Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Fascicled Ironweed (*Vernonia fasciculata*) in Canada

Fascicled Ironweed

2022

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For copies of the recovery strategy, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry[1].

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[1] www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[2] agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years after the publication of the final document on the SAR Public Registry.

The Minister of the Environment and Climate Change Canada is the competent minister under SARA for the Fascicled Ironweed and has prepared this recovery strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Government of Manitoba as per section 39(1) of SARA.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment and Climate Change Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Fascicled Ironweed and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment and Climate Change Canada and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area[3] be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

[2] www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2

[3] These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act;* The Rouge National Park established by the *Rouge National Urban Park Act;* a marine protected area under the *Oceans Act;* a migratory bird sanctuary under the *Migratory Birds Convention Act, 1994;* or a national wildlife area under the *Canada Wildlife Act. S*ee ss. 58(2) of SARA.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

Acknowledgments

This recovery strategy was prepared by Candace Neufeld (Environment and Climate Change Canada – Canadian Wildlife Service, Prairie Region) with contributions from Sarah Lee (Environment and Climate Change Canada – Canadian Wildlife Service, Prairie Region). Valuable reviews were provided by Yeen Ten Hwang and Medea Curteanu (Environment and Climate Change Canada – Canadian Wildlife Service, Prairie Region), Gina Schalk (Environment and Climate Change Canada – National Capital Region), and Manitoba Conservation.

The Manitoba Conservation Data Centre provided updated element occurrence information; Chris Friesen and Colin Murray provided valuable insight on the species occurrences and habitat requirements in Manitoba. Acknowledgement and thanks is given to all other parties that provided advice and input used to help inform the development of this recovery strategy including various Indigenous organizations and individuals, landowners, citizens and stakeholders who provided input and/or participated in consultations. The co-operation of all the landowners, lessees and land managers who granted access to their land to do surveys and who continue to provide habitat for species at risk is greatly appreciated.

Executive Summary

The Fascicled Ironweed (*Vernonia fasciculata)* is a perennial wildflower, producing 30-120 cm tall stems, with flat-topped clusters of purple flowers, and lance-shaped leaves alternating up the stem. Fascicled Ironweed flowers in July and August. Seeds are wind-dispersed but are likely also dispersed by flowing water. In Manitoba, plants inhabit moist to wet soils in open to semi-open riparian areas, sedge and wet meadows, river terraces, oxbows, banks of rivers and creeks, low-lying depressions in prairie, and ditches and can tolerate seasonal flooding.

Fascicled Ironweed is widespread in the tallgrass prairies of midwestern and eastern United States and into southern Manitoba. In Canada, Fascicled Ironweed is designated as Endangered on Schedule 1 of the federal *Species at Risk Act* (SARA). As of 2019, there were two extant populations in Manitoba, along with two historical populations that are likely extirpated (one in Manitoba and one in Saskatchewan). The Canadian population is coarsely estimated at 21,000 plants, although the majority of the plants are in one population (Rat River, MB), with less than 100 plants at the second population (Mile Road 4W, MB).

Additional loss of habitat quantity or quality among the known populations of Fascicled Ironweed could adversely affect the species' survival in Canada. Threats, in order of highest to lowest threat impact, are: annual and perennial non-timber crops (cultivation); dams and water management/use (alteration of flood duration/frequency); housing and urban areas (residential development and landscaping); agricultural effluents (herbicide use); roads (road construction and maintenance); livestock ranching (soil disturbance by livestock) and invasive non-native plant species.

Recovery is considered feasible for this species. The population and distribution objectives are to maintain the estimated population size and distribution, within the natural range of variation, of the extant populations as well as to maintain any newly discovered or re-discovered populations, and to ensure long-term persistence and natural expansion of Fascicled Ironweed in Canada. Broad strategies to be taken to address the threats to the survival and recovery of Fascicled Ironweed are presented in the section on Strategic Direction for Recovery.

Critical habitat is fully identified in this recovery strategy for all extant populations in Canada. In Manitoba, critical habitat is identified as all occupied suitable habitat and all natural biophysical attributes within a 300 m critical function zone extending from the outer boundary of the occupied suitable habitat.

One or more action plans for Fascicled Ironweed will be posted on the Species at Risk Public Registry within five years following the final posting of this recovery strategy.

Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, recovery of the Fascicled Ironweed has been deemed technically and biologically feasible.

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.

Yes. Several thousand Fascicled Ironweed individuals capable of reproduction are present, primarily in the Rat River population in Manitoba. Fascicled Ironweed may slowly expand through vegetative reproduction with underground rhizomes. Flower and seed production have also been observed at the extant populations. Assuming that no other major threats impact the species or its habitat, the Rat River population is expected to sustain itself and persist as it has historically; it is unknown whether the Mile Road 4W population is self-sustaining over the long-term due to recent loss of individuals and habitat through cultivation and ditch maintenance.

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

Yes. Suitable habitat currently exists where extant populations occur and the habitat should be sufficient to maintain or increase species persistence at current levels, with natural population fluctuations. Beneficial management practices have the potential to maintain and enhance the habitat, possibly creating additional suitable habitat within the current distribution. Unoccupied suitable habitat is available in small quantities. Roadside ditches would likely be suitable, given that historical and current populations reside in these habitats, although occurrences inhabiting these areas would be at risk from threats mentioned in section 4.2 and would be quite fragmented. Remnant moist to wet meadows still exist near the known extent of Fascicled Ironweed in Manitoba, primarily in the Manitoba Tall Grass Prairie Preserve, however, the majority of wet prairie in southern Manitoba has been converted to agricultural fields. Additional riparian habitat would likely be suitable (e.g. further downstream or upstream of the main Rat River population or in adjacent tributaries), although many waterways in the area have been channelized or otherwise altered for faster drainage, or riparian areas have been cleared for agriculture or development (COSEWIC 2014, Manitoba Conservation and Water Stewardship unpubl. data).

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

Yes. Identified threats are anthropogenic, related to loss in habitat quality and quantity, and can be mitigated through beneficial management practices, habitat stewardship/ conservation, increased awareness through communication of the species' needs and

threats and incorporating those considerations into land use planning. It should be noted, however, that Fascicled Ironweed occurs at the northern limit of its range in Canada, and is primarily concentrated in one population, making it vulnerable to stochastic events and possibly genetic inbreeding.

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

Yes. Recovery techniques such as increasing landowner and land manager awareness of the species' habitat requirements through communication and engagement strategies and land use planning, developing and employing adaptive beneficial management practices, using stewardship agreements or conservation easements for habitat conservation, continuing with inventory and monitoring work to assess population health, and conducting research into knowledge gaps can be developed within a reasonable timeframe, given adequate resources, and should contribute to achieving the population and distribution objective.

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1. COSEWIC* Species Assessment Information

Date of Assessment: November 2014

Common Name (population): Fascicled Ironweed

Scientific Name: *Vernonia fasciculata*

COSEWIC Status: Endangered

Reason for Designation: This showy perennial plant has a restricted geographic range in Canada, and occupies small prairie remnants mainly along roadside ditches and riversides in southern Manitoba. The few small subpopulations are at risk from such threats as flood duration/frequency alteration, cultivation, ranching, herbicide use, and road and right-of-way maintenance activites.

Canadian Occurrence: Manitoba

COSEWIC Status History: Designated Endangered in November 2014

* COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

2. Species Status Information

Fascicled Ironweed (*Vernonia fasciculata*) is designated as Endangered on Schedule 1 of the federal *Species at Risk Act* (SARA), and as Endangered under Manitoba's *Endangered Species and Ecosystems Act*. The conservation status of Fascicled Ironweed throughout its range is described in Table 1. It is estimated that the Canadian range is less than 1% of the species' global range.

Table 1. NatureServe conservation status of Fascicled Ironweed (NatureServe 2020b)[a].

Global (G) Rank[b]	National (N) Rank[b]	Sub-national (S) Rank[b]
G5	Canada (N1)	Manitoba (S1), Saskatchewan (SH)
	United States (N5?)[c]	Colorado (SNR), Illinois (SNR), Indiana (SNR), Iowa (S5), Kansas (SNR), Massachusetts (SNR), Michigan (SNR), Minnesota (SNR), Mississippi (SNR), Missouri (SNR), Nebraska (SNR), New York (SNR), North Dakota (SNR), Ohio (S2), Oklahoma (SNR), South Dakota (SNR), Wisconsin (SNR)

[a] Two subspecies of *Vernonia fasciculata* have been described (subspecies *corymbosa* and subspecies *fasciculata*) and are included in NatureServe (2020b) and in Flora of the Great Plains (Great Plains Flora Association 1986). However, COSEWIC (2014), the Biotic of North American Program (BONAP; Kartesz 2015), and the Flora of North America (Strother 2006) only recognize *Vernonia fasciculata* to the species

level, with both describing *Vernonia fasiculata* ssp *corymbosa* as a synonym of *Vernonia fasiculata*. Therefore, the conservation status listed here will be to the species level only, and will include distribution notes from other sources below in the footnotes.

[b] The NatureServe conservation status of a species is designated by a number from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global, N = National, and S = Subnational). The numbers have the following meaning: 1 = critically imperiled, 2 = imperiled, 3 = vulnerable, 4 = apparently secure, and 5 = secure. NR = not ranked, ? = inexact or uncertain and qualifies the character immediately before it (NatureServe 2020c).

[c] COSEWIC (2014) includes Kentucky (Jones 1972, Medley 1993, Strother 2006), Arkansas (Smith 1973, 1988), Alabama (no source), Montana (Lesica et al. 1984, Great Plains Flora Association 1986) and Texas (White 2012) in the global distribution map, as does Kartesz (2015) with the exception of Alabama and Arkansas, and USDA (2019) with the exception of Alabama, but NatureServe (2020b) does not include these states, nor does the Flora of North America (Strother 2006) with the exception of Kentucky. The Montana government states Fascicled Ironweed does not occur in Montana due to there being no herbarium record or relocation of this species, and believe the inclusion of this species in Montana in the Flora of the Great Plain (Great Plains Flora Association 1977) to be in error (Montana Natural Heritage Program 2019). NatureServe (2020b) includes a conservation status for New York and Massachusetts but COSEWIC (2014) and Kartesz (2015) list those as introduced populations. Kartesz (2015) and Flora of North America (Strother 2006) do not include Mississippi in the global distribution map but a herbarium specimen from Mississippi is located in the Delta State University Herbarium.

