

ORCHIDS OF THE REDBERRY LAKE BIOSPHERE REGION: DIVERSITY, DISTRIBUTION, HABITATS AND CONSERVATION

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Introduction

The orchid family (Orchidaceae) is one of the richest and most interesting in the plant kingdom. According to the latest data, it consists of 736 genera¹ and approximately 28,500 species.² Most orchids are tropical and epiphytic — these species derive moisture and nutrients from the air and rain and usually grow on other plants. In North America, orchids are generally quite small and grow on the ground, and some obtain nutrients from decaying soil matter.

Orchids are some of the most significant ornamental plants, known for their beauty, colour combinations, and shape of flowers.³ Orchids may possess medicinal properties and many cultures retain traditional beliefs suggesting that these plants have antibacterial substances and phytochemicals that can help in the treatment of certain illnesses.⁴ Recently, a number of compounds have been isolated from the different parts of the orchid plants which possess medicinal properties.⁵

Many orchids are on the verge of extinction as they are disappearing worldwide.⁶ Orchids are particularly vulnerable to climate and land-cover changes due to their narrow ecological preferences and complex biology.^{7,8} This is resulting in species decline so that many orchids become rare, threatened, or endangered.⁹ Because of the high risk of extinction, all orchids are listed in CITES¹⁰ (the Convention on International Trade in Endangered Species of Wild Fauna and Flora, also known as the Washington Convention) and several species are protected by law in many

countries around the world.

The overall count for the orchid family in the flora of North America (70 genera, 208 species; one genus, six species introduced) is approximate since new taxa are continually being recognised and numerous natural and artificial hybrids exist.¹¹ There are 17 genera and 77 orchid species in Canada.¹² The orchid family in Saskatchewan consists of 12 genera and 28 taxa.¹³ Due to the increase of anthropogenic impact and natural features of orchids, many of these plants are endangered and 21 taxa were included in the provincial list of species at risk.¹⁴ One of these species — small white lady's-slipper (*Cypripedium candidum* Muhl. ex Willd.) — is likely extirpated in Saskatchewan.

The Redberry Lake Biosphere Reserve (RLBR) is the only protected area of this type in Saskatchewan.¹⁵ Biosphere reserves are designated areas where communities are actively working to conserve biodiversity and implement the UN Sustainable Development Goals. During the past decade, the flora of RLBR has been systematically studied. It yielded in a several publications on native, non-native and rare plant species.¹⁶⁻²² In total, 27 plant species were identified as rare at global, national or provincial level, including five orchid species.^{19,22}

The existing information about the orchid family in the flora of the RLBR is limited to a few rare species only. The purpose of this study is to document diversity, distribution and habitat affinities of all orchid species known in the biosphere region, as well as suggest management options for their conservation based on exact data.

Methods

Study area

The Redberry Lake Biosphere Region is located in Central Saskatchewan (Figure 1). It was established in 2000 as a UNESCO Biosphere Reserve covering 112,200 ha. In 2019, the reserve expanded to become a region including

the Redberry Lake watershed and surrounding area encompassing around 700,000 ha of land.¹⁵ The territory of the biosphere region stretches across Boreal Plain ecozone (Boreal Transition ecoregion) and Prairie ecozone (Aspen Parkland ecoregion).

The landscape of the biosphere region comprises of nearly level to gently sloping glacial till, and glaciofluvial plains interrupted by hummocky morainal uplands. The valleys of several rivers add to the beauty of the region. There are a handful of lakes and variety of different types of wetlands. Vegetation cover is dominated by agricultural lands, aspen and shrub groves, and boreal forests. More than 50 per cent of all lands in the biosphere region are either arable, under permanent crops, or under pastures. There are also small patches of natural mixed prairie which are rare in this highly cultivated part of the province.

Field surveys

The field surveys of orchids were conducted as a part of the floristic inventory of the RLBR during 2011–2022. All species observed in the field were identified, and a few photos taken for each of them. The problematic taxa (usually subspecies or varieties) were collected and then confirmed using different floras and herbarium specimens deposited at the W.P. Fraser Herbarium at the University of Saskatchewan (SASK).²³

The presence and distribution of all orchids observed were recorded. Species occurrences were georeferenced using a GPS unit (Garmin Oregon 650t) with an accuracy of 2 m. We followed “Spatial Data Collection Guidelines”²⁴ for mapping. An individual plant, or plants that occur together in a relatively small area (a patch size of <5 m radius) were recorded with a single waypoint in the centre of the patch. Patches of plants that are >20-30 m apart were mapped as separate patches. Distinct locations were identified applying a threshold of 1 km. Thus, distribution of orchids is depicted on a map with dots, where each dot

represents an occurrence of individual species and on a map with 2 km x 2 km grid cells, where each cell represents the number of different species in that unit or species richness.

