

Interim Core Map Documentation for the Kentucky Glade Cress

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Interim Core Map Developer: U.S. Environmental Protection Agency (EPA), Office of Pesticide Programs

Species Summary

The Kentucky glade cress (*Leavenworthia exigua* var. *laciniata*; Entity ID #7167) is a threatened terrestrial plant (dicot). This species grows in shallow soils of cedar glades and glade-like areas underlain with Silurian dolomite or dolomitic limestone and is endemic to portions of Bullitt and Jefferson counties, Kentucky. Silurian dolomite and dolomitic limestones are an uncommon geological formation in Kentucky. The Kentucky glade cress does not compete well with other vegetation and is shade intolerant. The species relies on shallow soils or regular disturbance to reduce competition and it does well in disturbed sites such as lawns and pastures. The Kentucky glade cress blooms from late February to mid-April but does not rely on pollination for reproduction. Instead, this species reproduces asexually. There is a designated critical habitat for this species. Additional information is provided in **Appendix 1**.

Description of Core Map

The core map for the Kentucky glade cress is based on biological information. The outer extent of this core map is defined by the range. To make the core map, EPA removed forested areas that contain 25% or more canopy cover, as this species requires area with full sun. EPA also included the unaltered critical habitat and one known location (the Floyds Fork population) which was identified by the U.S. Fish and Wildlife Service (FWS).

Figure 1 depicts the resulting interim core map for the Kentucky glade cress. The size of this core map is approximately 38,908 acres. Landcover categories within the core map are included in **Table 1**. Landcover is predominately Grassland/herbaceous and developed areas. Since this species occurs in disturbed areas, many of these areas potentially represent habitat.

The core map developed for the Kentucky glade cress is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the Kentucky glade cress. This core map incorporates information developed by FWS and made available to the public; however, the core map has not been formally reviewed by FWS. This interim core map may be revised in the future to incorporate expert feedback from FWS. This interim core map has a "average" (3) best professional judgment classification to describe major uncertainties/limitations. The map is based on range, critical habitat and the Floyds Fork population described by FWS, and EPA removed some additional areas based on biological needs of the species. This core map does not replace or revise any range or designated critical habitat developed by FWS for this species.

