

**Braun's Rockcress**  
*(Borodinia (= Arabis) perstellata)*

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



Photo courtesy of Tara Littlefield, Office of KY Nature Preserves

**U.S. Fish and Wildlife Service  
Southeast Region  
Kentucky Ecological Services Field Office  
Frankfort, Kentucky**

**August 2023**

## 5-YEAR STATUS REVIEW

### Braun's rockcress (*Borodinia* (= *Arabis*) *perstellata*)

#### GENERAL INFORMATION

**Current Classification:** Endangered

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**Reviewers:**

**Lead Regional Office:** Southeast Region, Carrie Straight, carrie\_straight@fws.gov, 404-679-7226

**Cooperating Field Office(s):** Tennessee Ecological Services Field Office, Geoff Call, geoff\_call@fws.gov, 931-528-6481

**Date of original listing:** February 2, 1995 (60 FR 56; January 3, 1995)

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 biology, habitat, and threats of Braun's rockcress (*Borodinia* (= *Arabis*) *perstellata*) to inform this status review.

We announced initiation of this review in the Federal Register on May 13, 2022 (87 FR 29634) with a 60-day comment period and received no public comments. The primary sources of information used in this analysis were the 1995 final listing rule (60 FR 56), the 1997 recovery plan, peer-reviewed reports, agency reports, unpublished survey data and reports, and personal communication with recognized experts.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, Kentucky Ecological Services Field Office (KFO), Frankfort, Kentucky. All literature and documents used for this review are on file at the KFO. All recommendations resulting from this review are the result of thoroughly reviewing the best available information on the Braun's rockcress.

**FR Notice citation announcing the species is under active review:** May 13, 2022 (87 FR 29634)

**Species' Recovery Priority Number at start of 5-year review ([48 FR 43098](#)):** 5. This number indicates that Braun's rockcress is a species with a high degree of threat and a low recovery potential.

## **Review History:**

Five-Year Review: A five-year review was completed on May 28, 2010 (Service 2010). In this comprehensive review, the Service evaluated recovery progress, summarized the species' biology and status, and described the species' current threats. The review recommended no change in status for the species.

Five-Year Review: An additional five-year review for Braun's rockcress was completed on August 31, 2018 (Service 2018). This review summarized new survey records and provided new biological information, threats information gathered since completion of the previous five-year review, and range-wide distributional maps for the species. The review recommended no change in status for the species.

## **REVIEW ANALYSIS**

### **Listed Entity**

#### **Taxonomy and nomenclature**

Braun (1940) described Braun's rockcress as *Arabis perstellata* based on specimens discovered in Kentucky in 1936. The species was later transferred to the genus *Boechea* by Al-Shehbaz (2003, 2010) and ultimately transferred to the genus *Borodinia* by Alexander *et al.* (2013). This updated nomenclature does not impact our assessment of the listed entity (*e.g.*, does not change its distribution, biology, life history, or threats), and it is still considered a valid entity by the Service. Until we finalize a technical correction of the name, we will continue to reference the species using the name as it was listed.

#### **Distinct Population Segment (DPS)**

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 a not a vertebrate, the DPS policy does not apply.

### **Recovery Criteria**

#### **Recovery Plan or Outline:**

Braun's rockcress Recovery Plan, July 22, 1997 (Service 1997)

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](#)). Below are the downlisting and delisting criteria identified in the 1997 recovery plan (Service 1997).

*Downlisting Criteria. Braun's rockcress will be considered for downlisting when 10 geographically distinct self-sustaining populations consisting of 50 plants or more each are protected<sup>1</sup> within a significant portion of the species' range in Kentucky and Tennessee. At least half of these should be populations of 100 plants or more. It must also be demonstrated that these populations are stable or increasing through five years of monitoring.*

This criterion has not been met. There are over 20 geographically distinct, self-sustaining populations with 50-100 plants in Kentucky and Tennessee, but only 7 populations are protected through public ownership (state nature preserves) or conservation easements. Registry agreements were not counted toward recovery because they do not provide "permanent" protection.