Whenever possible, the number of individuals was either counted directly (for the rarest and least widely distributed species) or estimated from partial counts (for common species). To characterize the habitat for each orchid species, the corresponding vegetation surveys were conducted. Vegetation types were identified using the principles of the Ecological Land Classification for southern Ontario²⁵ adapted for Saskatchewan. Soil data were retrieved from Saskatchewan Soil Information System²⁶ and verified during the field surveys using the soil test kit (Luster Leaf 1601 Rapitest).

Data analysis

The nomenclature of the taxa follows the Database of Vascular Plants of Canada or VASCAN.²⁷ Taxonomic status of orchids was cross-checked by the Plants of the World Online database

(POWO).² The species conservation ranks are given according to the NatureServe²⁸ and IUCN²⁹ categories. The conservation ranks S1–S3 and VU, highlighted in bold, indicate that species are rare compared to more common species (S4–S5). Additional information on orchids was obtained through the Saskatchewan Conservation Data Centre (SKCDC)¹⁴ and the HABISask³⁰ databases. Data relating to the geographical distribution of study orchids come from POWO², the Virtual Herbarium of Plants at Risk in Saskatchewan at the W.P. Fraser Herbarium of the University of Saskatchewan (VHPRSK)³¹ and Flora of Saskatchewan.¹²

Maps of the RLBR and of orchids distribution were prepared using ArcGIS Pro.³² Overall, we followed the recently developed method for mapping the flora of Saskatchewan.³³ The following unites were recognised for mapping species distribution: 1) occurrence – the single point, where a species is recorded (separated from another points by 20–30 m), 2) location – the distinct area, where one or more species occurrences are

present (separated from another such area by 1 km), and 3) grid – a mesh of identically-sized square cells (a grid of size 2 km x 2 km is recommended by IUCN as the basis for an estimate of area occupied by species).

Results and Discussion

Diversity of orchids

Our study shows that the orchid family in the flora of the Redberry Lake Biosphere Region comprises 13 taxa in eight genera (Table 1). Species richness is evenly distributed across genera *Corallorhiza* and *Cypripedium* (each contains three taxa). Together they include almost half of all orchid plants (six taxa or 46.2 per cent of total). These top genera are followed by *Platanthera* with two taxa. The other five genera each include one taxon only.

Below is a short characterization of orchids recorded in the flora of the RLBR. This checklist contains information on all the orchid taxa (species and varieties) found in the biosphere region. Threatened species with conservation ranks S1–S3 are highlighted in bold.

