Spreading Avens
(*Geum radiatum*)

5-Year Status Review:
Summary and Evaluation

Photo credit: Michelle Henson/USFWS

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

August 2025

5-YEAR STATUS REVIEW
Spreading Avens (*Geum radiatum*)

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: Tennessee Ecological Services Field Office, U.S. Fish and Wildlife Service

Date of original listing: May 7, 1990 (55 FR 12793; April 5, 1990)

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 spreading avens (*Geum radiatum*) biology, habitat, and threats 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 no comments. The primary sources of information used in this analysis were the peer-reviewed reports, agency reports, unpublished survey data and reports, and personal communication with recognized experts. This review was completed by the Service's 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 spreading avens along with information and data received from state agencies. A completed draft of this 5-year review was sent to other affected Service offices in the species' range for review and comment. All recommendations resulting from this review are the result of thoroughly reviewing the best available information on spreading avens.

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):
2, corresponding to a species with high degree of threat and a high potential for recovery

Review History:
Previous 5-year reviews recommended no change in status on March 8, 2013, and March 17, 2020 (Service 2013, 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 Spreading Avens (*Geum radiatum*), signed April 28, 1993 (Service 1993)

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).

Criterion 1: It has been documented that at least 16 self-sustaining populations exist and that necessary management actions have been undertaken by the landowners or cooperating agencies to ensure their continued survival.

Criterion 2: All of the above populations and their habitat are protected from present and foreseeable human-related and natural threats that may interfere with the survival of any of the populations.

Currently, there are 15 extant populations and one extirpated population of spreading avens throughout its known range (North Carolina Natural Heritage Program (NCNHP) 2025, Tennessee Natural Heritage Program (TNHP) 2025). At the time of this review, 13 of the 15 extant populations are owned or protected by agencies, conservation organizations, or are listed as a Registered Heritage Area, and the remaining two populations are on private property. Although most populations are under some form of protection, land protection alone is not sufficient to mitigate threats. Both human-related and natural factors continue to pose significant threats to the species. These criteria have not been met.

Biology and Habitat Summary

Abundance, trends, demographics, and distribution

Spreading avens is a high elevation plant species endemic to the southern Appalachian Mountains of North Carolina (NC) and Tennessee (TN). The species occurs on rocky outcrops and cliffs above 1,500 meters (m) and grows in shallow acidic soils and gravelly talus in full sun, forming dense mats through rhizomes that occupy cracks and crevasses in the substrate.

At the time of the 1993 recovery plan, there were 11 extant and 5 extirpated populations of spreading avens that were documented (Service 1993). By the 2013 review, the number of extant populations had increased to 15, with 3 listed as extirpated. However, these earlier documents did not include an estimate of total plant abundance. Assessing population trends and patterns has historically been challenging due to inconsistent monitoring methods, variation in counting units, and incomplete surveys, particularly in inaccessible cliffside habitats. In the 2020 5-year review, 15 populations were reported across NC and TN. As of this review, there are 15 known extant populations, comprising approximately 961 individuals, and 3 extirpated populations across the species' range (Table A.1). Long-term annual demographic monitoring occurs at nine of the extant populations, either in whole or in part, where morphological characteristics such as length and width of each patch, number of rosettes, number of flowering stems, and survivorship are tracked and recorded for each subpopulation. All plants in the demographic study have been georeferenced with a precision of 10 cm or less (Ulrey 2025, pers. comm.).

To improve monitoring efficiency and identify potential undocumented occurrences, Reckling et al. (2021) conducted a drone-based study using a Maxent machine-learning model to highlight high-probability areas for the species. The model identified elevation, soils, and distance from water as key environmental variables, with the most important feature attributes characterized by elevations above 1,800 m, specific soil type, high solar insolation, and north-northwest facing aspects. Visual analysis of unmanned aerial system (UAS) imagery successfully verified 33 known plants and enabled more precise georeferencing of their locations. Additionally, four previously undocumented plants in known populations were discovered. While plants could not be directly identified in aerial imagery, the study demonstrates that combining UAS with machine learning can provide a data-driven framework for enhancing future monitoring and conservation efforts for spreading avens.

