COSEWIC
Assessment and Status Report

on the

Ute Ladies'-tresses
Spiranthes diluvialis

in Canada

ENDANGERED
2018

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

COSEWIC. 2018. COSEWIC assessment and status report on the Ute Ladies'-tresses *Spiranthes diluvialis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 31 pp. (http://www.registrelep-sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1).

Production note:
COSEWIC would like to acknowledge Enlichened Consulting Ltd. (Curtis Björk, Terry McIntosh, Ron Hall) for writing the status report on Ute Ladies'-tresses, *Spiranthes diluvialis*, prepared under contract with Environment and Climate Change Canada. This report was overseen and edited by Del Meidinger, COSEWIC Vascular Plants Specialist Subcommittee Co-chair.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur la Spiranthe des terrains inondés (*Spiranthes diluvialis*) au Canada.

Cover illustration/photo:
Ute Ladies'-tresses — Photo: Curtis Björk

Catalogue No. CW69-14/778-2019E-PDF
ISBN 978-0-660-31420-4

COSEWIC
Assessment Summary

Assessment Summary – November 2018

Common name
Ute Ladies'-tresses

Scientific name
Spiranthes diluvialis

Status
Endangered

Reason for designation
This short, globally rare orchid occurs in Canada at only two locations in British Columbia, one of which contains a single individual. Its habitat is seasonally moist, slightly to moderately saline lakeshores that are free from overly tall/competitive species. It is primarily threatened by invasive species.

Occurrence
British Columbia

Status history
Designated Endangered in November 2018.

COSEWIC
Executive Summary

Ute Ladies'-tresses
Spiranthes diluvialis

Wildlife Species Description and Significance

The orchid Ute Ladies'-tresses (*Spiranthes diluvialis*) occurs in wetlands in western North America. It is showy, white-flowered, and blooms late in the season. It is one of only two species of the genus *Spiranthes* known to occur in British Columbia. It is rare globally, and especially rare in Canada, where only a small fraction of the global population occurs.

Distribution

Ute Ladies'-tresses is endemic to western North America. It is known from few subpopulations in several clusters, mostly in the United States. In Canada, Ute Ladies'-tresses occurs in two subpopulations in the Okanagan Valley in extreme southern British Columbia: Mahoney Lake and Osoyoos Lake.

Habitat

Ute Ladies'-tresses occurs in diverse wetland habitats in its core US range, including riparian sedge-fringe, stream margins, gravel bars, springs, subirrigated meadows, and saline lakeshore marshes. Associated species vary among these habitats.

Commonalities among the Canadian and US populations suggest a requirement for a specific set of soil chemistry conditions. The Osoyoos Lake subpopulation experiences an altered hydrology due to the presence of a flood-control dam to the south in the US. The Mahoney Lake subpopulation is not evidently under any artificial hydrologic regime, but lake levels fluctuate with periods of wetter and drier weather.

Biology

Ute Ladies'-tresses is a perennial herb, regenerating annually from slender tubers. Longevity of the plants is unknown. Plants reproduce sexually, producing minute seeds that are dispersed by wind. There are suggestions that the plants may reproduce vegetatively through root fragmentation or apomictically through maturation of unfertilized ovules to the seed stage. Bees are the primary, or perhaps sole, effective pollinators of Ute Ladies'-tresses. Flowering of the Canadian population occurs in late summer. The seeds of this species, like all orchids, have effectively no food stores to sustain the embryo

over time, so to germinate and establish, the seeds must rapidly connect to nourishing mycorrhizal fungi. Young seedlings first develop underground, facilitated by their host fungi, for some years before producing above-ground, photosynthetic plants. Mature plants may also undergo prolonged below-ground dormancy.

Population Sizes and Trends

Two subpopulations of Ute Ladies'-tresses occur in Canada, with a total of 6-58 mature individuals observed, depending upon the year. The Mahoney Lake subpopulation included 57 mature individuals in 2017, but only 5 were observed in 2018. Surveys at Osoyoos Lake found one mature individual in 2006 and 2016.

Threats and Limiting Factors

Threats to Ute Ladies'-tresses in Canada include invasive plant species, altered hydrology, recreation/trampling, livestock grazing, possibility of chemical or oil spills, and herbicide drift. The habitat requirements of Ute Ladies'-tresses limit its range and reduce its ability to expand its range. Its long-term survival requires recruitment of new cohorts from viable seed. That requirement can be limited if pollinator populations decline.

Protection, Status and Ranks

Ute Ladies'-tresses is currently ranked by NatureServe as G2G3 (imperilled to vulnerable) globally and N1 (critically imperilled) in Canada. It is ranked S1 (critically imperilled, Red listed) by the British Columbia Conservation Data Centre but does not have legal status at either the provincial or federal levels. It is listed Threatened under the *Endangered Species Act* in the United States. It, like all orchids, is legally barred from international trade under the CITES Convention. The IUCN Red List ranks the species as Least Concern.

TECHNICAL SUMMARY

Spiranthes diluvialis

Ute Ladies'-tresses

Spiranthe des terrains inondés

Range of occurrence in Canada: British Columbia

Demographic Information

Generation time	Perennial of unknown longevity. 25-30 years was used in threats assessment.
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Yes, inferred decline due to decline in quality of habitat.
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	No trends can be deduced from annual variation in number of mature individuals.
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].	No trends can be deduced from annual variability in number of mature individuals
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	Threats could cause a decline in number of mature individuals of 3-70% over the next ten years.
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future.	Unknown. No trend can be deduced from annual variability.
Are the causes of the decline a. clearly reversible and b. understood, and c. ceased?	a. No. b. Yes. c. No.
Are there extreme fluctuations in number of mature individuals?	No, although there are fluctuations, the variation is usually less than ten-fold, and there are an unknown number of dormant plants in any year. .

Extent and Occupancy Information

Estimated extent of occurrence (EOO)	8 km²
Index of area of occupancy (IAO) (Always report 2x2 grid value).	8 km² *Two grid cells.*
Is the 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 (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a. Unknown. b. Yes.

Number of “locations”* (use plausible range to reflect uncertainty if appropriate)	2. Each subpopulation is a location..
Is there an [observed, inferred, or projected] decline in extent of occurrence?	If a single individual, the Osoyoos Lake subpopulation is at risk of potential extirpation by stochastic outcomes of environmental variability. Its loss would reduce the EOO by 50%
Is there an [observed, inferred, or projected] decline in index of area of occupancy?	If a single individual, the Osoyoos Lake subpopulation is at risk of extirpation by stochastic outcomes of environmental variability. Its loss would reduce the index of area of occupancy by 50%.
Is there an [observed, inferred, or projected] decline in number of subpopulations?	If a single individual, the Osoyoos Lake subpopulation is at risk of extirpation by stochastic outcomes of environmental variability. Its loss would reduce the number of subpopulations by 50%.
Is there an [observed, inferred, or projected] decline in number of “locations”?	If a single individual, the Osoyoos Lake subpopulation is at risk of extirpation by stochastic outcomes of environmental variability. Its loss would reduce the number of locations by 50%.
Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat?	Yes. Inferred decline in quality.
Are there extreme fluctuations in number of subpopulations?	No.
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 subpopulation)

Subpopulations (give plausible ranges)	**N Mature Individuals**
Mahoney Lake	5-57
Osoyoos Lake	1
Total	6-58

Quantitative Analysis

Is the probability of extinction in the wild at least [20% within 20 years or 5 generations, or 10% within 100 years]?	Unknown as analysis not completed. Threats calculator suggests 3-70% decline in the population over three generations based on calculated threats impact.