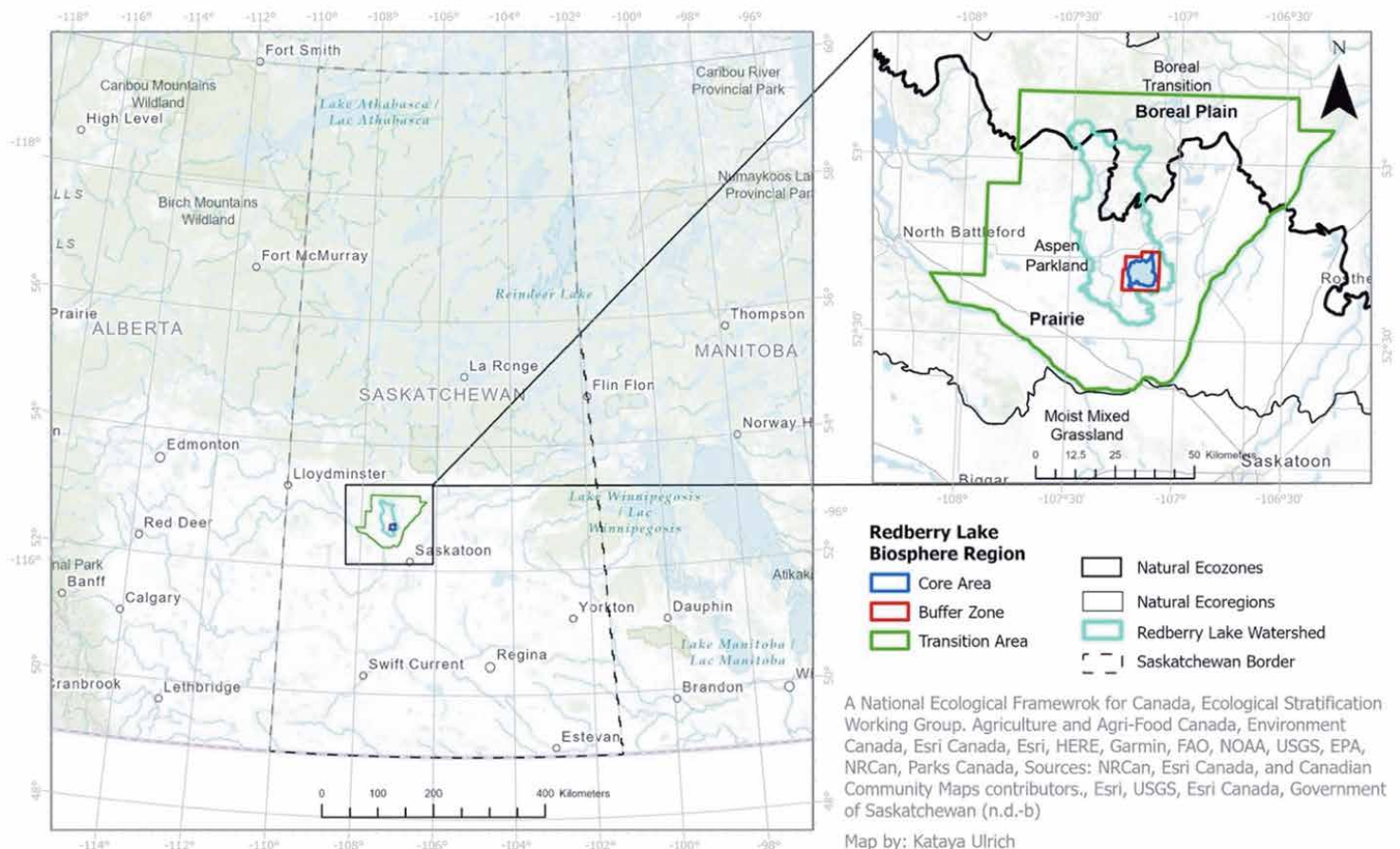


FIGURE 1. A map showing position of the Redberry Lake Biosphere Region in Saskatchewan.



FIGURE 2. *Coeloglossum viride*.
Photo credit: V. Kricsfalussy.

***Coeloglossum viride* (L.) Hartm.**
(= *Dactylorhiza viridis* (L.) R.M. Bateman, Pridgeon & M.W. Chase, *Habenaria viridis* (L.) R. Brown)
– frog orchid
(Figure 2)

Habit: plants 6–80 cm. Leaves 2–several; proximal blades obovate to oblanceolate, the distal oblong-lanceolate, becoming reduced to bracts, 2–18 × 1–7 cm. Floral bracts usually widely spreading, sometimes ascending (especially northward), conspicuous. Flowers greenish, often suffused with dull red or brown; sepals ovate, 3–8 × 2–5 mm, forming hood over column; petals

linear, 3–5 × 0.5 mm; lip descending beneath hood, 3–10 × 0.5–4 mm; spur inconspicuous. Capsules 7–14 × 4–5 mm.

Range: this species has a wide distribution – its native range encompasses Subarctic & Subalpine Northern Hemisphere.

Habitat: moist to wet forests, prairies, meadows, thickets, coastal heaths, and bogs.

Distribution in SK: Boreal Plain ecozone, Aspen Parkland and Cypress Hills ecoregions. RLBR – two locations.

Conservation Status: S4 N5 G5. Provincially common.

TABLE 1. Taxonomic and conservation status of orchids in the Redberry Lake Biosphere Region.