3. Species Information

3.1 Species Description

Fascicled Ironweed is a perennial wildflower which grows upright to 30-120 cm tall either as single stems or several stems clustered around a tough, fibrous-rooted base (Great Plains Flora Association 1986). Its stem is sometimes reddish at the base with many lance-shaped, stalkless leaves, alternating evenly up the stem; leaves have pointed teeth around the edge and small pits on the underside containing awl-shaped hairs (Great Plains Flora Association 1986). Plants flower in July and August. The inflorescence is a wide, flat-topped cluster of flower heads, each made up of 10-26 purple tubular (disc) florets (see cover photo). Plants spread by seeds which disperse by wind, due to the bristles (pappus) attached to the seeds (achenes), but likely also disperse by flowing water, as well as vegetatively by means of horizontal underground stems (rhizomes).

3.2 Species Population and Distribution

Global Distribution

Fascicled Ironweed is native to North America, occurring in both Canada and the United States. In Canada, its northern extent is limited to tallgrass prairie remnants in southern Manitoba, although a historical record exists from southeastern Saskatchewan. In the United States, it is present in central and mid-eastern States in the tallgrass prairie (Table 1, Fig. 1). Population data is not available for Fascicled Ironweed across its North American range.

Figure 1. Current distribution of Fascicled Ironweed in North America (adapted from Strother 2006, COSEWIC 2014, Kartesz 2015, NatureServe 2020b, USDA 2019). The black circle indicates the historical and likely extirpated record from Saskatchewan and the question marks indicate questionable records (see Table 1).

Canadian Distribution

As of March 2019 in Canada, there were two[4] known extant[5] native populations[6] in Manitoba (Fig. 2, Appendix A). Both populations are in the Prairie Ecozone, and the Lake Manitoba Plain Ecoregion. The largest population (Rat River) occurs adjacent to, or near, the Rat River. The second population (Mile Road 4W) is now limited to a small patch in a ditch near Lowe Farm, after the adjacent native prairie where the majority of the plants had resided was cultivated and the ditch was deepened. The Canadian population is estimated at 21,000[7] plants, with an extent of occurrence[8] of 338 km^2 and an index area of occupancy of 60 km^2 (COSEWIC 2014, Manitoba Conservation Data Centre unpublished data 2019, Manitoba Conservation Data Centre personal communication 2019). The actual area of occupancy[9] of the population has never been mapped so the full extent of the population along the Rat River, particularly as it extends away from the shore line, is not known. There has also never been an inventory done on the same year of the entire Rat River population to obtain a more accurate and precise estimate of population size; the actual counts of plants based on portions of the population are considerably less than the estimated overall population size (Table A1 in Appendix A).

Details on the original distribution and abundance of Fascicled Ironweed in Canada are not known (COSEWIC 2014). Although Fascicled Ironweed may always have been rare at its northern extent, it is probable it would have been more prevalent in Manitoba and possibly Saskatchewan, prior to habitat conversion from agricultural activities and settlements. Historical records exist from the Otterburne and Morris areas of Manitoba; the historical record from Morris area is likely extirpated (Table A1 in Appendix A, and

[4] COSEWIC (2014) lists “Provincial Road (PR) 200” and “Rat River” as separate element occurrences, but additional surveys found Fascicled Ironweed further down the Rat River closer to PR 200, which merged the two into one element occurrence based on NatureServe (2020a) habitat-based element occurrence delimitation guidance.

[5] Extant means the population has been recently verified as still existing, information is accurate, and habitat still exists at the time of writing.

[6] For the purposes of this recovery strategy, a population will be considered equivalent to an element occurrence as defined by NatureServe (2020a) and the Manitoba Conservation Data Centre and a subpopulation as defined by COSEWIC (2014). Populations may be comprised of one or more occurrences (patches of plants).

[7] From the COSEWIC (2014) status report regarding the population estimate of the Rat River population: “Considering the number of patches consisting of 1,000 or more stems (sometimes many more than 1,000), plus the number of smaller patches, it does not seem unreasonable to coarsely estimate the number of stems along the Rat River to be 125,000 ± 25,000 (20,833 plants ± 4,167 plants). Given the lack of precise estimation of the number of plants, a relatively high uncertainty value (± 25,000 stems) was chosen. This assessment will use the rounded value of 21,000 as the estimated number of plants in the Rat River subpopulation, but this is a very coarse estimate.” COSEWIC (2014) used the median number of stems per plant (six) to estimate number of plants.

[8] Extent of occurrence and index area of occupancy are as defined by COSEWIC 2020a and COSEWIC 2020b, respectively.

[9] Area of occupancy, as defined in the recovery strategy, is the actual area on the ground occupied by Fascicled Ironweed plants. Area of occupancy is often determined by walking the perimeter of the patches of plants using a GPS unit.

see Table 1 in COSEWIC 2014). There is one historical record from Saskatchewan in the Weyburn area, observed sometime prior to 1966, but that has never been relocated despite targeted search effort and is likely extirpated (Table A1 in Appendix A).

Determining trends in population size of Fascicled Ironweed in Canada are not possible for a few reasons. This species has not been consistently monitored, with portions of the primary population along the Rat River being visited only once. Targeted surveys with estimates of plant counts only began in 2005. Fluctations of numbers of plants appears to happen with moisture availability although it isn't clear whether the number of plants is actually changing or whether it is an issue with detection of plants between dry and wet years (COSEWIC 2014).

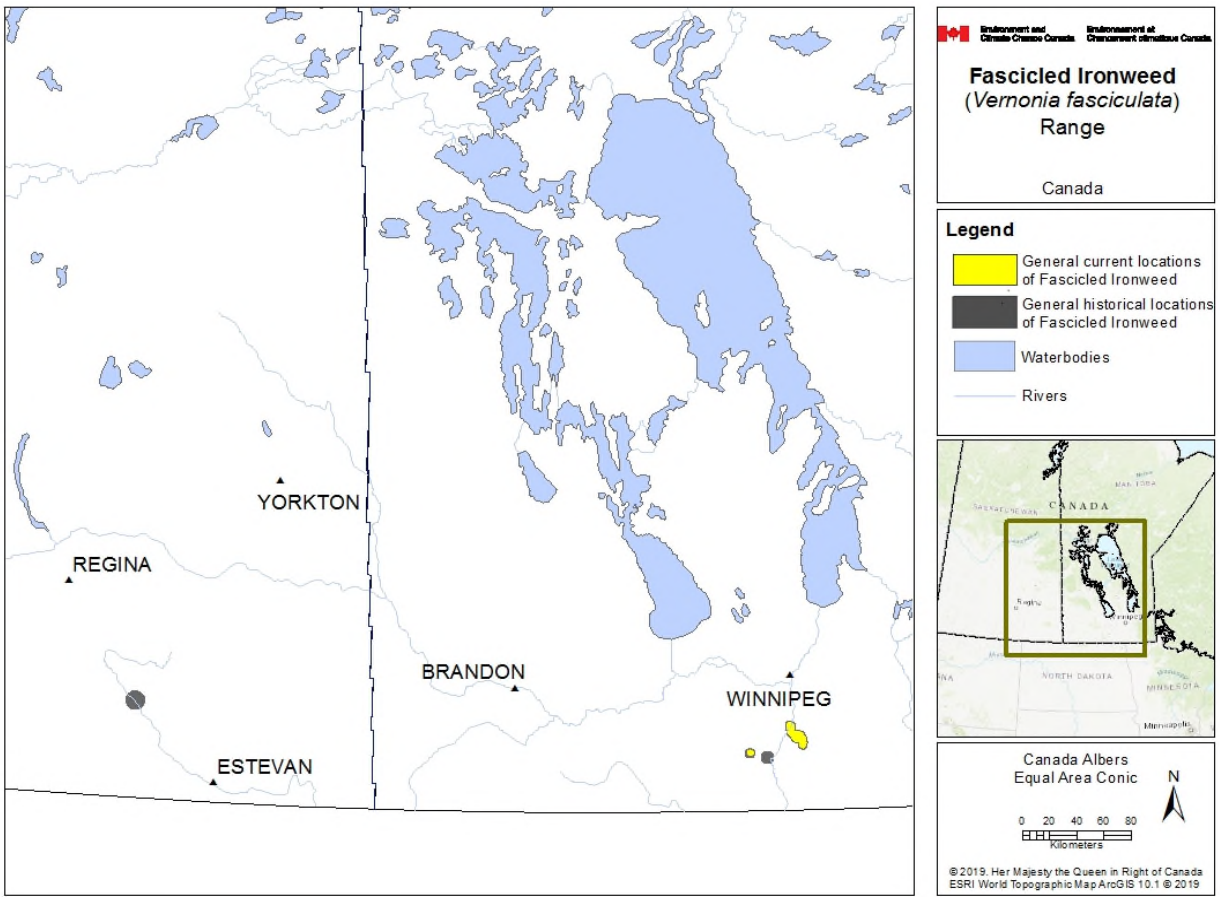

Figure 2. Current distribution of Fascicled Ironweed in Canada (compiled from Manitoba Conservation Data Centre data 2019).

3.3 Needs of the Fascicled Ironweed

In Manitoba, Fascicled Ironweed is now confined to remnant native habitat that has not been cultivated, or ditches and right of ways. It is unknown what the habitat and distribution would have been prior to European settlement and cultivation but it is likely quite restricted now compared to its original range given the amount of decline in moist prairie meadows and riparian forest habitat (COSEWIC 2014, Murray and Church 2017). In other parts of its North American range, it typically occupies wet meadows, banks of creeks and wetlands, roadsides/ditches, floodplains, and low-lying moist depressions or swales in prairie, often reported on sandy soils, but is found occasionally in the drier upland sandhill prairie (Strother 2006, Consortium of Pacific Northwest Herbaria unpubl. data 2015, Kansas State University Herbarium unpubl. 2017).

In Manitoba to date, the largest population grows in moist to wet clay soils in open to semi-open (deciduous treed) riparian areas including moist to wet meadows, river terraces, oxbows, banks of rivers and creeks and low-lying depressions, primarily along the margins of the Rat River (Foster and Reimer 2007, COSEWIC 2014, Manitoba Conservation unpubl. data 2019). The habitat along the Rat River is subject to seasonal flooding (Foster and Reimer 2007, COSEWIC 2014). Fascicled Ironweed has been recorded within 40-100 m of the Rat River, although surveys have often not extended into the upland beyond that distance; plants are in a band between the riverbank and the riparian forest or cultivated upland (Murray and Friesen 2012, Manitoba Conservation Data Centre unpubl. data 2019). The semi-open treed areas have an overstory of native tree species while open and semi-open areas have a very sparse to dense herbaceous understory containing both native and non-native plant species[10] (Foster and Reimer 2007, Manitoba Conservation Data Centre unpubl. data 2019). Fascicled Ironweed is sometimes the dominant or co-dominant species in the understory along the Rat River (Foster and Reimer 2007). Fascicled Ironweed has not been found growing in areas along the bank of the Rat River where there was very thick, dense vegetation from grasses and sedges with little to no tree cover, nor does it appear to tolerate dense shade (COSEWIC 2014, Manitoba Conservation Data Centre, unpubl. data 2019). In a few places along the Rat River, and at the Mile Road 4W population, Fascicled Ironweed grows in ditches; the ditches contain some introduced species of grass (COSEWIC 2014, Manitoba Conservation Data Centre unpubl. data 2019).

