Ontario Species at Risk Evaluation Report for Smooth Yellow False Foxglove Gérardie jaune (*Aureolaria flava*)

Committee on the Status of Species at Risk in Ontario (COSSARO)

Assessed by COSSARO as Threatened

November 2020

Gérardie jaune *(Aureolaria flava)*

La gérardie jaune est une grande herbacée vivace pouvant atteindre 2,5 m de hauteur. Les gérardies sont des hémiparasites qui peuvent absorber de l'eau et des nutriments en se fixant aux racines d'autres plantes, particulièrement celles de chênes (*Quercus spp*). Elles se rencontrent dans des habitats composés de forêts, de terres boisées et de savanes peuplées de chênes, dégagés à semi-dégagés et secs, situés en terrain élevé sur des sols bien drainés (COSEPAC, 2018). L'occupation est confirmée pour sept sous-populations potentiellement viables : complexe de prairies Ojibway, Essex; ruisseau Venison, Norfolk; île Walpole, Première Nation de l'île Walpole; escarpement du chemin Fifty, Hamilton; colline de chênes du chemin de fer Branchton, Waterloo; complexe du ruisseau Sixteen Mile, Halton; tourbière Sudden, Waterloo (COSEPAC, 2018).

D'après son évaluation, le CDSEPO classe la gérardie jaune dans la catégorie des espèces menacées. Cela tient compte du fait qu'il y a un nombre modeste et décroissant d'individus matures dans sept à neuf endroits, ce qui a pour conséquence une petite zone d'occurrence et un faible indice de zone d'occupation. À cela s'ajoute la projection d'une diminution continue de l'étendue et d'une perte de qualité de l'habitat découlant d'une suppression par le feu, de la présence d'espèces indigènes problématiques et de celle d'espèces envahissantes. Cette évaluation concorde avec la classification fédérale de cette espèce par le COSEPAC (2018).

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Executive summary

Smooth Yellow False Foxglove (*Aureolia flava*) is a tall, herbaceous perennial that can reach a height of 2.5m. This species are hemi-parasites where they secure some of their water and nutrients by tapping into the roots of other plants, particularly oak species (*Quercus spp*). They are found in dry, open to semi-open, upland oak forests, woodlands and savanna habitats on well-drained soils (COSEWIC, 2018). Occupancy was confirmed for seven potentially viable subpopulations: Ojibway Prairie Complex, Essex County; Venison Creek, Norfolk; Walpole Island, Walpole Island First Nation; Fifty Road Escarpment, Hamilton; Branchton Railway Oak Knoll, Waterloo; Sixteen Mile Creek Complex, Halton; and Sudden Bog, Waterloo (COSEWIC, 2018).

Smooth Yellow False Foxglove is classified by COSSARO as Threatened. This is considering that there is a small declining number of mature individuals that are at 7-9 locations resulting in a low extent of occurrence and index of area of occupancy. For these areas, there is a projected continuing decline in extent and habitat quality resulting from fire suppression, problematic native species as well as invasive species. This classification is consistent with the federal classification of this species by COSEWIC (2018).

1. Eligibility for Ontario status assessment

1.1. Eligibility conditions

1.1.1. Taxonomic distinctness

Yellow Foxgloves are part of the genus *Aureolaria* which contains eight species, three of which occur in Canada. *Aureolaria* as a genus refers to the golden-yellow colour of the flowers.

Smooth Yellow False Foxglove (*Aureolaria flava* (L.) Farw

Although many specimens in Canada have not been identified to variety, there is some documentation where two infraspecific taxa have been recognized as occurring; *A. flava* var. *flava* and *A. flava var. macrantha* (COSEWIC, 2018).

1.1.2. Designatable units

Smooth Yellow False Foxglove is considered to represent a single designatable unit throughout its Canadian range (COSEWIC, 2018).

1.1.3. Native status

Smooth Yellow False Foxglove as been reported from 45 sites in Canada since 1887 (COSEWIC, 2018).

