

Interim Core Map Documentation for the Leafy Prairie-Clover

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

Species Summary

The leafy prairie-clover (*Dalea foliosa* Entity ID 920) is an endangered terrestrial plant (dicot). The U.S. Fish and Wildlife Service (FWS) has not designated a critical habitat for the leafy prairie-clover. This species is typically found growing in close association with the cedar glades of central Tennessee and northern Alabama. In Illinois it is found growing in prairie remnants that occur on thin soil areas overlying dolomite. Pollinators of this species are several species of bees and bumblebees. Currently, the leafy prairie-clover is found in 63 known locations in three states (Alabama, Illinois, and Tennessee). Additional information on the species is provided in **Appendix 1**.

Description of Core Map

The core map for the leafy prairie-clover is biological information type based on the species' known locations and habitat preferences.

Figure 1 depicts the resulting interim core map for the leafy prairie-clover. The size of this core map is approximately 1,618,043 acres. Landcover categories within the core map area are included in **Table 1**. Landcover is predominantly pasture/hay and developed, low intensity land.

The core map developed for the leafy prairie-clover is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the leafy prairie-clover. 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 species expert feedback from FWS. This interim core map has an "average" (3) best professional judgment classification to describe major uncertainties/limitations. This core map does not replace or revise any range or designated critical habitat developed by FWS for this species.

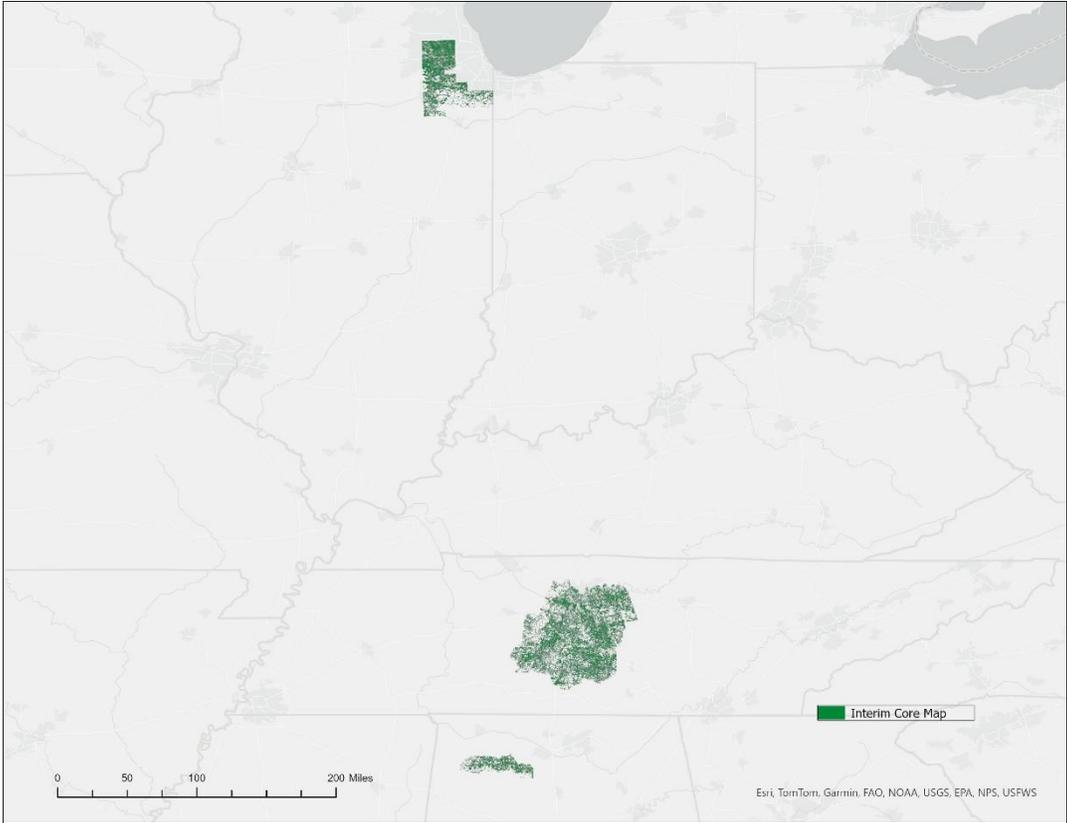


Figure 1. Interim core map for the leafy prairie-clover.

