

Interim Core Map Documentation for the Furbish's Lousewort (*Pedicularis furbishiae*, Entity ID 790)

Version 1

Review Completed: April 2026

Core Map Developer: Corteva Agriscience, LLC.

Species Summary

- **Location:** The Furbish's lousewort is a threatened plant species found only along the St. John River, which separates Maine, U.S., and New Brunswick, Canada.
- **Critical habitat designated:** No
- **Habitat:** It is an endemic plant species with narrow ecological requirements found only on the mainstem of the St. John River. The lousewort typically occurs in a narrow 2-meter margin between the forest and riverbank in shaded, moist, sloped areas primarily along the southern bank and requires intermittent flooding and periodic ice scour.
- **Pollination:** The lousewort is hemiparasitic, requiring a perennial host plant, and has an obligate dependency on the half-black bumblebee (*Bombus vagans*) for pollination. The foraging distance of the half-black bumblebee is less than 1 km. Flowering occurs from mid-July through the end of August.
- **Notable relevant pesticide use sites:** Upriver subpopulations occur in a landscape dominated almost exclusively by actively managed forests, whereas downriver segments are in a landscape dominated by agriculture and riverfront development.

Review Notes

The developers created this core map using the U.S. Environmental Protection Agency's (EPA) process available at: <https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas>. EPA reviewed the draft interim map and documentation and evaluated if: (1) the map and documentation are consistent with the agency's process; (2) areas included or excluded from the interim core map are consistent with the biology, habitat, and/or recovery needs of the species; (3) data sources are documented and appropriate; and (4) the GIS data and mapping process are consistent with the stated intention of the developer. EPA agrees that this map is a reasonable depiction of core areas for this species given the available data and was consistent with the agency's mapping process. This documentation was not prepared by EPA, and EPA may have edited this documentation for clarity or other purposes. Some views in this documentation may not necessarily be the views of EPA or its staff.

The core map developed for this species is considered interim and can be used to develop pesticide use limitation areas (PULAs). This core map incorporates information developed by the U.S. Fish and Wildlife Service (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 core map does not replace or revise any range or designated critical habitat developed by FWS.

Evaluation of Known Location Information

Within the U.S., the Furbish's lousewort is only found in Aroostook County, Maine. There are 15 known subpopulations in Maine, of which six downriver subpopulations are extirpated. Upriver habitat is more extensive and occurs in a managed industrial forest. Downriver habitats, including New Brunswick, Canada's five additional subpopulations, are smaller and more fragmented (88 FR 30047). The 15 Maine populations are distributed within the range in four segments. The four segments are (FWS, 2018):

1. Upstream, southern part of the range to Dickey Bridge, containing populations 1 – 6, and representing 28 km of suitable habitat
2. Downstream Dickey bridge to Mclean Brook, containing populations 7 – 8, and representing 6.4 km of suitable habitat
3. Downstream Mclean Brook to Fort Kent, containing populations 9-12, and representing 1.8 km of suitable habitat
4. Downstream Fort Kent to Hamlin, containing populations 13-15, and representing 0.5 km of suitable habitat

In addition to the 15 known subpopulations, nine Global Biodiversity Information Facility (GBIF) locations were considered. Two of the nine locations are within the U.S. and only one is located within the species range (segment 4). However, all GBIF locations lack accuracy information and as a result, are considered unreliable.

Approach Used to Create Core Map

FWS reports (88 FR 30047; FWS, 2007, 2018, 2019a,b) were reviewed for habitat requirements and known location information.

The core map for the Furbish's lousewort is based on habitat constraints and was driven by:

- No critical habitat for the species has been designated.
- Occurrence data is scarce.
- Virtually no agriculture in segments 1 and 2 and limited agriculture in segments 3 and 4
- Species locations are limited to riverbanks and steep bluffs in a narrow area along the St. John River.
- Roads and railroads act as artificial habitat barriers.

The generalized steps for the Furbish's lousewort included:

- 1) Obtain the most recent range data
- 2) Split the range data into the four subpopulation segments listed by FWS
- 3) Conduct an overlap assessment using EPA cultivated land layer for core mapping and 2024 Cropland Data Layer (CDL) to gain insights into the overall land use composition and agricultural lands within the range/segments
- 4) Obtain a Digital Elevation Model (DEM) from USGS for the range
- 5) Calculate slope (%) and aspect (north- or northwest-facing)
- 6) Use available Tiger line/shape data to represent and select roads/railroads within the range
- 7) Split the segments along the roads/railroads and mark them excluded from core map
- 8) Download occurrence data from GBIF and filter based on available location information and accuracy.

An overlap assessment conducted using the 2024 CDL and the EPA Cultivated layer, land areas larger than 25 acres showed very little agriculture in segments 1 and 2 of the range. Based on this finding,

there is no need to refine the range within segments 1 and 2 and they are included in the core map as the full range. This also represents the areas with the most suitable habitat.

Using the habitat requirements, GIS maps were generated for slope and aspect, and then visually inspected along the range. A 10m USGS Digital Elevation Model (DEM) was used because it had the same spatial resolution as the 2024 CDL. In segments 3 and 4, suitable habitat was primarily found between the river and several manmade features in a narrow band. As such, these manmade features (Tiger line/shape roads and railroads) were used as a boundary for the suitable habitat and core map in segments 3 and 4.

Description of Core Map

The core map for the Furbish's lousewort is biological information type based on range segments refined using habitat requirements. FWS documentation shows the range is split into four segments based on existing populations. The core map for segments 1 and 2, representing 8 of 15 subpopulations in Maine, is the full species range in this area. Since there is extensive suitable habitat throughout these segments (mostly forested land) and minimal cultivated land, the species could be found throughout, and it was unnecessary to refine further.

Conversely, the species range in segments 3 and 4 has unsuitable habitat, including manmade features, but has higher overlap with cultivated lands. Habitat requirements include steep slopes along the intermittently flooded, ice-scoured, north- and west-facing banks of the St. John River. Slopes and aspect were derived from the USGS 10 m Digital Elevation Model (DEM). Assessment showed that steep slopes are present along the riverbanks, along naturally occurring bluffs, and along artificial areas such as roads and railroads beds. Areas with steep slopes and suitable aspect area were found throughout the entire range. Thus, the core map for segments 3 and 4 was refined to the land area between the St. John River and Rte. 161, US Hwy 1, or Bangor and Aroostook Railroad. This ensured that only the areas between the river and the manmade features were included, which represents the most suitable habitat. Locally within floodplains, steep slopes are likely to exist as well and therefore are included in the core map. This interim core map has an "average" (3) best professional judgement classification for uncertainties since the core map was made using segments of the range refined by habitat requirements. The core map covers approximately 25,908 acres and is depicted in Figure 1.

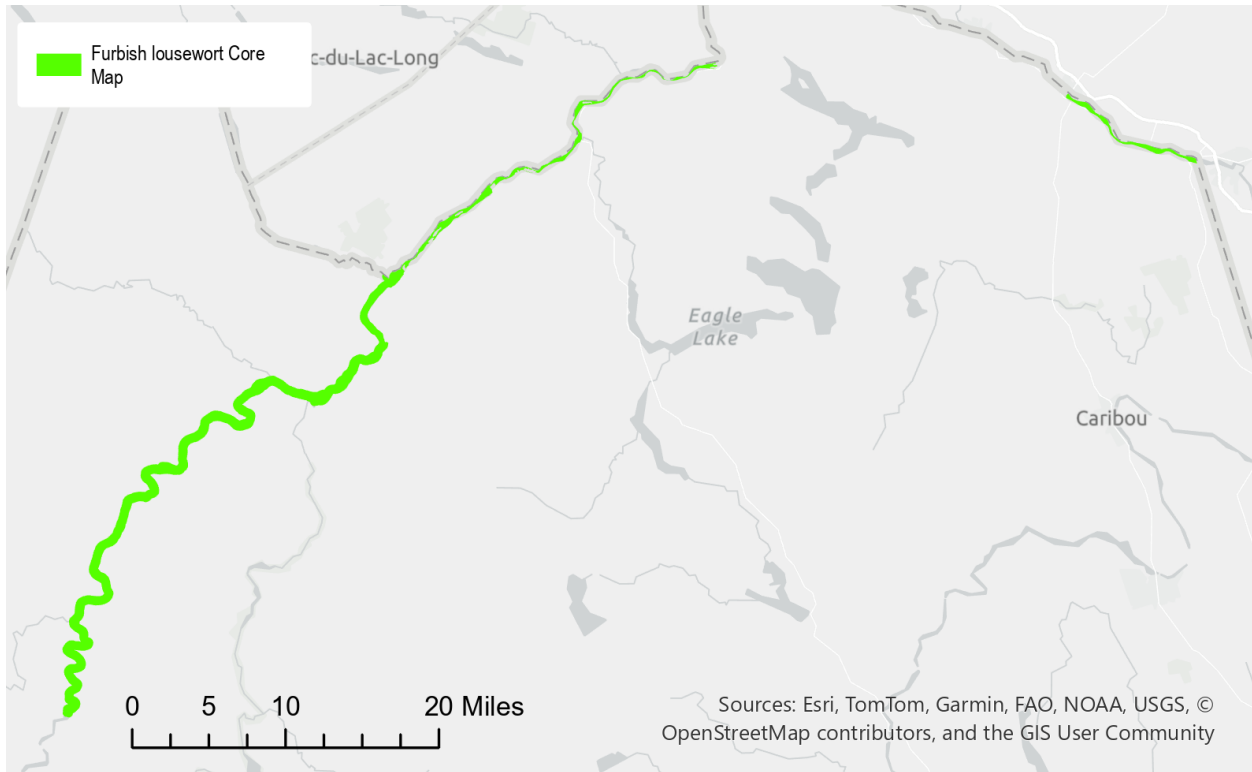


Figure 1. Core map for the Furbish’s lousewort.

