

**Bunched Arrowhead
(*Sagittaria fasciculata*)**

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



Photo credit: Gary Peeples/USFWS

**U.S. Fish and Wildlife Service
Southeast Region
Asheville Ecological Services Field Office
Asheville, North Carolina**

June 2025

5-YEAR STATUS REVIEW
Bunched Arrowhead (*Sagittaria fasciculata*)

GENERAL INFORMATION

Current Classification: Endangered

Lead Field Office: Asheville Ecological Services Field Office

Review Author(s): Michelle Henson, Asheville Ecological Services Field Office, U.S. Fish and Wildlife Service

Reviewers:

Lead Regional Office: Southeast Region, Carrie Straight

Cooperating Field Office(s): South Carolina Ecological Services Field Office, Charleston, South Carolina, Melissa Chaplin

Date of original listing: August 31, 1979 (44 FR 43700; July 25, 1979) (Service 1979)

Methodology used to complete the review: In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a status review is to assess each threatened species or endangered species to determine whether its status has changed and if it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants ([50 CFR 424.11](#)). The U.S. Fish and Wildlife Service (Service) evaluated the best available information about the biology, habitat, and threats of bunched arrowhead (*Sagittaria fasciculata*) to inform this status review.

We announced initiation of this review in the Federal Register on June 6, 2024 (89 FR 48437) with a 60-day comment period and received one comment. The primary sources of information used in this analysis were peer-reviewed reports, agency reports, unpublished survey data and reports, and personal communication with recognized experts. This review was completed by the U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office, Asheville, North Carolina. All literature and documents used for this review are on file at the Field Office. All recommendations resulting from this review are the result of thoroughly reviewing the best available information on bunched arrowhead. Along with information and data received from state agencies, we received one public comment containing information on the threats of bunched arrowhead in South Carolina from the Southern Environmental Law Center on behalf of itself, Naturaland Trust, South Carolina Native Plant Society, and Upstate Forever. Information on threats were incorporated into the Threats (Five-Factor Analysis) section of the document, as appropriate. A completed draft of this 5-year review was sent to other affected Service offices in the species' range for review and comment. All comments received were evaluated and incorporated into this final document as appropriate. All recommendations resulting from this review are the result of thoroughly reviewing the best available information on bunched arrowhead.

FR Notice citation announcing the species is under active review:

June 6, 2024 (89 FR 48437)

Species' Recovery Priority Number at start of 5-year review ([48 FR 43098](#)):
5C, corresponding to a high degree of threat with a low recovery potential for the species.

Review History:

Previous 5-year reviews recommending no change in status were signed on March 24, 2014, and August 26, 2020 (Service 2014, 2020).

REVIEW ANALYSIS

Listed Entity

Taxonomy and nomenclature

We are not aware of any changes to the taxonomy of this entity, and it is still considered valid by the Service.

Distinct Population Segment (DPS) ([61 FR 4722](#))

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 of a DPS to only vertebrate species. Because the species under review is not a vertebrate, the DPS policy does not apply.

Recovery Criteria

Recovery Plan or Outline

Recovery Plan for the Bunched Arrowhead (*Sagittaria fasciculata*), U.S. Fish and Wildlife Service, 1983

Date Issued: September 8, 1983

Recovery plans are not regulatory documents and are intended to provide guidance to the Service, States, and other partners on methods of minimizing threats to listed species and on criteria that may be used to determine when recovery is achieved. If the recovery criteria defined in the plan are still valid, meeting recovery criteria can indicate that the species no longer requires protections under the Act. However, when recommending whether a listed species should be delisted, the Service must apply the factors in section 4(a) of the Act ([84 FR 45020](#)).

This review adopts the same terminology outlined in previous bunched arrowhead 5-year reviews (Service 2014, 2020). We define a population as groups of colonies related by drainage and within 2 kilometers (km) of each other as measured in river or stream miles and define a colony as a population unit confined to a single seepage site (Service 1983). The following criteria are written as part of the Recovery Objectives narrative in the recovery plan but are separated here and numbered for better clarity.

Recovery Criterion 1: At least three colonies in each of four of the five populations should be protected. If there are less than three colonies in a population, then all known colonies should be protected.