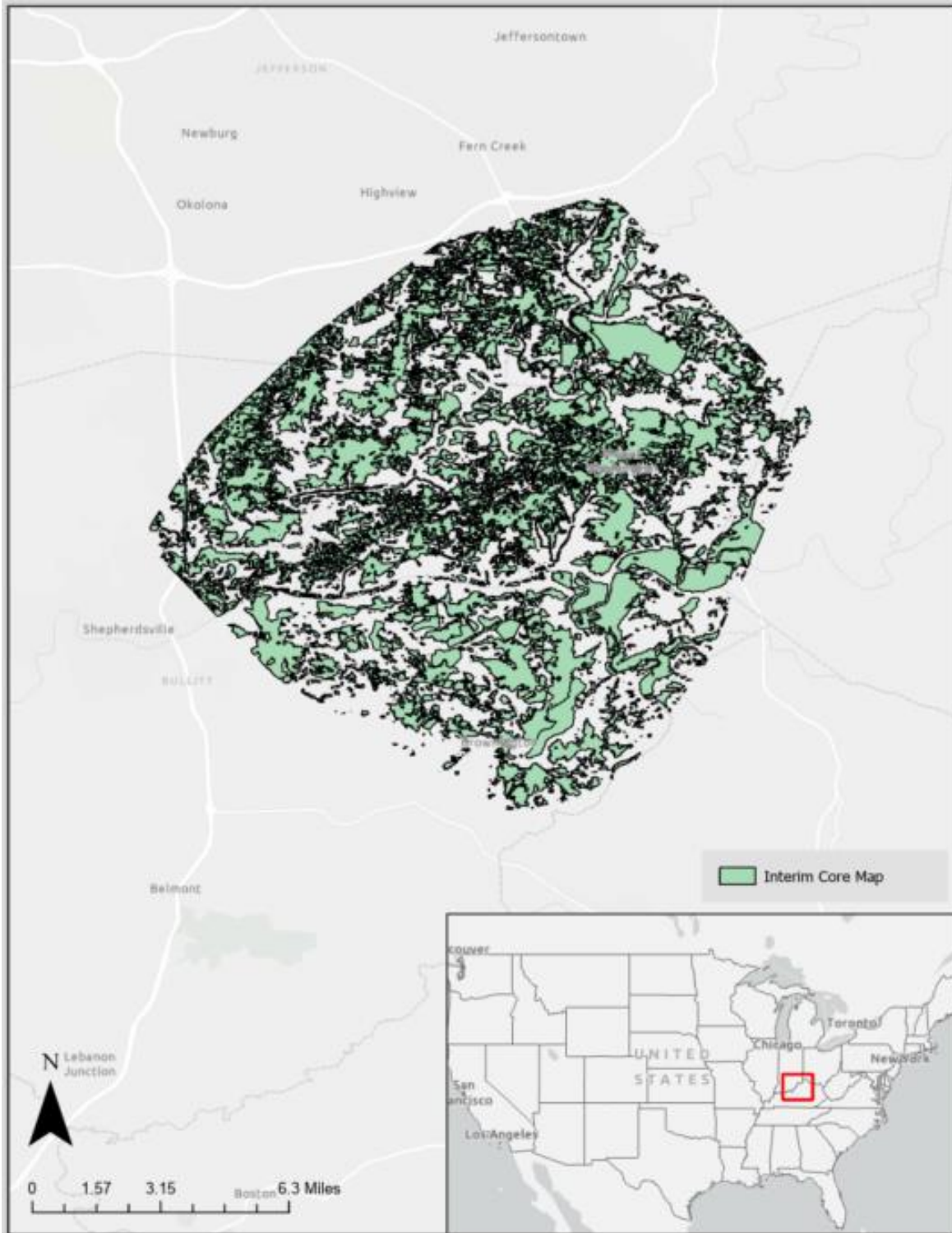


Figure 1. Interim core map for the Kentucky glade cress. The total acreage of the core map is approximately 38,908 acres.

Table 1. Percentage of Interim Core Map Represented by NLCD¹ Land Covers and Associated Example Pesticide Use Sites/Types.

Example pesticide use sites/types	NLCD Landcover (Value)	% of core map represented by landcover	% of core map represented by example pesticide use
Forestry	Deciduous Forest (41)	1	13
Forestry	Evergreen Forest (42)	11	13
Forestry	Mixed Forest (43)	0	13
Agriculture	Pasture/Hay (81)	8	13
Agriculture	Cultivated Crops (82)	5	13
Mosquito adulticide, residential	Open space, developed (21)	15	52
Mosquito adulticide, residential	Developed, Low intensity (22)	16	52
Mosquito adulticide, residential	Developed, Medium intensity (23)	12	52
Mosquito adulticide, residential	Developed, High intensity (24)	9	52
Invasive species control	Woody Wetlands (90)	3	22
Invasive species control	Emergent Herbaceous Wetlands (95)	0	22
Invasive species control	Open water (11)	2	22
Invasive species control	Grassland/herbaceous (71)	11	22
Invasive species control	Scrub/shrub (52)	7	22
Invasive species control	Barren land (rock/sand/clay; 31)	0	22
Total Acres	Interim Core Map Acres	~ 38,908	

Evaluation of Known Location Information

There are four datasets with known location information for this species:

- Descriptions of locations provided by FWS,
- Occurrence locations in iNaturalist;
- Occurrence locations in THE Global Biodiversity Information Facility (GBIF); and
- Occurrence locations in NatureServe.