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)	4%	7%
Forestry	Evergreen Forest (42)	1%	
Forestry	Mixed Forest (43)	2%	
Agriculture	Pasture/Hay (81)	53%	53%
Agriculture	Cultivated Crops (82)	0%	
Mosquito adulticide, residential	Open space, developed (21)	9%	34%
Mosquito adulticide, residential	Developed, Low intensity (22)	13%	
Mosquito adulticide, residential	Developed, Medium intensity (23)	8%	
Mosquito adulticide, residential	Developed, High intensity (24)	4%	
Invasive species control	Woody Wetlands (90)	<1%	6%
Invasive species control	Emergent Herbaceous Wetlands (95)	0%	
Invasive species control	Open water (11)	3%	
Invasive species control	Grassland/herbaceous (71)	2%	
Invasive species control	Scrub/shrub (52)	0%	
Invasive species control	Barren land (rock/sand/clay; 31)	<1%	
Total Acres	Interim Core Map Acres	1,618,043	

Evaluation of Known Location Information

There are four datasets with known location information:

- Descriptions of locations provided by FWS
- Occurrence locations in iNaturalist
- Occurrence locations in NatureServe
- Occurrence locations in the Global Biodiversity Information Facility (GBIF)

EPA evaluated these four sets of data before selecting the type of and developing the core map. FWS appeared to have the finest resolution of the location information, providing a map that depicted the current known locations all within Alabama, Illinois, and Tennessee (**Figure A1-2 in Appendix 1**). Occurrences in iNaturalist showed locations in Wisconsin. Those locations were not reported in FWS documents and were not included in this core map. **Appendix 1** includes more information on the available known location information.

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

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 Habitats²” (referred to as “the process”). This core map was developed by EPA 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 leafy prairie-clover from FWS, as well as observation information available from various publicly available sources (including iNaturalist, GBIF and NatureServe). The information compiled for the leafy prairie-clover is included in **Appendix 1**. Influential information that impacted the development of the core map included:

- There are 63 known populations in FWS documentation, all of which are within the species’ range.
- Occurrences and known locations of the leafy prairie-clover are in two counties in Alabama, two counties in Illinois, and seven counties in Tennessee.
- This species can exist in partial shade, but prefers partial to full sunlight, and is frequently found in dolomite prairie, limestone cedar glades, and limestone barrens.

For step 2, EPA used the compiled information to identify the core map type including species range and known location information. The extant populations are in areas identified by FWS (Franklin, Lawrence, DuPage, Will, Bedford, Davidson, Marshall, Maury, Rutherford, Williamson, and Wilson counties) within the species’ range. Therefore, EPA based the core map on the areas from the known locations identified by FWS. EPA further refined this area by removing areas with 25% or more canopy cover because this species prefers partial to full sunlight. Additionally, EPA removed areas with cultivated cropland. The entire range of the species was not used as the core map because the range contains areas where the species does not occur.

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 2022 5 Year Review for the leafy prairie-clover known location identified by FWS. EPA used the 2021 NLCD Tree Canopy Cover data to remove forested areas that do not provide full sunlight (i.e., 25% or more canopy cover). EPA also used 2021 USA NLCD Land Cover data to remove cultivated cropland. **Appendix 2** provides more details on the GIS analysis and data used to generate the core map.

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

EPA explored using GIS datasets that describe the species’ habitat to further refine the core map. Data from iNaturalist, GBIF, and NatureServe were also considered, but not used.

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 the Leafy Prairie-Clover During Step 1

1. Recent FWS documents/links and other data sources

- U.S. Fish and Wildlife Service. 1996. Leafy Prairie-clover Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, Georgia. 74 pp. [*960930c.pdf \(fws.gov\)](#)
- Leafy Prairie-clover 5-Year Review (2022) [Leafy Prairie Clover 5-Year Review \(ecosphere-documents-production-public.s3.amazonaws.com\)](#)
- Leafy Prairie-Clover 5-Year Review (2015) https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2255.pdf

2. Background information

- **Status:** Federally listed as endangered in 1991.
- **Resiliency, redundancy, and representation** (the 3Rs): (5 Yr. Review, 2015, 5 Yr. Review, 2022)

Resiliency: There are 18 populations that are high to moderately viable. Of these, 10 are protected in some from 2022-5-year review.