Criterion 1 refers to the populations identified during the development of the recovery plan: French Broad-East Flat Rock, South Tyger-Beaverdam Creek, Reedy River, Enoree River-Mainstem, and Enoree River-Beaverdam Creek (Service 1983). French Broad-East Flat Rock has one protected colony, Enoree River-Mainstem has seven, Reedy River has two, and South Tyger-Beaverdam Creek and Enoree River-Beaverdam Creek have no protected colonies (Table 1). This criterion has not been met.

Table 1. Summary of referenced recovery plan populations and colony size (total and protected) in North Carolina (NC) and South Carolina (SC).

State	County	Population Name	Total Colonies	Protected colonies
NC	Henderson	French Broad - East Flat Rock	2	1
SC	Greenville	Enoree River - Mainstem	18	7
SC	Greenville	South Tyger - Beaverdam Creek	5	0
SC	Greenville	Reedy River	10	2
SC	Greenville	Enoree River - Beaverdam Creek	4	0

Recovery Criterion 2: In light of the significance of this population [i.e., the Enoree River – Mainstem population] minimum of eight colonies should be protected to ensure that the integrity and genetic diversity exhibited in the Enoree River population is maintained.

The Enoree River-Mainstem only has seven protected colonies, therefore this criterion has not been met.

Recovery Criterion 3: The following colonies should be protected: the two North Carolina colonies in the East Flat Rock population, the single colony in the Beaverdam Creek-Enoree River population, the single colony in the Beaverdam Creek-Tyger River population, all three colonies in the Reedy River population, and eight colonies in the Enoree River population.

The East Flat Rock population contains one protected colony, Beaverdam Creek-Enoree River has no protected colonies, Beaverdam Creek-Tyger has no protected colonies, Reedy River has two protected colonies, and Enoree River has seven protected colonies. This criterion has not been met.

Biology and Habitat Summary

Bunched arrowhead is a semi-aquatic herbaceous perennial in the water plantain (Alismataceae) family, characterized by its lance-shaped basal leaves and small white flowers. The species grows in seepage forests and needs slow, continuous flow of shallow clear water year-round. Flowering occurs from April to May, and fruiting from June to July. The fruits, or clusters of achenes, have a reticulate surface that can float downstream or attach to the hair of mammals

(Newberry 2000). The species also reproduced clonally, forming ramets from broken off pieces of rhizomes that float downstream and colonize a new area.

When the species was federally listed in 1979, there were two extant populations (one in Henderson County, NC, and one in Greenville County, SC). The listing rule did not incorporate the number of colonies within the two populations. During the implementation of the recovery plan in 1983, the Service recognized 28 colonies within five extant populations (one in Henderson County, NC, and four in Greenville County, SC; Table 1). Overall, the species' distribution has remained unchanged since the implementation of the recovery plan.

The 2020 5-year review documented 36 colonies within 13 extant populations (six in Henderson County, NC, and seven in Greenville County, SC). Currently, there are 43 extant colonies distributed among the same 13 populations. Among these colonies, 16 are protected (in part or whole) (Appendix A; Table A.1, Table A.2) across the species' range. Eight new extant colonies have been documented since the previous 5-year review: one new colony at French Broad- Bat Fork Creek, two colonies in Enoree River- Mainstem, two colonies at South Tyger- Beaverdam Creek, two colonies at North Enoree River, and one at Enoree River- Beaverdam Creek. One new colony was reported in NC, and seven new colonies in SC (NC Natural Heritage Program 2024, SC Heritage Trust Program 2024).

Genetics

Fox et al. (2024) investigated the clonal structure of bunched arrowhead using nuclear microsatellite loci and found low overall genetic diversity and limited sexual reproduction. Across the eight study sites, research showed a dominant, single genotype, highlighting a strong dependence on clonal reproduction. While some gene flow was observed between specific populations, overall gene flow within and among populations was limited, hindering the species' ability to adapt to environmental changes over time. Clonal fragmentation from severed rhizomes, or ramets, was found to be a viable means of dispersal for the species and resulted in downstream propagation. They concluded that the species appears to be highly dependent on clonal reproduction and suggest that stem counts may not be an effective strategy in evaluating the overall status of the species in its recovery. Further evidence was supported by Fox and Morris (2025), showing that bunched arrowhead is highly dependent on clonal reproduction throughout its range. They observed low genetic diversity upstream relative to downstream, suggesting unidirectional gene flow and hydrochory, further indicating that stem counts may not be an appropriate metric to accurately assess population size.