EPA evaluated these four sets of data before selecting the type of and developing the core map. The FWS 2020 Species Status Assessment (SSA) and the most recent 5-year review (2020) detailed known locations of this species. FWS described 77 known extant populations. At the time Kentucky Glade Cress was listed (2014), there were 61 known extant populations. Since then, 12,= new populations were found. Seventeen historic populations are presumed extirpated and portions of three populations have been destroyed by developmental projects since the taxon was listed. Most potential sites have been surveyed for this species and even though 12 new populations have been found since the species was listed, it is not likely that a substantial number of undiscovered populations exist. The one population EPA was able to locate did not coincide with the critical habitat. iNaturalist had 105 research grade

¹ Dewitz, J., 2023, National Land Cover Database (NLCD) 2021 Products: U.S. Geological Survey data release, <https://doi.org/10.5066/P9JZ7AO3>

observations. NatureServe provided three documented locations. On GBIF, there were 177 “human observations” available for this species. The iNaturalist and NatureServe data had a coarse resolution and EPA could not determine conclusively if these data fell within the range; however, they generally appear to be consistent with the locations of the range and critical habitat given their resolution.

Appendix 1 includes more information on the available known location information.

Approach Used to Create Core Map

The core map was developed using the “Process EPA Uses to Develop Core Maps for Draft Pesticide Use Limitation Areas for Species Listed by the U.S. Fish & Wildlife Service (FWS) and their Designated Critical Habitats”² (referred to as “the process”). This core map was developed by EPA and was developed using the 4 steps described in the process document:

1. Compile available information for a species
2. Identify core map type
3. Develop the core map for the species
4. Document the core map

For step 1, EPA compiled available information for the Kentucky glade cress from FWS as well as observational information available from various publicly available sources (discussed in previous section). The information compiled for the Kentucky glade cress is included in **Appendix 1**. Influential information that impacted the development of the core map included:

- Current existing population occurring outside of the critical habitat
- The species’ critical habitat
- Species range

For step 2, EPA used the compiled information to identify the core map type, including the species range, critical habitat, and known location information. Critical habitat did not include all known locations described by FWS. The range of this species is unrefined and contains locations where the species does not occur but includes both the critical habitat and known location. EPA used the range as the outer extent and created the core map by removing forested areas that contain 25% or more canopy cover, as this species requires areas with full sun.

For step 3, EPA used the best available data sources to generate the core map. Data sources are discussed in the process document. For this core map, EPA used the FWS range map as the outer extent, the core map, known location and refined the range by removing forested areas that contain 25% of more canopy cover. Appendix 2 provides more details on the data used to generate the core map.

Discussion of Approaches and Data that were Considered but not Included in Core Map

Alternative approaches and data were considered in the development of this interim core map. This species relies on Silurian dolomite or dolomitic limestone, so EPA looked into consolidating the range map to where the limestone occurs. However, as the limestone map does not coincide with the critical habitat, EPA instead decided to refine the map based on this species reliance of full sunlight.

² Dated 2024, available online at: <https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas>

Appendix 1. Information Compiled for Species During Step 1

1. Recent FWS Documents/Links

- [Species Status Assessment Report for the Kentucky Glade Cress](#) – (8/25/2020)
- [Recovery Plan for the Kentucky Glade Cress](#) – (3/31/2022)
- [5-Year Review](#) – (9/3/2020)
- [Designation of Critical Habitat](#) – (5/6/2014)

2. Background information

- Status: Federally listed as threatened on May 6, 2014.
- Resiliency, redundancy, and representation (the 3Rs) (*Source: 2020 Species Status Assessment & 2022 Recovery Plan*)
 - Currently, there are three populations with excellent resiliency, four with good resiliency, 22 with fair resiliency, and 48 with poor resiliency. Very few populations exist in natural habitat; most occur in degraded remnant habitat like pastures and lawns, and where they do occur on glades, the habitat is often somewhat degraded by invasive species or from the legacy of previous land uses.
 - Redundancy is inherently low for this endemic plant, and has declined over time, as 23 of the 95 known populations are extirpated or potentially extirpated (not found during most recent surveys).
 - Representation is inherently low due to very low levels of genetic variation within the species.
- **Habitat, Life History, and Ecology** (*Source: 2022 Recovery Plan & 2020 5-Year Review & 2020 Species Status Assessment*)
 - **Habitat:** The Kentucky glade cress grows in shallow soils of cedar glades and glade-like areas underlain with Silurian dolomite or dolomitic limestone and is endemic to portions of Bullitt and Jefferson counties, Kentucky.
 - Kentucky glade cress is adapted to environments with shallow soils interspersed with flat-bedded, Silurian dolomite and dolomitic limestones, which is an uncommon geological formation in Kentucky.
 - Does not appear to compete well with other vegetation and is shade intolerant.
 - Does well in disturbed sites like lawns and pastures.
 - **Reproduction/pollinators:**
 - Reproduces asexually
 - Flower from late February to mid-April
 - While pollination and recombination seem to not be necessary for reproduction, bee flies (Bombyliidae) have been observed visiting flowers.
- **Taxonomy**
 - Flowering dicot plant, self-pollination.
- **Essential Physical Biological Features (PBFs) for Designated Critical Habitat** (*Source: 2020 Species Status Assessment*):
 - The natural habitat for the Kentucky glade cress is dolomitic limestone glades, but the taxon is also known from disturbed dolomite glades that are now pastures, lawns, and