SCIENTIFIC NAME	SYNONYM	COMMON NAME	CONSERVATION RANK		
			GLOBAL	NATIONAL	SUBNATIONAL
<i>Coeloglossum viride</i> (L.) Hartm.	<i>Dactylorhiza viridis</i> (L.) R.M. Bateman, Pridgeon & M.W. Chase, <i>Habenaria viridis</i> (L.) R. Brown	frog orchid	G5	N5	S4
<i>Corallorhiza maculata</i> var. <i>occidentalis</i> (Lindl.) Ames	<i>C. maculata</i> subsp. <i>occidentalis</i> (Lindl.) Cockerell, <i>C. multiflora</i> var. <i>occidentalis</i> Lindl.	western spotted coralroot	G5T3T5	N5	S4
<i>Corallorhiza striata</i> Lindl. var. <i>striata</i>		striped coral root	G5T5	N5	S3
<i>Corallorhiza trifida</i> Châtel.		early coral root	G5	N5	S4
<i>Cypripedium parviflorum</i> var. <i>pubescens</i> (Willd.) Knight	<i>C. calceolus</i> var. <i>pubescens</i> (Willd.) Correll	large yellow lady's slipper	G5T5	N5	S2
<i>Cypripedium parviflorum</i> var. <i>makasin</i> (Farwell) Sheviak	<i>C. pubescens</i> var. <i>makasin</i> Farwell	small yellow lady's slipper	G5T4T5	N4N5	S3
<i>Cypripedium passerinum</i> Richardson*		sparrow's-egg lady's slipper	G5	N5	S3
<i>Galearis rotundifolia</i> (Banks ex Pursh) R.M. Bateman	<i>Amerorchis rotundifolia</i> (Banks ex Pursh) Hultén, <i>Orchis rotundifolia</i> Banks ex Pursh	small round-leaved orchid	G5	N5	S4
<i>Goodyera repens</i> (L.) R. Brown	<i>Epipactis repens</i> (L.) Crantz	dwarf rattlesnake-plantain	G5	N5	S5
<i>Liparis loeselii</i> (L.) Rich.		yellow twayblade	G5	N4N5	S3
<i>Platanthera aquilonis</i> Shev.	<i>P. hyperborea</i> auct. non. (L.) Lindl., <i>Habenaria hyperborea</i> (L.) R. Brown	tall northern green orchid	G5	N5	S4
<i>Platanthera obtusata</i> (Banks ex Pursh) Lindl.	<i>Habenaria obtusata</i> (Banks ex Pursh) Richardson	blunt-leaved orchid	G5	N5	S4
<i>Spiranthes romanzoffiana</i> Cham.		hooded ladies'-tresses	G5	NN5	S4

Conservation ranks

NatureServe/SKDCDC:

- G1 (N1, S1) Critically Imperiled/Extremely rare. At very high risk of extinction or extirpation due to extreme rarity, very steep declines, high threat level, or other factors.
- G2 (N2, S2) Imperiled/Very rare. At high risk of extinction or extirpation due to a very restricted range, very few populations, steep declines, threats or other factors.
- G3 (N3, S3) Vulnerable/Rare to uncommon. At moderate risk of extinction or extirpation due to a restricted range, relatively few populations, recent and widespread declines, threats, or other factors.
- G4 (N4, S4) Uncommon but not rare. Some cause for long-term concern due to declines or other factors.
- G5 (N5, S5) Secure/Common. Demonstrably secure under present conditions; widespread and abundant; low threat level.
- NR Not Ranked. Rank is not yet assigned, or species has not yet been assessed (not ranked).
- T Intraspecific Taxon (trinomial). The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank.

*IUCN:

- VU Vulnerable. Comparable to G2 (N2, S2) – Imperiled/Very rare.



FIGURE 3. *Corallorhiza maculata* var. *occidentalis*.
Photo credit: V. Kricsfalussy.

***Corallorhiza maculata* var. *occidentalis* (Lindl.) Ames** (= *C. maculata* subsp. *occidentalis* (Lindl.) Cockerell, *C. multiflora* var. *occidentalis* Lindl.)
– western spotted coralroot (Figure 3)

Habit: stems ± strongly thickened, base not bulbous. Floral bracts averaging 1–2.8 mm, often forked. Flowers: middle lobe of lip distinctly expanded, ratio of width of dilated part to base of middle lobe greater than 1.5; column curved, 3.5–7.8 × 1–1.3 mm at stigma; stigmatic surface oblong-pentagonal, 0.8 × 1.3 mm. Capsules pendulous, ellipsoid, 9–24 × 5–9 mm.