[10] Tree species recorded in the overstory include Green Ash (*Fraxinus pennsylvanica*), Manitoba Maple (*Acer negundo*), American Elm (*Ulmus americanus*), Bur Oak (*Quercus macrocarpa*), Eastern Cottonwood (*Populus deltoides*) and willow species (*Salix* species). Native herbaceous species recorded in the understory include Tall Beggarticks (*Bidens vulgata*), Hedge Bindweed (*Calystegia sepium*), Riverbank Grape *(Vitis riparia*), Wild Cucumber (*Echinocystis lobata*), Carrion flower (*Smilax lasioneura*), Canada Moonseed (*Menispermum canadense*), Poison Ivy (*Toxicodendron rydbergii*), Wild Mint (*Mentha arvense*), Alkali Cordgrass (*Spartina gracilis*), Slender Wildrye (*Elymus trachycaulus*) and Smooth-fruited Sedge (*Carex laeviconica*) among others, while non-native species include Narrow-leaved Dock (*Rumex stenophyllus*), Smooth Brome (*Bromus inermis*), Reed Canarygrass (*Phalaris arundinaceaea*), Sow Thistle (*Sonchus arvensis*), Common Plantain (*Plantago major*), and Common Hemp-nettle (*Galeopsis tetrahit*) (Foster and Reimer 2007, Manitoba Conservation Data Centre unpubl. data 2019).

Limiting Factors

Fascicled Ironweed reaches the northern extreme of its range in Canada. Populations at the limit of a species' range often occupy poorer habitat and are more fragmented, less dense, and more variable than those at their core range (Channell and Lomolino 2000, Vucetich and Waite 2003). These peripheral populations are therefore more vulnerable to extinction due to low immigration rate, disrupted pollinator relationships, and other density-related factors. Genetic diversity is sometimes, but not always, less in peripheral populations, but they may possess unique genetic characteristics (Vucetich and Waite 2003). Since there is only one population in Manitoba containing almost all of the Fascicled Ironweed plants, and this population is greatly isolated from populations in the United States, it may make it more vulnerable to stochastic events (e.g. extreme or prolonged flooding events) and genetic issues like inbreeding depression, due to isolation from other populations , although research into this is needed.

4. Threats

4.1 Threat Assessment

The Fascicled Ironweed threat assessment is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system. Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational). Limiting factors are not considered during this assessment process. For purposes of threat assessment, only present and future threats are considered. Historical threats, indirect or cumulative effects of the threats, or any other relevant information that would help understand the nature of the threats are presented in the Description of Threats section.

Table 2. Threat calculator assessment.

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]	Detailed threats
1	Residential & commercial development	Low	Small	Extreme-Moderate	Moderate	
1.1	Housing & urban areas	Low	Small	Extreme-Moderate	Moderate	Acreages, farm yards, rural lots with landscaping or mowing up to the river's edge
2	Agriculture & aquaculture	Medium-Low	Restricted-Small	Extreme-Serious	Moderate	
2.1	Annual & perennial non-timber crops	Medium-Low	Restricted-Small	Extreme-Serious	Moderate	Cultivation
2.3	Livestock farming & ranching	Negligible	Negligible	Serious-Slight	Moderate	Soil disturbance by livestock
4	Transportation & service corridors	Negligible	Negligible	Extreme-Serious	High	
4.1	Roads & railroads	Negligible	Negligible	Extreme-Serious	High	Road and ditch maintenance and construction

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]	Detailed threats
7	Natural system modifications	Medium-Low	Pervasive	Moderate-Slight	High	
7.2	Dams & water management/use	Medium-Low	Pervasive	Moderate-Slight	High	Alteration of flood duration/frequency from dams, drains, dykes, diversions and other flood control measures
8	Invasive & other problematic species & genes	Negligible	Negligible	Unknown	High	
8.1	Invasive non-native/alien species	Negligible	Negligible	Unknown	High	Invasive non-native species
9	Pollution	Low	Restricted	Moderate	High	
9.3	Agricultural & forestry effluents	Low	Restricted	Moderate	High	Herbicide use in adjacent fields

[a] **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

[b] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

[c] **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

[d] **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

4.2 Description of Threats

Appendix A identifies the threats associated with each population. Threats are discussed below in decreasing order of Level 1 threat impact.

IUCN Threat 2. Agriculture and Aquaculture

Threat 2.1 Annual & perennial non-timber crops

The threat of cultivation is mostly historical. Historical conversion of upland tallgrass prairie and adjacent riparian habitats to cultivated cropland likely contributed to the loss of Fascicled Ironweed habitat (Murray and Friesen 2012, COSEWIC 2014). Almost all suitable upland habitat has been cultivated along the Rat River population (EO 2709), sometimes right up to the river's edge. The population at Mile Road 4W (EO 4867) declined significantly when the prairie upland was converted to agricultural land, leaving only a small portion of the population remaining in the ditch (Foster and Reimer 2007, Friesen and Murray 2011, COSEWIC 2014). There are portions of uncultivated upland habitat remaining along the Rat River, some of which would not be suitable for agriculture due to flooding, poor grade, or moist conditions but which may be cultivated in drought conditions. There are also areas along the Rat River where Fascicled Ironweed is growing immediately adjacent to agricultural fields, and are at risk of cultivation. However, as the majority of the Rat River population occurs within 40 m from the water, the impact of encroaching cultivation on the Fascicled Ironweed population as a whole is limited.

Threat 2.3 Livestock farming & ranching

Fascicled Ironweed is suspected to be unpalatable to cattle despite having good nutritional value and crude protein levels (Hubbard and Boe 1988), and has been reported to increase in wet pastures where cattle graze around it (Shaw and Schmidt 2003). COSEWIC (2014) reported Fascicled Ironweed absent or declining in an area along the Rat River heavily grazed by cattle but present adjacent to the grazed area; the absence of plants in the grazed area may be a result of trampling or other soil disturbance caused by the cattle.

IUCN Threat 7. Natural System Modifications

Threat 7.2 Dams & water management/use

Fascicled Ironweed appears to be flood tolerant (Shaw and Schmidt 2003). Its seeds are buoyant due to bristly hairs (pappi) attached to the seed, and they likely disperse downstream through the water (hydrochory) or further into the upland during times of high flow or floods (Groves 2010, Catford et al. 2014, Carthey et al. 2016). In areas where it floods regularly, such as along the Rat River, Fascicled Ironweed likely has a competitive advantage over plants that aren't flood tolerant due to its ability to spread through rhizomes (Sluis and Tandarich 2004, Catford et al. 2014); these rhizomes may

also break off and drift downstream and form new plants if they root in suitable habitat. In addition, seasonal floods or higher water levels likely maintain the wet meadows and riparian areas that are required habitat for Fascicled Ironweed. Upstream of the Rat River population (EO 2709), there is a major dam at St. Malo along with smaller dams, drains, dykes, diversions etc. These water control structures are in an attempt to control floods and water levels along the Rat River. Lowering of water levels or changes in the duration and frequency of floods through dams, diversions and flow regulation structures may result in a decline in habitat suitability for seed germination and seedling establishment for Fasicled Ironweed or change the plant community composition along the Rat River (Jansson et al. 2005, Uowolo et al. 2005, Merrit and Wohl 2006). Flow regulation structures in rivers can also physically prevent dispersal of seeds downstream, or affect how far seeds disperse and where they are deposited (Merritt and Wohl 2002, Brown and Chenoweth 2008). Since more than 99% of the Fascicled Ironweed in Manitoba resides along the Rat River, this threat is pervasive in scope.

IUCN Threat 1. Residential and Commercial Development

Threat 1.1 Housing & urban areas

There are over 50 farm yards or acreages, in addition to the community of Otterburne, along the stretch of Rat River containing Fascicled Ironweed (EO 2709). Some of these parcels of land have mowed lawn and landscaping where there would naturally have been wet meadows or riparian treed areas; this existing activity is considered historical and not included in the scope of this threat assessment. The remaining parcels are either cultivated very close to the river's edge (threat 2.1) or have a buffer of varying width of riparian vegetation, trees, and/or wet meadow. These areas are mostly unsuitable for housing development due to annual flood risk and poor grade but landowners may alter the remaining natural areas by landscaping (e.g. removing natural vegetation, grading the area, putting in non-native lawn grass) or regular mowing as others have done, particularly with successive drought years. Depending on the extent of the activity, it could alter the habitat and destroy Fascicled Ironweed plants growing in these areas. There is also a golf course bordering the Rat River, but since it has already been created, it is considered a historical threat; if there were plans to expand the golf course, this threat would need to be re-evaluated.

IUCN Threat 9. Pollution

Threat 9.3 Agricultural & forestry effluents

Use of pesticides intended to control undesirable plants (broad-leaf herbicide) or insect pests (indirectly through herbicide or directly through insecticide) in areas occupied by, or adjacent to, Fascicled Ironweed can affect Fascicled Ironweed plants and its pollinators. Broad-leaf herbicides directly sprayed on Fascicled Ironweed will kill the plant, and use of broad-leaved herbicides in fields adjacent to Fascicled Ironweed may drift during application or leach out with rains and damage or kill Fascicled Ironweed plants. Targeted spot applications or other means of invasive non-native species control

are required in areas with Fascicled Ironweed plants. Fascicled Ironweed occurs directly adjacent to agricultural fields, yards, and golf courses, as well as in ditches in some areas along the Rat River and at Mile Road 4W, and is therefore at risk from improper use of pesticides in those areas (Murray and Church 2015).

In general, reducing flowering plants in an area through herbicide use, as well as spraying insecticides to control insect pest species, can both reduce pollinators and potentially affect seed production of those plants. Fascicled Ironweed relies primarily on insect pollinators such as long-tongued bees (Apidae, Anthophoridae, Megachilidae), and short-tongued bees (Halictinae), but also bee flies (Bombyliidae), ants (Formicidae), butterflies (Nymphalidae, Lycaenidae, Pieridae, Papilionidae), skippers (Hesperiidae), moths (Noctuidae) and beetles (Cantharidae) for pollination (Reed 1993, Discover Life 2019, Hilty 2019). Declining native bee populations across North America have been observed to coincide with declines in native plant populations, although it is not clear whether bee declines are causing plant declines or vice versa (Nabhan and Buchmann 1997, Kearnes et al. 1998, Gill and Raine 2014, Godfray et al. 2014, Scheper et al. 2014). However, there is emerging evidence in the literature that pesticide use in croplands is one of the major factors causing bee declines worldwide either through acute (lethal doses causing death) or chronic effects (sublethal doses altering behavior) (Gill and Raine 2014, Godfray et al. 2014).