* See Definitions and Abbreviations on COSEWIC website and IUCN (Feb 2014) for more information on this term

Threats (direct, from highest impact to least, as per IUCN Threats Calculator)

Was a threats calculator completed for this species? Yes; calculated High to Medium impact.

i. Invasive species (low – high impact)
ii. Dams & water management (low impact)
iii. Livestock farming & ranching (low impact)
iv. Recreational activities (low impact)
v. Climate change (unknown impact)
vi. Herbicides and chemical spills (unknown impact)

What additional limiting factors are relevant? Habitat specificity, reliance on pollinator populations.

Rescue Effect (immigration from outside Canada)

Status of outside population(s) most likely to provide immigrants to Canada.	Critically Imperilled in Washington State. Nearly all US subpopulations are far distant; only one is close to the international border, but that subpopulation is reported to be extirpated.
Is immigration known or possible?	Unlikely.
Would immigrants be adapted to survive in Canada?	Yes.
Is there sufficient habitat for immigrants in Canada?	Possibly.
Are conditions deteriorating in Canada?	Yes.
Are conditions for the source population deteriorating?	Unknown.
Is the Canadian population considered to be a sink?	Unknown.
Is rescue from outside populations likely?	No.

Data Sensitive Species

Is this a data sensitive species? No.

Status History

COSEWIC: Designated Endangered in November 2018.

Status and Reasons for Designation:

Status:	**Alpha-numeric codes:**
Endangered	B1ab(iii)+2ab(iii); C2a(i,ii); D1

Reasons for designation:
This short, globally rare orchid occurs in Canada at only two locations in British Columbia, one of which contains a single individual. Its habitat is seasonally moist, slightly to moderately saline lakeshores that are free from overly tall/competitive species. It is primarily threatened by invasive species.

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Population size shows annual variability and data are inadequate to evaluate long-term trends. A reduction in mature individuals is inferred from a decline in quality of habitat.

Criterion B (Small Distribution Range and Decline or Fluctuation): Meets Endangered, B1ab(iii)+2ab(iii) as EOO and IAO are below thresholds, there are fewer than 5 locations, and there is an inferred decline in habitat quality due to ongoing threats.
Criterion C (Small and Declining Number of Mature Individuals): Meets Endangered C2a(i,ii), as total population has fewer than 2500 mature individuals, there is an inferred continuing decline in numbers of mature individuals, no subpopulation contains more than 250 mature individuals; and one subpopulation has over 95% of the mature individuals.
Criterion D (Very Small or Restricted Population): Meets Endangered D1 as population is fewer than 250 mature individuals. May meet Threatened D2 with small EOO, IAO and number of locations, and population could become critically endangered in a short period of time.
Criterion E (Quantitative Analysis): Data not available to conduct analysis.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS (2018)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

Environment and Climate Change Canada
Canadian Wildlife Service
Environnement et Changement climatique Canada
Service canadien de la faune
Canada

The Canadian Wildlife Service, Environment and Climate Change Canada, provides full administrative and financial support to the COSEWIC Secretariat.

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TABLE OF CONTENTS

List of Figures

List of Tables

List of Appendices

WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

Scientific name: *Spiranthes diluvialis* Sheviak

Synonyms: *Spiranthes romanzoffiana* var. *diluvialis* (Sheviak) S.L. Welsh

English common name: Ute Ladies'-tresses

French common name: Spiranthe des terrains inondés

Other common names: Diluvim Ladies'-tresses, Flood Ladies-tresses, Intermountain Ladies-tresses, Plateau Lady's Tresses

Family name: Orchidaceae

Major group: Monocots, flowering plants

Bibliographic citation: Brittonia 36: 11. 1984.

Morphological Description (modified from Sheviak & Brown 2002).

Ute Ladies'-tresses (Figure 1) is a perennial forb that grows from tubers; the leaves are mostly in a basal cluster, narrowly oblong to narrowly oblong-lanceolate, glabrous, 5-28 x 1-1.5 cm; stems 10-62 cm, pubescent in the inflorescence, hairs to 0.2-0.4 mm long, gland-tipped, stem leaves mostly near the base or more distal ones reduced; flowers resupinate (borne on an ovary that is twisted 180° so the flowers are upside-down), arranged in spirals, each subtended by a conspicuous, lanceolate, chlorophyllous bract; sepals pubescent like the distal stem, creamy white, lanceolate to narrowly lanceolate, 7.5-15 mm long, shortly fused at the base or free, lateral sepals more or less separate from the upper sepal, ascending to moderately recurved or slightly incurved, the upper sepal arching over the floral mouth; petals coloured as the sepals, the upper two elliptic-lanceolate to lanceolate, held closely together and together with the upper sepal arching over the floral mouth, lower petal oblong to oblong-lanceolate, 7-12 x 2.5-6.8 mm, rarely with the distal portion dilated, recurved, papillose, margins slightly crisped, with two proximal marginal protrusions; fruit capsules, 4-10 mm long, splitting longitudinally; seeds minute.

The only other *Spiranthes* species in British Columbia is *S. romanzoffiana* (Hooded Ladies'-tresses), which differs in having a pandurate (violin-shaped) lip petal, shorter hairs in the inflorescence, and lateral sepals being more up-swept and less recurved. *Spiranthes porrifolia* (Creamy or Western Ladies'-tresses) occurs in central Washington and could be overlooked in British Columbia. It differs from Ute Ladies'-tresses in its creamy yellowish flowers, narrower and strongly papillate lip petal, and nearly glabrous inflorescence, with hairs only up to 0.18 mm long.

Figure 1. Ute Ladies'-tresses at Mahoney Lake (C. Björk 2016).

Population Spatial Structure and Variability

The Canadian population is comprised of two small subpopulations of very small areal extent. The Mahoney Lake subpopulation is formed of scattered or loosely scattered plants (though underground dormant plants may be numerous and of a different spatial structure than the observed flowering individuals). The Osoyoos Lake subpopulation has, in the two years of observation, been recorded as only a single plant, so no spatial structure is evident. With only one observed mature individual, it is unknown whether Osoyoos Lake is truly a viable subpopulation. However, the Osoyoos Lake subpopulation meets the COSEWIC and IUCN definition of a subpopulation: *Subpopulations are defined as geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange.*

Ute Ladies'-tresses is a sessile, perennial plant. Seedling recruitment data are lacking. The plants appear to be long-lived and can undergo underground dormancy for years. Considering these factors, demographic variability in subpopulations may be difficult to assess with any accuracy. Long-term demographic data are lacking for the Canadian population.

Designatable Units

The two Canadian subpopulations are about 25 km apart, there are no recognized subspecies or varieties, and so the species is considered here as a single designatable unit.

Special Significance

Ute Ladies'-tresses is a rare plant of narrow ecological amplitude, at the northern limit of its range. Only a small fraction of the global population, likely much less than 1 percent, occurs in Canada.

DISTRIBUTION

Global Range

Ute Ladies'-tresses range is United States and Canada (Figure 2): south-central British Columbia, north-central Washington, eastern Idaho, southwestern Montana, Wyoming, eastern Nevada, Utah, Colorado and far western Nebraska. Most known localities occur in the central U.S. Rocky Mountains, in more or less discrete clusters: north-central Colorado, the Uinta and Wasatch mountains (Utah), the Snake River headwaters region in eastern Idaho, and the intermontane valleys of southwest Montana. Elsewhere in the U.S., a few populations are scattered in the Great Plains (southeast Wyoming and far western Nebraska), the eastern Great Basin (Nevada and Utah), the northern Colorado Plateau (Utah), and in north-central Washington. Approximately 53 extant occurrences were known as of 2005, comprising approximately 85,000 individuals (Fertig *et al.* 2005).