Land Use Assessment

Using the CDL 2024 dataset, an overlap assessment was conducted to determine the percent overlap of the core map with agricultural lands based on the EPA Cultivated Land for Core Mapping layer. The results are presented in Table 1. The core map encompasses an area of 25,364 acres of which 155 acres (0.16%) can be considered cultivated lands (Table 1).

Table 1. Land use assessment of the Furbish’s lousewort core map based on the 2024 Cropland Data Layer.

CDL CLASS NAMES	ACRES
BACKGROUND	141
SORGHUM	1
BARLEY	1
SPRING WHEAT	0
RYE	29
OATS	9
MUSTARD	0
ALFALFA	11
OTHER HAY/NON ALFALFA	8
BUCKWHEAT	10
POTATOES	94
PEAS	1

CDL CLASS NAMES	ACRES
CLOVER/WILDFLOWERS	19
CHRISTMAS TREES	2
OPEN WATER	5,275
DEVELOPED/OPEN SPACE	159
DEVELOPED/LOW INTENSITY	474
DEVELOPED/MED INTENSITY	222
DEVELOPED/HIGH INTENSITY	114
BARREN	125
DECIDUOUS FOREST	889
EVERGREEN FOREST	6,225
MIXED FOREST	8,928
SHRUBLAND	53
GRASSLAND/PASTURE	1,373
WOODY WETLANDS	679
HERBACEOUS WETLANDS	521
BROCCOLI	0
RADISHES	0

Appendix 1. Species Information for the Furbish's Lousewort

1. References

88 FR 30047. Endangered and Threatened Wildlife and Plants; Reclassifying Furbish's Lousewort (*Pedicularis furbishiae*) from Endangered to Threatened Status with a Section 4(d) Rule. Federal Register 88(90): 30047-30057. <https://www.govinfo.gov/content/pkg/FR-2023-05-10/pdf/2023-09847.pdf#page=1>

FWS. 2007. Furbish's Lousewort (*Pedicularis furbishiae*) 5-Year Review: Summary and Evaluation. US Fish and Wildlife Service, Maine Field Office, Old Town, ME. https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/1044.pdf

FWS. 2018. Species Status Assessment Report for Furbish's Lousewort (*Pedicularis furbishiae*). US Fish and Wildlife Service, Maine Field Office, East Orland, ME. <https://iris.USFWS.gov/APPS/ServCat/DownloadFile/166496>

FWS. 2019a. Furbish's Lousewort (*Pedicularis furbishiae*) 5-Year Review. US Fish and Wildlife Service, Maine Field Office, East Orland, ME. https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2686.pdf

FWS. 2019b. Recovery Plan for the Furbish's Lousewort (*Pedicularis furbishiae*) Second Revision. US Fish and Wildlife Service, Maine Field Office, East Orland, ME. https://ecos.USFWS.gov/docs/recovery_plan/20190926_furbishs%20lousewort%20Recovery%20Plan_signed.pdf

2. Background information

Status:

The Furbish's lousewort was listed as endangered in 1978 and reclassified as threatened in 2023.

Resiliency, redundancy, and representation (the 3Rs)

- **Resiliency** – “Long-term census data demonstrate that the Furbish's lousewort is resilient to stochastic events (periodic ice scour, flooding). Resilience at the subpopulation level is currently diminished because Furbish's lousewort does not tend to colonize new sites and is often very slow to recolonize sites after it is locally extirpated. Therefore, subpopulations that become locally extirpated tend to remain so. In 37 years of monitoring, only one subpopulation, Big Rapids at Dickey Bridge, dropped to zero flowering stems and now supports reproductive plants. In contrast, six subpopulations (all downriver) dropped to zero flowering stems and remain locally extirpated... We believe the loss in resiliency in downriver subpopulations is attributed to habitat loss and degradation because of development and an increase in the severity and frequency of ice scour events... Habitat quality also contributes to the species' resilience. Habitat in upriver areas is intact in a managed forest landscape, resilient to normal ice scour frequency, and severe erosion events are rare. Habitat quality is diminished in downriver areas, less resilient to the current ice scour frequency, and severe erosion events are common. Lousewort is not colonizing severely eroded sites and may not for decades, which explains why downriver populations are locally extirpated and not recovering (FWS, 2018).”
- **Redundancy** – Redundancy has diminished appreciably since 1989, especially at the downriver Segments 2, 3, and 4. Currently, lousewort is absent from six of nine downriver subpopulations. For example, in the 2000-2001 census, most downriver census sites were occupied and supported 73

percent of the total population. In the most recent 2016-2017 census, Furbish's lousewort was absent from most downriver sites and these subpopulations comprised just 16 percent of the total population... Redundancy in the downriver subpopulations has diminished, and the condition in the upriver subpopulations has remained constant (FWS, 2018)."

- **Representation** – "Overall, ecological diversity is naturally low for the species. Furbish's lousewort occupies a narrow niche, growing almost exclusively in moist, shaded habitats having appropriate host plants, and is pollinated only by half-black bumble bees. We know of no morphological variation throughout the limited range of this endemic species. Genetic diversity in Furbish's lousewort is very low. We consider the representative unit to be the entire metapopulation and conclude that the species has low ability to adapt to environmental change (FWS, 2018)."

Habitat, Life History, and Ecology

Habitat:

The Furbish's lousewort is endemic to Maine, U.S. and New Brunswick, Canada. There are 20 populations that occur along portions of a 225 km stretch of the St. John River. Fifteen of the populations are in Maine and the remaining five populations are in New Brunswick. The lousewort is confined to a narrow band (often less than 2 m) of eroding riverbank below the forest edge and lives on the intermittently flooded, ice-scoured banks of the river. Plants grow almost exclusively on the north- or west-facing bank. Seeds germinate in moist, cool microhabitats having minimal herbaceous or woody plant competition or leaf litter, such as moss-covered soil or parts of the riverbank that are constantly wet. The portion of the river basin incorporating the range of the Furbish's lousewort is characterized by cool summers, a short growing season, and long, snowy winters. In downriver segments supporting Furbish's lousewort (below Allagash, Maine), the river carves through thick deposits of glacial till and fluvial deposits with pockets of lacustrine silt-clay deposits, shorelines have a more gradual slope, and bedrock outcrops are relatively rare. Upriver reaches supporting Furbish's lousewort have more rocky outcrops, tall, steeply-sloped riverbanks and less glacial and fluvial deposits. Groundwater seeps, many of which are extensive, occur periodically along the riverbank. Suitable habitat is confined to a narrow 2 m band of ice-scoured, eroding riverbank below the forest edge and well above the rank herbs and grasses and cobble along the riverbed. The species is not found along tributaries of the St. John River because ice scour is too infrequent and vegetation is too dense along the river's edge. Plants grow on gravelly, calcareous soils and on lacustrine or glacial till deposits, and almost always in the presence of groundwater seepage. Soils along the river are low in nitrogen and organic matter and high in calcium (FWS, 2007; 2018).

Diet:

N/A

Pollination Type and Pollinator:

Reproductive plants emerge in May and produce an average of 2 to 3 flowering stems; each stem has one or more inflorescences, and each inflorescence has up to 25 flowers. Flowers bloom several at a time from about July 10 to the end of August. The species has a single known pollinator, the half-black bumble bee (*Bombus vagans*), which has a foraging distance of <1 km from the nest (88 FR 30047; FWS, 2018).

Life Stage	Description, characteristics
Seed	<ul style="list-style-type: none"> • Seeds produced in capsules • 7 to 17 seed capsules per inflorescence; up to 50 seed capsules per mature plant • Seeds ripen in late-September; capsule dehisce; seeds drop; limited dispersal capability • Seeds overwinter and germinate the following June through August • Seeds lack long-term seed dormancy; no seed bank
Seedlings	<ul style="list-style-type: none"> • Develop two true leaves (only 6mm; ¼ inch) in height during the initial growing season • Seedlings are hemiparasitic; host generalists, perhaps nitrogen fixing plants • Rosette of leaves at ground level; difficult to find • Take three or more years to grow to sufficient size to produce flowers
Vegetative and Flowering Plants	<ul style="list-style-type: none"> • Mature plants are perennial, emerge in May and by early June produce a crown of basal leaves (rosette) up to 15cm (6 inches) in diameter • Mature plants may be hemiparasitic in nutrient-poor soils, unknown • Mature plants produce just one or two flowering stems (scapes) in their first year; may produce an average of 2 to 3 flowering stems in subsequent years. • Each stem may have several inflorescences (maximum of 25 total per plant) • Each inflorescence has about 20 flowers that bloom several at a time from mid-July to mid-August • Pollinated only by the half black bumble bee, <i>Bombus vagans</i> • Average inflorescence produces 7 to 17 egg-shaped seed capsules • Seed capsules mature in late-September • Plant dies back with first frost • Plants are perennial; longevity up to 15 years; likely limited because of competition with other woody and herbaceous vegetation and periodic flooding and ice scour.