roadsides. The species is a poor competitor and relies on shallow soils or regular disturbance to reduce competition.

- Habitat requirements of the Kentucky glade cress are very specific with shallow soils and high moisture content in winter and earlier spring, drying out by early summer.

- **Relevant Pesticide Use Sites in FWS Documents (*Source: 2020 5-Year Review*)**

- Pesticide threats to the species listed in FWS documents include: activities such as herbicide application could eliminate a patch or an entire population.

- **Relevant Recovery Criteria and Actions (*Source: 2022 Recovery Plan*)**

- De-listing criteria include:
 1. At least 40 Kentucky Glade Cress populations, distributed across its range, exhibit a stable or increasing trend over 10 years of monitoring.
 2. At least 20 of the populations from Criterion 1 occur on natural or restored high-quality glade habitat and have 1,000 or more plants during 5 of the past 10 years of monitoring.
 3. All the populations in Criterion 1 are permanently protected and managed under an agreement such that threats are abated to the extent to ensure population viability for the foreseeable future.

3. Description of the species range

- The current geographic range is restricted northeastern Bullitt County and extreme southeastern Jefferson County in Kentucky.
- Figure A1-1 depicts the current FWS species range (last updated 12/28/2023).
- The species range is approximately 77,350 acres.

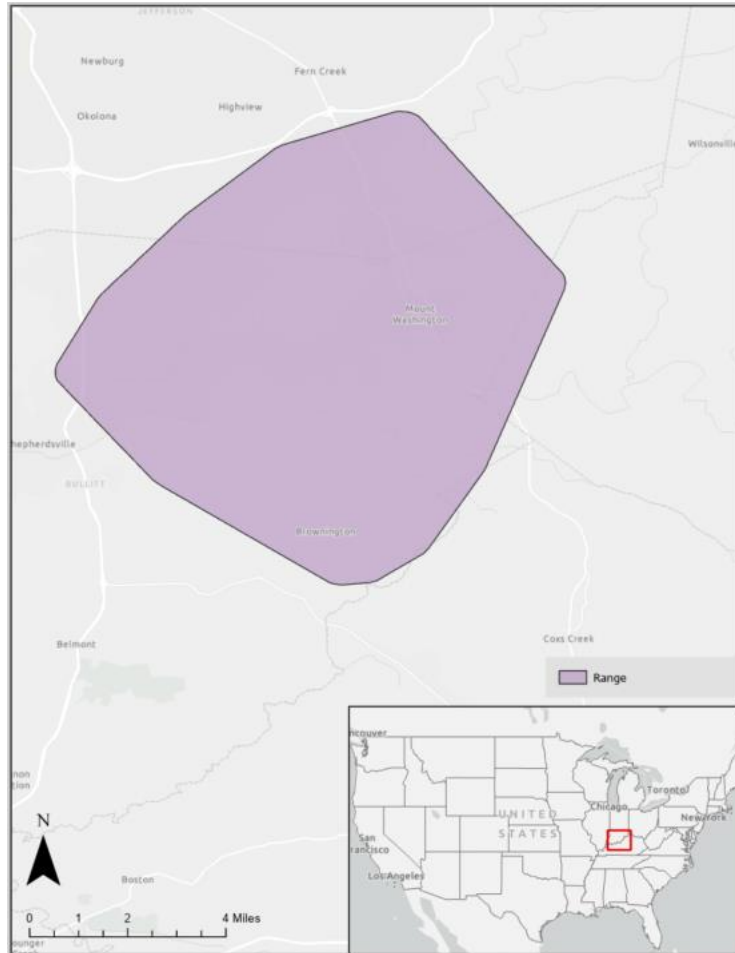


Figure A1-1. FWS Range of the Kentucky glade cress.