Range: the native range of this variety is Canada to U.S.A.

Habitat: coniferous and mixed woods, and conifer plantations.

Distribution in SK: Boreal Plain ecozone and Aspen Parkland ecoregion. RLBR – one location.

Conservation Status: S4 N5 G5T3T5. Provincially common.



FIGURE 4. *Corallorhiza striata* var. *striata*.
Photo credit: V. Kricsfalussy.

Corallorhiza striata* Lindl. var. *striata
– striped coral root, hooded coralroot (Figure 4)

Habit: lives off decaying organic matter in the soil and therefore does not need to have chlorophyll to obtain food. Inflorescences: racemes lax to dense, 10–67 × 1.2–4.5 cm. The stems are purplish to yellowish-brown, base not bulbous and the leaves are reduced to small bracts. The flowers 2–35, arranged in an unbranched cluster at the top of the stem. The sepals and petals can be spreading or touching at the tip. They are reddish-purple or yellow with 3–5 darker purple veins. The lip obovate, unlobed, 3.2–16.5 × 2–6.2 mm; has deep red margins and a white or yellow centre striped with purple. The column is slender and yellow, curved toward lip, 3–6 mm; ovary 3–8.5 mm; mentum absent. Capsules ellipsoid, 11–30 × 5–10 mm.

Range: widespread across much of southern Canada, the northern and western United States, and Mexico.

Habitat: lives in dry, decaying plant matter on the ground in forests and woodlands, and it obtains its nutrients from fungi via mycoheterotrophy.

Distribution in SK: Boreal Plain ecozone, Aspen Parkland and Cypress Hills ecoregions. RLBR – three locations.

Conservation Status: S3 N5 G5T5.



FIGURE 5. *Corallorhiza trifida*.
Photo credit: V. Kricsfalussy.

***Corallorhiza trifida* Châtel.**
– early coral root (Figure 5)

Habit: stems ± strongly thickened, base not bulbous. Inflorescences: racemes lax to dense, 8–35 × 1–3 cm. Flowers 3–18, inconspicuous; perianth open; sepals spreading, yellowish to green, lanceolate, 1-veined, 3.5–7 mm; lateral sepals often strongly recurved; petals arching over and clasping column, light yellow-green, often spotted with purple, lanceolate, 1-veined, 3–5.5 mm; lip white, often purple spotted, 2.5–4 × 1.5–3 mm, thin, with 2 small lateral lobes or teeth, middle lobe oblong, often somewhat dilated near apex, with 2 distinct basal lamellae; column curved toward lip, yellowish green, sometimes spotted purple basally, with shallow adaxial channel, 2–3.3 mm; mentum inconspicuous. Capsules ellipsoid, 4.5–15 × 4.3–6 mm.

Range: has a wide distribution – the native range of this species is Temperate & Subarctic Northern Hemisphere.

Habitat: coniferous, deciduous, and mixed woods, swamps, upland habitats northward, restricted to cool, moist habitats southward.

Distribution in SK: Boreal Plain ecozone, Aspen Parkland and Moist Mixed Grassland ecoregions. RLBR – one location.

Conservation Status: S4 N5 G5. Provincially common.



FIGURE 6. *Cypripedium parviflorum* var. *makasin*.
Photo credit: V. Kricsfalusy.

***Cypripedium parviflorum* Salisb. var. *makasin* (Farwell) Sheviak**
(= *C. pubescens* Willd. var. *makasin* Farwell) – small yellow lady’s slipper, hairy yellow lady slipper (Figure 6)

Habit: flowers small; lip 15–29 mm; labellum 1.5–3 (–3.5) cm long; lateral petals mostly 3–5 cm long, either densely spotted or evenly suffused with red-purple or red-brown. Uppermost sheathing bract glabrous or inconspicuously pubescent; the red-purple colour of lateral petals due to an even suffusion of pigment; floral scent intensely sweet.

Range: North American taxon that occurs from Alaska across entire Canada to adjacent northeastern and western parts of the United States.

Habitat: rich, moist, semi-open woods, fringes of bogs and fens, and moist meadows.