*Delisting Criteria. Braun's rockcress will be considered for delisting when 20 geographically distinct self-sustaining populations, also consisting of 50 more plants each, are protected in Kentucky and Tennessee, and it has been demonstrated that they are stable or increasing after another 5 years of monitoring following reclassification.*

This criterion has not been met; please refer to the downlisting discussion above.

## **Biology and Habitat**

For details on the species' biology, habitat, and life history, please see the species' final recovery plan (Service 1997), the species' 2018 five-year review (Service 2018), and the references therein.

## **Distribution**

Based on current monitoring and distributional data compiled by the Office of Kentucky Nature Preserves (OKNP) and the Tennessee Department of Conservation (TDEC), Braun's Rockcress is represented by a total of 57 extant occurrences (51 populations) in Kentucky and Tennessee (Table 1; Appendix A, Tables A-1 and A-2) (OKNP 2020, 2021; Crabtree 2023, pers. comm.). Of this total, 45 occurrences (45 populations) are in Kentucky, and 12 occurrences (6 populations) are in Tennessee. Since completion of the last review, the number of extant occurrences increased by two in Kentucky and remained constant for Tennessee. The increase in Kentucky occurrences was the result of a status change for one occurrence (EO#2) and discovery of a new occurrence by OKNP (EO#66, Peyton site). Currently, 17.5% of extant occurrences are A-ranked (10 of 57), 10.5% are B-ranked, 38.5% are C-ranked, 35.1% are D-ranked, and 3.5% are F-ranked (F = failed to find). OKNP has not assessed the viability of the new Kentucky occurrence, EO#66 (Salam 2023, pers. comm.).

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<sup>1</sup>Protection can be achieved through ownership by government or private actions. It can also include legal dedication or the placement of conservation easements on private land. Site registry agreements are an important conservation tool, but they do not guarantee long-term protection and were not considered in meeting recovery criteria. All protected sites must have management plans or agreements in place that ensure the long-term maintenance of Braun's rockcress habitat.

**Table 1. Rank summary of extant Braun’s rockcress occurrences.**

Rank	Number of Extant Occurrences*					
	Kentucky		Tennessee		Total	
	2018	2023	2018	2023	2018	2023
A	4	5	5	5	9	10
B	5	3	3	3	8	6
C	14	17	3	3	17	20
D	17	17	1	1	18	18
F	3	2	0	0	3	2
<b>Total</b>	<b>43</b>	<b>45*</b>	<b>12</b>	<b>12</b>	<b>55</b>	<b>57</b>

\*Total number of 2023 Kentucky occurrences includes 44 summarized in table, plus one additional EO (#66) not yet assessed for viability by OKNP (see Appendix A, Table A-1).

During 2020-2022, OKNP monitored 17 Kentucky occurrences, including hand-pulling of garlic mustard at 5 high quality occurrences (Rockcress Hills, Rivercliffs, Strohmeiers Hill, Swallowfield, and Camp Pleasant Woods) (OKNP 2020, 2021, 2022). Repeated annual treatments have not eliminated garlic mustard at these sites, but the species has been dramatically reduced. Within Tennessee, TDEC monitors all extant occurrences every three to five years, including comprehensive surveys in 2008, 2011, 2015, 2018, and 2021 (Crabtree 2023, pers. comm.). Currently, 42.1 percent of extant occurrences (24 of 57) in Kentucky and Tennessee are stable or increasing with respect to viability (Table 2).

**Table 2. Summary of Braun’s rockcress occurrence trends.**

Population Trends	Kentucky		Tennessee		2018 Total	2023 Total
	2018	2023	2018	2023		
Increasing	2	0	3	3	5	3
Stable	7	21	0	0	7	21
Declining	16	13	3	3	19	16
Unknown	18	11	6	6	24	17

**Threats (Five-Factor Analysis) Summary**

As specified in section 4 (a)(1) of the Act, a species’ status must be determined through consideration of the following five factors:

- A. present or threatened destruction, modification, or curtailment of its habitat or range;
- B. over-utilization of the species for commercial, recreational, scientific, or educational purposes;
- C. disease or predation;
- D. inadequacy of existing regulatory mechanisms; and