- Alabama - There are two populations with unknown viability, but there is no monitoring of the population to determine if the changes in resiliency
- Illinois – There are 11 populations, two are considered highly viable, and five are moderately viable.
- Tennessee – There are 50 populations. Of these, 1 was ranked as highly viable, 10 ranked moderately viable, 6 ranked as low viability. The remaining 33 are not monitored.

Redundancy:

- Alabama – The spatial distribution remains unchanged since the 2015 5-year review.
- Illinois – One population is considered extirpated. An additional population in Cook County was removed since the 2015 review.
- Tennessee – “The number of extant populations in Tennessee has increased from 49 to 50 and the species spatial distribution has remained similar in extent in Tennessee compared to estimates in the 2015 5- year review.” (5 Yr. Review, 2022)

Representation:

- Alabama – no information
- Illinois – Four of the extant populations have been restored by introduction of seed or propagated plants. Other populations have been increased with plants grown from seeds. Two additional attempts to establish introduced populations in Illinois have apparently failed, based on the absence of plants during the most recent surveys at these sites. (5 Yr. Review, 2022)
- Tennessee – no information

- **Habitat**

- Alabama and Tennessee: (Recovery Plan 1996)
 - “Only found in open limestone cedar glades, limestone barrens, and dolomite prairies which have shallow, silt to silty clay loam soils over flat and often highly fractured, horizontally bedded limestone or dolomite

with frequent expanses of exposed bedrock at surface elevations” between 168-213m.

- Habitats experience high surface and soil temperatures.
- Low soil moisture but are wet in the spring/fall and become droughty in the summer.
- Above characteristic creates seasonal aspect to flora.
- Distribution of location is determined by subtle variations in soil and bedrock depths, topographical position, and other little variations.
- Prefer open sun with soil depth of 4-45cm; most abundant between 10-30cm
- Fire is assumed to be important in maintaining limestone cedar glades and barrens.
 - Pre-settlement fires such as those used by Indigenous Peoples helped maintain tall-grass prairies due to regeneration effect on soil from fire byproducts.
 - Post-settlement fire suppression has led to glades turning from suberic to forested ones.
 - Exceptions: “none of the leafy prairie-clover sites in Tennessee and Alabama are being managed for the control of woody plant succession.”
- **Illinois:** (Recovery Plan 1996)
 - Former and extant sites from Kane and Will counties exist in the Morainal section of the NE Morainal Division
 - “Characterized by prominent glacial features such as kettles, kames, eskers, lake plain deposits, outwash plains, and moraines”
 - Extant populations: occur only in the dolomite prairie
 - Less than 1.5m of soil, less than 0.3 m high, high pH, range from wet to dry
 - Found in mesic to wet-mesic dolomite prairie with other indicator species along the soil moisture gradient
- **Pollinator/reproduction (5-Year Review 2021)**
 - Flowering begins in late July, peaks in mid-August until late August (Recovery Plan 1996).
 - Pollinators are several bee species, bumblebees and weevil.
 - Visitation occurs in mid-afternoon.
- **Taxonomy**
 - Terrestrial Plant
 - FWS Category: Flowering dicot plants (group 11)
- **Relevant Pesticide Use Sites**
 - No information specific to pesticides was found.
- **Recovery Criteria/Objectives (Recovery Plan 1996)**
 - Must have at least 3 high-viability populations in both Illinois and Alabama AND 12 high-viability populations in Tennessee that are protected and managed

- If the above requirements are not possible due to distribution in the region, there is also the option to manage populations to higher viability status, and substitute three moderately viable populations for one high-viability populations.
- Additionally, new populations can be established at “suitable recovery sites” to meet the criteria as long as they “persist at a moderate or high viability for at least 10 years.”

Recovery Actions (Recovery Plan 1996)

- Identify and prioritize protection, management, and restoration needs.
- Develop preserve designs and implement protection plans.
- Develop and implement management plans, enhance existing populations and establish new populations.
- Develop and implement population monitoring studies.
- Conduct demographic and life history studies and conduct public education efforts.

3. Description of Species Range (Recovery Plan 1996)

- The species is mainly found in the limestone cedar glades of central Tennessee and northern Alabama, where the species is considered nearly endemic
- In Illinois the species is restricted to dolomite prairies on river terraces in the northeastern part of the State.
- It occurs with the glade endemic *D. gattingeri* in Tennessee and Alabama and with *D. purpurea* in Illinois
- Figure A1-1 and A1-2 depicts the range.