Canadian Range

Known from two subpopulations in the south Okanagan Valley, British Columbia (Figure 3). The Canadian subpopulations occur in the Southern Mountain COSEWIC National Ecological Area. The Osoyoos Lake subpopulation occurs in the Bunchgrass Biogeoclimatic Zone and the Mahoney Lake subpopulation occurs in the Ponderosa Pine Biogeoclimatic Zone, as defined by the British Columbia Ministry of Forests and Range (2017).

Extent of Occurrence and Area of Occupancy

Extent of occurrence (EOO) is 8 km^2, considered to be the same as the index of area of occupancy as there are only two sites. Index of area of occupancy (IAO) is 8 km^2 (two 2 x 2 km grid cells).

Search Effort

Ute Ladies'-tresses was first found in Canada in 2006, with the nearly simultaneous discovery of the Osoyoos Lake and Mahoney Lake subpopulations. Since that time, the Mahoney Lake subpopulation has been surveyed by Paul Catling (Catling pers. comm. 2011), Josie Symonds and others (Symonds 2014), Sara Bunge, and by the present report writers (T. McIntosh, C. Björk, R. Hall) from 2010 – 2014, 2016, and 2017 (see Table 1). The Osoyoos Lake subpopulation and/or nearby suitable habitats were revisited by McIntosh and Hall in 2007-2009, 2011, and 2016 (Table 1). Potential habitats in other sites were visited by various surveyors in south-central British Columbia and are also summarized in Table 1. As no additional records were found despite this intensive search effort, it seems unlikely that additional sites occur in Canada.

Table 1. Survey effort in 2016 and summary of past effort.

Year	Site	Surveyors	Effort*
2006	Osoyoos Lake	McIntosh, Hall, Björk	30
2006	Mahoney Lake	G. and O. Westby, McIntosh, Björk	2
2006	White Lake	McIntosh, Björk	2
2006	Pritchard	Björk	3
2007-2008	BCTC transmission line	Björk	5
2007-2008	Osoyoos Lake	McIntosh, Hall	4
2007-2011	Apex Mine, Kamloops	Björk	15
2007 - 2014	Mahoney Lake	G. and O. Westby	1
2007 - 2016	Mahoney Lake	McIntosh	10
2007 - 2013	White Lake and associated ponds	McIntosh and G. Westby	5
2008	Lower Adams River	Björk	1.5
2008	NE shore Kamloops Lk.	Björk	2.5
2009	All shorelines around Osoyoos Lake (excluding OIB Reserve lands)	McIntosh	40
2010	Sleeping Waters Lake	McIntosh and G. Westby	3
2011	Open shoreline habitats from ~ 8km E to ~14km W of Kamloops along the Thompson River (during surveys for *Rotala ramosior* Status Report)	McIntosh	28
2011	Osoyoos Oxbows and Willow Beach area (during surveys for *Rotala ramosior* Status Report)	McIntosh	15
2011	Mahoney Lake	Catling / McIntosh	Unknown
2011	Frank Lake	Catling	Unknown
2011	Blue Lake	Catling	Unknown
2011	Kilpoola Lake	Catling	Unknown
2011	2 unnamed lakes near Blue Lake	Catling	Unknown
2011	Kruger Mt. Road	Catling	Unknown
2011	Green Lake	Catling	Unknown
2011	Sleeping Waters Lake	Catling	Unknown

Year	Site	Surveyors	Effort*
2011	White Lake and nearby lakes	Catling	Unknown
2011	North of Mahoney Lake	Catling	Unknown
2011	Kobau Mt. Road	Catling	Unknown
2011	Osoyoos	Catling	Unknown
2011	Haynes Provincial Park	Catling	Unknown
2011	Skaha Lake	Catling	Unknown
2013	Vaseux Lake, Willow Beach area (north end of Osoyoos Lake)	McIntosh, Symonds	16
2010-2014	Mahoney Lake	Symonds *et al.*	Unknown
2014	East Chopaka	Björk	4
2014	Swan Lake Park, Vernon	Björk, Batten	2
2014	Penticton area	Björk, Batten	2
2014	Naramata area	Björk, Batten	1
2014	Deadman Lake	Björk, Batten	1
2014	Midway area	Björk, Batten	0.5
2014	Skaha Lake	Björk, Batten	1.5
2014	Kettle River	Björk, Batten	1.5
2014	Kootenay River	Björk, Batten	3
2014	Pritchard	Björk, Batten	0.5
2014 - 2015	South Okanagan, 24 locations from north of Summerland to just north of the American border, west Osoyoos	McIntosh, Durand	84
2015	Sicamous area	Björk	3
2015	Napier Lk. area	Björk	4
2006-2015	Lac du Bois area	Björk	10
2016	Mahoney Lake	Björk	4
2016	Pritchard/Lafarge	Björk	3.5
2016	Mahoney Lake	Bunge	2
2016	Kettle River	Björk	3
2016	Castlegar	Björk	1.5
2016	Genelle	Björk	3
2016	Similkameen River	Björk	5
2016	Osoyoos Lake	McIntosh/Hall	8

* Effort as an estimate of person-hours in potential habitat.

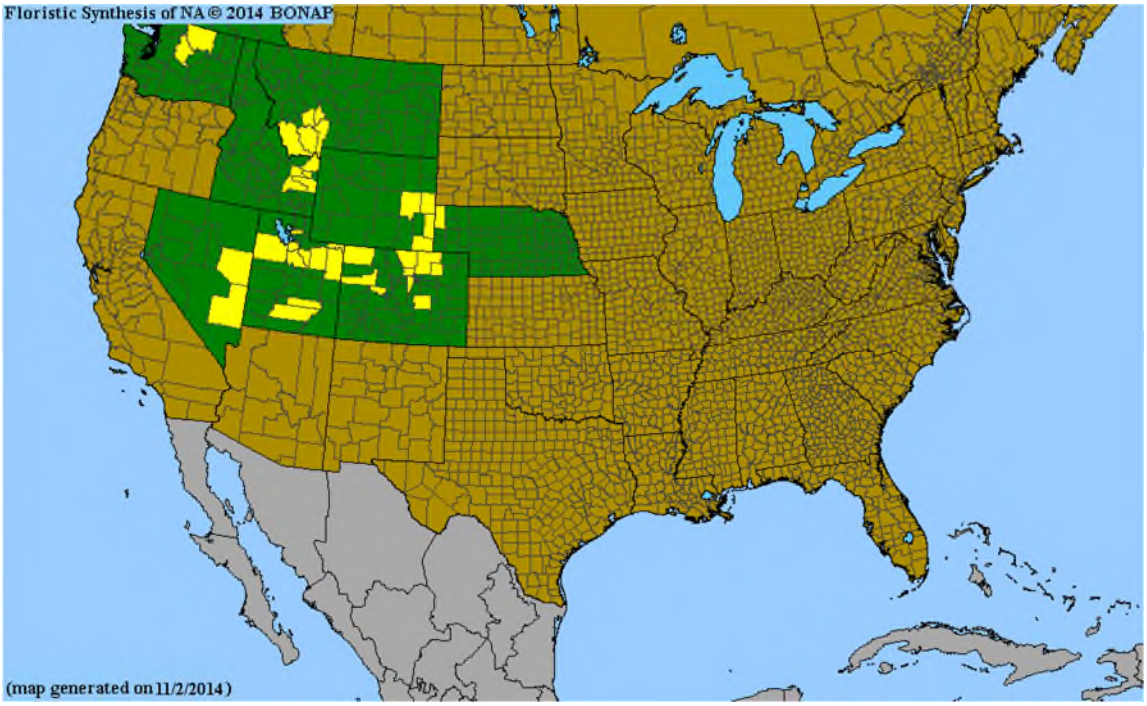

Figure 2. Jurisdictional range of Ute Ladies'-tresses in North America (Kartesz 2015). Green indicates the states and provinces where Ute Ladies'-tresses is present and native; yellow indicates the US counties within those states where Ute Ladies'-tresses is present and rare.