Distribution in SK: Boreal Plain ecozone, Aspen Parkland, Moist Mixed Grassland, and Cypress Hills ecoregions. RLBR – one location.

Conservation Status: S3 N4N5 G5T4T5.



FIGURE 7. *Cypripedium parviflorum* var. *pubescens*.
Photo credit: V. Kricsfalusy.

***Cypripedium parviflorum* Salisb. var. *pubescens* (Willdenow) Knight**
(= *C. calceolus* L. var. *pubescens* (Willd) Correll) – large yellow lady’s slipper (Figure 7)

Habit: flowers commonly large, lip to 54 mm, but very small in some boreal specimens. Labellum usually 3–5.4 cm long; lateral petals mostly 5–8 cm long, entirely yellow-green or sparsely to moderately spotted or streaked with red-purple; has a musty floral fragrance.

Range: Newfoundland, south to Georgia; most of Midwest, Great Lakes, and Plains states; in the southwest to Arizona and California, north to Pacific Northwest.

Habitat: mesic to moist forests, shrub-thickets, meadows, clearings, and wet ditches.

Distribution in SK: Boreal Plain ecozone and Aspen Parkland ecoregion. RLBR – seven locations.

Conservation Status: S2 N5 G5T5.



FIGURE 8. *Cypripedium passerinum*.
Photo credit: V. Kricsfalusy.

***Cypripedium passerinum* Richardson**
– sparrow’s-egg lady’s-slipper (Figure 8)

Habit: it is a rhizomatous geophyte. Plants erect, up to 50 cm in height. Leaves 3–7, along length of stem, alternate, ascending to spreading; blade elliptic to elliptic-lanceolate or ovate-lanceolate. Flowers 1(–2); sepals white or green; petals spreading, white, oblong to linear-elliptic, flat; lip white, rarely pinkish, obovoid, 11–20 mm.

Range: Alaska to Canada, Montana.

Habitat: moist forests, gravelly shores of lakes and rivers.

Distribution in SK: Boreal Plain ecozone, Aspen Parkland and Cypress Hills ecoregions. RLBR – one location.

Conservation Status: S3 N5 G5; VU (IUCN).



FIGURE 9. *Galearis rotundifolia*.
Photo credit: V. Kricsfalusy.

***Galearis rotundifolia* (Banks ex Pursh) R.M. Bateman** (= *Amerorchis rotundifolia* (Banks ex Pursh) Hultén, *Orchis rotundifolia* Banks ex Pursh) – small round-leaved orchid (Figure 9)

Habit: plants 7–33 cm. Leaves blades 2.7–11 × 1.2–8 cm. Floral bracts lanceolate to linear, 5–15 × 1–5 mm, apex acute to acuminate. Flowers showy; sepals white to pale magenta, ovate to elliptic-oblong, 6–10 × 3–4 mm; petals white to pale magenta, ovate to lance-oblong, 5–6 mm, less than 1/2 as wide; lip white, prominently magenta-spotted, rarely with broad, longitudinal, reddish bars, ovate in outline, 6–9 × 4–8 mm, lateral lobes spreading, spur conspicuous, 2/3 as long as to equaling lip, slender. Capsules erect, ellipsoid.

Range: the native range of this species is Subarctic America to Northern U.S.A.

Habitat: moist, often calcareous coniferous forests, thickets, fens, tundra.

Distribution in SK: Boreal Plain ecozone, Aspen Parkland and Cypress Hills ecoregions. RLBR – one location.

Conservation Status: S4 N5 G5. Provincially common.



FIGURE 10. *Goodyera repens*.
Photo credit: V. Kricsfalusy.

***Goodyera repens* (L.) R. Brown** (= *Epipactis repens* (L.) Crantz) – dwarf rattlesnake-plantain (Figure 10)

Habit: Leaves blade uniformly green or with green lateral veins bordered by white or greenish white tissue, narrowly to broadly ovate, 1.1–3.2 × 0.5–1.8 cm, apex acute or obtuse. Inflorescences secund, infrequently loosely spiraled, 7–36-flowered; peduncle 3–18 cm. Flowers: lateral sepals 3–5.2 mm; petals distinct; hood 3–5.5 mm; lip narrowly saccate, lanceolate, 1.8–4.8 × 1.4–3.2 mm, apex acute, recurved or reflexed, inner surface with 2 or 4 glandular ridges; anther inflexed, not immersed in shallowly concave clinandrium, apex apiculate; pollinia blunt; rostellar beak 2-pronged, 0.2–0.6 mm, shorter than body of stigma; viscidium orbiculate.