1.1.4. Occurrence

The current range of Smooth Yellow False Foxglove is generally within the southern portion of the Great Lakes Plain Ecological Area and largely restricted to the Carolinian ecoregion (COSEWIC, 2018).

1.2. Eligibility results

Smooth Yellow False Foxglove (*Aureolaria flava*) is eligible for status assessment in Ontario.

2. Background information

2.1. Current designations

Smooth Yellow False Foxglove

- GRANK: G5 for *A. flava;* T5 for *A. flava var. flava;* T4 for *A. flava var. macrantha* (NatureServe 2020)
- IUCN: na
- NRANK Canada: *A. flava:*N2?
- COSEWIC: Threatened (April, 2018)

- SARA: Not on Schedule 1
- ESA 2007: Not on ESA
- SRANK: S2? (2015)

2.2. Distribution in Ontario

There are 25 known subpopulations for Smooth Yellow False Foxglove in Ontario which encompass multiple sites: Ojibway Prairie (5 sites), Sixteen Mile Creek (2 sites), and the Barrie's Lake-Altrieve Lake (2 sites) and Walpole Island (multiple sites). Note there are twelve records with imprecise locational information that are within 10km of other records that are not considered discrete subpopulations. In 2016, occupancy was confirmed for seven potentially viable subpopulations: Ojibway Prairie Complex, Essex County; Venison Creek, Norfolk; Walpole Island, Walpole Island First Nation; Fifty Road Escarpment, Hamilton; Branchton Railway Oak Knoll, Waterloo; Sixteen Mile Creek Complex, Halton; and Sudden Bog, Waterloo (COSEWIC, 2018).

NHIC records 16 occurences for Smooth Yellow False Foxglove with observation dates ranging between 1901 to 2016. Recent NHIC observations (2016) are at similar locations reported in the COSEWIC assessment report.

2.3. Distribution, status and the broader biologically relevant geographic range outside Ontario

The full range of Smooth Yellow False Foxglove beyond southern Ontario covers most of the Eastern United States extending from Wisconsin to Maine in the north and from Texas to Florida in the south. Smooth Yellow False Foxglove is considered globally secure (G5) and is not listed on the IUCN redlist.

Populations of Smooth Yellow Foxglove from southern Ontario occupy North American Terrestrial Ecoregion 8.1, which extends into southern Minnesota, Wisconsin, and Michigan, northern Iowa, Illinois, Indiana, Ohio, New York, and Pennsylvania (North America Atlas, 2006).

When considering immigration of the species, Smooth Yellow False Foxglove is limited as this species has no long-distance dispersal mechanism. Further, this species is self-incompatible, which also decreases the probability of establishing new colonies. Plants could disperse through natural processes along the Lake Ontario or Lake Erie shorelines or across the Niagara or Detroit systems. However, the probability of this occurring is extremely low given the limited available of potentially suitable habitat. Further, habitat availability, in particular oak forests, is in decline which also restricts the broader biological relevant geographic range (Rodewald, 2003).

Table 1. Condition of Smooth Yellow False Foxglove in Adjacent Jurisdictions and Broader Biologically Relevant Geographic Range

Adjacent Jurisdictions	Biologically Relevant to Ontario (n/a, yes, no)	Condition	Notes & Sources
Quebec	n/a	n/a	n/a
Manitoba	n/a	n/a	n/a
Michigan	Yes	SNR	NatureServe
Minnesota	No	n/a	n/a
Nunavut	No	n/a	n/a
New York	Yes	SNR	NatureServe
Ohio	Yes	SNR	NatureServe
Pennsylvania	Yes	S2	NatureServe
Wisconsin	No	n/a	n/a
Other Relevant Jurisdiction	n/a	n/a	n/a

2.4. Ontario conservation responsibility

Estimated to be less than one percent given the global range for Smooth Yellow False Foxglove. The percentage of the global population that exists in Ontario is unknown.