4. Critical Habitat (Source: 2020 Species Status Assessment)

- FWS designated critical habitat for the Kentucky glade cress in 2014.
- Critical habitat units were designated by considering the physical and biological features (referred to as primary constituent elements in the Final Rule) that provide for the Kentucky glade cress’s life-history processes and are essential to the conservation of the species:
 - o Cedar glades and glade-like areas within the range of *L. exigua* var. *laciniata* that include:
 - Areas of rock outcrop, gravel, flagstone of Silurian dolomite or dolomitic limestone, and/or shallow (1 to 5 cm [0.393 to 1.97 in]), calcareous soils;
 - Intact cyclic hydrologic regime involving saturation and/or inundation of the area in winter and early spring, then drying quickly in the summer;
 - Full or nearly full sunlight; and
 - An undisturbed seed bank.
 - Vegetated land around glades and glade-like areas that extends up and down slope and ends at natural (e.g., stream, topographic contours) or manmade breaks (e.g., roads).
- Six units of critical habitat are:
 - o McNeely Lake

- Old Mans Run
 - Mount Washington
 - Cedar Creek
 - Cox Creek
 - Rocky Run
- Approximately 2,053 acres in Bullitt and Jefferson Counties, Kentucky, fall within the boundaries of the critical habitat designation.
 - **Figure A1-2** depicts a table of land within critical habitat boundaries.
 - **Figure A1-3** depicts the current critical habitat.

Critical Habitat Unit	Sub-unit	Land Ownership	Size of Unit in Acres (Hectares)
1-McNeely Lake	(NA)	Louisville/Jefferson County Metro Government	18 (7)
2-Old Mans Run	2A	Future Fund Land trust	102 (41)
2-Old Mans Run	2B	21 st Century Parks, Future Fund Land trust, Private	870 (352)
2-Old Mans Run	2C	Private	42 (17)
3-Mount Washington	3A	Private	25 (10)
3-Mount Washington	3B	Private	7 (3)
3-Mount Washington	3C	Private	10 (4)
4-Cedar Creek	4A	The Nature Conservancy	91 (37)
4-Cedar Creek	4B	OKNP; Private; Private with OKNP easement	69 (28)
4-Cedar Creek	4C	Private	83 (34)
4-Cedar Creek	4D	Private	46 (19)
4-Cedar Creek	4E	Private	102 (41)
4-Cedar Creek	4F	Private	120 (49)
4-Cedar Creek	4G	Private	20 (8)
4-Cedar Creek	4H	Private	16 (6)
5-Cox Creek	5A	Private	8 (3)
5-Cox Creek	5B	Private	50 (20)
6-Rocky Run	(NA)	Private (Registered Natural Area)	374 (151)
Total			2,053 (830)

Figure A1-2. Designated critical habitat units for Kentucky Glade Cress. Area estimates reflect all land within critical habitat unit boundaries.