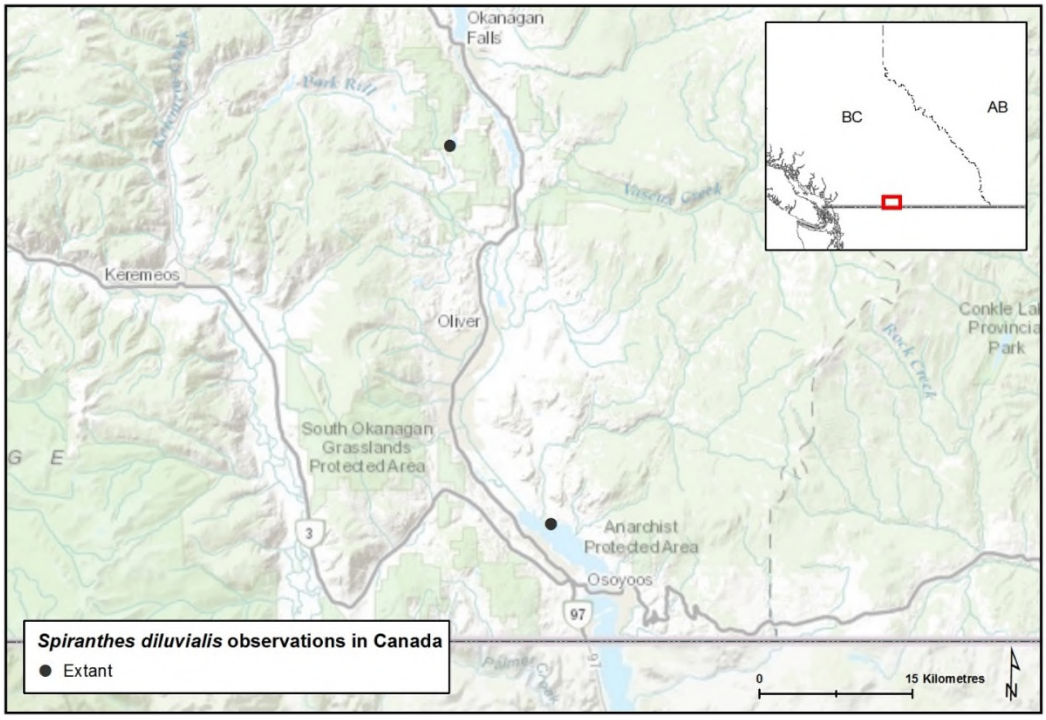

Figure 3. Range of Ute Ladies'-tresses in Canada.

HABITAT

Habitat Requirements

General ecological attributes common to the Canadian and US habitats for Ute Ladies'-tresses are seasonally moist, moderately saline soil in open habitats without overly tall or competitive associated native vascular plants (Figure 4). Habitats of Ute Ladies'-tresses in the US include seasonally flooded river terraces, subirrigated or spring-fed abandoned stream channels, reservoirs and lakeshores, irrigation canals, berms, levees, irrigated meadows, excavated gravel pits, roadside borrow pits. Most though are reported from alluvial banks, point bars, floodplains, and oxbows. The range of reported elevations is 220-2134 m a.s.l. (Fertig *et al.* 2005). In Canada, Ute Ladies'-tresses has been observed growing in sandy, seasonally wet soils in open, graminoid-dominated habitats alongside two lakes.

Detailed habitat requirements are poorly known for Ute Ladies'-tresses. Commonalities among the Canadian and US populations suggest a requirement for a specific set of soil chemistry conditions (slightly to moderately high salinity, pH, and/or concentration of certain ions). One of the two Canadian subpopulations (Osoyoos Lake) experiences an altered hydrology because a flood-control dam keeps lake levels from falling in late summer–fall as would happen naturally in the summer-dry climate there. The other Canadian subpopulation (Mahoney Lake) is not evidently under any artificial hydrologic regime, but lake levels fluctuate with periods of wetter and drier weather.

Figure 4. Habitat of Ute Ladies'-tresses at Mahoney Lake in 2016 (C. Björk 2016).

Habitat Trends

The open, wetland habitats occupied by Ute Ladies'-tresses are subject to invasion by exotic species that exclude native species through shading, smothering, possible allelopathic effects, or root competition. Wetlands across temperate western North America have by a large percentage been lost to weeds, especially to Redtop (*Agrostis gigantea*), Quackgrass (*Elymus repens*), Reed Canarygrass (*Phalaris arundinacea*),

Common Reed (*Phragmites australis* s. str.), and Tamarisk[1] (*Tamarix* spp.). Invasive species have been observed at the two Canadian sites, see **Threats** section. Climate changes have caused hydrologic changes, especially periodic recession or desiccation of many wetlands but also, at least in BC in recent years, extensive and long-lasting flooding of many lakes and ponds, including Mahoney Lake. In the United States, dams have also altered or perhaps destroyed river-shore habitats that otherwise would be suitable for Ute Ladies'-tresses (Moseley 2000; Murphy 2001; Fertig *et al.* 2005). The effects of the flood control dam on Osoyoos Lake are poorly known, but rapid erosion of near-shore bench habitats has been noted (McIntosh and Björk pers. obs. 2006-2016). Overall, the trend for suitable habitats throughout Ute Ladies'-tresses Canadian and global ranges is declining.

BIOLOGY

The following is based largely on the most recent status report written for Ute Ladies'-tresses in the United States (Fertig *et al.* 2005).

Life Cycle and Reproduction

Ute Ladies'-tresses is a perennial, regenerating annually from slender tubers. Longevity of the plants is not known. Though some reproduction may occur through tuber fragmentation (Fertig *et al.* 2005), reproduction is primarily or entirely accomplished through sexual reproduction. Like all orchids, Ute Ladies'-tresses produces minute seeds. Orchid seeds have such scant food stores that the embryo dies unless it is supported by mycorrhizal fungi (Zomlefer 1994). The chances of success of this system are very slight, but the number of seeds produced per plant can exceed 100,000 (Fertig *et al.* 2005), increasing the chances of what otherwise would be a rare success at germination and establishment. Recent attempts to germinate Ute Ladies'-tresses seeds in lab culture found it took up to 1.5 years for germination to occur (ECOS 2018).

Upon establishment, young plants of *Spiranthes* undergo an underground dormant stage that may last 8-11 years (Wells 1981) before producing above-ground leafy or flowering growth. After flowering and fruiting, or after a period of only vegetative above-ground growth, individuals may re-enter below-ground dormancy (Fertig *et al.* 2005). The duration of time mature individuals can remain in below-ground dormancy is unknown.

Above-ground growth is reported in the US to begin in autumn, starting with a winter rosette of small basal leaves (Fertig *et al.* 2005). Whether this winter-rosette stage occurs also in British Columbia is unknown, but it is likely; winter in the region of the Canadian population is warmer than in regions in the US, where most American subpopulations occur. Whether the leaf rosettes emerge in autumn or spring, the rosette leaves are all that may be seen of a plant until flowering time in late summer.

[1] According to VASCAN only the Odessa Tamarisk (*T. ramosissima*) is known in Canada. However, there are at least two species in British Columbia—one is naturalized (may be a hybrid of *T. chinensis* x *T. ramosissima*); the other has the potential to spread. As such, *Tamarisk* spp. used here.

Flowering commences anywhere from late July to early August in the Canadian population, though some subpopulations in the US may flower as late as late October (Fertig *et al.* 2005). The plant is not monocarpic, but some individuals may die after fruiting.

