

**Ontario Species at Risk Evaluation Report for
Downy Yellow False Foxglove**

**Gérardie de Virginie
(*Aureolaria virginica*)**

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

Assessed by COSSARO as Endangered

November 2020

Gérardie de Virginie (*Aureolaria virginica*)

La gérardie de Virginie est une grande herbacée vivace pouvant atteindre 2,5 m de hauteur, aux tiges et aux feuilles recouvertes de poils fins et duveteux. 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 cinq sous-populations potentiellement viables : subdivision de Shep, Waterloo; bois de l'escarpement Clappison, Halton; Gorge Spencer, Hamilton; écloserie Normandale, Norfolk; lacs Spottiswood, Brant (COSEPAC, 2018).

D'après son évaluation, le CDSEPO classe la gérardie de Virginie dans la catégorie des espèces en voie de disparition. Cela tient compte d'une zone d'occurrence réduite et d'un faible indice de zone d'occupation, selon les déductions, dans cinq à sept emplacements. 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).

Cette publication hautement spécialisée «COSSARO Candidate Species at Risk Evaluation for Downy Yellow False Foxglove» n'est disponible qu'en anglais conformément au Règlement 671/92, selon lequel il n'est pas obligatoire de la traduire en vertu de la Loi sur les services en français. Pour obtenir des renseignements en français, veuillez communiquer avec le ministère l'Environnement, de la Protection de la nature et des Parcs au cossarosecretariat@ontario.ca

Executive summary

Downy Yellow False Foxglove (*Aureolaria virginica*) is a tall, herbaceous perennial that can reach a height of 2.5m and has finely pubescent stems. 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 five potentially viable subpopulations: Shep's Subdivision, Waterloo; Clappison Escarpment Woods, Halton; Spencer Gorge, Hamilton; Normandale Fish Hatchery, Norfolk; and Spottiswood Lakes, Brant (COSEWIC, 2018).

Downy Yellow False Foxglove is classified by COSSARO as Endangered. This is considering an inferred low extent of occurrence and index of area of occupancy for 5-7 locations. There is also 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

There are no recognizable infraspecific taxon for Downy Yellow False Foxglove (COSEWIC, 2018).

1.1.2. Designatable units

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

1.1.3. Native status

Downy Yellow False Foxglove has been reported from 18 sites in Canada since 1891 (COSEWIC, 2018).

1.1.4. Occurrence

The current range of the Downy 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

Downy Yellow False Foxglove (*Aureolaria virginica*) is eligible for status assessment in Ontario.

2. Background information

2.1. Current designations

- GRANK: G5 (NatureServe 2020)
- IUCN: na
- NRANK Canada: N1
- COSEWIC: Endangered (April, 2018)
- SARA: Not on Schedule 1
- ESA 2007: Not on ESA
- SRANK: S1 (2015)

2.2. Distribution in Ontario

There are 12 subpopulations for Downy Yellow False Foxglove. Occupancy was confirmed for five subpopulations in 2016: Shep's Subdivision, Waterloo; Clappison Escarpment Woods, Halton; Spencer Gorge, Hamilton; Normandale Fish Hatchery, Norfolk; and Spottiswood Lakes, Brant (COSEWIC, 2018).

NHIC records 13 occurrences for Downy Yellow False Foxglove, all have which were initially observed between 1891 and 1990 and some with recent observations of the same groups as recent as 2018. Recent NHIC observations (2016-2018) 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 Downy Yellow False Foxglove beyond southern Ontario covers most of the Eastern United States extending from Michigan to New Hampshire in the north and from Texas and Florida in the south. Downy False Foxglove is considered globally secure (G5) and is not listed on the IUCN redlist.

Populations of Downy 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).

The broader biologically relevant geographic range for Downy Yellow False Foxglove is limited as this species has no long-distance dispersal mechanism. Further, this species is self-incompatible, which further 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 Downy 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

Adjacent Jurisdictions	Biologically Relevant to Ontario (n/a, yes, no)	Condition	Notes & Sources
New York	Yes	S5	NatureServe
Ohio	Yes	SNR	NatureServe
Pennsylvania	Yes	SNR	NatureServe
Wisconsin	No	n/a	n/a
<i>Other Relevant Jurisdiction</i>	n/a	n/a	n/a

2.4. Ontario conservation responsibility

Estimated to be less than one percent given the global range for Downy 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 Downy 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 – Medium to Low Impact
- iv) Recreational activities – Medium to Low Impact
- v) Logging and Wood harvesting – 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. 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 (COSEWIC, 2018). 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 understorey, sparse groundcover and exposed mineral soils. However, the various species differ somewhat in their specific habitat requirements (COSEWIC, 2018).