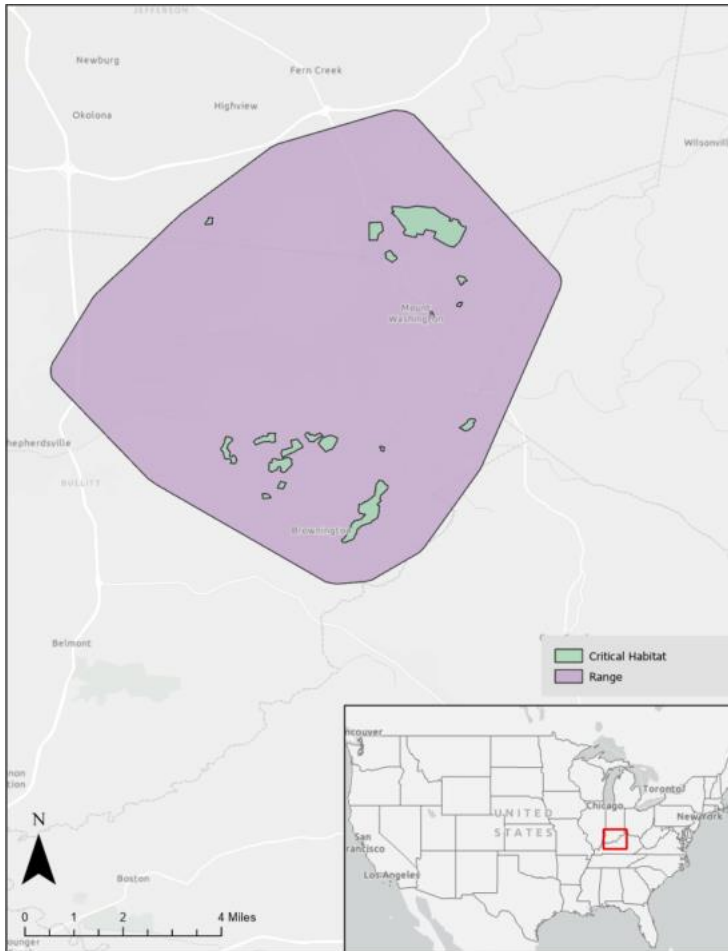


Figure A1-3. FWS critical habitat of the Kentucky glade cress. Range also included for reference.

5. Known Locations

- **Known Locations (Source: 2020 5-Year Review & 2020 Species Status Assessment)**
 - There are 77 known extant populations – at the time it was listed, there were 61 extant populations. Since then, 12 new populations have been found.
 - Most of the land on which Kentucky glade cress occurs is privately owned, although some occurrences are located on public land.
 - Seventeen historic populations are presumed extirpated or were unable to be found during the most recent survey. Portions of three populations have been destroyed by development projects since the taxon was listed.
 - There are still some un-surveyed areas in the region, and several new occurrences of Kentucky Glade Cress have been discovered in the last few years (2015-2018), but most potential sites have been surveyed and it is not likely that a substantial number of undiscovered populations exist.
 - **Figure A1-3** depicts the known location data in FWS' most recent 5 year review.
 - **Figure A1-4** depicts the known location data from FWS's Species Status Assessment, including extant and extirpated populations.

- When considering the locations of the current extant populations (**Figure A1-3**), they are consistent with the location of the Critical habitat (**Figure A1-2**).

Site	Landowner	Current Resiliency Rank*	Most Recent Population Assessment (Year)
Pine Creek Barrens	The Nature Conservancy	A	7,264 plants (2019)
Apple Valley Glade	Office of Kentucky Nature Preserves (OKNP)	A	5,134 plants (2019)
McNeely Lake Park	Louisville Metro Parks and OKNP conservation easement	B	1,856 plants (2019)
Pennsylvania Run (1)	Kentucky Natural Land Trust, will be transferred to OKNP	C	21 plants (2018)
Pennsylvania Run (2)	Kentucky Natural Land Trust, will be transferred to OKNP	BC	>247 plants (2019)
Floyds Fork area (1)	Future Fund Land and 21 st Century Parks	BC	Thousands of plants (2018)
Floyds Fork area (2)	Future Fund Land and 21 st Century Parks	D	Thousands of plants (2016)
Floyds Fork area [^]	21 st Century Parks Endowment	C	786 plants (2018)
Rocky Run RNA	Private, Registered Natural Area	A	5,797 plants (2012)

*A= excellent, B=good, BC= good or fair, C=fair and D=poor

[^]This property is currently slated for development

Figure A1-3. Known locations of the Kentucky glade cress. Reproduced from FWS 5-year review (2020).