Figure 2. Summary of life cycle of Furbish’s lousewort by life stages (Table 1, FWS, 2018).

Taxonomy:

The Furbish’s lousewort is a terrestrial dicot plant and member of the broomrape family, Orobranchaceae.

Relevant Pesticide Use Sites:

The St. John River carves through boreal forests of northern Maine before widening into rich farmland of the middle and lower valley. Upriver subpopulations occur in a landscape dominated almost exclusively by actively managed forests. Downriver segments, including those in New Brunswick, are in a landscape dominated by agriculture and riverfront development (FWS, 2018).

Relevant pesticide use sites (agricultural fields) are primarily found in the downstream segments (3 and 4) of the species range along the St. John River. Agriculture is dominated by potatoes, rye and buckwheat and covers 6.6% and 7.7% in segments 3 and 4, respectively. Grasslands/Pasture cover 3.2% to 16.5% of the range segments based on the 2024 CDL assessment.

Relevant Recovery Criteria and Actions:

Long-term viability of the lousewort requires enough highly resilient populations that (FWS, 2019b):

- Each have a high probability of surviving and recovering from stochastic events (periodic, local ice scour and flooding) (=resilience);
- Are distributed throughout the historical range of the species so that the species can rebound from catastrophic events (extensive ice scour and flooding) (=redundancy); and
- Maintenance of genetic diversity through sufficient gene flow (=representation).

This will be accomplished by addressing threats, restoring subpopulations where the plant is extant, as well as extirpated. Healthy subpopulations are large (greater than 440 flowering stems), can persist through ice scour and flooding events of varying magnitude, have adequate rates of seed production and germination, and maintain connectivity (the potential for gene flow between subpopulations).

Near-term recovery efforts will focus on restoring subpopulations that have declined, re-establishing those that have been extirpated, and protecting habitat. Near-term recovery efforts will also include research to better understand the effects of increased ice scour frequency and to document the temperature and drought tolerance of the species.

Recovery Criteria (FWS, 2019b):

1. The metapopulation is viable, comprising a 30-year median of 4,400 flowering stems or greater, and distributed as follows:
 - a. Upriver: a 30-year median of 2,800 flowering stems or greater in at least 6 subpopulations with at least 3 good and 3 fair subpopulations.
 - b. Downriver: a 30-year median of 1,600 flowering stems or greater in at least 9 subpopulations with at least 3 good and 6 fair subpopulations.

Once the upriver and downriver criteria are reached, the median number of flowering stems for each respective river section will remain stable or increase over a period of at least 30 years (three generations) without augmentation, reintroduction, or hand-pollinating of plants. Additionally, in New Brunswick there is a 30-year median of 1,100 plants distributed among at least 5 subpopulations.

2. There is a long-term habitat protection plan for all subpopulations in Maine that provides for the species' needs throughout its life cycle. Long-term habitat protection mechanisms must ensure important species' needs:
 - a. Forest overstory shade conditions (about 50% sunlight) by protecting or restoring a forested riparian buffer of 250 feet adjacent to suitable habitat
 - b. Moist soil conditions and seeps by limiting further shoreline erosion and bank slumping, and restoring suitable habitat where it has been damaged from past events
 - c. Native vegetation that newly germinated Furbish's lousewort plants can parasitize
 - d. Site conditions without excessive plant competition, especially from tall shrubs and robust herbs
 - e. Populations of half-black bumblebee sufficient to ensure pollination and subsequent seed production.

Recovery Actions (FWS, 2019b):

1. Monitor the Furbish's lousewort population and demographics and periodically assess the status of the bumble bee pollinator to document trends
2. Improve the health and viability of extant subpopulations and restore extirpated subpopulations throughout the historical range
3. Achieve long-term habitat protection for each subpopulation
4. Conduct scientific investigations to improve understanding of stressors, viability, propagation, restoration and genetic needs
5. Periodically review progress toward achieving recovery criteria and employ strategic conservation and adaptive management to address threats
6. Establish new subpopulations in unoccupied areas having suitable habitat

7. Store seeds and establish captive populations.
8. Enhance seed production
9. Work with Canadian partners to implement strategies that prevent extinction

2.1. Range

The species is endemic to a 225 km section of the St. John River between Maine and New Brunswick (Figure 3). The range extends from a short distance upstream from the confluence of the St. John and Big Black Rivers in Maine to the confluence of the Aroostook River in New Brunswick. The last 30 km of the range is within Canada. There is a 13-mile gap in species range between the subpopulations at St. Francis and Fort Kent and a 40-mile gap between the subpopulations at Fort Kent and Van Buren, Maine (FWS, 2018, 2019b). The range is approximately 29,920 acres.

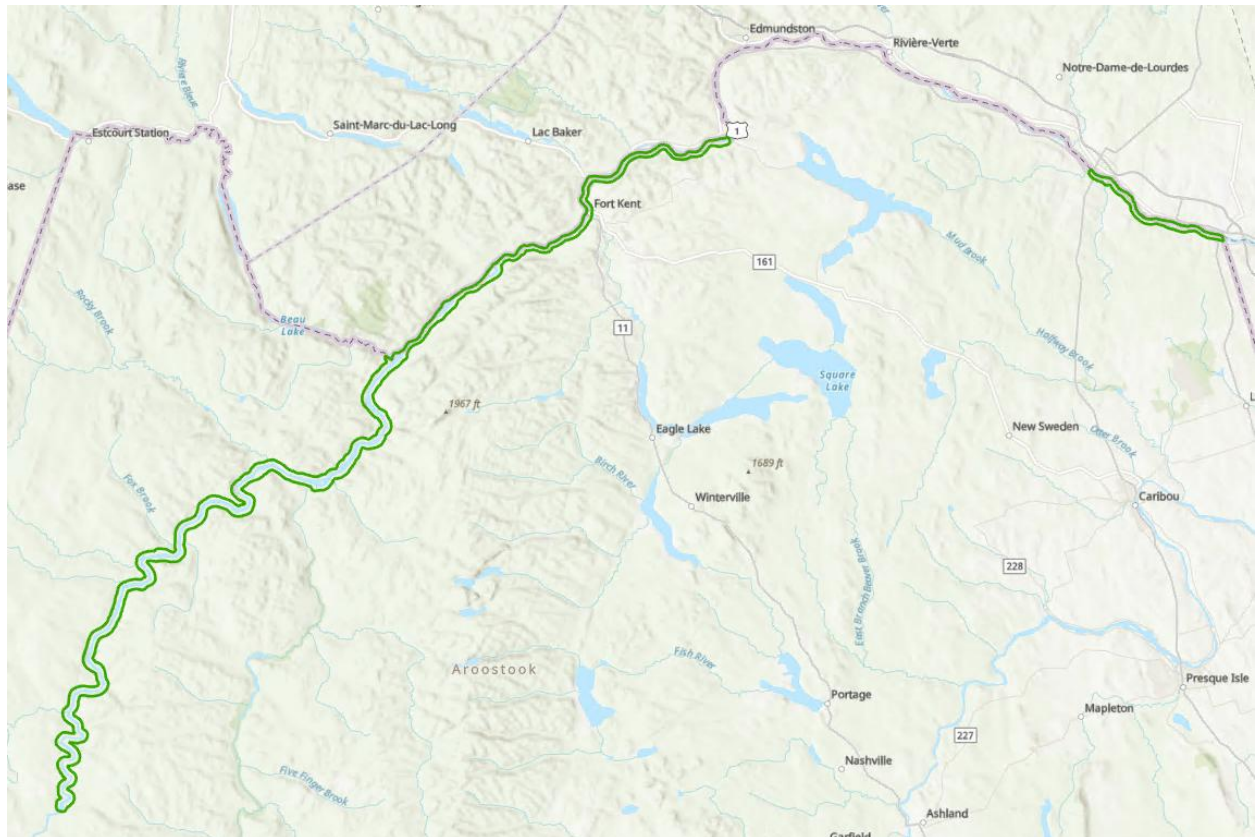


Figure 3. Map depicting the range of the Furbish's lousewort as of 06/06/2022.

2.2. Critical Habitat

No critical habitat has been described or designated for the Furbish's lousewort.

2.3. Known Locations

There are currently 15 subpopulations located in Maine (#1-15 in figure below) and 5 subpopulations in New Brunswick (A-E in figure below). The Furbish's lousewort is currently present in 9 of the 15 subpopulations in Maine (FWS, 2018). Upriver subpopulations occur in a landscape dominated almost exclusively by actively managed forests. Downriver segments, including those in New Brunswick, are in a landscape dominated by agriculture and riverfront development.