Figure 1. Distribution and Status of *Dalea foliosa*

- = Extant population(s)
- = Historic record with voucher specimen
- ▲ = Referenced as historic without voucher specimen



Figure A1-1. FWS range for the leafy prairie-clover (Recovery Plan 1996).



Figure A1-2 – FWS range from ECOS website.

4. Critical Habitat

- FWS has not designated a critical habitat for this species (<https://ecos.fws.gov/ecp/species/5498>).

5. Known Locations

- Known Locations Described in FWS Documents
 - Currently found in Alabama, Tennessee and Illinois. (5-Year Review 2022)
 - Figure A1-2 depicts the currently known locations from FWS.
 - The following table, Table 1, identify the known locations (Recovery Plan 1996).
 - Range wide *Dalea foliosa* occurs within 63 populations. Of those, 50 are in central Tennessee, while 11 are disjunct in northeast Illinois and 2 in northwest Alabama (5-year Review 2022)

Table 2. Population status summary for the leafy-prairie clover*

ALABAMA Jefferson County	1984	1984	Extirpated by road work	No information
ALABAMA Lawrence County	1990	1992	339; line maintenance threats	Private (TVA ROW)
ALABAMA Morgan County	1966	1992	33; extirpated by road work or grazing	Road ROW
ILLINOIS Boone County	?	?	No voucher specimen	No information
ILLINOIS Kane County	1867	1891	Extirpated, likely by development	Location unknown
ILLINOIS Kankakee County	1872	1873	Extirpated by over-collecting	Public (IDC)
ILLINOIS LaSalle County	1881	1885	Extirpated, likely by development	Private
ILLINOIS Madison County	?	?	No voucher specimen	No information
ILLINOIS Ogle County	?	?	No voucher specimen	No information

ILLINOIS Will County; Keepataw Forest Preserve	1979	1992	75; persistence from seed bank, ORVs, cool-season grasses	Public (FPDWC)
ILLINOIS Will County; Lockport Prairie East	1979	1981	Extirpated; habitat scraped	Private
ILLINOIS Will County; Lockport Prairie Nature Preserve	1974	1992	>5,000; best example in Illinois	Public
ILLINOIS Will County; Romeoville Prairie	1907	1992	295; decline from drought, ORVs, and line maintenance threats	Private (CEC)
ILLINOIS Winnebago County	?	?	No voucher specimen	No information
TENNESSEE Bedford County, Burnt Hill Road (16)	1990	1993	>1,500; best example in Tennessee	Private
TENNESSEE Davidson County, Woodmont Boulevard (6)	1980	1992	11; extirpation is certain from development; plants moved to Cheekwood Botanical Garden in 1993	Private
TENNESSEE Davidson County, Mt. View School (8)	1931	1992	13; extirpation is likely from woody succession or development	Public
TENNESSEE Davidson County, Lake Trail Wet Barren (31)	1993	1994	6; threatened by woody succession; needs to be control-burned	Private
TENNESSEE Davidson County, Hamilton Creek (13)	1985	1985	0; habitat highly degraded; seed bank unlikely	Public (TDEC)
TENNESSEE Davidson County, Couchville Glade (14)	1985	1993	7; habitat intact, possible seed bank; is being managed by TNC; will be transferred to State	Private (TNC)
TENNESSEE Sumner County	1975	1975	Extirpated by development	Private
TENNESSEE Marshall County, Rt. 99 Glade (4)	1970	1992	23; extirpation likely from woody succession and mowing in road ROW	Private
TENNESSEE Marshall County, South Berlin Glade (17)	1983	1993	80; TVA manages power line through site	Private
TENNESSEE Maury County, Columbia Glade (5)	1980	1992	1,130; threatened by dam project and woody succession	Public (TVA)
TENNESSEE Maury County, Baskin Site (12)	1966	1971	Extirpated by residential development	Private
TENNESSEE Maury County, Sowell Mill Road (20)	1989	1993	142; threatened by woody succession	Private, Public (TVA)
TENNESSEE Maury County, TVA Sowell Mill North (28)	1993	1993	55; needs to be cleared or control-burned to control woody plants	Public (TVA)