Orchid pollen remains aggregated in waxy structures called pollinia, which are carried by pollinators as a whole mass rather than as individual pollen grains (Zomlefer 1994). Bees (solitary bees, bumble bees, and honey bees) are the lead pollinators of *Spiranthes* species, including Ute Ladies'-tresses (Sipes *et al.* 1995; Pierson and Tepedino 2000; Fertig *et al.* 2005). Other insect taxa (including hover flies, skippers, and various wasps) have been observed visiting Ute Ladies'-tresses blooms for nectar but are too small or improperly shaped to function as pollen vectors (ECOS 2018).

The differential timing of male and female function of individual Ute Ladies'-tresses flowers makes the species obligately outcrossing (Fertig *et al.* 2005). However, this outcrossing strategy does not ensure that pollinia are not carried from one flower to another on the same plant, which would be in effect self-pollination. This raises the question of whether small subpopulations of Ute Ladies'-tresses are capable of producing viable seed. However, it is possible that self-pollination can result in viable offspring. Genetic load (the prevalence of deleterious alleles that in homozygous condition lowers the viability or fitness of offspring) is unknown in Ute Ladies'-tresses. If genetic load is high, then small subpopulations may be unable to persist as offspring fail and older plants die.

Sipes and Tepedino (1995) suggest that Ute Ladies'-tresses may be capable of apomixis (production of viable seed from unfertilized ovules). If so, recruitment of offspring may not be limited. However, further questions must be asked regarding the utility of such clonal, genetically identical individuals in maintaining subpopulations over the long term.

Physiology and Adaptability

Nothing is known of the physiology of Ute Ladies'-tresses. It could be assumed that some adaptability is afforded the plants by their ability to undergo multi-year underground dormancy.

Dispersal and Migration

The minute size of the seeds gives them the potential for wind dispersal. However, the distance those seeds can travel in the wind is unknown. Factors other than total per-seed mass may compromise their wind-dispersal capability, such as surface electric charge or a surface microstructure that may make them adhere in masses. Thus, wind dispersal should not be assumed. Suitable habitats are rare in the landscape, so even if the seeds are effectively dispersed by wind, the vast majority would settle into unsuitable habitats. Taken together, these factors may make the chance of successful dispersal into new habitats small.

Interspecific Interactions

Bees (solitary bees, bumble bees, and honey bees) are the lead pollinators of *Spiranthes* species, including Ute Ladies'-tresses (Sipes *et al.* 1995; Pierson and Tepedino 2000; Fertig *et al.* 2005). Recruitment of new cohorts that maintain suitably diverse genetic diversity in the population requires effective outcrossing, which requires pollinating insects.

POPULATION SIZES AND TRENDS

Sampling Effort and Methods

Total search effort is summarized in Table 1. Despite the many years of inventory and survey work in suitable habitats at phenologically appropriate times throughout the greater Thompson-Okanagan and Boundary regions, no new subpopulations of Ute Ladies'-tresses have been discovered in Canada. The two known subpopulations have had an unequal amount of survey effort. The Mahoney Lake subpopulation has been revisited numerous times from 2006 to 2018, while the Osoyoos Lake subpopulation has had exhaustive directed survey effort to relocate the subpopulation at a suitable time of year only in 2016.

Table 2. Mature individuals recorded among years for Mahoney Lake subpopulation.

Date	Count	Surveyor	Survey thoroughness
12 Aug 2006	6	Westby, McIntosh, Björk	Incomplete
13 Sept 2010	11	Westby, McIntosh, Björk	Complete
11 Aug 2011	Delayed count	Symonds	Incomplete
17 Aug 2011	24	Catling/Symonds	Complete
23 Aug 2012	23	Symonds *et al.*	Complete
17 Jul 2013	0	Symonds *et al.*	Complete
25 Jul 2013	Delayed count*	Symonds *et al.*	Incomplete
4 Aug 2013	Delayed count*	Symonds *et al.*	Incomplete
13 Aug 2013	24	Symonds *et al.*	Complete
7 Aug 2014	12	Symonds *et al.*	Incomplete
26 Aug 2014	15	Symonds *et al.*	Complete
16 Aug 2016	35	Bunge	Complete
21 Aug 2016	29	Björk	Complete
14 Aug 2017	57	Bunge	Complete
23 Aug 2018	5	Bunge	Complete
15 Sept 2018	2	Bunge	Complete

*Delayed counts during visits in which the plants were found to be in bud only.

In the 2016 searches, a wandering path survey method was used and waypoints of individual plants that were observed were recorded with a GPS. Also in the 2016 survey, photographs were taken of each individual. Plants were counted as genets rather than as total stems. Most plants observed bore a single stem, but where two or more stems emerged from a single point, these stems were assumed to be part of a single plant (multiple stems of a single genet).

At Mahoney Lake, the camera was held so the lens pointed straight down from about 1.5 m above ground. Later, these photographs were reviewed to ensure that each patch of surrounding vegetation was visually unique; this helped to ensure that no plants were recorded more than once.

Abundance

In assessing the population size of this orchid, emergent stems were considered mature individuals. As with many orchids, Ute Ladies'-tresses tubers can remain dormant underground for years and there is no way to count these without excavation or by a long-term study marking individual emerging stems over time. In addition, it is the above-ground stems that are capable of reproduction—it is not possible to know if a dormant tuber will ever produce above-ground leafy or flowering plants. Although the dormant tubers are part of the population, the population size is determined by the number of mature individuals (IUCN 2017).

Two subpopulations occur in Canada. The Mahoney Lake subpopulation (Table 2) consisted of 35 mature individuals in 2016, 57 in 2017, and 5 in 2018. Complete surveys in previous years have resulted in counts of between 11 and 37 mature individuals. The Mahoney Lake subpopulation data (6 mature individuals recorded) taken in 2006 should not be assumed to be accurate because the bounds of the subpopulation were determined only in later years; in 2006, the surveyors (the writers of the present report) did not know whether the entire potential area occupied by the subpopulation had been searched.

The Osoyoos Lake subpopulation (Table 3) consisted of one mature individual in 2006. No Ute Ladies'-tresses were observed during various surveys and inventories around Osoyoos Lake in the intervening years. In the 2016 surveys, one mature individual was found.

Table 3. Mature individuals detected among years for Osoyoos Lake subpopulation. Note: Surveys between 2007 and 2013 were not designed to search for Ute Ladies'-tresses, either covering unsuitable habitats or conducted too early or late for the species' typical flowering time.

Date	Count	Surveyor	Survey thoroughness
4 Aug 2006	1	McIntosh, Björk	Incomplete
8 Sept 2016	0	McIntosh, Hall	Incomplete
21 Sept 2016	1	McIntosh, Hall	Complete

Fluctuations and Trends

Data are too sparse from the Osoyoos Lake subpopulation to discuss fluctuation or trends. Only a single plant was found there in 2006, and a single plant found in 2016. No data are available for the intervening years. It is uncertain whether there is more than one individual at this site, so this may not even be a viable subpopulation.

Complete surveys at the Mahoney Lake subpopulation have resulted in counts of between 5 and 57 individuals. If all plants present in that subpopulation are assumed to produce above-ground leaves and stems in all years, then over the total of eight years of complete survey results, the subpopulation will have fluctuated by over 1000%. However, because mature and young plants of Ute Ladies'-tresses can remain dormant over multiple years, this assessment of fluctuation is not valid. No assessment of fluctuation within the two subpopulations can be established over such a short time span as 10 years.

The minimal viable population size is unknown, and probably cannot be known. There are two main issues to assessing minimal viable population size for this species: 1) the multi-year dormancy (underground growth or dormancy cannot be tracked; any attempt to do so would likely damage or destroy the plants), and 2) it is not possible to know viability of any seeds that are the result of self-fertilization (that would have to be done in situ with the host fungus, which would be too delicate an operation without clear observation of the fate of each of those minute seeds). As such, it is uncertain whether the population is severely fragmented.