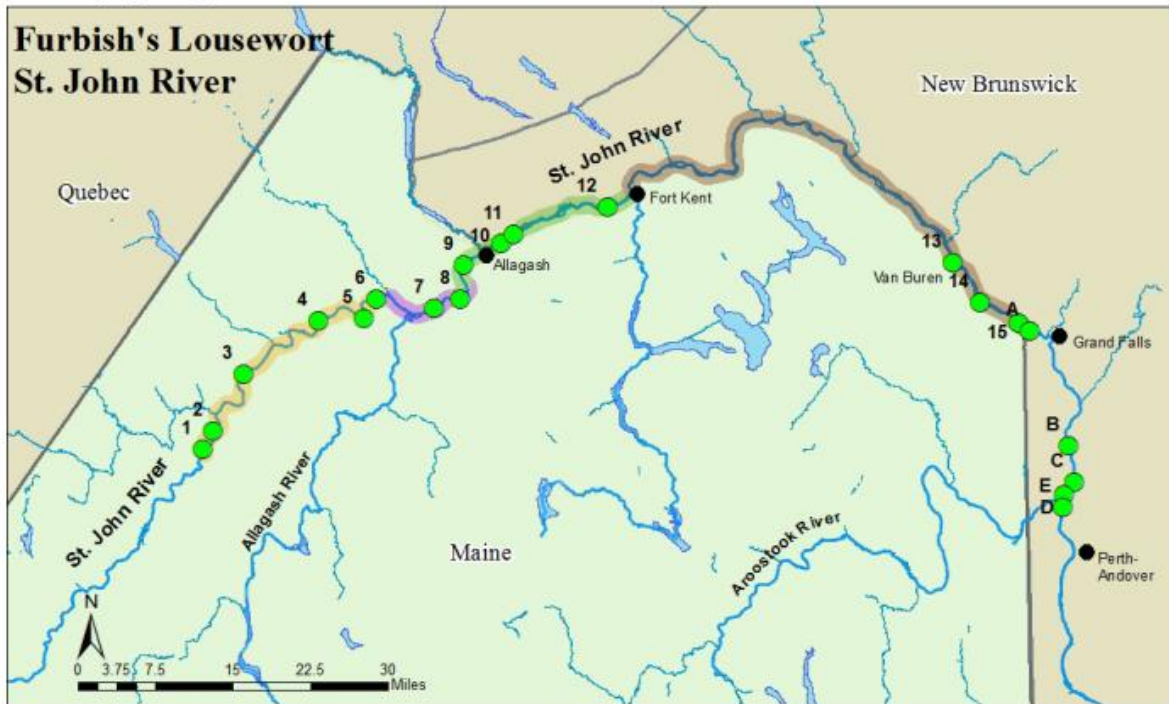


Figure 4. FWS known subpopulations of the Furbish’s lousewort with census data points in green (Figure 4, FWS, 2018).

Table 2. FWS assessment of the total length of suitable habitat within each population segment (FWS, 2018)

River segment	Kilometers (miles of suitable habitat)	Permanently Protected (percent)
River segment 1 (upriver)	28km (17.4 miles)	7.7 km (4.8 miles) (28 percent)
River segment 2 (downriver)	6.4km (4.0 miles)	2.1km (1.3 miles) (62 percent)
River segment 3 (downriver)	1.8km (1.1 miles)	0
River segment 4 (downriver)	0.5km (0.3 miles)	0
Total	36.7km (22.8 miles)	9.8km (6.1 miles)

Table 3. Summary of the current conditions of the Furbish's lousewort (FWS, 2018)

Table 5. Summary of current condition of Furbish's lousewort.

Subpopulation	Landowner	Protection status	Abundance (flowering stems – Maine, total plants Canada)	Density (plants/mi.)	Current status within the site	Length of mapped potential habitat	Riparian buffer	Number of erosion events/mile	Current condition
Blue Brook Downstream, T13/T14 Townline, Basford Rips Upstream	Irving, Orion, Prentis & Carlisle	St. John R. plan, (Prentis Carlisle no longer in Plan) LUPC	362 2 Fair	161/mi. 3 Good	Middle quartile 2 Fair	2.25 mi. 3 Good	>250 ft. 3 Good	0/mi. 3 Good	2.7 Good
Basford Rips	Orion, Irving	St. John R. plan	113 2 Fair	141/mi. 3 Good	Middle quartile 2 Fair	0.8 mi. 2 Fair	>250 ft. 3 Good	0/mi. 3 Good	2.5 Fair/Good
Big Black R Junction & Big Black River Jxn NW Shore, Camp 107 - Stewart Brook, Seminary Brook, Unnamed Rapids #2, Long's Rapids upriver (N), Long's Rapids downriver (N), Castonia Farm	Seven Islands, Irving, Prentis & Carlisle	4.3 mi./61% NE Forestry Foundation easement on Seven Islands land, St. John R. plan (Prentis Carlisle no longer in Plan), LUPC	749 3 Good	105/mi. 2 Fair	Middle quartile 2 Fair	7.1 mi. 3 Good	>250 ft. 3 Good	0.1/mi. 3 Good	2.7 Good
Schoolhouse Rapids, Ouellette Farm upriver, Ouellette Farm downriver, Fox Brook Rapids, Fox Brook Ledges, Hafford Brook (N), Poplar Island Rapids, Allagash	Irving	Minimum Shoreland zoning	317 2 Fair	67/mi. 2 Fair	Lower quartile 1 Poor	4.7 mi. 3 Good	>250 ft. 3 Good	0/mi. 3 Good	2.3 Fair
Campbell Brook, Walker Brook, Allagash	Irving	Minimum Shoreland zoning	142 2 Fair	142/mi. 3 Good	Middle quartile 2 Fair	1.0 mi. 2 Fair	>250 ft. 3 Good	0/mi. 3 Good	2.5 Fair/Good
Big Rapids, Dickey Bridge, Allagash	Irving, Private landowners	Minimum Shoreland zoning	38 1 Poor	127/mi. 2 Fair	Lower quartile 1 Poor	0.3 mi. 1 Poor	Modest treeline 2 Fair	3.3/mi. 1 Poor	1.3 Poor
St Paul's Church downriver, Allagash Delta, Pelletier Brook, Casey Brook - Cross Rock, Allagash	Irving, MBPL, Private landowners	1 mi./38% MBPL, minimum Shoreland Zoning	267 2 Fair	103/mi. 2 Fair	Lower quartile 1 Poor	2.6 mi. 3 Good	>50% with 250 ft. buffer 2 Fair	2.3/mi. 2 Fair	2.0 Fair
Wiggins Brook, St. Francis	Private landowners	Minimum Shoreland zoning	0 0 Very Poor	0/mi. 0 Very Poor	Lower quartile 1 Poor	0.3 mi. 1 Poor	1 Poor	6.7/mi. 1 Poor	0.7 Poor
Rankin Rapids, St. Francis	Private landowners	Minimum Shoreland zoning	0 0 Very Poor	0/mi. 0 Very Poor	Lower quartile 1 Poor	0.3 mi. 1 Poor	1 Poor	10/mi. 1 Poor	0.7 Poor
Thibodeau Brook, St. Francis	Private landowners	Minimum Shoreland zoning	0 0 Very Poor	0/mi. 0 Very poor	Lower quartile 1 Poor	0.6 mi. 2 Fair	1 Poor	0/mi. 3 Good	1.2 Poor
St. Francis Line, St. Francis	Private landowners	Minimum Shoreland zoning	0 0 Very Poor	0/mi. 0 Very poor	Lower quartile 1 Poor	0.6 mi. 2 Fair	1 Poor	1.7/mi. 2 Fair	1.0 Poor
Camel Brook, Fort Kent	Private landowners	Minimum Shoreland zoning	13 1 Poor	13/mi. 1 Poor	Lower quartile 1 Poor	1.0 mi. 2 Fair	1 Poor	0/mi. 3 Good	1.5 Poor
Van Buren	Private landowners	Minimum Shoreland zoning	0 0 Very Poor	0/mi. Very poor	Lower quartile 1 Poor	0.05 mi. 1 Poor	Modest treeline 1 Poor	0/mi. 3 Good	1.0 Poor
Hamlin	Private landowners	Minimum Shoreland zoning	0 0 Very Poor	0/mi. Very poor	Lower quartile 1 Poor	0.02 mi. 1 Poor	Riparian intact, some clearing 2 Fair	0/mi. 3 Good	1.2 Poor
Hamlin Corners	Irving, Private landowners	Minimum Shoreland zoning	239 2 Fair	956/mi. 3 Good	Lower quartile 1 Poor	0.25 mi. 1 Poor	>250 ft., reforestation 3 Good	0/mi. 3 Good	2.2 Fair
Aroostook			2 1 Poor	1 Poor	Lower quartile 1 Poor				
Above Grand Falls			70 2 Fair	2 Fair	Lower quartile 1 Poor				
Stirrett Preserve	Nature Trust of New Brunswick		1 1 Poor	1 Poor	Lower quartile 1 Poor		3 Good		
Medford			64 1 Poor	2 Fair	Lower quartile 1 Poor				
Big Flat			20 1 Poor	1 Poor	Lower quartile 1 Poor				

2.4. Additional Information (Include when applicable)

Conservation efforts summarized from EPA, 2018:

- Shoreline Zoning – Maine
 - Agriculture requires a 75-foot setback from the river
 - Some districts prohibit vegetation cutting within 50 to 75 feet of river

- St. John River Resource Protection Plan
 - Voluntary
 - Signed by industrial forest owners
 - Forest management within 250 ft of river is highly constrained
- Shoreland Protection – New Brunswick
 - Permitting required for activities within 39 m of the river
- Permanent Habitat Protection
 - Pingree Forest Partnership has ~750,000 acres conservation easement along river where lousewort occurs; includes 1000-foot river buffer; protects 6.2% of Maine population
 - Maine Bureau of Parks and Lands protects 2% of Maine occurrences, all located within Town of Allagash
 - George M. Stirrett Preserve in NB is permanently protected by the Nature Trust of New Brunswick

Appendix 2. Core Map Development

1. References and Software

Software used: *ArcGIS Pro 3.4*

2. Datasets Used in Core Map Development

The following datasets were used to develop the core map of the Furbish's lousewort

- FWS species range map:
https://ecos.USFWS.gov/docs/species/shapefiles/usUSFWS_complete_species_current_range.zip
- USGS 10m Digital Elevation Model
- Tiger line/shape roads 2022: <https://www2.census.gov/geo/tiger/TIGER2022/ROADS/>
- Tiger line/shape railroads 2022: <https://www2.census.gov/geo/tiger/TIGER2022/RAILS/>
- Cropland Data Layer 2024:
https://www.nass.usda.gov/Research_and_Science/Cropland/Release/datasets/2024_10m_cdl.zip
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2.1. Range

Range data (Figure 3) was extracted from

https://ecos.USFWS.gov/docs/species/shapefiles/usUSFWS_complete_species_current_range.zip which was downloaded on Feb 5, 2025. The range is approximately 29,921 acres.