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

The high elevation, exposed habitats occupied by spreading avens are characterized by dense fog, high rainfall, and perennial seepage. These sites are also subjected to harsh, extreme winter and high velocity winds – conditions which presumably exceed the tolerances of many species which would attempt to colonize these habitats. These extreme conditions also generate a disturbance pattern in which extensive sheets of ice form and then break free, in the process of

uprooting and dislodging the established vegetation (including spreading avens) upon which the ice has formed. Extreme participation events also have the potential to result in rockslides/landslides that can result in loss of plants (see Service 2020 for details).

The final listing rule identified trampling, soil erosion, and soil compaction from recreational activities (including hiking, climbing, and sightseeing), as well as development for commercial and residential purposes as significant threats to the species (Service 1990). Recreational activities remain a primary threat to the species, particularly in areas where it overlaps with population destinations. Of the 13 protected populations, 8 are in areas with high levels of public access, leaving them highly vulnerable to ongoing recreational impacts. The use of informal social trails (i.e., trails created by repeated use, but not designated or maintained) can directly and indirectly impact spreading avens through trampling, soil compaction, erosion, introduction of invasive species, and alterations in microclimate conditions. Due to the species' long lifespan, slow growth, and infrequent seedling recruitment, spreading avens is especially vulnerable to impacts from physical disturbance from outdoor recreation, and can directly reduce plant abundance and negatively affect genetic diversity and population persistence.

Trampling by hikers remains a significant threat to spreading avens at both Craggy Pinnacle and Roan High Bluff. At Craggy Pinnacle (Blue Ridge Parkway), plant mortality continues to occur despite active management efforts. During the summer months, National Park Service (NPS) Rover volunteers are stationed at the summit daily during peak hiking hours, and signage is in place year-round to restrict access to sensitive outcrop areas where spreading avens occurs (Ulrey 2025, pers. comm.). Similarly, at Roan High Bluff, hikers are bypassing the designated trail to access outcrops, resulting in direct trampling of plants. Despite these management interventions, unauthorized foot traffic continues to reduce abundance and degrade occupied habitat at these sites.

At Mount LeConte in the NPS's Great Smoky Mountains National Park, a study was conducted in 1977 to assess visitor-use patterns around the Cliff Tops area where spreading avens occur (NPS 2022, unpublished report). They mapped approximately 200 m of social trails and estimated around 500 m of disturbance outside of the established trail. To reduce disturbance, a sign encouraging users to stay off the cliff ledges was installed from 1989 to 1995, but was largely ineffective, and soil erosion and damage to the site continued throughout this period. In 2022, NPS staff repeated the study and documented a significant increase in social trail development, mapping 29 informal trails totaling 825 m (NPS 2022, unpublished report). They observed disturbances such as soil erosion, trash, poaching, vegetation damage, and illegal fire rings at the site. Visitors frequently left the established summit trail to access secluded ledges, resulting in further degradation of spreading avens habitat. As a result, some or all individuals in affected populations have since been extirpated from these areas.

In NC's High Country, the proposed Northern Peaks State Trail would span approximately 40 miles, connecting Boone to West Jefferson through the Amphibolite Mountains, a region known for its unique geology and high biodiversity. The planned route passes through Elk Knob State Park and Three Top Mountain Game Lands, where known populations of spreading avens occur. In 2022, NC Natural Heritage Program (NCNHP) was contracted to conduct biological inventory surveys at Three Top Mountain to help assess design and build options to limit impacts to rare species and sensitive habitats along the proposed corridor. Based on these surveys, the trail

corridor was rerouted to avoid rocky outcrops and other sensitive species and habitats (NCNHP Permit Letter, 2024). Surveys at Elk Knob State Park were completed in 2022 and 2023, and the remaining sections of the trail will be finalized following additional future surveys by NCNHP. Although the proposed trail design aims to avoid areas with sensitive or rare plant populations, the risk of visitor-created social trails remains a significant concern for spreading avens and other rare species that have historically persisted in remote, inaccessible habitats. Trail planners intend to install signs to encourage visitors to stay on designated paths; however, observations from other high-use recreational areas indicate that informal visitor-created trails frequently emerge despite such efforts. The unintended consequence of increased visitation, proliferation of social trails, and noncompliance with signage can result in habitat degradation and direct impacts to spreading avens. As such, recreational use continues to pose a substantial threat to the persistence of the species.