Rescue Effect

The nearest American subpopulations of Ute Ladies'-tresses occur in Washington State at Wannacut Lake and on the shore of the Columbia River near Rocky Reach Dam, 11.5 and 175 km south of the border, respectively. Although the Wannacut Lake subpopulation was considered extirpated over 10 years ago (Fertig *et al.* 2005), a few individuals were located there during more recent surveys (Arnette pers. comm. 2017). Migration from Washington State is not expected given the small population sizes there, and the chance of seeds being transported in any way from there to the rare suitable habitats in British Columbia is remote.

The next nearest subpopulations of Ute Ladies'-tresses (southeast Idaho and southwest Montana) are much more distant. Even assuming wind-driven dispersal, these subpopulations in the core geographical range of the species are unlikely to provide rescue given that the winds and storm-flow are strongly prevailing from a west to southwest direction rather than from a south to southeast direction to carry the seeds to British Columbia.

THREATS AND LIMITING FACTORS

Threats

Direct threats facing Ute Ladies'-tresses assessed in this report were organized and evaluated based on the IUCN-CMP (World Conservation Union-Conservation Measures Partnership) unified threats classification system (Master *et al.* 2012). Threats are defined as the proximate activities or processes that directly and negatively affect the population. Results on the impact, scope, severity, and timing of threats are presented in tabular form in the appendix. The overall calculated and assigned threat impact is High to Medium. The threats are listed below according to their calculated level of impact, from highest to lowest impact.

Invasive & other problematic species & genes

Invasive & non-native/alien species/diseases (IUCN 8.1 – Low to High Impact)

Invasive plant species (aggressively spreading species that are not native to North America) are an immediate concern for the Mahoney Lake subpopulation. Surveys up to 2014 recorded the presence of Canada Thistle (*Cirsium arvense*) in the immediate vicinity of the Ute Ladies'-tresses subpopulation, a species not present near the subpopulation in 2016. Subsequent pulling of the thistle by reserve stewards may have caused the species' disappearance. However, monitoring will be important to ensure that it does not return and spread. Around the perimeter of Mahoney Lake, there are dense stands of weedy species such as Redtop, Quackgrass, Prickly Lettuce (*Lactuca serriola*), White Sweet-clover (*Melilotus albus*), and Field Sow-thistle (*Sonchus arvensis*). In some areas around the lake, these weeds could conceivably have already caused a reduction in the Ute Ladies'-tresses population.

On the north side of Mahoney Lake, a stand of Common Reed (*Phragmites australis* s. str.) has recently established. This stand is already extensive and dense, with hundreds of culms. This species has been spreading rapidly in temperate western North America in the past 20-25 years (Catling and Mitrow 2011). It has the potential to spread all around the lake shore. Its tall stature (the local patch includes culms as high as 2.1 m, but once more established it can become even taller) can cause shading of the ground, and its dense rhizomes have the potential to outcompete the roots of native plants to the point that it can become a monoculture.

Many invasive species occur around Osoyoos Lake. Common Reed is present and spreading rapidly in wetlands in the vicinity and the native species Broad-leaved Cattail (*Typha latifolia*) can spread aggressively and exclude other native species, especially under altered hydrological regimes.

Natural system modifications

Dams & water management/use (IUCN 7.2 – Low Impact)

Altered hydrology is a threat to the Osoyoos Lake subpopulation. The lake level is controlled by a dam at the lake's outlet across the international border in Washington. The raising and lowering of the lake level is under the control of agreements between the two nations. Canada's interests in preserving its SARA-listed species on the lake shore do not necessarily override other concerns regarding lake levels. If the water level is kept too high, wind-driven waves and boat wakes can rapidly erode the shoreline (an effect already documented on the east shore of the lake). Lake levels kept too low may draw down the water table in the habitat occupied by Ute Ladies'-tresses. Even if a lower water table is not a direct threat to the plant or plants, it may cause a change in vegetation that could result in a change of associated species that could exclude Ute Ladies'-tresses through shading, smothering, or root competition. Timing of draw-down could also be a concern. These potential and actual threats need study.

Agriculture & aquaculture

Livestock farming & ranching (IUCN 2.3 – Low Impact)

Livestock grazing is not expected at the Mahoney Lake subpopulation. No evidence of any grazing on the orchids has been observed. Deer may graze the plants, but deer are light grazers that do not cause the mowing effect of cattle. Deer also do not usually graze for long periods of time in one site, unlike cattle. Cattle, when grazing in single habitats, can cover a large portion of the vegetation with fecal matter (especially in wetlands, which cattle tend to congregate in for prolonged periods during the summer months), which can produce unnatural thatching and nitrifying effects. Deer scat is smaller, and contains more thoroughly digested material, so does not have the same thatching effect. Because deer move across the landscape more rapidly, their scat does not cover a significant portion of the ground and hence does not cause significant nitrification.

The Osoyoos Lake site is periodically used for livestock grazing both by cattle and, less commonly, horses. The intensity of grazing has varied greatly over time (Hall pers. obs. 2016). Any intensity of livestock grazing can be damaging to native plants. Livestock tend to graze plants to the ground, and they tend to move slowly as they graze, causing a mowing effect. Mowing of a budding, flowering or fruiting Ute Ladies'-tresses would obviously have the effect of eliminating the chance of the plant successfully reproducing in a given year and could impact on the opportunity to store its carbon source for pending winter or prolonged dormancy. Livestock have a highly damaging trampling effect,

especially in wetlands and other moist sites (Kaweck et al. 2018) where they tend to congregate and persist in the summer months.

Human intrusions & disturbance

Recreational activities (IUCN 6.1 – Low Impact)

The Mahoney Lake subpopulation has faced direct threats from off-road vehicles. The site had been used illegally for “mud bogging”, and a damaging off-road vehicle incident occurred shortly after the 2006 discovery of Ute Ladies’-tresses there. A wire fence has been in place around all but the southern portion of the perimeter since 2000, and a post and rail fence completed the perimeter fencing in 2007 specifically to exclude vehicles (BC Parks 1996; Weston pers. comm. 2016).

Recreational foot-traffic is of concern at Mahoney Lake. Hiking is welcome at the site along a trail to the west, and there is a possibility of hikers crossing the habitat of Ute Ladies’-tresses, potentially trampling the plants or helping to establish and spread invasive plants into the subpopulation. Where the paved road runs closest to the site perimeter (along the post and rail fence), there are two pullouts in close proximity. One (the west pullout) leads directly to the hiking trail. The other (east) pullout may be used by hikers when parking at the other pullout is already occupied. Anyone parked at the east pullout can enter the site there through the adjacent gap in fencing, and the traverse from that entry point to the established trail will likely lead the hikers directly through the subpopulation.

Pollution

Agricultural & forestry effluents (IUCN 9.3 – Not Calculated)

Chemical spills could be a concern if a vehicle carrying a hazardous substance is involved in an accident on the road adjacent to the Mahoney Lake subpopulation. But as this is a rural road, it is not likely that a commercial vehicle would be involved. However, herbicides are often used in rural regions, and spills are possible in transport.

Air-borne pollutants (IUCN 9.5 – Unknown Impact)

Herbicide drift is a major concern, especially in possible control of noxious weeds along the roadway near the Ute Ladies’-tresses subpopulation.

Climate change & severe weather

Droughts (IUCN 11.2 – Unknown Impact)

Mahoney Lake is said to be the first ecological reserve in British Columbia to exhibit effects of climate change (BC Parks 1996). Warmer temperatures cause more rapid evaporation of the lake water, which may result in faster recession of the shoreline. This may affect soil moisture at the elevation above shoreline where Ute Ladies'-tresses grows.