2.2. Critical Habitat

Critical habitat data is not available for the Furbish's lousewort.

2.3. USGS 10m DEM

The USGS 10-meter DEM (Digital Elevation Model), part of the 3DEP (3D Elevation Program), is a seamless, high-resolution raster dataset representing the bare-earth surface of the United States with a ground spacing of approximately 10 m, covering the conterminous US, Hawaii, and territories.

2.4. Tiger line/shape Detailed Roads

The TIGER/Line Roads dataset is a detailed, national dataset from the U.S. Census Bureau that provides geographic and cartographic information, including road features, address ranges, street names, and ZIP codes, for use with Geographic Information Systems (GIS).

2.5. Tiger line/shape Railroads

The Tiger line/shape railroads layer was used to determine potential artificial slopes and boundaries within the range of the Furbish's lousewort. The railroad is present in population segments 3 and 4 and generally follows the St. John River along the top of the steep bluffs. This layer was not processed, and the full dataset was used for editing (see section 3).

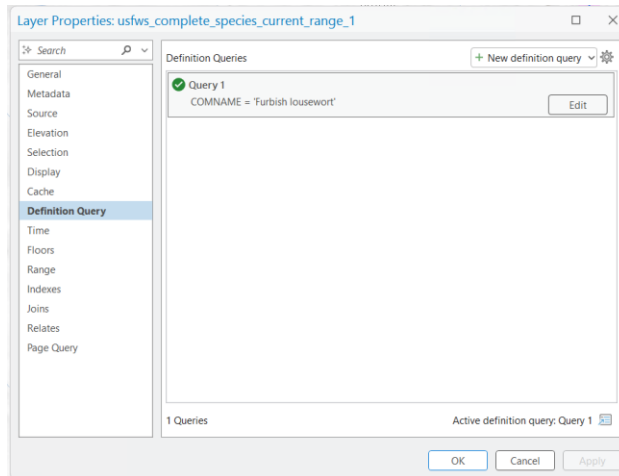
2.6. Cropland Data Layer 2024

The Cropland Data Layer (CDL) for 2024, produced by the U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS), is an annual, geo-referenced, crop-specific land cover dataset for the continental United States, using satellite imagery and ground truth data. The CDL aims to map which crops are grown in specific areas, providing a detailed understanding of land use for agricultural purposes. This map is provided at a 10 m resolution.

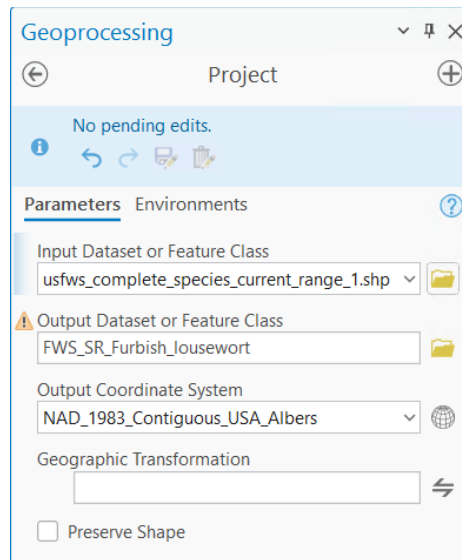
3. Core Map Development

The development of the Furbish's lousewort core map was a multi-step process which is described below.

- Step 1 – Load the FWS range and setup a definition query to create a virtual Furbish's lousewort layer



- Step 2 – Reproject the layer into a new feature class named USFWS_SR_Furbish_lousewort
-



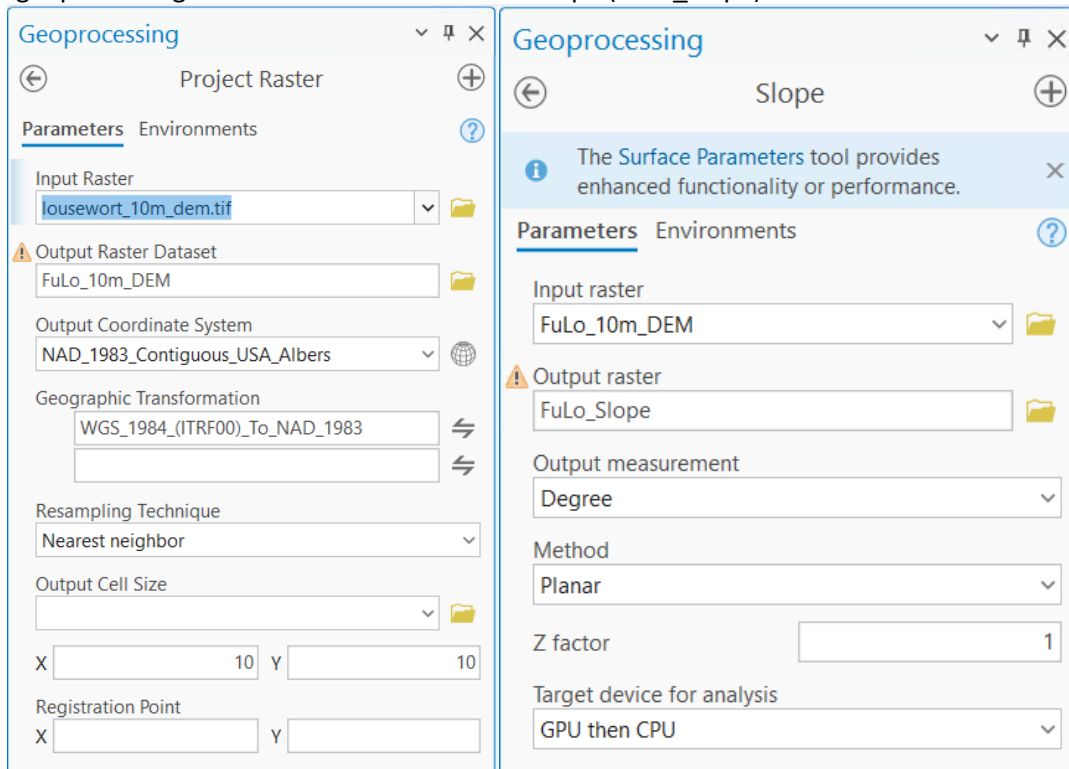
- Step 3 – Create the 4 population segments by editing the USFWS_SR_Furbish_lousewort feature class. The file was editing using the “Split” option. Three splits were executed at the following locations:
 - Dickey Bridge
 - Mclean Brook
 - Fisher River south of Fort Kent

As part of this step an initial land use assessment was conducted to determine the acreage of agricultural lands in each segment and the percentage of agriculture (Table 4). The overlap assessment was conducted using the CDL of 2024.

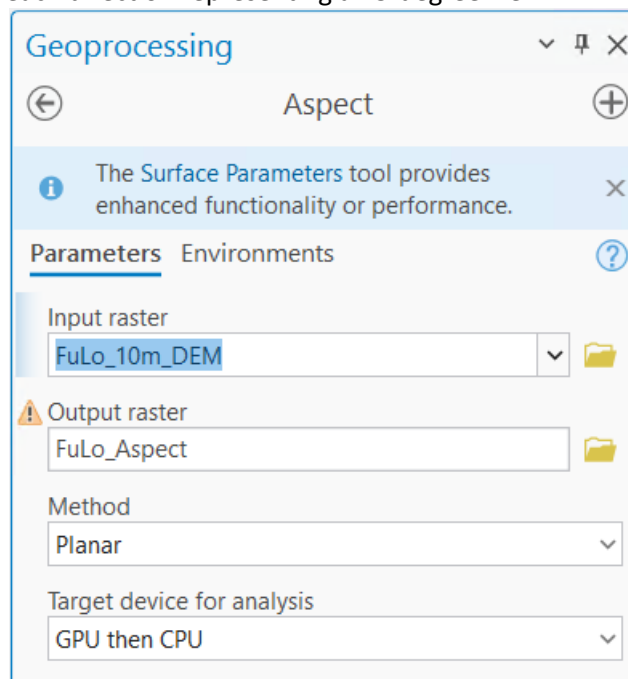
Table 4. Land use assessment using CDL 2024 for the four Furbish’s lousewort population segments showing total acres of crops in each segment