2.5. Direct threats

Species in the Yellow False Foxglove bundle face similar threats due to their association with open to semi-open oak ecosystems (COSEWIC, 2018). Oak ecosystems across eastern North America are in decline for a variety of reasons. Fire suppression and invasive species are threats to the persistence of Yellow False Foxgloves because they result in shading and competition from other species. There is moderate to severe damage to plants due to browsing by White-tailed Deer, which had been observed at most sites during the recent 2016 fieldwork.

A threats calculation was completed for Smooth Yellow False Foxglove as part of the COSEWIC (2018) report as follows:

i) Fire suppression – Medium Impact
ii) Problematic native species – Medium Impact
iii) Invasive non-native species – Low Impact
iv) Recreational activities – Medium to Low Impact

Other threats include: possible expansion of formal trail networks, periodic defoliation and increased oak mortality due to European Gypsy Moth (*Lymantria dispar*), nectar robbing by honeybees, declines in native bumble bee populations, herbivory by leaf and seed-eating insects, and infrastructure maintenance on plants near existing roads and hydro corridors (COSEWIC, 2018). Climate change impacts are uncertain but

increased drought and storm activity could be beneficial for these species by reducing competition and creating canopy gaps.

2.6. Specialized life history or habitat use characteristics

Yellow False Foxgloves are found in dry, open to semi-open, upland oak forests, woodlands and savanna habitats on well-drained soils including sand dunes, sand plains, clay ridges, slopes, stony loams on moraines and shallow soils over carbonate bedrock (COSEWIC, 2018). All Yellow False Foxglove species are hemi-parasites where they secure some of their water and nutrients by tapping into the roots of other plants, particularly oak species (*Quercus spp*). This behavior provides them with a competitive advantage on drought-prone soils. They are shade intolerant and are often found in specific topographic situations which result in increased light penetration, such as valley and escarpment rims, south or west facing slopes, near open water or on ridge backs. Other common habitat features include open understory, sparse groundcover and exposed mineral soils. However, the various species differ somewhat in their specific habitat requirements.

Mature plants flower over an extended period in mid-to-late summer with some plants still flowering in late fall. Each day, two flowers open on each stalk. The complete flowers (sepals, petals, stamens and pistils present) are insect-pollinated by a variety of native bees and Lepidoptera. Seed capsules contain 300 to 500 seeds and each plant is capable of producing numerous seed capsules. Bare soil is an important factor in seed germination (COSEWIC, 2018).

Smooth Yellow False Foxglove and Fern-leaved Yellow False foxglove are the sole larval food source for False-foxglove Sun Moth (COSEWIC, 2018).

Smooth Yellow False Foxglove is a tall, herbaceous perennial that can reach a height of 2.5m but is typically between 0.5-1.5m. Individual plants form clumps of several to many (100 or more) stems arising from a central root. Stems are often not branched and are characteristically smooth (glabrous) with a glaucous bloom and range in colour from green to purple-tinged. The lower leaves are up to 15cm long and deeply lobed. Upper leaves (the bracts) are progressively smaller and vary from shallowly lobed or toothed to entire. The flowers are on short stalks, 5-10mm long. The lobed calyx at the base of the flower is about 5mm in length and bell-like yellow corolla is 35-60mm. Seed capsules are smooth and ovoid and are 12-16mm long. Seeds are 2mm long with thin wings.

Smooth Yellow False Foxglove grows in dry upland woods in a wide range of situations such as; on clay ridges running perpendicular to valley or escarpment slopes, on rims of steep-sided valleys and valley slopes, on a small oak knoll surrounded by open wetlands and old fields, on oak hummocks and small openings in oak woodlands. White oak (*Quercus alba*) is the typical host species for Smooth Yellow False Foxglove, it can also be associated with Black Oak (*Quercus velutina*) and Red Oak (*Quercus rubra*) (COSEWIC, 2018).