Threats (Five-Factor Analysis) Summary

The status of a species is determined from an assessment of factors specified in section 4 (a)(1) of the Act. A summary of this assessment is detailed below.

Factor A: the present or threatened destruction, modification, or curtailment of its habitat or range

As previously identified in the 2014 and 2020 5-year reviews, hydrological changes, development, and interspecific competition continue to pose serious threats to bunched arrowhead (Service 2014, 2020). The species is highly sensitive to changes in water flow and silt

deposition (Newberry 1991), making hydrologic changes from land-use conversion the most significant threat. Urbanization fragments the landscape and alters watershed hydrology by filling in low-lying areas, increasing surface runoff, and channeling stormwater into streams and wetlands. These changes reduce infiltration and groundwater recharge, significantly altering suitable habitat (Dripps et al. 2013).

Development pressures are rapidly accelerating in areas within the range of bunched arrowhead, particularly in and around Greenville, Travelers Rest, and Greer, SC (Holleman 2024 and 2019, letter). For example, a new methane gas pipeline along Highway 290 between Taylors and Travelers Rest is planned to be installed near Clear Creek Heritage Preserve, where a protected population of bunched arrowhead occurs. Further, the City of Travelers Rest has rezoned over 50 acres for an 87-unit development, where a significant portion of the development would occupy a recharge zone on both sides of a forest seepage that supports an unprotected population of bunched arrowhead (Holleman 2024, letter). Efforts are being made to conserve a portion of this area; however, the surrounding population will remain vulnerable to intense development near the seepage and poses a risk to the biological and physical integrity of the watershed complex. Protecting a portion of the habitat does not mitigate the secondary impacts of development and urbanization, and protection of the entire watershed complex and buffer zones should be prioritized.

In wetlands where bunched arrowhead occurs, interspecific competition from exotic and invasive species outcompetes the species for nutrients and space and alters suitable habitat for the species. Marsh dayflower (*Murdannia keisak*), privet (*Ligustrum sinense*), wisteria (*Wisteria* spp.), English ivy (*Hedera helix*), Japanese honeysuckle (*Lonicera japonica*), oriental bittersweet (*Celastrus orbiculatus*), and stilt grass (*Microstegium vimineum*) continue to pose significant threats to the species throughout its range (Loughran 2025, pers. comm.; Holleman 2024, letter).

Factor B: overutilization for commercial, recreational, scientific, or educational purposes

We have no information to suggest that this is a significant factor currently affecting the species.

Factor C: disease or predation

The Service is not aware of any information indicating disease or predation is a threat to the species.

Factor D: the inadequacy of existing regulatory mechanisms

The North Carolina Plant Conservation and Protection Act (NC State Code Article 19B, §106-202.12) provides limited protection from unauthorized collection and trade of plants listed under that statute. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities.

Plant species are afforded less protection in South Carolina, where they are protected only from disturbance at South Carolina Heritage Preserves (SC State Code of Regulations Part 123 § 200-204). There are no other statutes that afford significant protections to bunched arrowhead. In South Carolina, one colony is afforded some protection through a registration agreement

between the landowner (Furman University) and SCDNR Heritage Trust Program. This agreement, signed in 1981, recognizes the natural heritage significance of the property, and acknowledges the mutual interests of SCDNR and the landowner in preserving its habitat. The agreement is non-binding but remains in effect.

While the Clean Water Act does protect wetlands from destruction without a permit, it does not limit upland development that can impact wetland hydrology. Therefore, the Clean Water Act does not provide adequate protection to bunched arrowhead.

Factor E: other natural or manmade factors affecting its continued existence.