Range: has a wide distribution – the native range of this species is Temperate Northern Hemisphere.

Habitat: shady, moist, coniferous or mixed woods, on mossy or humus-covered ground, sometimes in bogs or swamps.

Distribution in SK: Boreal Plain ecozone, Aspen Parkland and Moist Mixed Grassland ecoregions. RLBR – one location.

Conservation Status: S4 N5 G5. Provincially common.



FIGURE 11. *Liparis loeselii*.
Photo credit: V. Kricsfalusy.

***Liparis loeselii* (L.) Rich.** – yellow twayblade, fen orchid (Figure 11)

Habit: grows up to 25 cm tall from a short rhizome. There is an enlargement at the base of the stem that is covered in bracts. The stem is pale or yellowish-green. There are two green, glossy leaves. The flowers are in an unbranched cluster up to 10 cm long. The sepals and petals are greenish, yellowish, or whitish. The petals are threadlike with a wedge-shaped base. The column is short and stout.

Range: has a wide distribution in North America, Europe and Asia, but is uncommon to rare in most of its range.

Habitat: wet meadows, fens, sloughs, and disturbed areas.

Distribution in SK: Boreal Plain ecozone, Aspen Parkland and Moist Mixed Grassland ecoregions. RLBR – two locations.

Conservation Status: S3 N4N5 G5.



FIGURE 12. *Platanthera aquilonis*.
Photo credit: V. Kricsfalusy.

***Platanthera aquilonis* Shev.**

(= *P. hyperborean* auct. non. (L.) Lindl.,
Habenaria hyperborea (L.) R. Brown)

– tall northern green orchid
(Figure 12)

Habit: plants 5–60 cm. Leaves few–several, ascending to arcuate-spreading, scattered along stem, gradually reduced to bracts distally; blade oblong to linear-lanceolate, 2.7–23 × 0.4–4 cm. Spikes lax to very dense. Flowers resupinate, not showy, yellowish green with dull yellowish lip, or more whitish green under cool conditions; lateral sepals spreading to reflexed; petals rhombic-ovate- to lance-falcate, margins entire; lip descending, projecting, or apex adhering to dorsal sepal and petal apices, rhombic-lanceolate to lanceolate, without basal thickening, 2.5–6 × 1–1.5 mm, base not rounded-dilated, margins entire; spur clavate or sometimes rather cylindrical, 2–5 mm, apex usually broadly obtuse; pollinaria straight; viscidia orbiculate.

Range: the native range of this species is Subarctic America to Northern U.S.A. and New Mexico.

Habitat: wet meadows, tundra, marshes, fens, stream banks, shores, ditches, seeping slopes, roadsides, borrow pits, mesic deciduous forests.

Distribution in SK: All ecozones – Taiga Shield, Boreal Shield, Boreal Plain, and Prairie. RLBR – nine locations.

Conservation Status: S4 N5 G5.
Provincially common.



FIGURE 13. *Platanthera obtusata*.
Photo credit: V. Kricsfalusy.

***Platanthera obtusata* (Banks ex Pursh) Lindl.** (= *Habenaria obtusata*

(Banks ex Pursh) Richardson
– blunt-leaved orchid

(Figure 13)

Habit: plants 5.5–35 cm. Leaves 1(–2, rarely), spreading-ascending on base of stem; bracts 0(–1, rarely); blade linear-oblongate, elliptic, or broadly obovate, 3.5–15 × 0.8–5 cm. Spikes lax. Flowers resupinate, not showy, greenish white to yellowish green; corolla commonly whiter than calyx; lateral sepals reflexed; petals rhombic, lanceolate-falcate, margins entire; lip descending, linear, narrowly lance-rhombic, or linear-hastate, with median basal thickening, unlobed, 2.5–8(–10) × less than 1–2 mm, margins entire; spur slenderly conic, 3–8(–10) mm; pollinaria straight; pollinaria remaining enclosed in anther sacs; viscidia orbiculate.

Range: the native range of this species is Subarctic America to Rocky Mountains.