As of 2014, neonicotinoids were being used on more than 40 million hectares of cropland in the United States and are now the most widely used insecticide in the world, trends that are consistent with the Canadian use of this insecticide (Douglas and Tooker 2015). Research has shown that even sublethal exposure to this insecticide can cause acute and chronic effects in pollinating species, specifically in social bees (honeybees, bumblebees, and stingless bees) (Gill and Raine 2014, Godfray et al. 2014). Chronic exposure to sublethal doses of neonicotinoids can alter bumblebee (*Bombus spp.*) behavior including changing forager preferences for flower types, impairing forager performance (carry out fewer foraging bouts and bring back smaller pollen loads), and impair bee learning performance (Gill and Raine 2014, Godfray et al. 2014). Bees are the main pollinator of Fascicled Ironweed and effects from changes in bee behaviour could be exacerbated by the competition for pollinators with other co-flowering plants. Further research into this and its potential impact on Fascicled Ironweed is needed.

IUCN Threat 4. Transportation and Service Corridors

Threat 4.1 Roads & railroads

Habitat, plants, and seed banks can be damaged or destroyed by road construction or maintenance activities such as road widening, realigning or improving the road, ditch deepening/widening (cleaning), trenching, and drainage projects. Habitat and plants can also be affected by incompatible or inappropriately-timed road maintenance activities on shoulders and in ditches, such as spraying pesticides (threat 9.3), grading, haying or mowing. Portions of the Fascicled Ironweed population along the Rat River (EO 2709) are growing where roads cross the river. A portion of this population is adjacent to the

Rat River in a roadside ditch and drain which has been mowed in the past with no Fascicled Ironweed plants observed that year (COSEWIC 2014, Manitoba Conservation Data Centre unpubl. data 2019). The remnant population at Mile Road 4W (EO 4867) is in a ditch and at risk from road maintenance activities (Murray and Friesen 2012). It was almost eliminated after the ditch was cleared of vegetation for faster drainage (COSEWIC 2014, Manitoba Conservation Data Centre unpubl. data 2019).

IUCN Threat 8. Invasive and Other Problematic Species and Genes

Threat 8.1 Invasive non-native/alien species

In Manitoba, Fascicled Ironweed often co-occurs and competes with "weedy" non-native species due to its preference for disturbed habitats where non-native species have an easier time getting established (Shaw and Schmidt 2003, Foster and Reimer 2007). Fascicled Ironweed can have a weedy growth habit and be quite competitive with other native species or non-native species (Shaw and Schmidt 2003, Foster and Reimer 2007). Fascicled Ironweed hasn't always occupied habitat with non-native species, however, and the long-term impacts of this increased competition on its growth, reproductive output, recruitment and survival has not been studied. Despite the competitive ability of Fascicled Ironweed, it was found to be outcompeted and displaced by Reed Canary Grass over a 15 year period in a riparian area in Wisconsin when water levels were lower than normal (Barnes 1999). In particular, there is an introduced non-native strain of Reed Canary Grass which is more aggressive than the native strain and can be an issue due to its large size, dense colonial growth, and ability to quickly colonize newly disturbed areas created by changing water levels (Barnes 1999 Lavergne and Molofsky 2007). Reed Canary Grass (strain unknown) was reported growing with Fascicled Ironweed at a location along the Rat River where the population of Fascicled Ironweed was estimated at 10,000 stems or more (Foster and Reimer 2007); this area has not been monitored to date (Colin Murray, pers. comm. 2019) so the impact of the Reed Canary Grass on the Fascicled Ironweed is not known at this time, but if aggressive, a portion of the Fascicled Ironweed population could be displaced. Narrow-leaved Dock was also mentioned as a potential concern by Foster and Reimer (2007) as it is can also be quite competitive although its ability to compete with Fascicled Ironweed is unknown.

5. Population and Distribution Objectives

The population and distribution objectives for Fascicled Ironweed are to maintain the estimated population size and distribution, within the natural range of variation, of the extant populations as well as any newly discovered[11] populations, to ensure long-term persistence and natural expansion of Fascicled Ironweed in Canada.

[11] Note that occurrences or populations that are considered historical are excluded from these objectives until such time as they are reconfirmed.

In Canada, Fascicled Ironweed is at the northern limit of its range restricted to two populations; there is one large population (Rat River) which contains almost all of the individuals in Canada, and a small population (Mile Road 4W) which has declined due to recent habitat loss and may not be viable (Table A1 in Appendix A). Much of the information known about its presence in Manitoba has come in the last decade with increased survey effort. Substantial increases in the number of populations, index area of occupancy, or extent of occurrence are not likely to be documented in the future given that:

1) the suitable habitat for Fascicled Ironweed in Manitoba is now limited, fragmented, and declining in quality and quantity,
2) the new occurrences recently documented have all been within the same population,
3) a considerable amount of suitable habitat has been surveyed already, and
4) the species is at the northern limit of its range and may always have been rare.

The known area of occupancy (and index area of occupancy) of the main population along the Rat River should continue to increase incrementally with continued survey effort and mapping of plants in adjacent upland habitat. It is possible additional populations will be found with future survey effort in suitable remaining habitat in Manitoba, particularly upstream or downstream of the Rat River population including river systems connected to the Rat River.

At this time, it is problematic to define specific quantitative population objectives because of the very coarse estimate of population size, absence of long-term data on population trends, and unknown impacts of year to year fluctuations in population size to indicate the range of natural variability for Fascicled Ironweed populations (section 3.2). Similarly, since the full extent of the main Fascicled Ironweed population is not known, setting specific quantitative distribution objectives is also difficult. Employing standardized methodology to obtain an understanding of the full extent (area of occupancy) and density (population size) of the main Fascicled Ironweed population is required, as is collecting multiple years of data on portions of the population to quantify the natural range of variation. Once this information is obtained, more specific targets for population and distribution objectives may be defined.

For this species to be downlisted to Threatened under the COSEWIC status assessment critieria for category B[12] (small distribution range and decline or fluctuation), additional populations would need be confirmed to increase the number of locations (as defined by COSEWIC 2015), and the observed decline in the extent of occurrence, index area of occupancy, quality of habitat, number of locations, and number of mature individuals would have to cease or be reversed (COSEWIC 2014, 2015). For the reasons bulleted above, the likelihood of the species being downlisted under these criteria is low. Therefore, the population and distribution objective has been set in the

[12] COSEWIC (2014) assessed Fascicled Ironweed as Endangered under the following criteria: small extent of occurrence; small index area of occupancy; known to exist at under 5 locations; and continuing observed decline in extent of occurrence, index area of occupancy, area/extent/quality of habitat, and number of locations or populations – B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv).

context of maintaining the populations and their distribution (index area of occupancy and extent of occurrence), and preventing or reversing further declines in quality and quantity of habitat through beneficial management practices, stewardship agreements and communication strategies with targeted groups (Table 3).

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

Inventory and Monitoring

- Manitoba Conservation Data Centre staff has searched historical and known Fascicled Ironweed locations, as well as suitable riparian areas, ditches, and upland habitat in Manitoba during species at risk inventories in 2005, 2006, 2009-2016, 2018, and 2019 (Foster and Hamel 2006, Foster and Reimer 2007, Friesen and Murray 2010, Friesen and Murray 2011, Murray and Friesen 2012, Murray 2013, Murray 2014, Murray and Church 2015, Murray and Church 2017, Manitoba Conservation Data Centre unpubl. data 2019). New occurrences have been found and all previously reported populations have been revisited at least once in recent years (Appendix A).

Habitat Assessment, Management and Stewardship

- Fascicled Ironweed is listed under Manitoba's *Endangered Species and Ecosystem Act* as Endangered.

6.2 Strategic Direction for Recovery

Table 3. Recovery Planning Table

Threat or Limitation	Priority[a]	Broad Strategy to Recovery	General Description of Research and Management Approaches
All threats	High	Communication, Collaboration and Engagement	• Develop and deliver a communication/outreach strategy targeting landowners and land managers whose properties contain Fascicled Ironweed to raise awareness of the species and its habitat needs and threats (e.g. mowing, cultivation, herbicides, landscaping). • Develop and deliver a communication strategy targeting road maintenance personnel (municipal and provincial) and municipal planners to minimize or eliminate habitat deterioration or destruction during road and ditch maintenance or construction activities. • Develop and deliver a communication strategy targeting provincial, municipal and conservation districts involved with dams and water control in the vicinity of the main Fascicled Ironweed population along the Rat River to discuss impact of hydrological changes on the species. • Encourage land owners and the public to report sightings of Fascicled Ironweed.
All threats	High	Habitat Assessment, Management and Stewardship	• Using adaptive habitat management, develop and implement beneficial management practices (BMPs) for the species and its habitat, targeting reduction or mitigation of threats (e.g., dams and water control structures, acreage and residential development, landscaping practices like mowing or seeding non-native species (including grass species that create a dense cover), creating natural buffers at river's edge safe from cultivation, indiscriminate application of herbicides, control of invasive non-native species, using compatible grazing practices, etc.). Monitor effectiveness of BMPS at improving habitat and species presence; amend as necessary. • Mitigate the impact of threats to populations and habitat by engaging landowners and land managers in stewardship agreements, including conservation agreements if feasible,

Threat or Limitation	Priority[a]	Broad Strategy to Recovery	General Description of Research and Management Approaches
			aimed at implementing BMPs and protecting critical habitat. Monitor effectiveness of agreements in conserving habitat. • Integrate habitat management with that for other species occurring in the same habitat and surrounding management area (Appendix C). • Promote consistent enforcement or implementation of existing protection measures and regulations (*Manitoba Endangered Species and Ecosystems Act*).
Knowledge Gaps, all threats	Medium	Inventory and Monitoring	• Using standardized protocols (e.g. Henderson 2010a), determine area of occupancy of each Fascicled Ironweed population (element occurrence) and obtain a more precise estimate of population size. • Establish regular monitoring program for Fascicled Ironweed populations, including habitat quality and threats. • Using consistent survey techniques (e.g. Henderson 2010a), continue inventories of suitable habitat to locate new populations; habitat models may be useful in predicting priority search areas (e.g., habitat suitability and/or species distribution models).
Knowledge gaps, all threats	Medium	Research as part of an adaptive management framework	• Determine effect of population size and isolation on genetic diversity and population viability, and develop a seed gene bank if deemed necessary. • Conduct research to develop a better understanding of the species ecology and habitat needs (e.g., seed bank viability, seed viability in flooding conditions, impact of hydrochory, recruitment and survival rates, pollination biology, pesticide use on pollinators, genetic exchange) • Assess short- and long-term impacts of threats to Fascicled Ironweed and its habitat quality (e.g. long term impacts of non-native species on Fascicled Ironweed growth and survival, habitat changes with differing water levels). • Apply findings to develop or refine BMPs for the species.