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

The Service is not aware that overutilization poses a current threat to the species. However, some instances of plant poaching along social trails have been documented even on protected lands (see above, NPS 2022, unpublished report). Those working with the species should be mindful of the potential for collection and report any observations to the Service.

Factor C: disease or predation

The Service is not aware of any information regarding disease or predation as a threat to spreading avens.

Factor D: the inadequacy of existing regulatory mechanisms

U.S. Forest Service (USFS) regulation 36 CFR 261.9 prohibits removing or damaging any plant that is classified as a threatened, endangered, sensitive, rare, or unique species (USFS 2003). Additionally, Forest Service Manual 2673 establishes policy that prohibits the removal and collection of any threatened or endangered plants on USFS lands under Federal jurisdiction except when authorized by permits (USFS 2009). Gathering and removing plants or plant parts is currently prohibited in National Park System areas unless specifically authorized by federal statute, treaty rights, or conducted under the limited circumstances authorized by existing codified regulations (NPS 2025). Although these regulations and policies should protect spreading avens on USFS and NPS property, people continue to impact spreading avens because lack of resources prevents monitoring of compliance and enforcement. In addition, these protections do not address all threats impacting the species.

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

Spreading avens occurs in small, isolated populations at the edge of its environmental range and is highly dependent on microclimatic refugia buffered from broader climatic conditions. However, increasing temperatures, altered disturbance regimes, and more frequent extreme precipitation events are projected to impact the species' range, with up to 83% of its viable habitat expected to be lost by 2050 (Ulrey et al., 2016). Recent, long-term monitoring has documented physical habitat changes associated with these shifts, particularly the increasing frequency of freeze-thaw cycles. These cycles contribute to the destabilization of rock outcrops,

resulting in the degradation of suitable microsites (Harrison et al., 2024). Over the past five years, multiple instances have been recorded where adult plants were dislodged from cliff faces due to these processes, likely accelerated by shifts in temperature and precipitation patterns (Ulrey 2025, pers. comm.). Future models predict increasing warming resulting increases in soil moisture loss and increases in extreme precipitation events in North Carolina and Tennessee, which could exacerbate these threats (Frankson et al. 2022, Runkle et al. 2022). These ongoing impacts represent a significant and escalating threat to the species' long-term persistence and survival within its restricted, high-elevation habitat.

Synthesis

Spreading avens is a cliff-dwelling perennial restricted to high-elevation bluffs, rock outcrops, and cliffs in the southern Appalachian region of western NC and eastern TN. There are 15 extant populations across the species' range containing approximately 961 individuals. Eight of these populations have high levels of public access, and recreational use poses ongoing significant threats. Additionally, recreational pressure is expected to increase as trail networks expand to previously inaccessible sites where spreading avens occurs, exposing plants to trampling and poaching and the potential of disturbance, erosion, and destabilization of their habitats. Spreading avens is highly vulnerable to projected climate change within its refugial habitat. Given the species' slow growth, limited recruitment, and low resilience to disturbance, protecting existing individuals and their habitats remains important for the species' recovery. Data and information outlined in this review demonstrate that spreading avens continues to meet the definition of an endangered species under the Endangered Species Act.

RECOMMENDED FUTURE ACTIVITIES

A detailed discussion of recovery actions and criteria are presented in the Recovery Plan (Service 1993) and previous 5-year reviews (Service 2013, 2020). In the course of this status review, new and/or targeted potential recovery activities were identified and are included below.

Recovery Activities

- Collaborate with federal, state, and non-profit agency partners to evaluate protection for all known populations through conservation easements, land acquisition, or management agreements with private landowners.
- Limit or redirect recreational use (e.g. trails, rock climbing) near populations to reduce trampling, soil erosion, and disturbance.
- Install durable, long-term signage to discourage social trails and consider physical barriers such as fencing or vegetation buffers to help keep foot traffic limited to areas outside of spreading avens populations.
- Develop a coordinated plan for conserving the species in ex-situ collections through seed banking, living collections, or propagation efforts in botanical gardens.
- Augment small or declining populations with known genotypes native to the site/population to increase genetic diversity and demographic stability.
- Identify suitable unoccupied habitat for potential reintroduction, prioritizing areas that are protected and buffered from recreational disturbance.

- Manage and restore critical microhabitat features (e.g., moist seeps, north to northwest facing slopes) that may buffer populations from climate extremes and promote seedling recruitment.