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

The species continues to be threatened by habitat destruction and disturbance (Factor A) associated with residential, commercial, and industrial development; livestock grazing (trampling); and timber harvesting; however, invasive plants represent the greatest threat to Kentucky populations, and the magnitude and scope of these threats increase every year without active management. Garlic mustard (*Alliaria petiolata*) and bush honeysuckle (*Lonicera maackii*) are the most common invasive plants threatening Braun's rockcress populations, followed by chickweed (*Stellaria media*), winter creeper (*Euonymus fortuneii*), and privet (*Ligustrum* sp.) (Littlefield 2018a, Service 2018). Dramatic effects have been observed over the past 10 years in forest canopies of Franklin, Henry, and Owen counties due to the spread of the emerald ash borer (*Agrilus planipennis*) and its adverse effects on white ash (*Fraxinus americana*) and green ash (*Fraxinus pennsylvanica*). At least two Braun's rockcress sites have been logged by landowners due to ash tree mortality (KY EO 16 and 24), and most Braun's rockcress sites in Kentucky have experienced some canopy loss and increased disturbance from ash tree death. The loss of ash trees has resulted in open canopy conditions, allowing for rapid colonization by invasives such as garlic mustard (Littlefield 2018b).

Tennessee populations have less competition from invasive species in part due to topography. The Tennessee populations occur on isolated knobs in contrast to the Kentucky populations existing along steep slopes of the Kentucky River and its tributaries. Despite these conditions, garlic mustard was noted as a threat to two of Tennessee's historical/extirpated sites (TN EO#1 and 4), and monitoring of new infestations is critical to the viability of Tennessee populations (TDEC 2018) (Appendix A, Table A-2). The two main clusters of Braun's rockcress occurrences in Tennessee are located on opposite sides of an extensive urban corridor, with virtually no habitat connectivity. This differs from the higher connectivity of Kentucky occurrences along the Kentucky River corridor in a largely forested rural area.

The species is not overutilized for commercial, recreational, scientific, or educational purposes (Factor B). No diseases are known to be adversely affecting the species (Factor C), but herbivory by whitetail deer has been noted at a few sites. However, deer herbivory is not considered to be a significant threat. Existing regulatory mechanisms (Factor D) have protected occurrences under state ownership, but these protections do not extend to occurrences located on private property. The species does not appear to be threatened by any other natural or manmade factors.

### **Synthesis**

Braun's rockcress is a perennial herb that grows on shaded slopes of calcareous, mesophytic and sub-xeric forests in north-central Kentucky and north-central Tennessee. The species was originally described by E. Lucy Braun (1940) based on her discovery of the species in Kentucky in 1936. The species has a restricted range in Kentucky and Tennessee. Within Kentucky, the species is currently known from 45 occurrences (45 populations) in three counties (Franklin, Henry, Owen), all of which are associated with the Kentucky River or its tributaries (primarily Elkhorn Creek). The 12 extant Tennessee occurrences (6 populations) occupy portions of three counties, Rutherford, Smith, and Wilson, with the majority of these situated along the Stones River.

The recovery plan (Service 1997), critical habitat rule (Service 2004), and second five-year review (Service 2018) listed the primary threats to the species as alteration or loss of habitat through development (primarily home and road construction), competition with native and exotic weedy species, grazing and trampling, and timber harvesting (Listing Factor A - present or threatened destruction, modification or curtailment of its habitat or range). These threats still exist, and the most severe threat continues to be competition from exotic plants such as garlic mustard and bush honeysuckle.

At the time of listing, this species had a high degree of threat and a low recovery potential, resulting in a recovery priority number of 5. At present, the Service does not have any additional information to suggest that the degree of threat or the recovery potential has changed. Therefore, we believe the recovery priority number for Braun’s rockcress should remain at 5 (moderate threat, low recovery potential, species level taxonomy).