[a] "Priority" reflects the degree to which the broad strategy contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species

6.3 Narrative to Support the Recovery Planning Table

Due to the continued loss of habitat quality and quantity, and the limited number of populations, engagement with landowners and land managers and encouraging conservation through stewardship are essential to the recovery of Fascicled Ironweed. Habitat requirements of Fascicled Ironweed on private and public lands should be considered during land use planning at all levels (local, municipal, regional, provincial) and during maintenance or construction activities to ensure that land management practices benefitting the species can be implemented. This will be particularly important for occurrences at risk from threats like cultivation, residential development and landscaping, ditch maintenance and road construction, and considerations regarding dams and water control structures. Development and implementation of adaptive site-specific best management practices for the species and its habitat to reduce or mitigate threats from practices such as incompatible landscaping practices for residential lots (e.g. mowing during flowering or seed set, planting non-native species including lawn grass, not leaving a natural buffer at the river's edge), incompatible grazing (trampling along the river's edge), and indiscriminant spraying of pesticides adjacent to cropland is required for successful conservation and may be possible to implement through stewardship agreements.

Research into aspects of Fascicled Ironweed ecology and impact of its threats is a medium priority but will help with better understanding the habitat and species' needs, and will help refine beneficial management practices. Knowledge gaps exist in areas like seed bank viability, seed viability in flooding conditions, importance of water versus wind in dispersal, recruitment and survival rates, reproduction vegetatively versus sexually, generation time, pollination biology, short and long-term impact of various non-native invasive species, and short and long term habitat changes with differing water levels. This information is required to understand population demographics, reproductive ecology, dispersal and recruitment, and resiliency and will help inform best management practices and a better informed definition of critical habitat. Research on seed viability and germination requirements may be available from native plant/seed suppliers in Manitoba. Finally, research is needed to determine whether the limited number of populations and isolation of these populations represents a threat to genetic diversity and/or population viability of the Canadian population as a whole. This type of information will help determine the feasibility of restoration efforts and when/if restoration efforts would be deemed necessary.

Additional inventory and monitoring work is a medium priority and required to know the full extent (extent of occurrence and area of occupancy) of the population in Manitoba and to obtain better estimates of population size. Regular monitoring will determine the natural range of variability, trends, and health of the populations and will track whether the population and distribution objectives are being met. Monitoring protocols should be standardized and include metrics related to habitat quality, threats, plant health and reproduction.

7. Critical Habitat

Critical habitat is defined in the *Species at Risk Act* (S.C.2002, c29) section 2(1) as "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species". Section 41 (1)(c) of *SARA* requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction.

Critical habitat for Fascicled Ironweed is fully identified to the extent possible in this recovery strategy, and is sufficient to achieve population and distribution objectives. Additional critical habitat may be added or amended in the future if new or additional information supports the inclusion or refinement of areas beyond those currently identified (e.g., new sites become colonized, existing sites expand into adjacent areas, historical populations are relocated, new information becomes available about habitat requirements).

7.1 Identification of the Species' Critical Habitat

Critical habitat for the Fascicled Ironweed is identified for the two known extant populations based on best available information[13] regarding the species' location and the associated biophysical attributes. Critical habitat is identified as all areas or types of sites within critical habitat units (polygons; Appendix B) for the two known extant populations that possess the following biophysical attributes (Table 4). Note that not all biophysical attributes in Table 4 must be present in order for areas or types of sites to be identified as critical habitat. If the area or type of site as described in Table 4 is present and capable of supporting the species, the area or type of site is considered critical habitat for the species.

[13] Information on Fascicled Ironweed occurrences known to Environment and Climate Change Canada as of October 2019 was used in this recovery strategy.

Table 4. General summary of the areas and types of sites and biophysical attributes of critical habitat for Fascicled Ironweed in Manitoba.

Area or type of site[a,b]	Biophysical attributes[b,c]

• open to semi-open native riparian areas including:
  • river terraces, oxbows, banks of creeks and wetlands;
  • moist to wet meadows;
  • floodplains, low-lying moist depressions or swales in tallgrass prairie
• roadsides/ditches;
• occasionally drier upland tallgrass prairie
	• tree species, when present, are deciduous (e.g. Green Ash, American Elm, Manitoba Maple, Eastern Cottonwood)
	• shrub layer is sparse to absent
	• herbaceous layer ranges from sparse to dense native vegetation
	  • may have non-native species of plants amongst the native plants,
	  • does not include thick dense vegetation cover from grasses and sedges or dense shade
	• soil is typically moist to wet clay but may tolerate other soil textures
	• habitat is seasonally flooded but may tolerate other levels of soil moisture and flooding

[a] Derived from Strother 2006, Foster and Reimer 2007, Manitoba Conservation unpubl. data 2019).
[b] Area or type of site: The area or type of site where the listed species naturally occurs or depends on in order to carry out its life processes.
[c] Biophysical attributes: measureable properties or characteristics of the area or type of site. In essence, biophysical attributes provide the greatest level of information about the area or type of site required to support the life process requirements of the species.

7.1.1 Information and methods used to identify critical habitat

The approach used for identifying critical habitat for Fascicled Ironweed is based on a decision tree developed by the Recovery Team for Plants at Risk in the Prairie Provinces as guidance for identifying critical habitat for terrestrial and aquatic prairie plant species at risk (see Appendix A in Environment Canada 2012 for the full decision tree). Since Fascicled Ironweed is a perennial, reliably present, and easily detectable, and occupies habitat that can be delineated in space and time, critical habitat was identified as per criteria 3a of the decision tree. Accurate and precise occurrences that had been confirmed in the last 25 years and habitat that had been confirmed in the past five years were used. Occupied suitable habitat[14] was mapped using the biophysical attributes description, and included continuous or connected suitable habitat extending away from the known occurrences. The river was also included in the mapping as it is likely important for seed and propagule dispersal, maintaining connectivity and gene

[14] Suitable habitat patches were delineated ex-situ using the best available satellite imagery (WorldView 02 imagery from May 2016 at 0.5 m spatial resolution at 1:3000 map scale, 10.2 m horizontal positional accuracy) following concepts of object-based segmentation (Jobin et al. 2008). Suitable habitat patches were visually identified based on vegetation community type using colour and texture. A 10 m buffer was placed around the delineated occupied habitat patches to account for the horizontal positional accuracy of the image (Paredes-Hernández et al. 2013, DigitalGlobe 2016) and temporal dynamics of habitat boundaries.

flow within the Rat River population, and allowing for natural expansion of the population. For occurrences in roadside ditches where mapping boundaries was not always obvious using the biophysical attributes description, the occupied suitable habitat was bounded lengthwise by intersecting roads or road allowances/approaches and widthwise by the road edge and the property line as this area contains uniform conditions of hydrology and habitat (Environment Canada 2014). Critical habitat is identified as all occupied suitable habitat and all natural biophysical attributes within a 300 m critical function zone extending from the outer boundary of the occupied suitable habitat. Although the exact extent of habitat needed to surround Fascicled Ironweed plants to fulfill the reproductive, dispersal and long-term survival needs of the population is not fully documented, the 300 m critical function zone is based upon a detailed literature review that examined edge-effects of various land use activities that could affect resource availability and contribute to negative population growth for native prairie plants generally (Henderson 2010b; Appendix B in Environment Canada 2012). In addition, based on a detailed literature review that examined factors affecting the quality of native prairie patches in the tallgrass prairie of Manitoba, the 300 m critical function zone is appropriately applied to critical habitat identification of Fascicled Ironweed in Manitoba (Environment and Climate Change Canada 2019 unpublished review). Thus, to ensure the long-term persistence, and where feasible, the natural expansion, of Fascicled Ironweed in Manitoba, the 300 m critical function zone is thought to be the minimum distance needed to maintain the habitat required to meet the population and distribution objectives. As new information on species' habitat requirements and site-specific characteristics become available, this distance may be refined. The 300 m critical function zone has been cropped so as to not include obvious existing human developments and infrastructure, including cultivated lands, within the area identified as critical habitat as these are not considered as critical habitat.

7.1.2 Geographic information (Geographic Location of Areas Containing Critical Habitat)

The area containing critical habitat is approximately 1132 hectares (11.32 km^2); no critical habitat is on federal lands. Generalized geographic locations at the scale of standardized 1x1 km grids and critical habitat unit polygons are provided in critical habitat maps (Appendix B). All jurisdictions and landowners who are controlling surface access to the area, or who are currently leasing and using parts of this area, may be provided upon request with geo-referenced spatial data or large-format maps delineating the boundaries of critical habitat displayed in Appendix B.

7.2 Activities Likely to Result in the Destruction of Critical Habitat

Destruction of critical habitat is assessed on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single or multiple activities at one point in time (direct effect) or from the cumulative effects of one or more activities over time (cumulative effect). Activities described in Table 5 outline examples of activities likely to cause destruction of critical

habitat for Fascicled Ironweed; however, destructive activities are not limited to those listed.

Table 5. Activities likely to result in the destruction of critical habitat.