SEGMENT	1	2	3	4
ALFALFA	0.0	0.2	11.5	2.3
BACKGROUND	0.0	0.0	85.9	55.4
BARLEY	0.0	0.3	1.2	14.2
BARREN	52.9	34.0	40.9	9.0
BROCCOLI	0.0	0.0	0.0	0.2
BUCKWHEAT	0.0	0.3	76.7	38.4
CHRISTMAS_TREES	0.0	0.0	4.0	0.9
CLOVER_WILDFLOWERS	0.0	0.0	3.9	36.4
DECIDUOUS_FOREST	537.1	102.8	220.9	68.5
DEVELOPED_HIGH_INTENSITY	12.4	31.6	83.9	138.4
DEVELOPED_LOW_INTENSITY	72.1	116.0	309.2	368.1
DEVELOPED_MED_INTENSITY	21.3	56.4	194.4	286.8
DEVELOPED_OPEN_SPACE	70.7	29.3	78.4	113.0
EVERGREEN_FOREST	5288.8	647.2	401.2	93.5
GRASSLAND_PASTURE	478.9	147.0	870.8	805.9
HERBACEOUS_WETLANDS	252.6	99.5	122.1	65.1
MIXED_FOREST	5453.5	1837.9	1846.0	1279.0
MUSTARD	0.0	0.0	0.0	0.4
OATS	0.0	0.1	4.1	33.3
OPEN_WATER	2357.3	781.5	1200.7	941.9
OTHER_HAY_NON_ALFALFA	0.0	0.0	5.0	8.6
PEAS	0.0	0.1	1.0	0.5
POTATOES	0.0	0.1	260.8	160.2
RADISHES	0.0	0.0	0.0	0.1
RYE	0.0	0.0	108.9	54.7
SHRUBLAND	29.0	11.4	14.9	0.9
SORGHUM	0.0	0.0	0.4	7.3
SPRING_WHEAT	0.0	0.0	0.0	0.1
WOODY_WETLANDS	252.1	70.9	240.3	305.6
<i>Total</i>	14878.9	3966.6	6187.1	4888.775
<i>Agriculture w/Grasslands</i>	478.9	148.2	1344.3	1127.2
<i>Percent ag in range segment</i>	3.2%	3.7%	21.7%	23.1%
<i>Agriculture w/out Grasslands</i>	0.0	1.2	473.4	321.3
<i>Percent ag in range segment</i>	0.0%	0.0%	7.7%	6.6%
<i>Pastures</i>	3.2%	3.7%	14.1%	16.5%

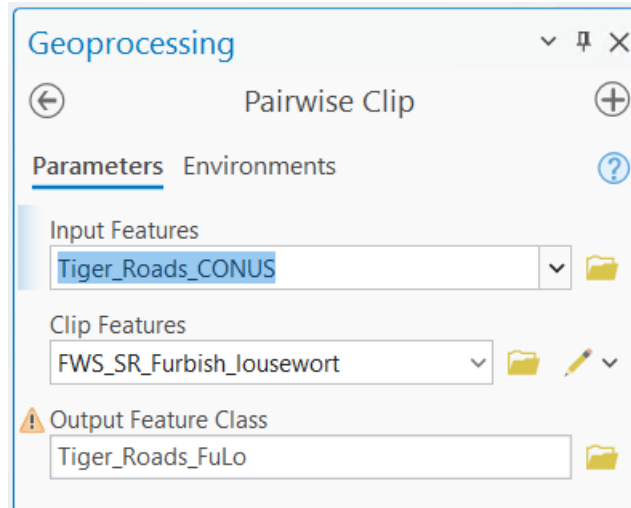
- Step 4 – Calculate the slope. To calculate the slope, first the source data (lousewort_10m_DEM.tif) was reprojected from a geographic projection to NAD1983 Contiguous US Albers to ensure key data was in the same coordination reference system. Next, the “Slope” geoprocessing tool was run to calculate the slope (FuLo_Slope)



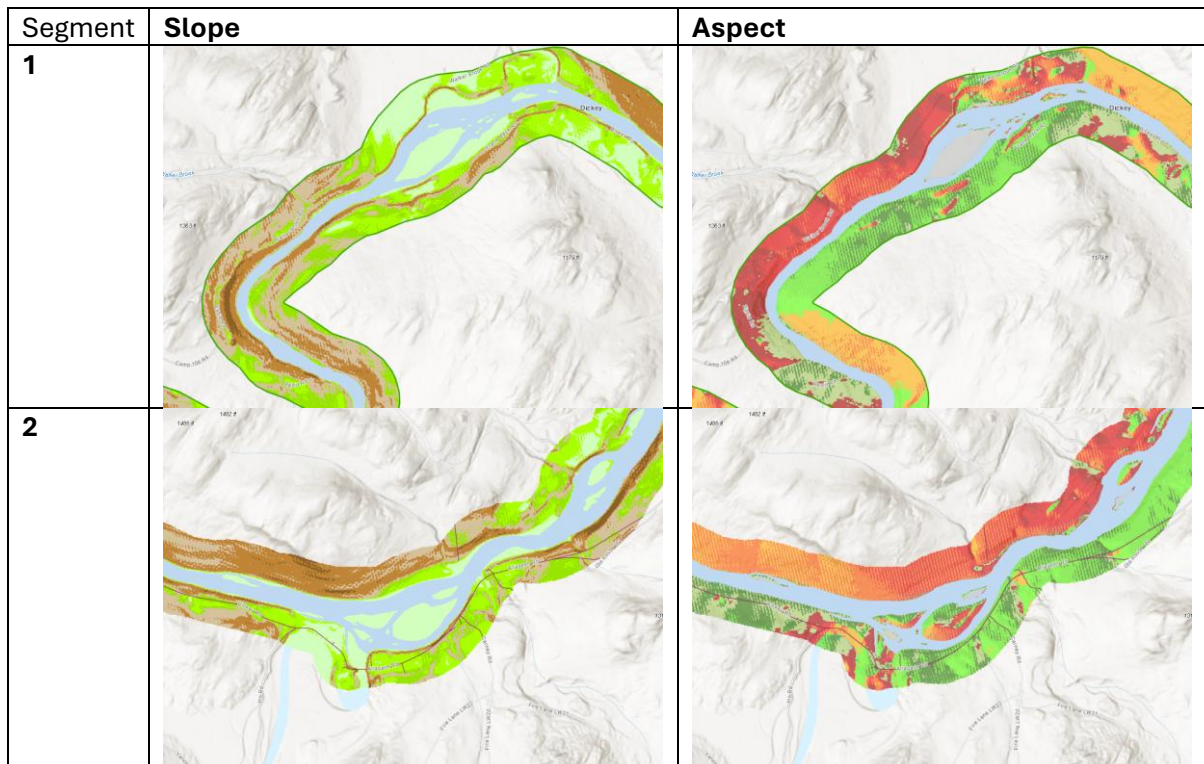
- Step 5 – Calculate the aspect. To calculate the west to north facing direction on the slope, the “Aspect” geoprocessing tool was run. The resulting layer shows the aspect in 9 different directions, which each direction representing a 45-degree view.



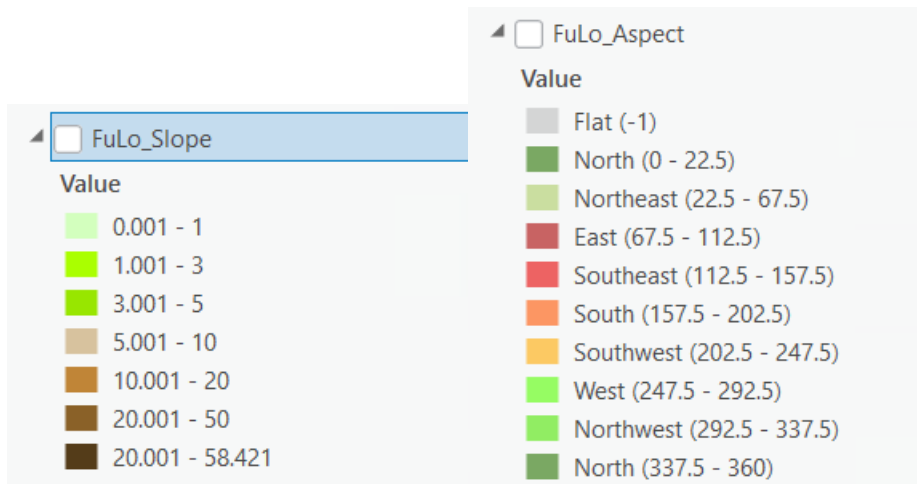
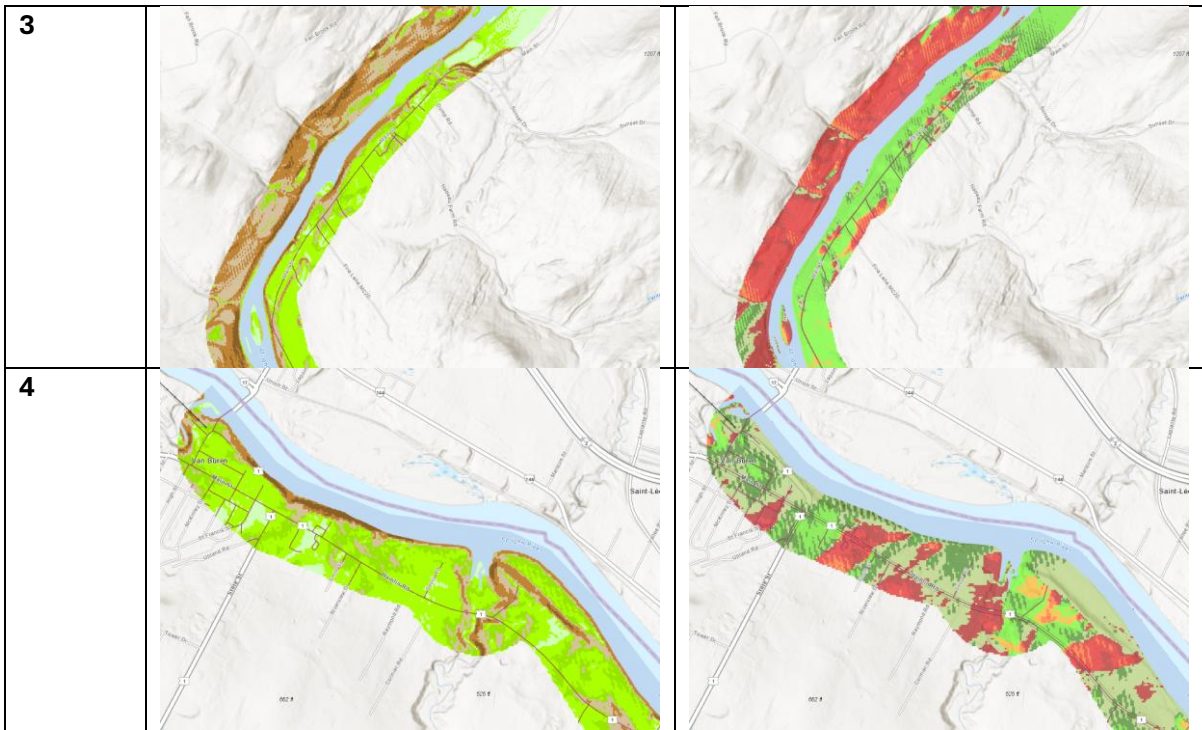
- Step 6- add railroads and detailed roads to the map. To provide additional context to the data, the railroads layer (unprocessed) and detailed roads (clipped to range for faster rendering using the pairwise clip), were added to the map