Smooth Yellow False Foxglove starts flowering early August to about mid-September.

Seeds are dormant at dispersal time, but break dormancy following cold stratification. Smooth Yellow False Foxglove is not self-compatible, therefore areas are not considered viable if only one plant has been observed (COSEWIC, 2018).

3. Ontario status assessment

3.1. Application of endangered/threatened status in Ontario

3.1.1. Criterion A – Decline in total number of mature individuals

Not applicable. While, population declines are suspected, abundance information is insufficient to calculate a percent decline of mature individuals (COSEWIC, 2018).

3.1.2. Criterion B – Small distribution range and decline or fluctuation

Meets Threatened B1 ab(i)(ii)(iii)(iv). The EOO is 11,646km^2 , the AOO is 40km^2, there are 7-9 locations, an observed EOO decrease of 5.7-17.6%, an observed AOO decrease of 23-57%, an observed and projected decline of habitat quality based on a number of threats and a decrease in the number of locations.

3.1.3. Criterion C – Small and declining number of mature individuals

Meets Threatened C2a(i) for Smooth Yellow False Foxglove where total individuals are estimated to be between 928-2,773, and subpopulations contain 286-1036, 50-200, 74, 31, 11, 7, 5 and 464-1409 individuals.

3.1.4. Criterion D – Very small or restricted total population

Does not apply.

3.1.5. Criterion E – Quantitative analysis

A quantitative analysis has not been completed.

3.2. Application of Special Concern in Ontario

Not applicable.

3.3. Status category modifiers

3.3.1. Ontario’s conservation responsibility

Not applicable.

3.3.2. Status modification based on rescue effect or level of risk in broader

biologically relevant geographic range

Rescue effect not applicable due to very low probability of individual immigration and that rescue effect is unlikely from outside populations.

Broader biologically relevant geographic range not applicable. Populations in most adjacent jurisdictions have no status listings (NatureServe 2020). Populations in Pennsylvania are listed as imperiled (S2). Also habitat availability, in particular oak forests, is in decline which further restricts the broader biological relevant geographic range (Rodewald, 2003).

3.4. Other status categories

3.4.1. Data deficient

Not applicable.

3.4.2. Extinct or extirpated

Not applicable.

3.4.3. Not at risk

Not applicable.

4. Summary of Ontario status

Smooth Yellow False Foxglove (*Aureolaria flava*) is classified as Threatened in Ontario based on meeting criterion B1av(i)(ii)(iii)(iv) and C2a(i).

5. Information sources

COSEWIC. 2018. COSEWIC assessment and status report on the Yellow False Foxglove Bundle, Smooth Yellow False Foxglove *Aureolaria flava,* Fern-leaved Yellow False Foxglove *Aureolaria pedicularia* and the Downy Yellow False Foxglove *Auerolaria virginica,* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xx+100pp. (https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/srYellowFalseFoxglove2018e.pdf)

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

Natural Heritage Information Centre. 2020: An online database of species observations for Ontario

North American Atlas. 2006. Ecological Regions of North America: Level I-III. In partnership with: cec.org; atlas.gc.ca; nationalatlas.gove; www.inegi.gov.mx. Website: https://www.epa.gov/eco-research/ecoregions-north-america

Rodewald, A.D. 2003. Decline of Oak Forests and Implications for Forest Wildlife Conservation. Natural Areas Journal 23(4): 368-371

Appendix 1: Technical summary for Ontario

Species: Smooth Yellow False Foxglove (*Aureolaria flava)*

Demographic information

Demographic attribute	Value
Generation time. Based on average age of breeding adult: age at first breeding = X year; average life span = Y years.	est 7-15 years
Is there an observed, inferred, or projected continuing decline in number of mature individuals?	Unknown based on insufficient and inconsistent data.
Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over the last 10 years or 3 generations.	Unknown
Projected or suspected percent reduction or increase in total number of mature individuals over the next 10 years or 3 generations.	Unkonwn
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over any 10 years, or 3 generations, over a time period including both the past and the future.	Unknown
Are the causes of the decline (a) clearly reversible, and (b) understood, and (c) ceased?	a. Yes b. Yes c. No
Are there extreme fluctuations in number of mature individuals?	Unknown (unlikely)