Storms & flooding (IUCN 11.4 – Not Calculated)

No identifiable threats; Ute Ladies'-tresses is known to tolerate non-persistent flooding, as reflected in its specific epithet *diluvialis*, meaning "of the flood".

Biological resource use

Gathering terrestrial plants (IUCN 5.1 – Negligible Impact)

Wildflower enthusiasts attracted by the showy flowering spikes of Ute Ladies'-tresses could pose a risk to the plants by digging up plants, especially at Mahoney Lake, which serves as a hiking destination.

Transportation & service corridors

Roads & railroads (IUCN 4.1 – Not Calculated)

The Mahoney Lake subpopulation occurs close to a road bed. Road maintenance or realignment could have detrimental impacts to the plants and their habitat. Planning and work should take into consideration potential direct and indirect effects and be modified accordingly. There are two potential road projects being discussed: one would be a new connector highway that would pass by (or potentially through) the Mahoney Lake subpopulation. The other is a revision to the existing road.

Limiting Factors

Ute Ladies'-tresses requires moist soil in open sites. Commonalities among the Canadian and US populations suggest a requirement for a certain set of soil chemistry conditions (pH and/or concentrations of certain ions). It is therefore limited by habitat availability. Long-term survival of subpopulations requires recruitment of new cohorts from viable seed. That requirement can be limited if pollinator populations decline. Orchid germinants are unable to survive without connection to a facilitating mycorrhizal fungus. However, nothing is known of the mycorrhizal requirements of Ute Ladies'-tresses.

Number of Locations

Two subpopulations occur in Canada, at Mahoney Lake and Osoyoos Lake, both in the South Okanagan region. The two subpopulations are approximately 25 km apart and are considered as two locations.

The Mahoney Lake location is primarily threatened by invasive plant species. Lower impact threats include recreation activities, drought, and wildflower gathering.

The Osoyoos Lake location is threatened by hydrological modification, livestock grazing, and invasive plant species.

PROTECTION, STATUS AND RANKS

Legal Protection and Status

No legal protection or status in Canada as of January 2017. In the United States, legally listed Threatened under the *Endangered Species Act* (U.S. Fish & Wildlife Service 1992). As of 2018, it has protected status in three states: Washington – Endangered; Nebraska – Threatened; Nevada – Fully Protected. All orchids are protected under the CITES Convention, which prohibits cross-border trade. Assessed as Least Concern by the IUCN in 2014.

Non-Legal Status and Ranks

Ute Ladies'-tresses is currently globally ranked by NatureServe as G2G3 (Imperilled to Vulnerable) and, in Canada, N1 (Critically Imperilled) (NatureServe Explorer 2018). It is ranked S1 (Red listed, last ranked in 2015) by the British Columbia Conservation Data Centre but does not have legal status either provincially or federally. Conservation ranking is Imperiled to Critically Imperiled in each of the U.S. states where the species occurs: Colorado (S2), Idaho (S1), Montana (S1S2), Nebraska (S1), Nevada (S1), Utah (S1), Washington (S1), Wyoming (S1S2) (NatureServe Explorer 2018).

Habitat Protection and Ownership

The Mahoney Lake subpopulation is encompassed within an Ecological Reserve managed by BC Parks. Ecological Reserves are considered permanent and are protected for special ecological and/or biodiversity attributes. The Osoyoos Lake subpopulation occurs on the Osoyoos Indian Reserve, on land that has no special conservation status.

ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED

The report writers are grateful to the Osoyoos Indian Band for permission to enter their property, and to Alan Baptiste, Jennifer Cameron, Ryan Durand, and Pati Hill for assistance in the field. They also thank Joe Arnette, Paul Catling, and Mark Weston for sharing information used in this report. The report writers acknowledge Greta and Ole Westby for their discovery of the Mahoney Lake subpopulation, for their generous support of fieldwork over the years, and for their stewardship work. In memory, the report writers honour Greta for her devotion to appreciating and protecting nature.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER(S)

Curtis Björk is a botanist and lichenologist with 25 years of field experience and is co-curator of lichens at the herbarium UBC (Beaty Biodiversity Museum, Vancouver). He earned his MS in Botany from Washington State University in 2003, and currently manages Enlichened Consulting along with Trevor Goward. He has authored or co-authored numerous publications, including publication of a number of lichen and plant species new to science, and is currently co-authoring the Manual of Vascular Plants of British Columbia.

Terry McIntosh has had over 35 years of experience in botanical research, ecological consulting, and public education. He is a Research Associate in the Botany Department at the University of British Columbia. He has completed numerous vascular plant and bryophyte surveys in British Columbia, in particular in arid land ecosystems, including the Okanagan, Similkameen, and Thompson River Valleys, the Cariboo, and coastal BC. His more recent work has focused mainly on at risk plant and habitat surveys. Dr. McIntosh has prepared ten COSEWIC Status Reports and eight Recovery Strategies. He has worked with twenty-seven First Nations bands in British Columbia, mainly assisting restoration projects and plant inventories. He is a board member and a principal editor for the Flora of North America project.

Ron Hall is the Environmental Coordinator for the Osoyoos Indian Band. He has facilitated numerous projects on the Reserve, most importantly along Osoyoos Lake. He was fundamental in the success of the Habitat Stewardship Fund (HSP) projects that first allowed our research to proceed and, ultimately, enabled discovery of numerous rare plants in these areas, including *Spiranthes diluvialis*.

COLLECTIONS EXAMINED

In preparation for this report, *Spiranthes* specimens were examined for any overlooked *S. diluvialis* at the two herbaria that best represent British Columbia Plants: UBC (University of British Columbia, Vancouver) and V (Royal British Columbia Museum, Victoria). No additional collections of *S. diluvialis* were found.

Appendix 1. Threats Calculator.

Species or Ecosystem Scientific Name	**Ute Ladies'-tresses - *Spiranthes diluvialis***
Element ID	**Elcode**
Date (Ctrl + ";" for today's date):	2017-09-21
Assessor(s):	Del Meidinger (Co-chair), Bruce Bennett (SSC), Jeannette Whitton (SSC), Sue Meades (SSC) SR writer: Curtis Björk, Terry McIntosh, Ron Hall COSEWIC members & external experts: Dave Fraser, Ruben Boles, Brenda Costanzo, Marta Donovan Facilitator: Dwayne Lepitzki
References:	

Overall Threat Impact Calculation Help:		**Level 1 Threat Impact Counts**	
Threat Impact		**high range**	**low range**
A	Very High	0	0
B	High	1	0
C	Medium	0	0
D	Low	3	4
	Calculated Overall Threat Impact:	High	Medium

Assigned Overall Threat Impact:	**High - Medium**
Impact Adjustment Reasons:	
Overall Threat Comments	Two sites: Mahoney Lake (57 individuals - 98% of Canadian population) - Ecological Reserve; Osoyoos Lake (1 individual) - occurs on Osoyoos Indian Band land. Slightly to moderately saline lake shores. The plants appear to be long-lived and can undergo underground dormancy for years. Generation time estimated as a minimum of 10 years for the purposes of the threats assessment -- in report is statement: "Upon establishment, young plants of Spiranthes undergo an underground dormant stage that may last 8-11 years (Wells 1981) before producing above-ground leafy or flowering growth." Generation time may be 25-30 years.