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).

The morphology of Downy Yellow False Foxglove is very similar to Smooth Yellow False Foxglove but differs that the stems are shorter, about 0.1 to 1.5m in height. The stems are also downy or finely pubescent. The flower structure is very similar to Smooth Yellow False Foxglove except the pedicels are shorter (1-3mm) and the lobes on the calyx are blunter. Seed capsules are downy and 12-15mm long with seeds that are 2mm long with thin wings.

The habitat requirements of this species are similar to Smooth Yellow False Foxglove but appears to require somewhat less light and is able to persist in mostly closed forests with canopy cover about 70-90%. However, plants observed in more shaded settings were not vigorous.

Downy Yellow False Foxglove flowering dates range from early July through late August, with peak flowering likely occurring in the last two weeks of July or first week of August. This species is not self-compatible, therefore areas are not considered viable if only one plant has been observed.

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). Data collected on mature individuals was inconsistent between 1990 and 2016. However percent declines in abundance have been documented in three extant subpopulations

since 1990 where there has been an 88% decline at Clappison Escarpment Woods, 48% decline at Spencer Gorge, 43% decline at Normandie Fish Hatchery and 78% decline at Spottiswood Lakes, totaling an overall average decline of 63%. The causes of decline are trampling through extensive trail usage at Spencer Gorge, Clappison Escarpment Woods and assumed to be associated with logging for Spottiswood Lakes. There is also a notable documented increase in the number of mature individuals at one subpopulation where there was a 325% increase due to forest management at Shep's Subdivision.

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

Meets Endangered B1ab(i)(ii)(iii)(iv) + B2ab(i)(ii)(iii)(iv). The EOO is 1,315km², the AOO is 20km², there are 5-7 locations, an inferred EOO decrease, an inferred AOO decrease, an inferred decline of habitat quality based on a number of threats and an inferred decrease in the number of locations.

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

Meets Threatened C2a(i) as the total individuals are estimated to be 388, and subpopulations contain 287, 66, 14, 12 and 9 individuals.

3.1.4. Criterion D – Very small or restricted total population

Meets Threatened D1 as the total number of mature individuals is estimated to be 388.

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 due to species status not ranked in other jurisdictions except for one where it appears to be secure (NatureServe,

2020). 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

Downy Yellow False Foxglove (*Aureolaria virginica*) is classified as Endangered in Ontario based on meeting criterion B1ab(i)(ii)(iii)(iv) + B2ab(i)(ii)(iii)(iv).

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 *Aureolaria 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.gov; 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: Downy Yellow False Foxglove (*Aureolaria virginica*)

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.	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.	Unknown
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 (EEO). <i>If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.</i>	1,315 km ²
Index of area of occupancy (IAO). <i>If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.</i>	20 km ²
Is the total population severely fragmented? i.e., is >50% of its total area of occupancy in habitat patches that are: (a) smaller than would be required to support a viable population, and	a. Unknown b. Yes

Extent and occupancy attributes	Value
(b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	
Number of locations. <i>See Definitions and Abbreviations on COSEWIC and IUCN websites for more information on the term "location". Use plausible range to reflect uncertainty if appropriate.</i>	5-7 locations
Number of NHIC Element Occurrences <i>Request data from MNRF.</i>	13
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
<i>Shep's Subdivision, Waterloo</i>	287
<i>Normandale Fish Hatchery, Norfolk</i>	66
<i>Clappison Escarpment Woods, Halton</i>	14
<i>Spencer Gorge, Hamilton</i>	12
<i>Spottiswood Lakes, Brant</i>	9

Quantitative analysis (population viability analysis conducted)

No population viability analysis has been conducted.

Threats

A threats calculation was completed for Downy 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 – Medium to Low Impact
- iv) Recreational activities – Medium to Low Impact
- v) Logging and Wood harvesting – 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 SNR, New York S4
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?	No
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