TENNESSEE Maury County, Sowell Creek (35)	1994	1994	325; need to contact landowner	Private
TENNESSEE Rutherford County, Sharp's Barren (1)	1958	?	Extirpated by industrial development	Private
TENNESSEE Rutherford County, Walterhill Site (7)	1958	1968	Extirpated by dumping and woody succession	Private
TENNESSEE Rutherford County, Lascassas Site (9)	1962	1962	Extirpated by grazing	Private
TENNESSEE Rutherford County, Fosterville (10)	1980	1980	Extirpated by roadwork and woody succession	Road ROW
TENNESSEE Rutherford County, Jones Mill Road (21)	1985	1994	194; EOR location incorrect, not on public land	Private
TENNESSEE Rutherford County, Factory Road (22)	1984	1984	0; woody succession, but site regularly bush-hogged; seed bank unlikely	Private
TENNESSEE Rutherford County, Manus Road #4 (23)	1990	1994	100+; site protection design completed by TNC in 1994	Private
TENNESSEE Rutherford County, Hall Farm (32)	1994	1994	400; stable, with many seedlings, need to contact landowner	Private
TENNESSEE Rutherford County, Adams #3 (11)	1993	1994	135; site protection design completed by TNC in 1994.	Private
TENNESSEE Rutherford County, Overbridge (34)	1993	1994	2; new State natural area	Public (TDEC)
TENNESSEE Williamson County, Sneed Road Cedar Glade (2)	1987	1994	800-1,500; threatened by woody succession	TNC; private (Woodmont Golf Club)
TENNESSEE Williamson County, Sneed Road (15)	1987	1987	Extirpated by dumping and woody succession	Private
TENNESSEE Wilson County, Cedars of Lebanon SF (3)	?	1979	Extirpated by woody succession	Public (TDF)
TENNESSEE Wilson County, Cedars of Lebanon SF (18)	1990	1992	17; threatened by ORVs	Public (TDF)
TENNESSEE Wilson County, Cedars of Lebanon SP (19)	1989	1992	11; threatened by woody succession	Public (TDF)
TENNESSEE Wilson County, Cedars of Lebanon SF (24)	1989	1992	16; in heavy little bluestem matrix; TNC doing	Public (TDF)

TENNESSEE Wilson County, Cedars of Lebanon SP (25)	1990	1992	14; in roadside ditch, heavy woody succession; extirpation likely	Public (TDF)
TENNESSEE Wilson County, Cedars of Lebanon SF (30)	1989	1993	100; appears stable; need to exclude ORVs	Public (TDF)
TENNESSEE Wilson County, Cedars of Lebanon SF (33)	1993	1994	130; need to use control-burns	Public (TDF)
TENNESSEE Wilson County, Lane Farm (26)	1992	1993	About 25	Private

*Occurrence/status information based on Baskin and Caudle 1967, Baskin and Baskin 1973, Smith and Wofford 1980, Kurz and Bowles 1981, Baskin and Wofford 1990, Bowles and Jones 1992, TDEC Natural Heritage data base files, and 1992 site surveys by the lead author.

Key to acronyms:

- CEC – Commonwealth Edison Company (utility)
- EOR – Element Occurrence Record
- FPDWC – Forest Preserve District of Will County Illinois
- IDC – Illinois Department of Conservation
- TDEC – Tennessee Department of Environment and Conservation
- TDF – Tennessee Division of Forestry
- TNC – The Nature Conservancy
- TVA – Tennessee Valley Authority
- ORVs – Off- road vehicles
- ROW – Right-of way

- **Occurrences Included in Public Databases**

EPA queried iNaturalist, GBIF, and NatureServe. Occurrences in NatureServe were also consistent with other occurrence data.

iNaturalist (available [here](#)) had 173 research grade observations for this species, 2 of which appear to fall outside the known locations. The two observations are in Wisconsin. Figure A1-3.

GBIF (available [here](#)) included 186 occurrences and human observations (from 2010-2025). All these observations are also included in iNaturalist or NatureServe. Figure A1-4.

Occurrences in NatureServe were consistent with other occurrence data except for the Wisconsin locations. (linked [here](#)). Figure A1-5.