Threat		**Impact (calculated)**		**Scope (next 10 Yrs)**	**Severity (10 Yrs or 3 Gen.)**	**Timing**	**Comments**
1	Residential & commercial development						
1.1	Housing & urban areas						
1.2	Commercial & industrial areas						
1.3	Tourism & recreation areas						May have possibility for new trails/picnic sites in Osoyoos Lake. Currently, people stay more on the north side but traffic in the area may increase in the future. No threat for Mahoney Lake - managed by BC Parks.
2	Agriculture & aquaculture	D	Low	Small (1-10%)	Extreme - Serious (31-100%)	High (Continuing)	
2.1	Annual & perennial non-timber crops						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
2.2	Wood & pulp plantations						
2.3	Livestock farming & ranching	D	Low	Small (1-10%)	Extreme - Serious (31-100%)	High (Continuing)	Livestock treated here, not 8.1, as although potentially freely roaming, they are managed animals and are herded up. Trampling by livestock a potential problem as they gather in wet areas. Osoyoos Lake site periodically has livestock. Manure accumulation could increase nitrogen in wetlands. Mahoney Lake fenced so livestock not likely a problem; grazing is not a permitted use in the Ecological Reserve; there is a range tenure on adjacent crown land and there is potential (although low probability) for cattle to access the site if there was a breach in the fence. Cannot compare grazing impacts in the Canadian population to the ones in US; Utah and Idaho recovery strategy indicates that grazing is beneficial in the winter months but grazing is not beneficial west of Rockies. West of Rockies plants did not evolve from grazing by bison. Severity range based on level of uncertainty.
2.4	Marine & freshwater aquaculture						
3	Energy production & mining						
3.1	Oil & gas drilling						
3.2	Mining & quarrying						
3.3	Renewable energy						
4	Transportation & service corridors		Not Calculated (outside assessment timeframe)	Large - Small (1-70%)	Serious - Slight (1-70%)	Low (Possibly in the long term, >10 yrs/3 gen)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
4.1	Roads & railroads		Not Calculated (outside assessment timeframe)	Large - Small (1-70%)	Serious - Slight (1-70%)	Low (Possibly in the long term, >10 yrs/3 gen)	Mahoney Lake near a road bed. Maintenance or realignment could have impact; road likely won't expand, just repaved recently. Road is also far enough from subpopulation that regular maintenance has no direct impact. In Osoyoos Lake, there is good probability that land could be opened for development with the CP within the next 5-10 years (300 units already built). Possibility of major new highway to link Okanagan with the Coast that could have impact, but confirmed with Transportation and Highways that there are no planned updates in the works over the next while. Changed scoring after call to reflect potential of maintenance impact.
4.2	Utility & service lines						
4.3	Shipping lanes						
4.4	Flight paths						
5	Biological resource use		Negligible	Pervasive - Large (31-100%)	Negligible (<1%)	Moderate (Possibly in the short term, < 10 yrs/3 gen)	
5.1	Hunting & collecting terrestrial animals						
5.2	Gathering terrestrial plants		Negligible	Pervasive - Large (31-100%)	Negligible (<1%)	Moderate (Possibly in the short term, < 10 yrs/3 gen)	Mahoney Lake site: orchids are historically prone to collecting by enthusiasts; no collecting for research known or planned; site is easily accessible adjacent to roadway with gate into area; public permitted in area. The area is small so the whole area would be subjected; range given for uncertainty factor.
5.3	Logging & wood harvesting						
5.4	Fishing & harvesting aquatic resources						
6	Human intrusions & disturbance	D	Low	Large - Restricted (11-70%)	Slight (1-10%)	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
6.1	Recreational activities	D	Low	Large - Restricted (11-70%)	Slight (1-10%)	High (Continuing)	Mahoney Lake site: walking, hiking; note that there are no trails in area of plants, and most recreational activities would be directed to existing trail that occurs to the west. No evidence that hikers use area where plants occur (uninterested area). There are two parking areas and if people wander, there is a chance of trampling. Trampling is worse than someone picking the flower; have to photosynthesize.
6.2	War, civil unrest & military exercises						
6.3	Work & other activities		Negligible	Small (1-10%)	Negligible (<1%)	High (Continuing)	Mahoney Lake site: monitoring of species is ongoing; trampling is not a significant factor during monitoring activities.
7	Natural system modifications	D	Low	Small (1-10%)	Serious - Slight (1-70%)	High (Continuing)	
7.1	Fire & fire suppression						Mahoney Lake site: fire and fire suppression are prevalent in the Okanagan; site could be subject to fire. Fire suppression won't have an impact; site won't burn; wetland.
7.2	Dams & water management/use	D	Low	Small (1-10%)	Serious - Slight (1-70%)	High (Continuing)	Mahoney Lake site: water level of Mahoney Lake varies seasonally; there is no source to the lake; there are no surface Water Licences on Mahoney Lake or within 800 m; it is unknown if groundwater extraction occurs in the area or affects the water table. Flood control dam on Osoyoos Lake on US side. Species management in Canada may not factor into water control in US. The natural hydrology is suppressed; impacting on lakeshore vegetation. Shorelines are being eroded away; causing cutbank rather than gradual slope. Species favour sites where the shoreline periodically floods and then recedes. Large range for severity selected as impact uncertain but certainly has some impact.
7.3	Other ecosystem modifications		Unknown	Unknown	Unknown	Unknown	Tree fruit industry is important in the Okanagan; could be adding pollinators; unknown scope and impact. No data known at present.
8	Invasive & other problematic species & genes	BD	High - Low	Pervasive (71-100%)	Serious - Slight (1-70%)	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
8.1	Invasive non-native/alien species/diseases	BD	High - Low	Pervasive (71-100%)	Serious - Slight (1-70%)	High (Continuing)	Canada Thistle noted up to 2014 at Mahoney Lake site. Invasive species occur around Mahoney Lake now, including Common Reed (*Phragmites*), Redtop, Quackgrass, Prickly Lettuce (*Lactuca serriola*), White Sweet-clover (*Melilotus albus*), and Field Sow-thistle (*Sonchus arvensis*). Invasive species have not reduced subpopulation in last 10 years but may be historical habitat loss. *Phragmites* has only been seen once in 2016; already a sizable patch; without a program to control the size, it could have significant impact. Addition of *Phragmites* has increased concern and scored accordingly, although severity scored with wide range due to uncertainty of what will happen. Canada thistle dense in some areas at Mahoney Lake site.
8.2	Problematic native species/diseases						Deer browse has been noted on some individuals in the past. Deer population not known to be significant issue.
8.3	Introduced genetic material						
8.4	Problematic species/diseases of unknown origin						
8.5	Viral/prion-induced diseases						
8.6	Diseases of unknown cause						
9	Pollution		Unknown	Pervasive (71-100%)	Unknown	High (Continuing)	
9.1	Domestic & urban waste water						
9.2	Industrial & military effluents						
9.3	Agricultural & forestry effluents						Potential for spills of herbicides.
9.4	Garbage & solid waste						
9.5	Air-borne pollutants		Unknown	Pervasive (71-100%)	Unknown	High (Continuing)	Mahoney Lake site: spot/wick treatment of herbicides known to be used in area around Lake. Osoyoos Lake: not in the direct area but there is potential drift from residents spraying. Drift potentially an issue for all of population. Scope high due to herbicide drift. Severity unknown as dependent upon concentration of herbicides in drift.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
9.6	Excess energy						
10	Geological events						
10.1	Volcanoes						
10.2	Earthquakes/tsunamis						
10.3	Avalanches/landslides						
11	Climate change & severe weather		Unknown	Pervasive (71-100%)	Unknown	High (Continuing)	
11.1	Habitat shifting & alteration						
11.2	Droughts		Unknown	Pervasive (71-100%)	Unknown	High (Continuing)	Warmer temperatures cause more rapid evaporation of the lake water, resulting in faster recession of the shore line. This may affect soil moisture at the elevation above shoreline where Ute Ladies'-tresses grows.
11.3	Temperature extremes						
11.4	Storms & flooding						Mahoney Lake site: site has not flooded in recent years (>15 years) but is known to have flooded in the past; site may be drier now than in the past. Species can tolerate flooding.
11.5	Other impacts						
Classification of Threats adopted from IUCN-CMP, Salafsky *et al*. (2008).							