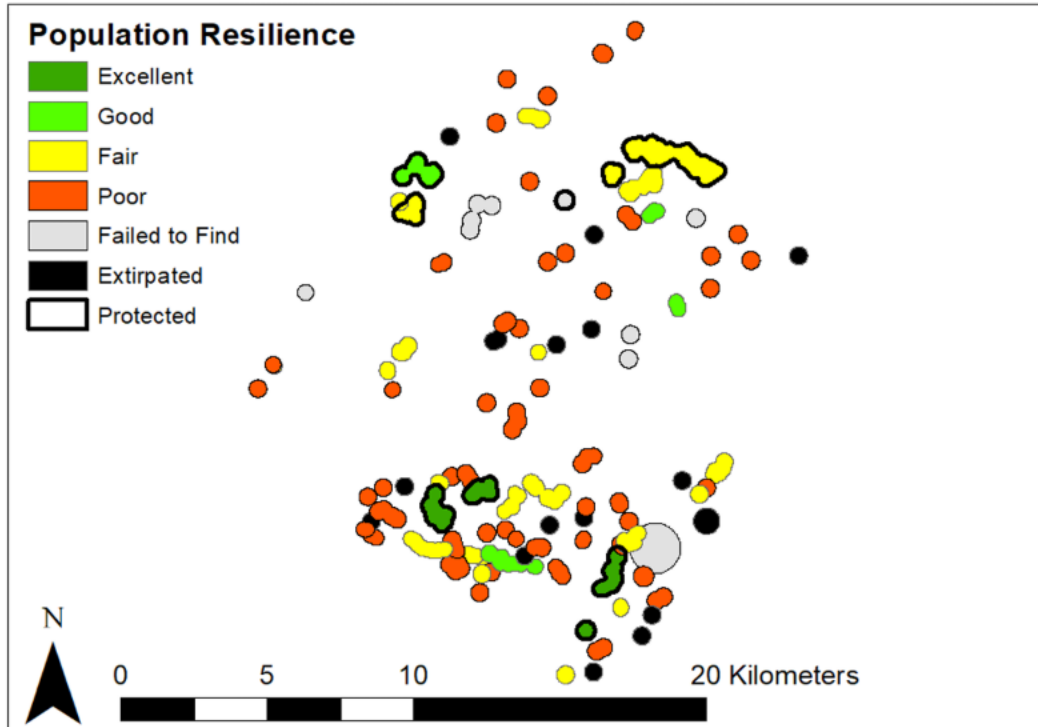


Figure EX1. Distribution of *L. exigua* var. *laciniata* populations and resiliency scores. Populations bordered in bold indicate those on public land or with significant private ownership (see section 2.6.3).

Figure A1-4. Known locations of the Kentucky glade cress. Reproduced from FWS Species Status Assessment (2020). Occurrences were buffered in this figure to enhance visibility of populations, and do not represent overlapping populations.

- **Occurrences in iNaturalist**
 - Searched on 7/14/2025
 - https://www.inaturalist.org/observations?page=2&quality_grade=research&subview=map&taxon_id=241263
 - There are 105 research grade observations available from 2018-2025.
 - **Figure A1-5** depicts the locations of these observations.
 - Due to the coarse resolution of these data, the observations are generally consistent with the range and critical habitat.

