosa* var. *alabamensis* in habitats should be carefully recorded, e.g., whether plants occur in crevices or on flat surfaces, whether they are equally distributed on ceilings and back walls, whether they primarily occur closer to, or farther from light. The specific distribution of *T. pilosa* var. *alabamensis* with respect to other vegetation (i.e., mosses, liverworts) may also prove to be valuable information. Maps showing *T. pilosa* var. *alabamensis* habitat and distribution will provide an excellent foundation for all future monitoring.

- 5.2. Implement basic population monitoring designs.
The Forest Service has committed to monitoring *T. pilosa* var. *alabamensis* sites annually for population trends (Overbay *in litt.* 1992). A stable and healthy population of Alabama streak-sorus fern is one of the fundamental elements of achieved recovery.

The monitoring design employed under this recovery plan should include a method for assessing the size of each occurrence. Counts may be sufficient for smaller sites while a sampling scheme may be needed for estimating the size of the larger sites. Several sites should be selected for more detailed monitoring and tracking of individual plants. Observations on health, vigor, and mortality of plants, presence of mature sori, presence of any fungal or insect damage, etc. should also be recorded for all sites.

Once monitoring is initiated, it should be conducted annually (or semi-annually) for at least 3 years. Semi-annual monitoring may be needed initially to determine the optimum time of the year to gather information on the population. Monitoring visits every 2 to 3 years may be sufficient to observe any changes in the population after this initial period.

Any established populations will require monitoring, probably more frequently than naturally occurring ones. These populations could be monitored along with, and by the same methods as natural occurrences.

C. Literature Cited

Crawford, L. C. 1951. A new fern for the United States.
Amer. Fern J. 41:15-20.

Dean, B. E. 1969. Ferns of Alabama. 2nd ed. Southern
University Press, Birmingham, Alabama. 222 pp.

Gunn, S. C. 1994. A survey for the occurrences and habitats
of the federally listed threatened Alabama streak-sorus
fern, *Thelypteris pilosa* (Mart. & Gal.) Crawford
var. *alabamensis* Crawford on the Bankhead National Forest.
Unpublished report to U.S. Forest Service, Montgomery,
Alabama. 37 pp.

Gunn, S. C. 1991. An update on the status of *Thelypteris
pilosa* var. *alabamensis*. Unpublished report to U.S. Fish
and Wildlife Service, Jackson, Mississippi. 19 pp.

Gunn, S. C. 1990. Sensitive plants of Bankhead National
Forest: survey of selected compartments of the northern
one-third. Unpublished report to the U.S. Forest Service,
Montgomery, Alabama. 68 pp.

Iwatsuki, K. 1964. An American species of *Stegnogramma*.
Amer. Fern J. 54:141-145.

Kral, R. 1983. A Report on Some Rare, Threatened, or
Endangered Forest-Related Vascular Plants of the South.
U.S. Forest Service, Atlanta, Georgia. Technical
Publication R8-TP 2. Vol. 2. pp. 12-15.

Lellinger, D. B. 1985. A Field Manual of the Ferns and Fern-
Allies of the United States and Canada. Smithsonian
Institution Press, Washington, D.C. 389 pp.

Malone, J. W. 1992. Sipsey Fork, West Fork Wild and Scenic
River Implementation Schedule. William Bankhead National
Forest. U.S. Forest Service, Montgomery, Alabama. 62 pp.

- Mickel, J. T. 1989. The current status of *Thelypteris pilosa* var. *alabamensis*. Unpublished report of the New York Botanical Garden, Bronx, New York. 4 pp.
- Short, J. W. and J. D. Freeman. 1978. Rediscovery, distribution and phylogeographic affinities of *Leptogramma pilosa* in Alabama. *Amer. Fern J.* 68(1):1-2.
- Smith, A. R. 1993. Thelypteridaceae. pp. 217-218. In: Flora of North America Editorial Committee, eds. Flora of North America North of Mexico. Vol. 2. Pteridophytes and Gymnosperms. Oxford University Press, New York, New York.
- U.S. Forest Service. 1986. Final Environmental Impact Statement: Land and Resource Management Plan - National Forests in Alabama. U.S. Forest Service, Atlanta, Georgia. pp. III-16 - III-17.
- U.S. Fish and Wildlife Service. 1992. Endangered and threatened wildlife and plants; determination of *Thelypteris pilosa* var. *alabamensis* (Alabama streak-sorus fern) to be a threatened species. Federal Register 50(131):30164-30168.
- Wherry, E. T. 1964. The Southern Fern Guide: Southeastern and South-Midland United States. Doubleday and Co. Inc., Garden City, New York. 349 pp.

III. IMPLEMENTATION SCHEDULE

The following Implementation Schedule outlines recovery actions and their estimated costs for the first 3 years of the recovery program. It is a guide for meeting the objective discussed in Part II of this plan. This schedule indicates task priorities, task numbers, task descriptions, duration of tasks, the responsible agencies, and lastly, estimated costs.

Priorities in column 1 of the following Implementation Schedule are assigned as follows:

- 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- 2 - An action that must be taken to prevent a significant decline in species' population and habitat quality or some other significant negative impact short of extinction.
- 3 - All other actions necessary to provide for full recovery of the species.