Delisting criteria have not been met for this species, but some progress has been made toward meeting the criteria needed for downlisting. Over 20 stable, self-sustaining occurrences are available to satisfy the downlisting goal of 10 occurrences; however, long-term management and protection has not been achieved in a sufficient number of these sites (Table 3), and invasive plants continue to threaten most of these occurrences. Because of the restricted distribution of the species, extirpation of some occurrences, continued high magnitude threats from invasive plants, and lack of progress toward achievement of recovery criteria, we believe the status of Braun’s Rockcress should remain as endangered.

**Table 3. Summary of stable or increasing Braun’s Rockcress occurrences with permanent protection.**

<b>Conservation Category</b>	<b>EO</b>	<b>KY</b>	<b>TN</b>	<b>Total<sup>1</sup></b>
Conservation Easement	KY: 11, 13, 32, 63	4	0	4
State Nature Preserve	KY: 33, 50 TN: 20	2	1	3

<sup>1</sup>The total number of protected occurrences (7) decreased from the previous five-year review (9) because registry agreements do not provide permanent protection and were not included in the 2023 total.

## **RECOMMENDED FUTURE ACTIVITIES**

### **Recovery Activities**

- Continue to pursue permanent protection of occurrences under private ownership through conservation easements or land purchases
- Expand the size of extant occurrences through habitat management and augmentation
- Establish viable occurrences in areas within the historical range that have suitable habitat and few invasive species
- Acquire potentially suitable but currently unoccupied habitat for the species where the species can be introduced and managed

- Continue implementation of management actions for permanently protected occurrences
- Work cooperatively with the KDFWR and OKNP to develop management plans and conservation agreements for populations occurring on KDFWR owned properties (e.g., WMAs).

### **Monitoring and Research Activities**

- Increase survey efforts for new populations in high quality habitat with mature forest
- Continue to investigate the life history and ecological requirements of the species (e.g., seedling establishment, seed, and pollen dispersal distances)
- Study the species' population genetics
- Conduct studies on garlic mustard management

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## RESULTS / SIGNATURES

### U.S. Fish and Wildlife Service Status Review of Braun's rockcress

#### **Status Recommendation:**

On the basis of this review, we recommend the following status for this species. 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 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:**

**Field Supervisor, Kentucky Ecological Services Field Office, Fish and Wildlife Service**

Approve \_\_\_\_\_

\* Since 2014, Field Supervisors in the Region have been delegated authority to approve 5-year reviews that do not recommend a status change.

## APPENDIX A. SUPPORTING DOCUMENTATION

Table A-1. Summary of Braun’s Rockcress occurrences in Kentucky.

EO #	Site Name	Public Land*	Protection*	2010 Rank	2018 Rank	2023 Rank	Last Obs	Trend
1	Skyview Drive <sup>1</sup>			C	C	C	2021	Declining
2	Backbone South			D	X	BC	2022	Stable
3	Peak Mill High School			X	X	X	1979	Extirpated
4	Benson South			D	X	X	1996	Extirpated
5	Juniper Hill			D	D	D	1996	Unknown
6	Snow Hill Road North <sup>2</sup>			X	X	X	1979	Extirpated
8	Benson Valley Woods			C	C	C	2001	Unknown
10	Cedar Run			D	D	D	2020	Declining
11	Swallowfield		CE	C	B	B	2022	Stable
12	Frankfort Fish Hatchery			D	D	D	2012	Declining
13	Strohmeiers Hill <sup>10</sup>		CE/Registry	B	B	A	2022	Stable
14	Penitentiary Creek			X	X	X	1989	Extirpated
15	Kentucky River Bluff			X	X	X	1981	Extirpated
16	Rockcress Woods <sup>6</sup>		Registry	C	B	C	2019	Stable
18	Drennon Chapel			D	D	D	2013	Unknown
19	Kentucky River WMA <sup>14</sup>	WMA		C	C	C	2018	Stable
20	Backbone North <sup>17</sup>			D	F	D	2020	Declining
22	Red Bridge Ridge <sup>3</sup>			B	B	B	2019	Stable
23	Backbone East			D	D	D	1996	Unknown
24	Saufley Woods <sup>13</sup>			B	C	C	2020	Stable
25	Stoney Creek			C	D	D	2019	Declining
30	Dobner Farm Site			D	D	D	2001	Unknown
31	Adkins Site			D	D	D	1990	Unknown
32	Cove Springs	Cove Spring	CE (HLCF)	D	C	C	2019	Stable
33	Rockcress Hills <sup>8</sup>	SNP		A	A	A	2022	Stable
34	Longs Ravine <sup>9</sup>			C	C	C	2019	Stable
37	Peaks Mill West			B	C	C	2020	Stable
38	Severn Creek Site			D	D	D	1990	Unknown
39	US 127/Severn Creek <sup>11</sup>			X	X	X	1990	Extirpated
40	West of Rocky Branch			C	D	D	2020	Stable
41	Salato Wildlife Center <sup>4</sup>	Salato		D	D	D	2019	Declining