Description of Activity	Description of Effect	Details of Effect
Compression or erosion of soils, which can be caused by activities such as: creation of trails and roads; motorized traffic; or concentration of livestock activity by the placement of bales, or establishment of new corrals or watering sites	Compression and erosion can damage soil structure and porosity, reduce water availability by increasing runoff and decreasing infiltration, prevent establishment of seedlings, or increase the likelihood of invasive non-native plants by disturbing native ground cover.	Related threats: 1.1 Housing & urban areas; 2.1 Annual & perennial non-timber crops; 2.3 Livestock farming & ranching; 4.1 Roads & railroads This activity must occur within the bounds of critical habitat to cause its destruction, can be a direct or cumulative effect, and is applicable at all times of the year, with the exception of winter months when the ground is snow covered and frozen solid (soil temperature below -10^{0}C).
Covering of soils, which can be caused by activities such as: creation or expansion of permanent/ temporary structures such as land conversion to residential housing/developments; spreading of solid waste materials; or roadbed construction and certain road maintenance activities	Covering the soil prevents solar radiation and water infiltration needed for germination of seeds and survival of plants, such that critical habitat is destroyed.	Related threats: 1.1 Housing & urban areas; 2.1 Annual & Perennial Non-timber Crops; 2.3 Livestock Farming & Ranching; 4.1 Roads & railroads This activity must occur within the bounds of critical habitat to cause its destruction, is a direct effect, and is applicable at all times of the year.
Inversion/excavation/extraction of soils, which can be caused by activities such as: new or expanded cultivation; new/expansion of existing dugouts; certain road construction and maintenance activities or ditch deepening; residential development; pipeline installation; or removal of topsoil	Inverting, excavating or extracting soil results in the direct loss of critical habitat by removing or disturbing the substrate within which the plant grows, and altering the biophysical conditions (e.g. soil porosity, soil temperature, soil moisture) required for germination, establishment and growth of the Fascicled Ironweed. This activity can also lead to vegetation community change to one dominated by competitive invasive species.	Related threats: 1.1 Housing & urban areas; 2.1 Annual & Perennial Non-timber Crops; 2.3 Livestock Farming & Ranching; 4.1 Roads & railroads This activity must occur within the bounds of critical habitat to cause its destruction, can be both a direct and cumulative effect, and is applicable at all times of the year.
Alteration to hydrological regimes, which can be caused by activities such as: long-term or permanent inundation of upland habitat, or lack of seasonal flooding, or groundwater depletion, from	Fascicled Ironweed is adapted to moist soils and seasonal flooding events; changes to soil moisture or hydrology where the soil is too dry or too wet for an extended period of time can negatively affect the suitability of the habitat, affect plant growth and survival as well as seed	Related threats: 1.1 Housing & urban areas; 4.1 Roads & railroads; 7.2 Dams & water management/use This activity can occur within and outside the bounds of critical habitat to cause its

Description of Activity	Description of Effect	Details of Effect
impoundments downstream or alternately releases of water upstream; including but not limited to water or flow control structures (dams, ditches, dykes,diversions), drains, culvert installation, road widening or straightening; or residential developments	germination or seed bank viability, and change species composition in the area. Fascicled Ironweed grows in areas along the Rat River known to regularly flood seasonally in spring (sometimes in summer and fall) that have been inundated with water for periods of 3-6 weeks (Foster et al. 2007) and survived while other reports indicate it can tolerate a water depth of 18 inches decreasing over a period of four days (Shaw and Schmidt 2003); long-term or permanent flooding, however, of the habitat adjacent the river may be sufficient to alter that habitat enough to be unsuitable for survival or restablishment. Alternately, altering hydrology to deplete groundwater or eliminate seasonal flooding long-term or permanently will likely result in conditions unsuitable for the species.	destruction, can be a direct or cumulative effect, and is applicable at all times of the year.
Indiscriminate application of fertilizers or pesticides	Herbicide and fertilizer can alter soil or water nutrient status, creating conditions suitable for some plant species and unsuitable for others, such that species composition in the surrounding plant community can change. Changes to soil or water nutrient status will also influence the outcome of interspecific competition for nutrients. Pesticide runoff and drift can alter plant and pollinator communities, thereby possibly reducing the capability of the habitat to support Fascicled Ironweed.	Related threats: 1.1 Housing & urban areas; 2.1 Annual & perennial non-timber crops; 4.1 Roads & railroads; 9.3 Agriculture & forestry effluents This activity can occur within and outside the bounds of critical habitat to cause its destruction (e.g. chemical drift, groundwater or overland flow of contaminated water), can be a direct or cumulative effect, and is applicable at all times of the year.
Deliberate introduction or promotion of invasive non-native plant species, which can be caused by activities such as: intentional dumping or spreading of feed bales containing viable seed of invasive non-native species; seeding invasive non-native species into critical habitat where the invasive non-native species did not already occur; use of motorized vehicles in critical habitat that are contaminated with invasive species material	Once established, invasive non-native plant species can alter hydrology, soil nutrient and moisture availability, and create dense shade or cover, resulting in direct competition with Fascicled Ironweed, such that population declines occur, effectively destroying the critical habitat. Critical habitat may be destroyed by invasive non-native species mentioned in Section 4.2 (threat 8.1), as well as by other noxious prohibited weeds and aggressive opportunistic species. It may also be destroyed by the following species which are not restricted by any legislation due to their economic value: Smooth Brome, Kentucky Bluegrass (*Poa pratensis*), Crested Wheatgrass (*Agropyron cristatum*), Yellow Sweet Clover (*Melilotus officinalis*), White Sweet Clover (*Melilotus alba*).	Related threats: 1.1 Housing & urban areas; 2.1 Annual & perennial non-timber crops; 2.3 Livestock farming & ranching; 4.1 Roads & railroads; 8.1 Invasive non-native species This activity can occur within or adjacent to the bounds of critical habitat to cause its destruction, can be a direct or a cumulative effect, and is applicable at all times of the year.

8. Measuring Progress

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives. Beginning in 2020 and every five years thereafter, success of recovery strategy implementation will be measured against the following performance indicators:

- The estimated population size and distribution of all extant populations and any newly discovered or relocated populations are maintained, within the range of natural variability.

9. Statement on Action Plans

One or more action plans will be posted on the Species at Risk Public Registry within five years following the final posting of this recovery strategy.

10. References

Barnes, W.J. 1999. The rapid growth of a population of reed canarygrass (Phalaris arundinacea L.) and its impact on some riverbottom herbs. Journal of the Torrey Botanical Society 126: 133-138.

Brown, R.L. and J. Chenoweth. 2008. The effect of Glines Canyon Dam on hydrochorous seed dispersal in the Elwha River. Northwest Science 82: 197-209.

Carthey, A.J.R, Fryirs, K.A., Ralph, T.J., Bu, H. and M.R. Leishman. 2016. How seed traits predict floating times: a biophysical process model for hydrochorous seed transport behaviour in fluvial systems. Freshwater Biology 61: 19-31.

Catford, J.A. and R. Jansson. 2014. Drowned, buried and carried away: effects of plant traits on the distribution of native and alien species in riparian ecosystems. New Phytologist 204: 19-36.

Channell, R. and M.V. Lomolino. 2000. Dynamic biogeography and conservation of endangered species. Nature 403: 84–86.

COSEWIC. 2014. COSEWIC assessment and status report on the Fascicled Ironweed Vernonia fasciculata in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. Ix + 26 pp. Website: https://wildlife-species.canada.ca/species-risk-registry/document/default_e.cfm?documentID=2758 (accessed February 24, 2020).

COSEWIC. 2015. COSEWIC assessment process, categories and guidelines. Committee on the Status of Endangered Wildlife in Canada. Website: https://www.canada.ca/content/dam/eccc/migration/cosewic-cosepac/94d0444d-369c-49ed-a586-ec00c3fef69b/assessment_process_and_criteria_e.pdf (accessed February 24, 2020).

COSEWIC. 2020a. Definitions and abbreviations. Website: http://cosewic.ca/index.php/en-ca/about-us/definitions-abbreviations (accessed February 24, 2020).

COSEWIC. 2020b. Guidelines for use of the Index Area of Occupancy in COSEWIC assessments. Website: http://cosewic.ca/index.php/en-ca/reports/preparing-status-reports/guidelines-index-area-occupancy (accessed February 24, 2020).

DigitalGlobe. 2016. Accuracy of WorldView Products: White Paper. Website: https://dgv4-cms-production.s3.amazonaws.com/uploads/document/file/154/DG_ACCURACY_WP_V3.pdf (accessed June 28, 2019).

Douglas, M.R. and J.F. Tooker. 2015. Large-scale deployment of seed treatments has driven rapid increase in use of neonicotinoid insecticides and preemptive pest management in U.S. field crops. Environmental Science and Technology 49: 5088-5097.

Environment Canada. 2012. Recovery strategy for the Small-flowered Sand-verbena (*Tripterocalyx micranthus*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. v + 47 pp.

Environment Canada. 2014. Recovery strategy for the Small White Lady's-slipper (*Cypripedium candidum*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. v + 30 pp.

Foster, C. and C. Hamel. 2006. Rare species surveys of the Manitoba Conservation Data Centre, 2005. MS Report 06-01. Manitoba Conservation Data Centre, Winnipeg, Manitoba. 43 pp.

Foster, C. and E. Reimer. 2007. Rare plant surveys by the Manitoba Conservation Data Centre, 2006. MS Report 07-01. Manitoba Conservation Data Centre, Winnipeg, Manitoba. 53 pp. Website: http://www.gov.mb.ca/conservation/cdc/pdf/field_report_2006.pdf (accessed May 17 2019).

Friesen, C. and C. Murray. 2010. Rare Species Surveys and Stewardship Activities by the Manitoba Conservation Data Centre, 2009. Report No. 2009-04. Manitoba Conservation Data Centre, Winnipeg, Manitoba. 20 pp. Website: http://www.gov.mb.ca/conservation/cdc/pdf/field_report_2009.pdf (accessed May 17 2019).

Friesen, C. and C. Murray. 2011. Rare species surveys and stewardship activities by the Manitoba Conservation Data Centre, 2010. Report No. 2010-01. Manitoba Conservation Data Centre, Winnipeg, Manitoba. 24 pp. Website: https://www.gov.mb.ca/sd/cdc/pdf/2010_final_report.pdf (accessed May 17 2019).

Gill, R.J. and N.E. Raine. 2014. Chronic impairment of bumblebee natural foraging behavior induced by sublethal pesticide exposure. Functional Ecology 28: 1459-1471.

Godfray,H.C.J., Blacquiere, T., Field, L.M., Hails, R.S., Petrokofsky, G., Potts, S.G., Raine, N.E., Vanbergen, A.J. and A.R. McLean. 2014. A restatement of the natural science evidence base concerning neonicotinoid insecticides and insect pollinators. Proceedings of The Royal Society Biological Sciences 281: 20140558.

Great Plains Flora Association. 1986. Flora of the Great Plains. University Press of Kansas, Kansas.1402 pp.

Groves, J. 2010. Fluvial seed dispersal processes and the sustainability of riparian vegetation. PhD thesis. University of Canberra, Canberra, ACT.

Henderson, D.C. 2010a. Occupancy survey guidelines for Prairie Plant species at risk. Environment Canada, Prairie and Northern Region, Canadian Wildlife Service. Edmonton, AB. Website: www.npss.sk.ca/docs/2_pdf/Rare_Plant_Occupancy_Survey_Guidelines.pdf (accessed July 18, 2019).