Key to acronyms used in Implementation Schedule

USFWS	-	U.S. Fish and Wildlife Service
ES	-	Ecological Services Division, U.S. Fish and Wildlife Service
USFS	-	U.S. Forest Service
ADOT	-	Alabama Department of Transportation
WCHD	-	Winston County Highway Department
APC	-	Alabama Power Company
ANHP	-	Alabama Natural Heritage Program
TNC	-	The Nature Conservancy
CPC	-	Center for Plant Conservation
Others	-	private individuals, universities, species specialists

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION	IMPLEMENTATION SCHEDULE			COST ESTIMATES (\$K)			COMMENTS/NOTES
				RESPONSIBLE PARTY			FY 1	FY 2	FY 3	
				USFWS		Other				
				Region	Division					
1	1.1.1	Develop Memorandum Of Understanding between Fish and Wildlife Service and Forest Service.	Continuous	4	ES	USFS				Salary costs only
1	1.1.2	Contact other governmental agencies for protection.	1 yr.	4	ES	ADOT, WCHD, APC				Salary costs only
1	1.2.1-1.2.3	Pursue protection on private lands.	Continuous	4	ES	ANHP, TNC	3.0	3.0	---	Intensive effort 1-2 years to make contacts
2	2 & 3.2	Search for new occurrences and potential establishment sites.	3 yrs.	4	ES	USFS, ANHP, others	5.0	5.0	5.0	
2	3.1	Maintain plants <i>ex situ</i> .	Continuous	4	ES	CPC, others	7.0	5.0	5.0	
2	3.3	Establish additional populations.	2-3 yrs.	4	ES	USFS, ANHP	---	---	---	Necessity of task to be determined at a later date
2	4	Develop management plan(s).	2 yrs.	4	ES	USFS, ANHP	5.0	5.0	---	
3	5.1-5.2	Monitor populations.	Continuous	4	ES	USFS, ANHP	5.0	3.0	3.0	

IV. APPENDIX

List of Reviewers

The following agencies, organizations, and individuals were mailed copies of this recovery plan. This does not imply that they provided comments or endorsed the contents of this plan.

Dr. Bob Cook Arnold Arboretum 125 Arborway Jamaica Plain, MA 12130	Dr. John Freeman Department of Botany and Microbiology Auburn University Auburn, AL 36830
Dr. Sidney McDaniel Box EN Mississippi State, MS 39762	Mr. Jack Short Rt. 2, Box 297 Opelika, AL 36801
Alabama Natural Heritage Program Dept. of Conservation & Natural Resources State Lands Division 64 North Union St., Rm. 752 Montgomery, AL 36130	Mr. Kyle Crider 2717 Seventh Ave., South Suite 291 Birmingham, AL 35233
Dr. John Mickel* New York Botanical Garden Bronx, NY 10458	Mr. Alan Cresseler 504 Calhoun Street, Apt. B Atlanta, GA 30318
Dr. Robert Kral Department of Biology Herbarium Vanderbilt University Nashville, TN 37235	Mrs. Louise Smith 3221 Pine Ridge Road Birmingham, AL 35213
Dr. David Whetstone Jacksonville State University Department of Biology Jacksonville, AL 36265	Dr. Alan R. Smith* University of California at Berkeley University Herbarium Berkeley, CA 94720

Mr. and Mrs. Robert Burks
The Alabama Conservancy
3733 Dunbarton Avenue
Birmingham, Al 35223

The Nature Conservancy
Alabama Field Office
Pepper Place 2821C
Second Avenue, South
Birmingham, AL 35233

Dr. Warren H. Wagner*
University of Michigan
Department of Biology
830 North University
Ann Arbor, MI 48109

EPA Project Manager (7507C)
Endangered Species Protection
Program
Office of Pesticides
401 M. Street, SW
Washington, D.C. 20460

Mr. James C. Overbay
U.S. Forest Service
14th and Independence SW
P.O. Box 9600
Washington, D.C. 20090-6090

Center for Plant Conservation
P.O. Box 299
St. Louis, MO 63166

Ms. Susan Jeffers
TVA Regional Heritage
Office of Natural Resources
Norris, TN 37828

Office of Public Affairs
(PA, 3447 MIB)
U.S. Fish and Wildlife Service
Washington, D.C. 20240

U.S. Fish and Wildlife Service
P.O. Box 845
Cookeville, TN 38503

U.S. Forest Service
National Forests of Alabama
2946 Chestnut Drive
Montgomery, AL 36107

Ms. Joyce M. Hudson
Biodiversity Legal Foundation
P.O. Box 130411
Birmingham, AL 35213

Mr. Mark Bosch
U.S. Forest Service
1720 Peachtree Street
Atlanta, GA 30367

Mr. John Shill
Alabama Department of
Transportation
1409 Coliseum Boulevard
Montgomery, AL 36130

Office of Research Support
(RD-8/ORS, Mail Stop 725
ARLSQ)
U.S. Fish and Wildlife Service
Washington, D.C. 20240

U.S. Fish and Wildlife Service
P.O. Box 1190
Daphne, AL 36526

Alabama Power Company
General Services Complex
Bldg Number 8, P.O. Box 2641
Birmingham, AL 35291

*Independent peer reviewers