Monitoring and Research Activities

- Continue long-term demographic monitoring at the nine established sites and expand monitoring to include additional populations, especially those under high recreational pressure.
- Track and map the development of social trails in and around spreading avens habitat to assess trends and inform adaptive management.
- Support research activities on the species' physiological tolerances, recruitment limitations, and adaptive capacity under changing environmental conditions.
- Install microclimate sensors at key populations to monitor fine-scale temperature and moisture variability and detect climate-related stressors.
- Evaluate the effectiveness of management actions (e.g., signage, barriers, trail rerouting) in reducing recreational impacts and protecting habitat.

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RESULTS / SIGNATURES

U.S. Fish and Wildlife Service
Status Review of Spreading Avens

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.*
__X__ No change needed.

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

Approve GARY PEEPLES Digitally signed by GARY PEEPLES Date: 2025.08.13 15:32:37 -04'00'

APPENDIX A. SUPPORTING DOCUMENTATION

Table A.1. Summary of extant element occurrences (EOs) of spreading avens. Each population contains the Service population number, site name, EO number, state, and county across the range. Estimates of patch size are included for 2015-2020 and 2020-2025, and rows with "ns" indicate no survey was conducted within that time period.

Service Population	Site	EO	State	County	2015-2020	2020-2025
1	Grandfather Mountain	44.000	NC	Avery		
1	Grandfather Mountain	44.002	NC	Avery	4	4
1	Grandfather Mountain	44.003	NC	Avery	8	8
1	Grandfather Mountain	44.014	NC	Avery	ns	ns
1	Grandfather Mountain	44.018	NC	Avery	11	
1	Grandfather Mountain	44.045	NC	Avery	37	36
1	Grandfather Mountain	44.049	NC	Avery	0	ns
1	Grandfather Mountain	44.050	NC	Avery	21	12
2	Hanging Rock Mountain	16.000	NC	Avery		
3	Roan Mountain Massif	4.000	NC	Avery/Mitchell	27	27
4	Roan Mountain Massif	36.000	NC/TN	Carter/Mitchell		
4	Roan Mountain Massif	36.008	NC	Mitchell		10
4	Roan Mountain Massif	36.009	NC	Mitchell	25	32
4	Roan Mountain Massif	36.010	NC	Mitchell		75
4	Roan Mountain Massif	36.011	NC	Mitchell	19	51
4	Roan Mountain Massif	36.020	TN	Carter	6	
4	Roan Mountain Massif	36.021	NC	Mitchell	56	25
4	Roan Mountain Massif	36.022	NC	Mitchell	112	118
4	Roan Mountain Massif	36.024	NC	Mitchell	1	1
4	Roan Mountain Massif	36.027	NC	Mitchell		
4	Roan Mountain Massif	36.028	NC	Mitchell	0	
4	Roan Mountain Massif	36.029	NC	Mitchell	3	4
4	Roan Mountain Massif	36.030	NC	Mitchell	3	
4	Roan Mountain Massif	36.037	TN	Carter	92	92
4	Roan Mountain Massif	36.038	NC	Mitchell	0	
4	Roan Mountain Massif	36.039	NC	Mitchell	10	12
4	Roan Mountain Massif	36.046	NC	Mitchell	150	15
4	Roan Mountain Massif	36.047	NC	Mitchell	22	22
5	Yellow Mountain	23.000	NC	Watauga	5	2
6	Tater Hill Natural Area	17.000	NC	Watauga	5	5
7	The Peak	15.000	NC	Ashe	74	75
8	Three Top Mountain	6.000	NC	Ashe	ns	136
9	Bluff Mountain	1.000	NC	Mitchell	8	ns
10	Phoenix Mountain	12.000	NC	Ashe	ns	ns

Service Population	Site	EO	State	County	2015-2020	2020-2025
11	Black Mountain	5.000	NC	Yancey	11	14
12	The Craggies	26.000	NC	Buncombe		
	The Craggies	26.041	NC	Buncombe	15	6
	The Craggies	26.042	NC	Buncombe	54	31
	The Craggies	26.043	NC	Buncombe	46	33
13	Devil's Courthouse	13.000	NC	Tra ylvania	89	33
14	Shiny Creek Watershed	40.000	NC	Haywood	85	23
15	Mount Leconte	2.000	TN	Sevier	ns	59
Total					**999**	**961**