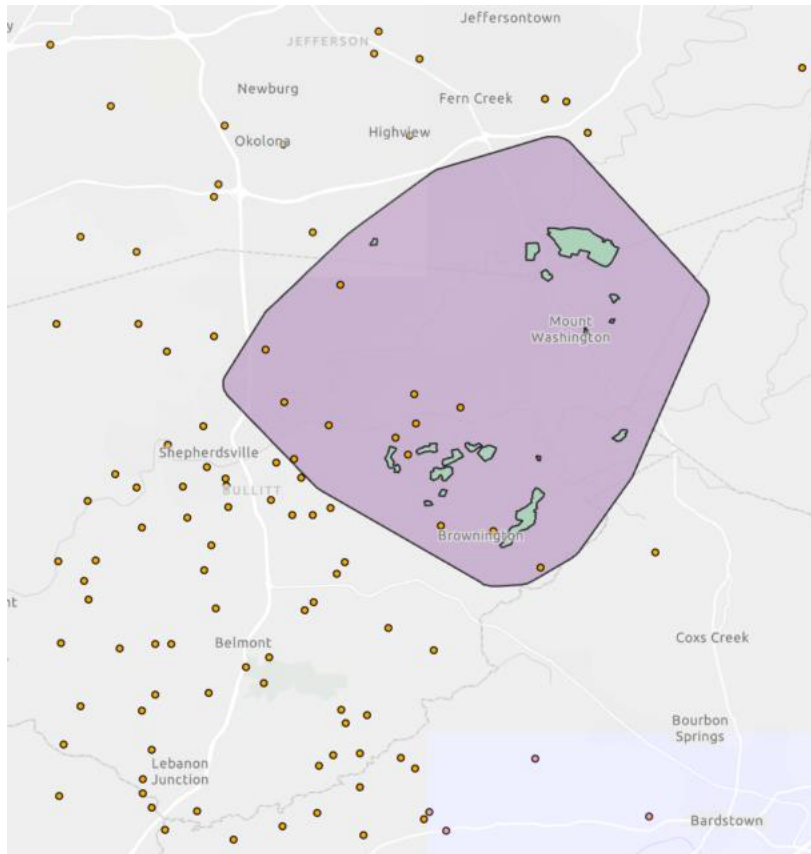


Figure A1-5. Screenshot of iNaturalist observations for Kentucky glade cress compared to range and critical habitat areas.

Occurrences in NatureServe

- NatureServe was searched on 7/14/2025
- https://explorer.natureserve.org/pro/Map?taxonUniqueld=ELEMENT_GLOBAL.2.149358
NatureServe has three documented locations located within Jefferson and Bullitt county.
- These locations are generally consistent with the location of the range and critical habitat

Occurrences in GBIF

- GBIF was searched on 7/14/2025
- There were 177 “human observations” available for this species.
- All observations were included in either iNaturalist or NatureServe.
- https://www.gbif.org/occurrence/search?basis_of_record=HUMAN_OBSERVATION&taxon_key=3047230

Collectively, the occurrence data from iNaturalist, GBIF, and NatureServe do not support expanding the core map beyond the designated critical habitat.

Appendix 2. GIS Data Review and Method to Develop Core Map (Step 3)

This core map was created based on biological information, including occupied location and species habitat. EPA used the Range map provided by FWS as the starting point (outer extent) for developing this core map. The outer extent of this core map is defined by the range which was refined with the critical habitat and one known location (Floyds Fork population) which was located. EPA further refined this area to remove areas with dense canopy cover.

1. Dataset References and Software

- NLCD Tree Canopy Cover 2021³
 - 30 m raster dataset that contains percent tree canopy estimates, as a continuous variable, for each pixel across all land covers and types for the conterminous US
- Kentucky Heritage Land Conservation Fund Areas⁴
 - show tracts that have been purchased with Kentucky Heritage Land Conservation Funds such as the known location – Floyds Fork population.
- Software used: ArcGIS Pro 3.2
- FWS Species Range – last updated on 1/27/2018

2. Datasets Used in Core Map Development

All datasets used in core map development are described in EPA's process document except for the Kentucky Heritage Land Conservation Fund Areas dataset.

3. Core Map Development

- EPA used the range map provided by FWS as the starting point for developing this core map and included the critical habitat provided by FWS and known location taken from the Kentucky Heritage Land Conservation Fund Areas.
- This species requires full sunlight; therefore, areas representing dense canopy is considered non-habitat and was removed. Areas with dense canopy cover were removed using 2021 NLCD Tree Canopy Cover layer (TCC).
 - cover was defined as anything greater than 25% tree canopy estimates and was removed using a conditional raster to mask areas of the HUC12s.
 - Raster calculator and Conditional statement: i.e., CON(TCC Raster >25, 0,1)
 - Raster to polygon
 - Create new layer from selection where attribute table VALUE = 1

The resulting core map includes the critical habitat and includes the FWS known location for the Kentucky glade cress. EPA refined the map to remove areas with greater than 25% canopy cover.

³ <https://epa.maps.arcgis.com/home/item.html?id=f2d114f071904e1fa11b4bb215dc08f3>

⁴ https://opengisdata.ky.gov/datasets/3b2baa2a81374c6687421a8d12c57417_0/explore?location=37.291089%2C-87.016079%2C9.97