Henderson, D.C. 2010b. Set-back distance and timing restriction guidelines for prairie plant species at risk. Environment Canada, Prairie and Northern Region, Canadian Wildlife Service. Edmonton AB. Website: https://www.npss.sk.ca/rsu_docs/documents/plant-setback-guidelines-nov-15-2010.pdf (accessed July 18, 2019).

Hubbard, D.E. and A. Boe. 1988. IVDDM and chemical constituents in selected species of wetland plants. Proceedings South Dakoda Academy of Science 67: 44-58.

Jansson, R., Zinko, U., Merritt, D.M. and C. Nilsson. 2005. Hydrochory increases riparian plant species richness: a comparison between a free-flowing and a regulated river. Journal of Ecology 93: 1094-1103.

Jobin, B., Labrecque, S., Grenier, M. and G. Falardeau. 2008. Object-based classification as an alternative approach to the traditional pixel-based classification to identify potential habitat of the grasshopper sparrow. Environmental Management 41: 20-31.

Jones, S.B. 1972. A systematic study of the Fasciculatae group of Vernonia (Compositae). Brittonia 24: 28-45.

Kartesz, J.T. 2015. *North America Plant Atlas.* Chapel Hill, N.C. [maps generated from Kartesz, J.T. 2015. Floristic Synthesis of North America, Version 1.0. Biota of North America Program (BONAP). (in press)]. Website: http://www.bonap.org/napa.html (accessed May 22, 2019).

Kearnes, C.A., Inouye, D.W. and N.M. Waser. 1998. Endangered mutalisms: The conservation of plant-pollinator interactions. Annual Review of Ecology and Systematics 29: 83–112.

Lavergne, S. and J. Molofsky. 2007. Increased genetic variation and evolutionary potential drive the success of an invasive grass. Proceedings of the National Academy of Sciences 104: 3883-3888.

Lesica, P., Moore, G., Peterson, K.M. and J.H. Rumely. 1984. Vascular Plants of Limited Distribution in Montana. Montana Academy of Sciences, Supplement to the Proceedings, Vol. 43, Monograph 2.

Medley, M. 1993. An Annotated Catalog of the Known and Reported Vascular Flora of Kentucky. Ph.D. Dissertation, Univ. of Louisville, Louisville.

Merritt, D.M. and E.E. Wohl. 2002. Processes governing hydrochory along rivers: hydraulics, hydrology, and dispersal phenology. Ecological Applications 12: 1071-1087.

Merritt, D.M. and E.E. Wohl. 2006. Plant dispersal along rivers fragmented by dams. River Research and Applications 22: 1-26.

Montana Natural Heritage Program. 2019. Montana Field Guide: Fascicled Ironweed – Vernonia fasciculata ssp. corymbosa. Website: http://fieldguide.mt.gov/speciesDetail.aspx?elcode=PDAST9S091 (accessed May 17 2019).

Murray, C. 2019. Personal Communications. Information Manager, Manitoba Conservation Data Centre, Manitoba Conservation.

Murray, C. and C. Friesen. 2012. Manitoba Conservation Data Centre Surveys and Stewardship Activities, 2011. Report No. 2012-01. Manitoba Conservation Data Centre, Winnipeg, Manitoba. 24 pp. Website: https://www.gov.mb.ca/sd/cdc/pdf/2012_field_report.pdf (accessed May 17 2019)

Murray, C. 2013. Manitoba Conservation Data Centre Surveys and Stewardship Activities, 2012. Report No. 2013-01. Manitoba Conservation Data Centre, Winnipeg, Manitoba. 30 pp. Website: https://www.gov.mb.ca/sd/cdc/pdf/2012_field_report_2013_01.pdf (accessed May 17 2019)

Murray, C. 2014. Manitoba Conservation Data Centre Surveys and Stewardship Activities, 2013. Report No. 2014-01. Manitoba Conservation Data Centre, Winnipeg, Manitoba. v+41 pp. Website: https://www.gov.mb.ca/sd/cdc/pdf/2014_field_report.pdf (accessed May 17 2019).

Murray, C. and C. Church 2015. Manitoba Conservation Data Centre surveys and stewardship activities, 2014. Report No. 2015-01. Manitoba Conservation Data Centre, Winnipeg, Manitoba. v+47 pp. Website: https://www.gov.mb.ca/sd/cdc/pdf/manitoba_conservation_data_centre_2014.pdf (accessed May 17 2019).

Murray, C. and C. Church. 2017. Manitoba Conservation Data Centre surveys and stewardship activities, 2015. Report No. 2017-02. Manitoba Conservation Data Centre, Winnipeg, Manitoba. Iii + 55 pp.

Nabhan, G.P. and S.L. Buchmann. 1997. Services provided by pollinators. In: Nature's Services Societal Dependence on Natural Ecosystems. G. C. Daily. Island Press. 412 pp.

NatureServe. 2020a. Habitat-based Plant Element Occurrence Delimitation Guidance, 1 October 2004. Version 7.1. NatureServe, Arlington, Virginia. Website: http://explorer.natureserve.org/decision_tree.htm (accessed January 13, 2020).

NatureServe. 2020b. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Website: http://explorer.natureserve.org/ (accessed January 13, 2020).

NatureServe. 2020c. Ranking species occurrences – A generic approach, 11 January 2008. Version 7.1. NatureServe, Arlington, Virginia. Website: http://explorer.natureserve.org/eorankguide.htm (accessed January 13, 2020).

Paredes-Hernández, C.U., Salinas-Castillo, W.E., Guevara-Cortina, F. and X. Martínez-Becerra. 2013. Horizontal positional accuracy of Google Earth's imagery over rural areas: a study case in Tamaulipas, Mexico. Boletim de Ciências Geodésicas 19: 5880601.

Scheper, J., Reemer, M., Kats, R., Ozinga, W.A., Linden, G.T.J., Schaminee, J.H.J., Siepel, H. and D. Kleijn. 2014. Museum specimens reveal loss of pollen host plants as key factor driving wild bee decline in The Netherlands. Proceedings of the National Academy of Sciences 111: 17552-17557.

Shaw, D. and R. Schmidt. 2003. Plants for stormwater design. Minnesota Pollution Control Agency, Saint Paul, Minnesota.

Sluis, W.J. and J. Tandarich. 2004. Siltation and hydrologic regime determine species composition in herbaceous floodplain communities. Plant Ecology 173: 115-124.

Smith, E.B. 1973. An annotated list of the Compositae of Arkansas. Castanea 38: 79-109.

Smith, E.B. 1988. An atlas and annotated list of the vascular plants of Arkansas, 2d ed. University of Arkansas, Fayetteville. 592 pp.

Strother, J.L. 2006. Vernonia. In: Flora of North America Editorial Committee, Eds. 1993+. Flora of North America North of Mexico. 16+ vols. New York and Oxford. Vol. 19. Pp. 206-213.

Uowolo, A.L., Binkley, D. and E. Carol Adair. 2005. Plant diversity in riparian forests in northwest Colorado: effects of time and river regulation. Forest Ecology and Management 218: 107-114.

USDA. 2019. The PLANTS Database. National Plant Data Center, Baton Rouge, LA. Website: http://plants.usda.gov (accessed July 18, 2019).

Vucetich, J.A. and T.A.Waite. 2003. Spatial patterns of demography and genetic processes across the species' range: Null hypothesis for landscape conservation genetics. Conservation Genetics 4: 639-645.

White, M. 2012. Vernonia fasciculata (Asteraceae): New to the flora of Texas. Phytoneuron 2012-90: 1-6. Website: http://www.phytoneuron.net/90PhytoN-VernoniaNew.pdf (accessed July 18, 2019).

Appendix A: Summary of Fascicled Ironweed Populations in Canada

Table A1. Summary of Fascicled Ironweed Populations in Canada. Light grey shading indicates the population is extirpated or historical.

Population Name [EO_ID]	First Observed	Last Observed	Recent Survey Estimate [Year]	Highest Estimate [Year]	Status	Threats	Notes
MANITOBA							
Morris [1750]	1896	1953	0 [2013]	1 clump [1953]	Historical but believed extirpated	N/A	Surveys in the area of Morris in 2005, 2006, 2010, and 2013 found no plants (MB Conservation Data Centre, unpubl. data 2019). Habitat description from 1896 was from along what is now the Morris River and another location from 1953 was "grassy road ditch"; COSEWIC has this population as extirpated and states it was eliminated by the conversion of native pasture to cropped field (Foster and Reimer 2007, Friesen and Murray 2011, COSEWIC 2014). A 12 km portion of the Morris River has also been searched but no Fascicled Ironweed found.
Mile Road 4W [4867]	1995	2014	~11 plants containing ~83 stems [2014]	35 plants plus 27 stems [2010]	Current	4.1; 9.3	The upland prairie portion of this population was extirpated between 1995-2006 through cultivation; plants are now restricted to a municipal ditch and drain with the ditch being cleared of vegetation sometime between 2010 and 2013 (Foster and Reimer 2007, Friesen and Murray 2011, COSEWIC 2014, MB Conservation Data Centre, unpublished data 2019).

Population Name [EO_ID]	First Observed	Last Observed	Recent Survey Estimate [Year]	Highest Estimate [Year]	Status	Threats	Notes
Rat River [2709]	1950	2019	>1,766 plants plus >15,911 stems [2018]; additional >2066 plants and >6361 stems [2019]	>1,766 plants plus >15,911 stems [2018]; additional >2066 plants and >6361 stems [2019]	Current	1.1; 2.1; 2.3; 4.1; 7.2; 8.1; 9.3	Population estimates between years are not comparable as different portions of the population were surveyed each year. The most recent survey effort in 2018 and 2019 does not include the entire Rat River population. Some portions have been revisited multiple times but the majority have not. Note that Provincial Road 200 (PR 200) was considered separately in the COSEWIC (2014) report but is now recognized as part of Rat River (2709).
SASKATCHEWAN							
Weyburn [16246]	pre-1949	pre-1949	0 [2017]	>1 (pre-1949)	Historical	Unknown	Population has never been relocated; original herbarium record is very vague with respect to the location (ie. “Weyburn prairie”). Targeted searches have occurred in seemingly suitable habitat in the Weyburn area with no success.