EO #	Site Name	Public Land*	Protection*	2010 Rank	2018 Rank	2023 Rank	Last Obs	Trend
42	Craddick Bottom Bluff <sup>16</sup>			C	C	C	2020	Stable
43	North of Monterey <sup>15</sup>			B	C	C	2003	Unknown
44	Shadrock Ferry Road <sup>7</sup>			B	BC	BC	2022	Stable
45	Camp Pleasant Woods <sup>12</sup>	SCC	Registry	B	A	A	2022	Stable
46	Holmes Street			D	F	F	1996	Declining
47	South of Capital			D	F	F	2001	Declining
48	Leeland Valley		Registry	B	C	C	2022	Stable
49	Colston Lane			D	D	D	1996	Unknown
50	River Cliffs <sup>5</sup>	SNP		A	A	A	2022	Stable
51	Far Side Farm (Tucker)		Registry	C	C	C	2019	Stable
53	Sullivan WMA	WMA		C	D	D	2019	Declining
54	Camp Pleasant South			B	B	B	2006	Unknown
56	Switzer Ravine			A	A	A	2019	Stable
57	Grindstone Creek			C	C	C	2020	Stable
60	Ottusville SE			C	CD	CD	2020	Declining
61	Ottusville East			D	CD	CD	2020	Declining
62	Sand Ripple			C	C	C	2009	Unknown
63	Vaughns Branch	W&W Land Trust	CE	D	D	C	2020	Stable
65	West 6 <sup>th</sup> Brewery			N/A	D	D	2023	Stable
66	Peyton Site			N/A	N/A	not rated	2022	Unknown

<sup>1</sup>Superscripts correspond to critical habitat unit numbers (69 FR 31460).

\*Public Land / Protection: conservation easement (CE); registry agreement – between OKNP & landowner (Registry); wildlife management area (WMA); Cove Spring Park, City of Frankfort (Cove Spring); Salato Wildlife Education Center, KY Department of Fish and Wildlife Resources (Salato); Southern Conservation Corp (Land Trust), McMinnville, Tennessee (SCC); Rivercliffs State Nature Preserve – managed by OKNP (SNP); Woods and Water Land Trust, Frankfort, Kentucky (W&W Land Trust).

Table A-2. Summary of Braun’s rockcress occurrences in Tennessee.

Pop	EO #	Site Name	Protection*	2010 Rank	2018 Rank	2023 Rank	Last Obs	Trend
1	5	Scales Mountain Knob (c-3)		A	A	A	2021	
	15	Scales Mountain Knob (10)		C	C	C	2021	
	16	Indian Mountain		A	A	A	2021	
2	6	Sophie Hill		D	D	D	2015	
	13	Sophie Hill		A	A	A	2015	
	9	Townsel Hill		A	A	A	2015	
	10	Townsel Hill		B	B	B	2015	
3	12	Grandfather Knob (2 sites)		B	B	B	2011	
4	14	Versailles Knob		A	A	A	2021	
5	18	Cole Knob		B	B	B	2021	
N/A	4	NW Walterhill		H	H	H	1966	
	2	Charleston Road Site		XN	XN	XN	1961	
	1	Fuqua Road Bluffs		H	H	H	1968	
	3	Percy Priest Dam		H	H	H	1968	
6	20	Walnut Knob	SNA	C	C	C	2022	
	21	Walnut Knob South		C	C	C	2021	

\*Public Land/Protection: state natural area (SNA)