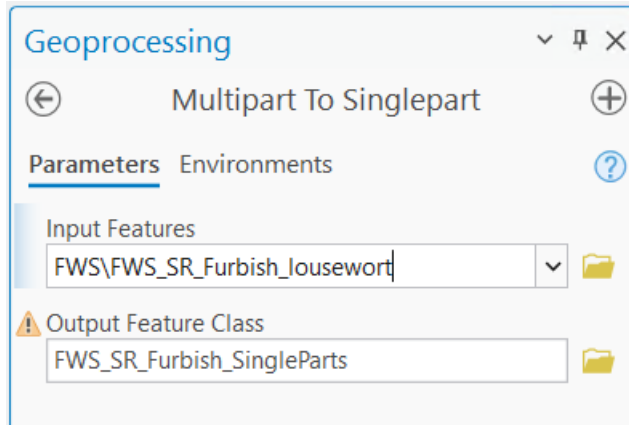
- Step 7-Visual inspection. A visual inspection was executed to review areas with both steep slopes (>30%¹), west- to north-facing aspects and general proximity to the St. John River. Below are a series of screenshots showing the slope and aspect for some areas of each population segment and nearby roads/railroads. Only areas within the United States were included.



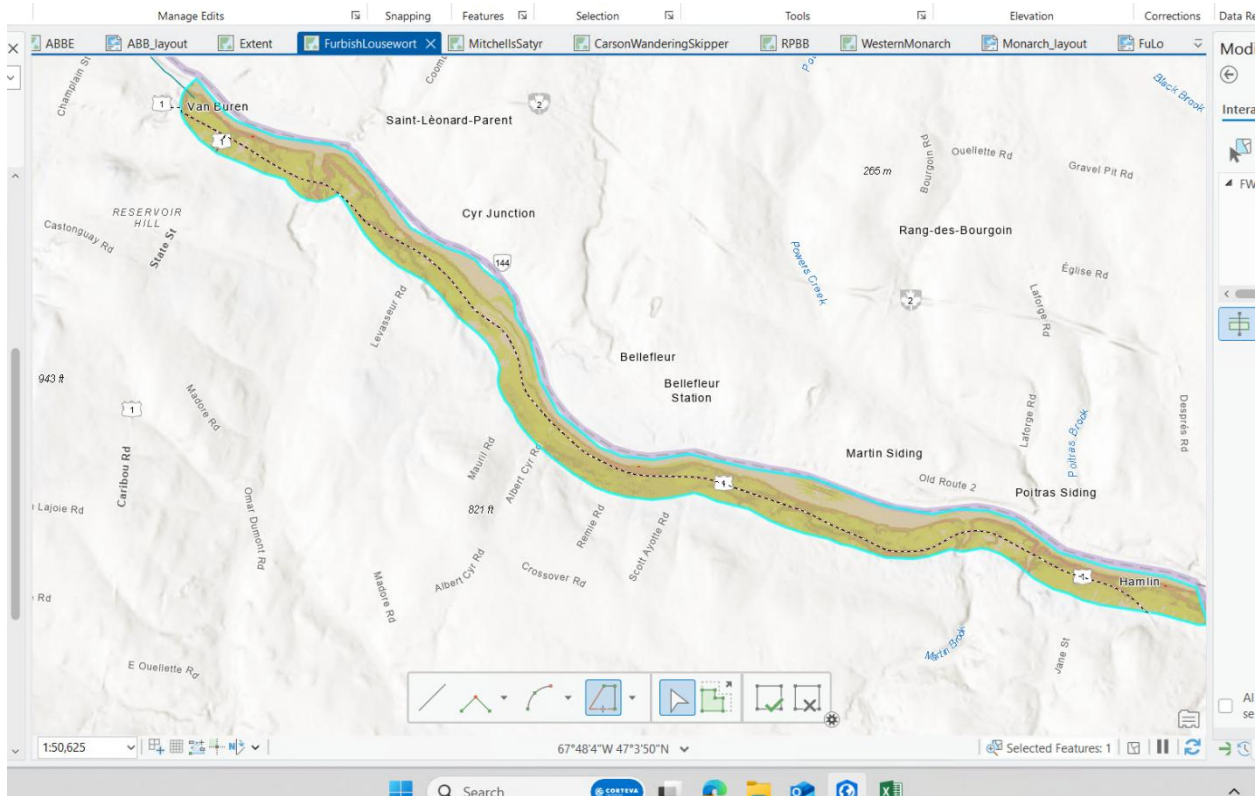
¹ [CS-R-16 Steep-Slope-Construction_rev1.pdf](#)



- Step 8 – Refining Segments 3 and 4 range. Following the visual inspection process, it was determined that potential habitat is located between the river and manmade features such as roads and railroads. As such the range was refined to only include those areas. First the multipart polygon was split into single part polygons and next these polygons were split.

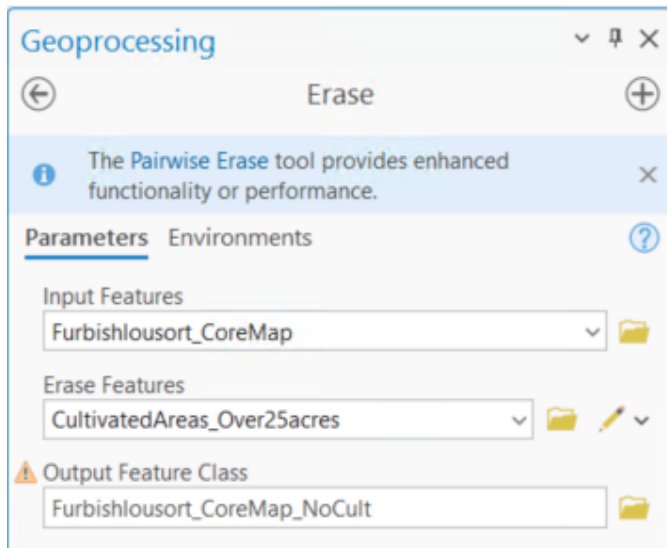


Splitting of the polygon was accomplished by selecting a polygon feature and setting the split option to “trace”. This allows for quick splitting of polygons following existing lines features, roads and railroads in this case.



Next an additional field named “Include” was added to the split feature class and those features to be excluded from the core map were set to “No”. Other features were left blank (aka <null>).

IN the final step of the core map development, EPA cultivated lands > 25 ac were removed from the dataset using the “Erase” geoprocessing tool. This removed 545 ac from the core map.



The resulting core map for the Furbish’s lousewort is shown in Figure 5.