Extent and occupancy information in Ontario

Extent and occupancy attributes	Value
Estimated extent of occurrence (EOO). *If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.*	11,646 km^2
Index of area of occupancy (IAO). *If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.*	40 km^2
Is the total population severely fragmented? i.e., is >50% of its total area of occupancy is in habitat patches that are:	a. Unknown b. Yes

Extent and occupancy attributes	Value
(a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	
Number of locations. *See Definitions and Abbreviations on COSEWIC and IUCN websites for more information on the term "location". Use plausible range to reflect uncertainty if appropriate.*	7-9 locations
Number of NHIC Element Occurrences *Request data from MNRF.*	16
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	Yes
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	Yes
Is there an observed, inferred, or projected continuing decline in number of sub-populations or EOs?	Yes
Is there an observed, inferred, or projected continuing decline in number of locations?	Yes
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	Yes
Are there extreme fluctuations in number of populations?	Unknown
Are there extreme fluctuations in number of locations?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of mature individuals in each sub-population or total population (if known)

Sub-population (or total population)	Number of mature individuals
Ojibway Praire Complex (3 extant sites, 1 historical site, 1 extirpated site; 7 patches counted	*163 individuals tallied during partial count in 2016, estimate of 286 to 1036 individuals*
Walpole Island	*50 to 200*
Venison Creek, Norfolk	*74*
Fifty Road Escarpment, Hamilton	*31*
Branchton Railway Oak Knoll, Waterloo	*11*
Sixteen Mile Creek Complex, Halton	*7*
Sudden Bog, Waterloo	*5*

Quantitative analysis (population viability analysis conducted)

No population viability analysis has been conducted.

Threats

A threats calculation was completed for Smooth Yellow False Foxglove as part of the COSEWIC (2018) report as follows:

i) Fire suppression – Medium Impact
ii) Problematic native species – Medium Impact
iii) Invasive non-native species – Low Impact
iv) Recreational activities – Medium to Low Impact

Rescue effect

Rescue effect attribute	Value
Does the broader biologically relevant geographic range for this species extend beyond Ontario?	Possibly
Status of outside population(s) most likely to provide immigrants to Ontario	Michigan SNR, Ohio SNR, Pennsylvania S2, New York SNR
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	No
Would immigrants be adapted to survive in Ontario?	Yes
Is there sufficient suitable habitat for immigrants in Ontario?	Possibly
Are conditions deteriorating in Ontario?	Yes
Is the species of conservation concern in bordering jurisdictions?	Yes in Pennsylvania
Is the Ontario population considered to be a sink?	No
Is rescue from outside populations likely?	No

Sensitive species

Not a data sensitive species group.

Acronyms

COSEWIC: Committee on the Status of Endangered Wildlife in Canada
COSSARO: Committee on the Status of Species at Risk in Ontario
ESA: Endangered Species Act
EO: Element occurrence (as defined by NHIC)
EOO: extent of occurrence
GRANK: global conservation status assessments
IAO: index of area of occupancy
IUCN: International Union for Conservation of Nature and Natural Resources
MNRF: Ministry of Natural Resources and Forestry
NHIC: Natural Heritage Information Centre
NNR: Unranked
NRANK: National conservation status assessment
SARA: Species at Risk Act
SNR: unranked
SRANK: subnational conservation status assessment
S1: Critically Imperiled
S2: Imperiled
S3: Vulnerable
S4: Apparently Secure
S5: Secure
IUCN: International Union for Conservation of Nature and Natural Resources
CDSEPO: Le Comité de détermination du statut des espèces en péril en Ontario