Events such as drought or flooding can drastically alter the hydrology of ecosystems that support bunched arrowhead. Impacts of Hurricane Helene in the upstate of SC and western NC region have yet to be formally assessed, but observations from state botanists suggest that some populations of bunched arrowhead appear intact (Loughran 2024, pers. comm.). However, the long-term changes in hydrology from Hurricane Helene's catastrophic flooding event and increased tree fall may impact bunched arrowhead populations through changes in canopy light exposure and temporary or permanent changes to hydrological stream flow (Fox and Morris 2025).

Synthesis

Bunched arrowhead is a small, semi-aquatic perennial herb endemic to the Piedmont seepage forests of western NC and upstate SC. The species grows in wet, sandy-muck sediments along gradually flowing groundwater seeps and is highly sensitive to hydrologic disturbances. Currently, 13 populations comprising 43 colonies are known across its range, with only 16 colonies under some degree of protection. While eight new extant colonies have been found in the past five years, the distribution of this narrowly endemic species remains largely unchanged, with fewer protected colonies per population than outlined in the recovery criteria. Additionally, infrequent and inconsistent monitoring hinders accurate assessments of its abundance, increasing the uncertainty of the species' status and population trends. Threats such as development pressure and interspecific competition from exotic plant species remain significant threats to the species. Compounding these threats is new evidence indicating limited genetic variation within populations and restricted gene flow between them, increasing the susceptibility of threats to the species. Given its narrow range, current condition, and ongoing threats, bunched arrowhead continues to meet the criteria for listing as an endangered species.

RECOMMENDED FUTURE ACTIVITIES

The 2014 and 2020 5-year reviews include a list of recommendations to improve recovery of the species. These actions remain applicable to species recovery:

- Work with partners and species experts to develop a standardized monitoring protocol that could be used on many different types of bunched arrowhead sites.
- Work with partners and land managers to conduct range-wide, consistent monitoring.
- Provide support and, if feasible, pool resources for management and monitoring.
- Prioritize unprotected sites critical for recovery and work toward permanent protection.

- Develop a standardized plan for conserving the species in ex situ collections – through either conservation gardens or seed banking.

Additional future actions are recommended below:

- Prioritize genetic research to assess the size and extent of current populations and colonies therewithin.
- Support genetic monitoring research that seeks to understand the longevity of genotypes and assess whether genetic patterns reflect long-term trends within the species.
- Investigate the factors driving high clonal reproduction and low genetic variation in NC compared to SC populations.
- Identify ecological and environmental factors contributing to the success at Blackwell Sites in SC.
- Study the pollination biology and ecology of bunched arrowhead and assess seed set success rates in the species.
- Monitor and control invasive plant species that may outcompete bunched arrowhead.
- Assess the effectiveness of invasive species management techniques and their targeted outcomes.
- Develop a standardized protocol for propagation and transplantation.

REFERENCES

Dripps, W., Lewis, G. P., Baxter, R., & Andersen, C. B. (2013). Hydrogeochemical characterization of headwater seepages inhabited by the endangered bunched arrowhead (*Sagittaria fasciculata*) in the upper Piedmont of South Carolina. *Southeastern Naturalist*, 12(3), 619-637.

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U.S. Fish and Wildlife Service (2014). Bunched Arrowhead (*Sagittaria fasciculata*) 5-Year Review: Summary and Evaluation. Asheville, North Carolina. 22pp.

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RESULTS / SIGNATURES

U.S. Fish and Wildlife Service Status Review of Bunched Arrowhead

Status Recommendation:

On the basis of this review, we recommend the following status for this species ([50 CFR § 424.11](#)). A 5-year review presents a recommendation of the species status. Any change to the status requires a separate rulemaking process that includes public review and comment, as defined in the Act.

- Downlist to Threatened.
- Uplist to Endangered.
- Delist:
 - The species is extinct.*
 - The species is recovered.*
 - New information indicates the species does not meet the definition of an endangered or threatened species.*
 - The listed entity does not meet the statutory definition of a species.*
- No change needed

FIELD OFFICE APPROVAL:

***Acting for* Field Supervisor, Asheville Ecological Services Field Office, U.S. Fish and Wildlife Service**

Approve _____

APPENDIX A. SUPPORTING DOCUMENTATION

Table A.1. Extant and extirpated bunched arrowhead populations. Each population contains the total number of colonies, extant colonies, new element occurrence records for South Carolina (SC EOs), and Natural Heritage Program EOs for North Carolina and former EOs for South Carolina (NHP EOs) (NC Natural Heritage Program 2024, SC Heritage Trust Program 2024).