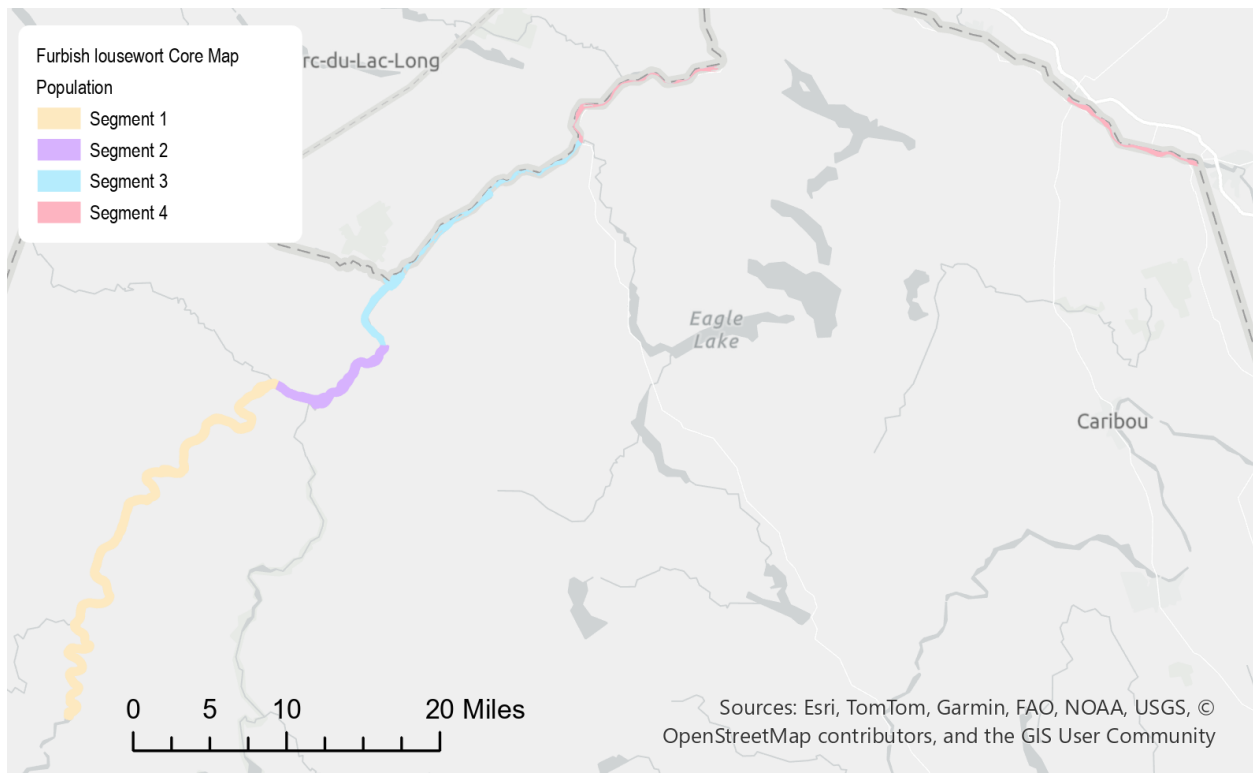


Figure 5. Proposed core map of the Furbish’s lousewort shown by population segment. Segments 3 and 4 are a refined range. Area outside of the United States was excluded.

3.1. Data Reviewed but not Used in Development

Data from the NatureServe Pro Explorer (<https://explorer.natureserve.org/pro/Welcome>) was reviewed but due to the coarseness of the public version of the data, this dataset was not used to modify the core map.

Global Biodiversity Index Facility

Occurrence data was downloaded from the Global Biodiversity Index Facility (GBIF) on March 31, 2025. The dataset consisted of 173 records of which 18 had positional data. Of these 18 records nine records had no information on coordinate uncertainty (in meters) and nine records had a coordinate uncertainty of at least 5000 m. Of the nine records without uncertainty information one record (near Fort Kent) is located within the range, and the remaining eight are outside the range (Figure 66 mostly centered around segment 1).

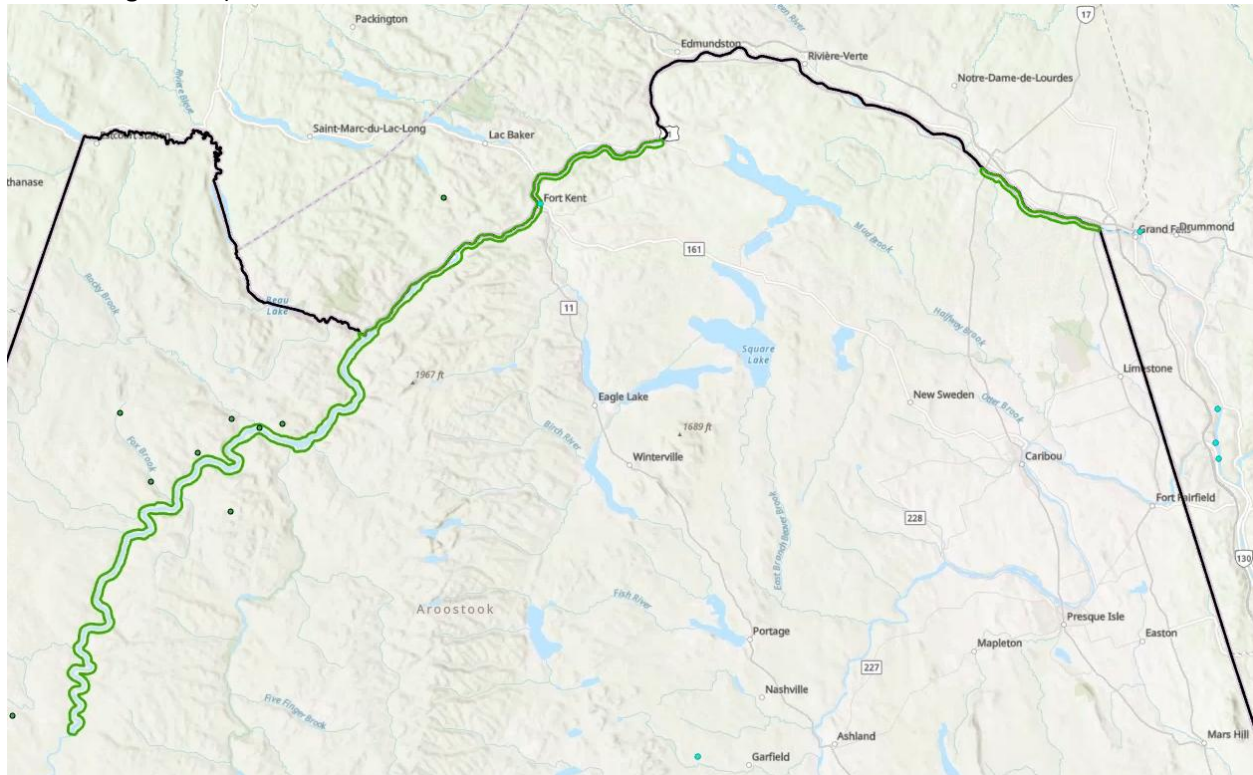


Figure 6. GBIF occurrence data of the Furbish's lousewort.

4. Proposed Core Map

The proposed core map for the Furbish's lousewort is shown in Figure 7 below and covers approximately 25,364 ac.

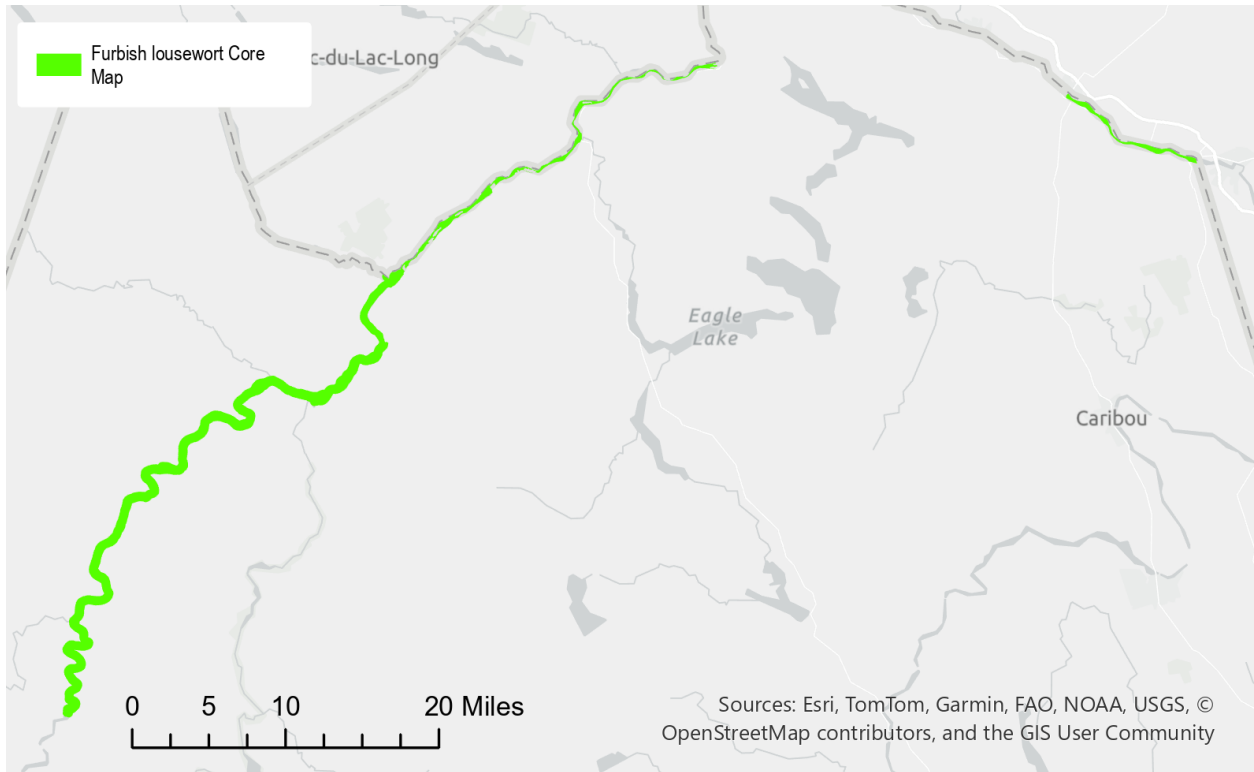


Figure 7. Core map for the Furbish's lousewort.