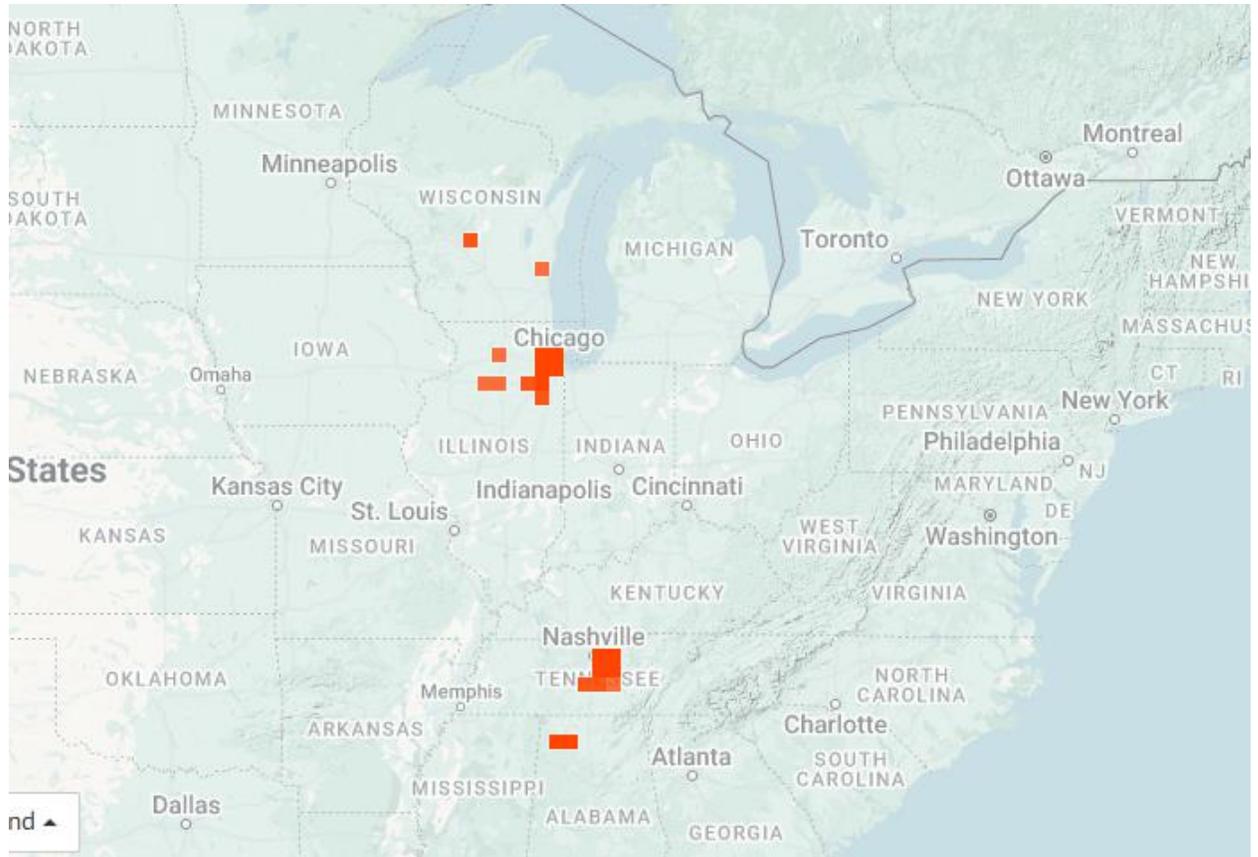


Figure A1-3. Locations for the leafy prairie-clover from iNaturalist.

TABLE GALLERY **MAP** TAXONOMY METRICS [DOWNLOAD](#)