Appendix B: Critical Habitat for Fascicled Ironweed in Canada

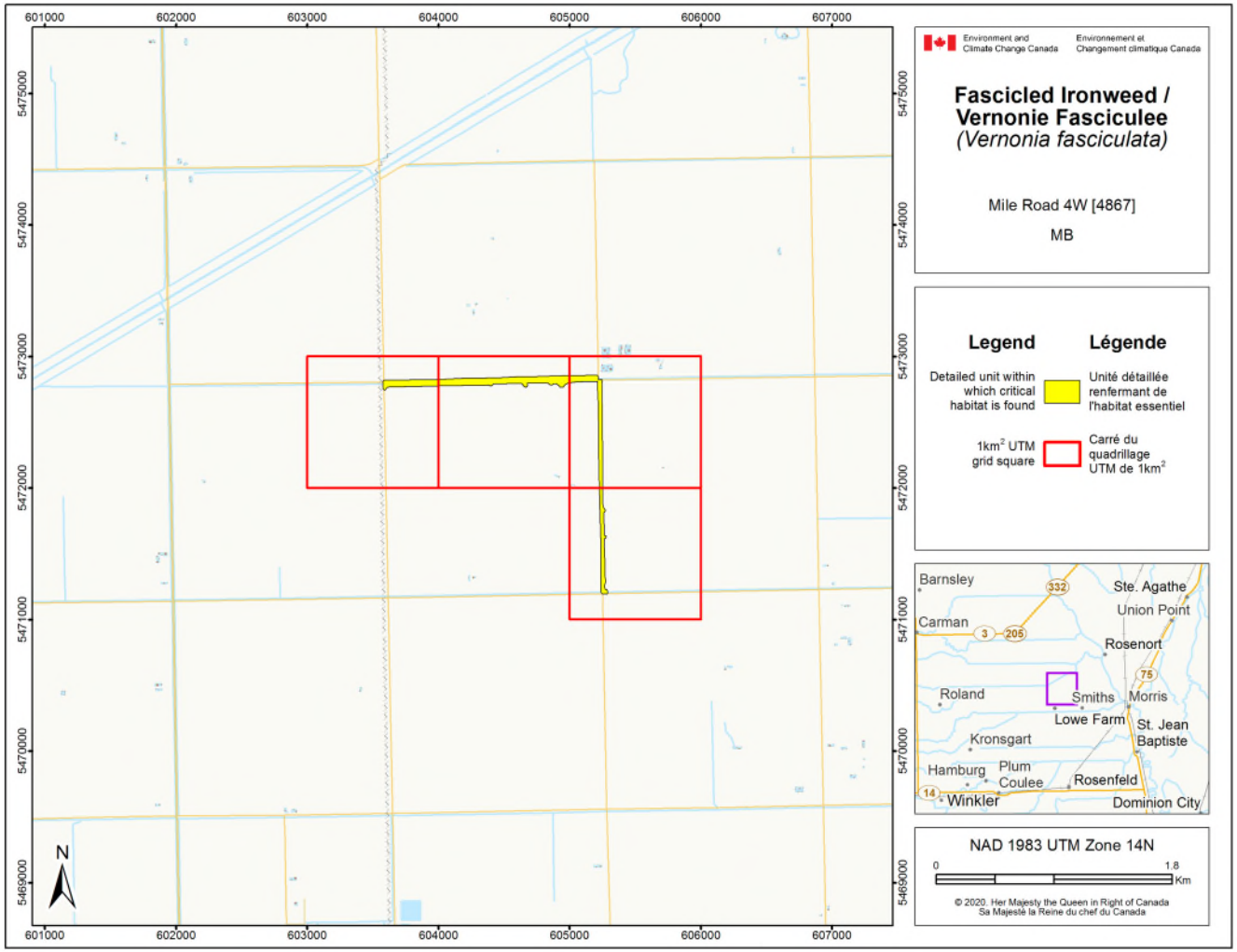

Figure B1. Critical habitat for Fascicled Ironweed in Manitoba (Mile Road 4W [EO 4867] population as described in Table A1) is represented by the yellow shaded units, where the criteria set out in Section 7.1 are met. The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat. Areas outside of the yellow shaded units do not contain critical habitat.

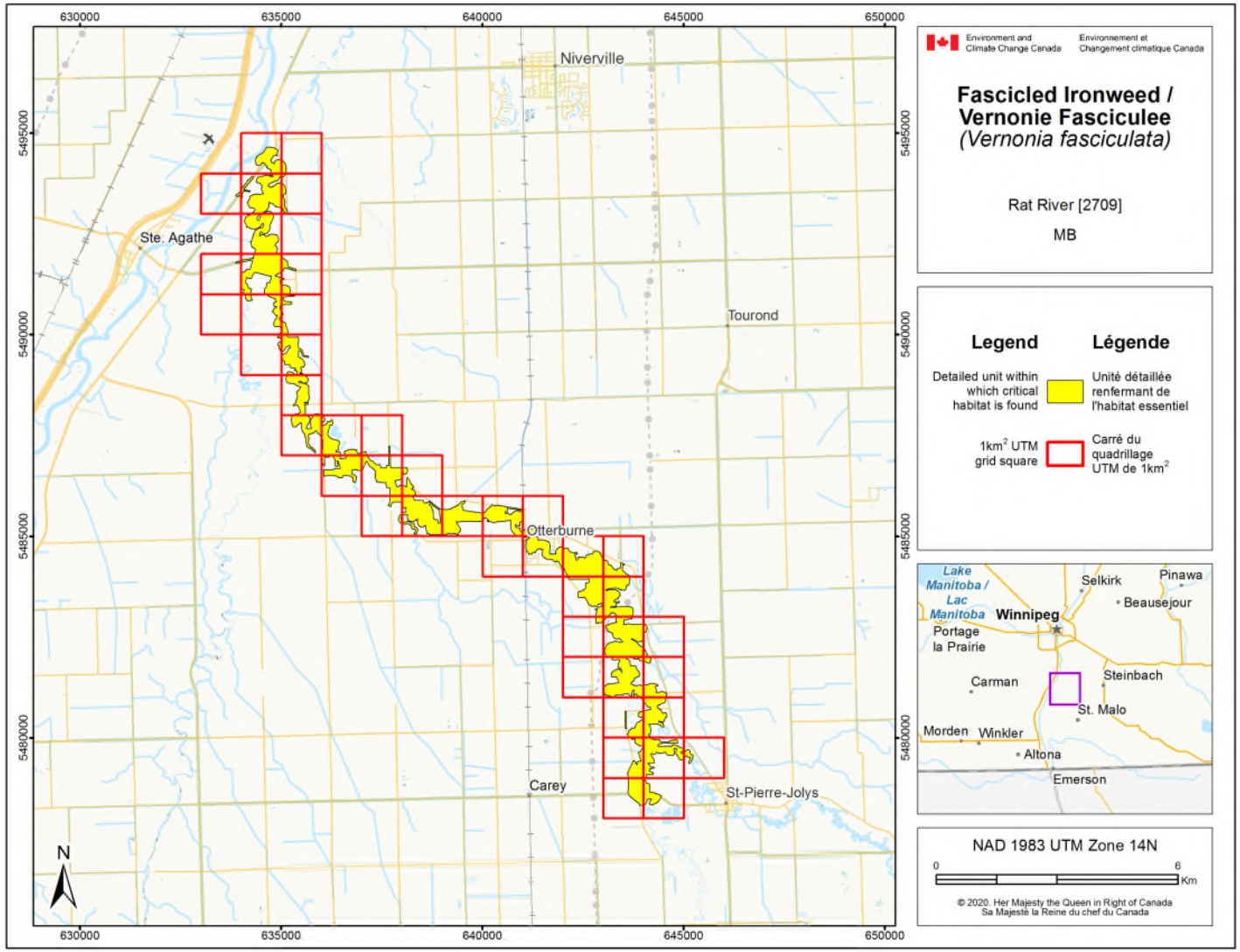

Figure B2. Critical habitat for Fascicled Ironweed in Manitoba (Rat River [EO 2709] population as described in Table A1) is represented by the yellow shaded units, where the criteria set out in Section 7.1 are met. The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat. Areas outside of the yellow shaded units do not contain critical habitat.

Appendix C: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*[15]. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy's[16] (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

The potential for the strategy to inadvertently lead to adverse effects on other species was considered, including the many federal species at risk and provincially rare speices that are found in habitat occupied by Fascicled Ironweed (Table C1). Broad approaches to recovery for the Fascicled Ironweed include communication/ collaboration /engagement, habitat assessment/ management/ stewardship activities, inventory/ monitoring, and research. These activities are aimed at maintaining or improving riparian and wet meadow habitats. For the most part, managing for healthy native ecosystems, maintaining or improving native habitat, and conservation or stewardship actions will benefit non-target species, natural communities, and ecological processes. As a general rule, management actions that incorporate or mimic natural processes are natural components of prairie ecosystems and are not likely to negatively impact the persistence of other native species particularly if the timing, intensity and frequency mimic those natural processes (Samson and Knopf 1994). However, some management practices, and some forms of integrated weed management, have the potential to affect some species negatively in the short or long-term. Therefore, it is important that management actions resulting from recovery strategies, action plans and beneficial management plans are developed with experts from an ecosystem perspective (including development of multi-species action plans and ecosystem beneficial management plans), incorporating as many species' needs as possible, and evaluating the ecological risks of any action, in order to reduce any possible negative effects to other species; in some cases, this may need to be done on a site-specific basis. An ongoing monitoring program should also be in place to evaluate baseline conditions, and the short and long term effects of management actions on the ecosystem and individual species at risk so efforts can be adapted if negative impacts

[15] www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html
[16] www.fsds-sfdd.ca/index.html#/en/goals/

are observed. Efforts should be coordinated with recovery teams and organizations working in the tallgrass prairie ecosystem to ensure the most efficient use of resources and to prevent duplication of effort or conflicts with research.

The SEA concluded that this strategy will not entail significant adverse environmental effects. For further details see the following sections: 3.3 Needs of the Fascicled Ironweed, 4. Threats, and 6. Broad strategies and general approaches to meet objectives.

Table C1. Federal species at risk that co-occur, or may co-occur, in areas occupied by Fascicled Ironweed, as identified by Conservation Data Centre records within a 1 km radius of Fascicled Ironweed.

Common Name	Scientific name	SARA status	COSEWIC status
Barn Swallow	*Hirundo rustica*	Threatened	Threatened
Bobolink	*Dolichonyx oryzivorus*	Threatened	Threatened
Chimney Swift	*Chaetura pelagica*	Threatened	Threatened
Eastern Wood-pewee	*Contopus virens*	Special Concern	Special Concern
Golden-winged Warbler	*Vermivora chrysoptera*	Threatened	Threatened
Mapleleaf Mussel	*Quadrula quadrula*	Endangered	Threatened
Monarch	*Danaus plexippus*	Special Concern	Endangered
Northern Leopard Frog	*Lithobates pipiens*	Special Concern	Special Concern
Snapping Turtle	*Chelydra serpentina*	Special Concern	Special Concern