Status	State	County	Population Name	Total Colonies	Extant Colonies	Protected Colonies ^a	SC EOs ^c	NHP EOs
Extant	NC	Henderson	French Broad - East Flat Rock	2	2	1	n/a	1.000
Extant	NC	Henderson	French Broad - Highland Lake Inn	1	1	1	n/a	8.000
Extant	NC	Henderson	French Broad - Mud Creek	2	2	1	n/a	10.002, 10.003
Extant	NC	Henderson	French Broad - Bat Fork Creek	2	2	1	n/a	14.004, 14.013
Extant	NC	Henderson	French Broad - Mills River	1	2	0	n/a	7.000
Extant	NC	Henderson	French Broad - King Creek	1	2	0	n/a	11.000
Extant	SC	Greenville	Enoree River - Mainstem	18	16	7	411, 25410	1, 3, 4, 5, 6, 8, 9, 18, 19, 20, 22, 23,24, 33
Extant	SC	Greenville	North Enoree River	6	5	2	411, 3482	16, 26, 30
Extant	SC	Greenville	South Tyger - Beaverdam Creek	5	3	0	2421, 7539	14, 25
Extant	SC	Greenville	South Tyger - Clear Creek	1	1	1	3583	15
Extant	SC	Greenville	Reedy River	10	7	2 ^b	2164	2, 10, 11, 12, 13, 21, 27, 28, 32
Extant	SC	Greenville	Enoree River - Cane Creek	1	0	0	5515	17
Extant	SC	Greenville	Enoree River - Beaverdam Creek	4	2	0	411, 7539	7, 31

Status	State	County	Population Name	Total Colonies	Extant Colonies	Protected Colonies ^a	SC EOs ^c	NHP EOs
Extirpated	NC	Henderson	French Broad - Memminger Creek	1	0	0	n/a	6.000
Extirpated	NC	Buncombe	French Broad - Biltmore Estate	1	0	0	n/a	12.000

^a Whole or in part

^b Information based on the 2020 5-year review

^c EOs in South Carolina have been revised to reflect NatureServe methodology, which consolidates populations located within 1 km of each other into a single EO

Table A.2. Protected bunched arrowhead populations with number of colonies, owner, new element occurrence records for South Carolina (SC EOs), and Natural Heritage Program EOs for North Carolina and former EOs for South Carolina (NHP EOs) (NC Natural Heritage Program 2024, SC Heritage Trust Program 2024).

Population Name	Site	Protected Colonies	Owner	SC EOs^a	NHP EOs
French Broad - East Flat Rock	East Flat Rock Natural Area	1	NGO, Federal Agency	n/a	1.000
French Broad - Highland Lake Inn	Highland Lake Rare Plant Site	1	NGO, State Agency	n/a	8.000
French Broad - Mud Creek	Teneriffe Mountain	1	State Agency	n/a	10.003
French Broad - Bat Fork Creek	Bat Fork Natural Area	1	State Agency	n/a	14.004
Enoree River - Mainstem	Bunched Arrowhead Preserve	3	State Agency	411	5, 6, 19
Enoree River - Mainstem	Blackwell Heritage Preserve	4	State Agency	411, 25410	3, 18, 22, 33
North Enoree River	Belvue Springs Heritage Preserve	1	State Agency	411	16
North Enoree River	River Confluence	1	NGO	411	30
South Tyger - Clear Creek	Clear Creek Heritage Preserve	1	State Agency	3583	15
Reedy River	Furman University	1	Private	2164	10
Reedy River	Berea Middle	1	NGO	13274	32

^a EOs in South Carolina have been revised to reflect NatureServe methodology, which consolidates populations located within 1 km of each other into a single EO

NGO: Non-governmental organization