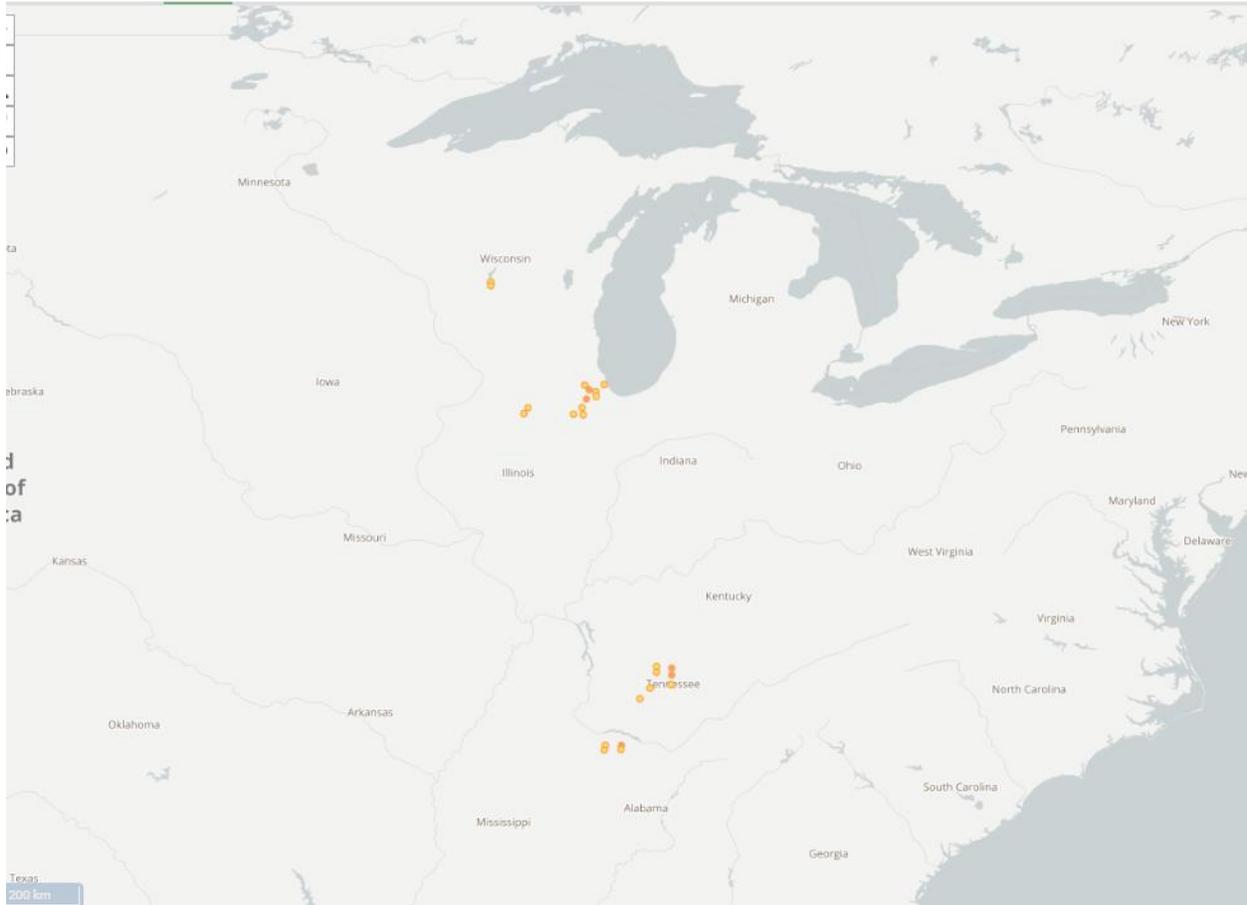


Figure A1-4. Map of leafy prairie-clover from GBIF.

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

EPA compiled available information for the leafy prairie-clover from FWS (**Appendix 1**). Influential information that impacted the development of the core map included:

- Occurrences and known locations of the leafy prairie-clover
- This species prefers full-to-partial sunlight.
- Cultivated Cropland area was not included.

1. Dataset References and Software

- NLCD Tree Canopy Cover 2021³:
<https://www.mrlc.gov/data?f%5B0%5D=category%3ANLCD%20Tree%20Canopy%20Cover&f%5B1%5D=category%3ATree%20Canopy>
 - 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 U.S.
- Software used: ArcGIS Pro 3.2
- FWS Species Range – last updated on 1/27/2018
- NLCD land cover data:
<https://epa.maps.arcgis.com/home/item.html?id=3ccf118ed80748909eb85c6d262b426f>

2. Datasets Used in Core Map Development

All datasets used in core map development are described in EPA's process document.

3. Core Map Development

- EPA started with the PULA provided by FWS during the Enlist consultation to set the outer extent of the core map. This PULA has three states which contain the FWS known locations for the species.
- This species prefers 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). Areas with cultivated cropland were also removed, using the 2021 NLCD land cover data.
 - 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 = 1The resulting core map includes the HUC12 watershed areas that contain the FWS known locations for the leafy prairie-clover with greater than 25% canopy cover. This area is also representative of other occurrence data sources including iNaturalist, GBIF and NatureServe.

³ Housman, I.W.; Schleeweis, K.; Heyer, J.P.; Ruefenacht, B.; Bender, S.; Megown, K.; Goetz, W.; Bogle, S. 2023. National Land Cover Database Tree Canopy Cover Methods v2021.4. GTAC-10268-RPT1. Salt Lake City, UT: U.S. Department of Agriculture, Forest Service, Geospatial Technology and Applications Center. 26 p