Habitat: mesic to wet coniferous forest, forested fens, sphagnum bogs, stream banks, tundra, moist roadsides.

Distribution in SK: Boreal Plain ecozone, Aspen Parkland and Cypress Hills ecoregions. RLBR – three locations.

Conservation Status: S4 N5 G5.
Provincially common.



FIGURE 14. *Spiranthes romanzoffiana*.
Photo credit: V. Kricsfalusy.

***Spiranthes romanzoffiana* Cham.**

– hooded ladies'-tresses
(Figure 14)

Habit: plants 8–55 cm. Roots few–several, spreading to descending, tuberous, mostly to 1 cm diam. Leaves persisting through anthesis or fugaceous, basal, often on proximal portion of stem, ascending to spreading, linear to linear-lanceolate, elliptic, or oblanceolate, to 26 × 3 cm. Spikes usually very tightly spiraled, three flowers per cycle of spiral, rarely with more than five flowers per cycle; rachis glabrous to very sparsely pubescent, capitate glands short-stalked or often sessile. Flowers ascending, white to ivory, rarely yellowish white, tubular; sepals and petals connivent, forming hood above abruptly reflexed lip; sepals connate at base, 5.3–12.5 mm; petals linear to ovate, apex obtuse to subacute; lip pandurate, 4.8–10.2 × 1.6–6.8 mm, rarely lip nearly ovate, glabrous or with a few scattered trichomes on adaxial surface; veins typically three, branches wide-spreading; viscidia linear-lanceolate.

Range: the native range of this species is Subarctic America to N. & W. Central U.S.A., Ireland, NW. & SW. Great Britain.

Habitat: Moist to wet meadows, tundra, marshes, fens, prairies, stream banks, seeps, coastal bluffs, dunes.

Distribution in SK: All ecozones – Taiga Shield, Boreal Shield, Boreal Plain, and Prairie. RLBR – three locations.

Conservation Status: S4 N5 G5.
Provincially common.

Distribution of orchids

The distribution of orchids in the Redberry Lake Biosphere Region is shown in Figure 15. The produced map depicts 86 recorded occurrences for 13 orchid taxa. The number of species and represented occurrences were not balanced. Of the species studied, *Platanthera aquilonis* (38.4 per cent), *Cypripedium parviflorum* var. *pubescens* (19.8 per cent), and *Spiranthes romanzoffiana* (12.8 per cent) had the largest proportion (71 per cent of all records). The least represented (each species 1.2 per cent) were *Corallorhiza maculata* var. *occidentalis*, *Corallorhiza trifida*, *Cypripedium parviflorum* var. *makasin*, and *Goodyera repens* which had a small proportion of records (4.8 per cent). Furthermore, five rare species with S2–S3 conservation ranks (Table 1) were narrowly represented by 31 occurrences

(36 per cent), while 10 common species (S4–S5) were widespread, including 55 occurrences (63.4 per cent).

In terms of the species locations (each includes from one to 13 occurrences), the obtained patterns look different (Figure 16). The most represented species — *Platanthera aquilonis* (27.3 per cent) and *Cypripedium parviflorum* var. *pubescens* (21.2 per cent) — had less than half of all locations (48.5 per cent). The group of the least represented species (seven species, each has one location or three per cent) had much larger proportion of locations (21.2 per cent) unlike occurrences (4.8 per cent). Besides, five rare species with S2–S3 conservation ranks (Table 1) were narrowly represented in 14 locations (42.4 per cent), while 10 common species (S4–S5) were represented in 19 locations (57.6 per cent). Overall, the number of

locations is more evenly distributed than the number of occurrences.

Spatial analysis was conducted based on the distribution of orchid species in the biosphere region (see inset maps in Figure 15). Two species rich areas with more than five taxa each, were observed as hotspots for the orchids. Most orchid species are located in the buffer zone of the RLBR and another hotspot is in the north-eastern part of the biosphere region, in its transition zone.

The next step in the spatial analysis was completed based on 2 km x 2 km grid cells in the biosphere region (Figure 16). Of 5,625 units that make up the RLBR territory, only 16 grid cells (0.28 per cent) contained orchid species. Most of these grid cells (11 or 68.75 per cent) had only 1-2 species, two cells (12.5 per cent) included 3-4 species and three cells

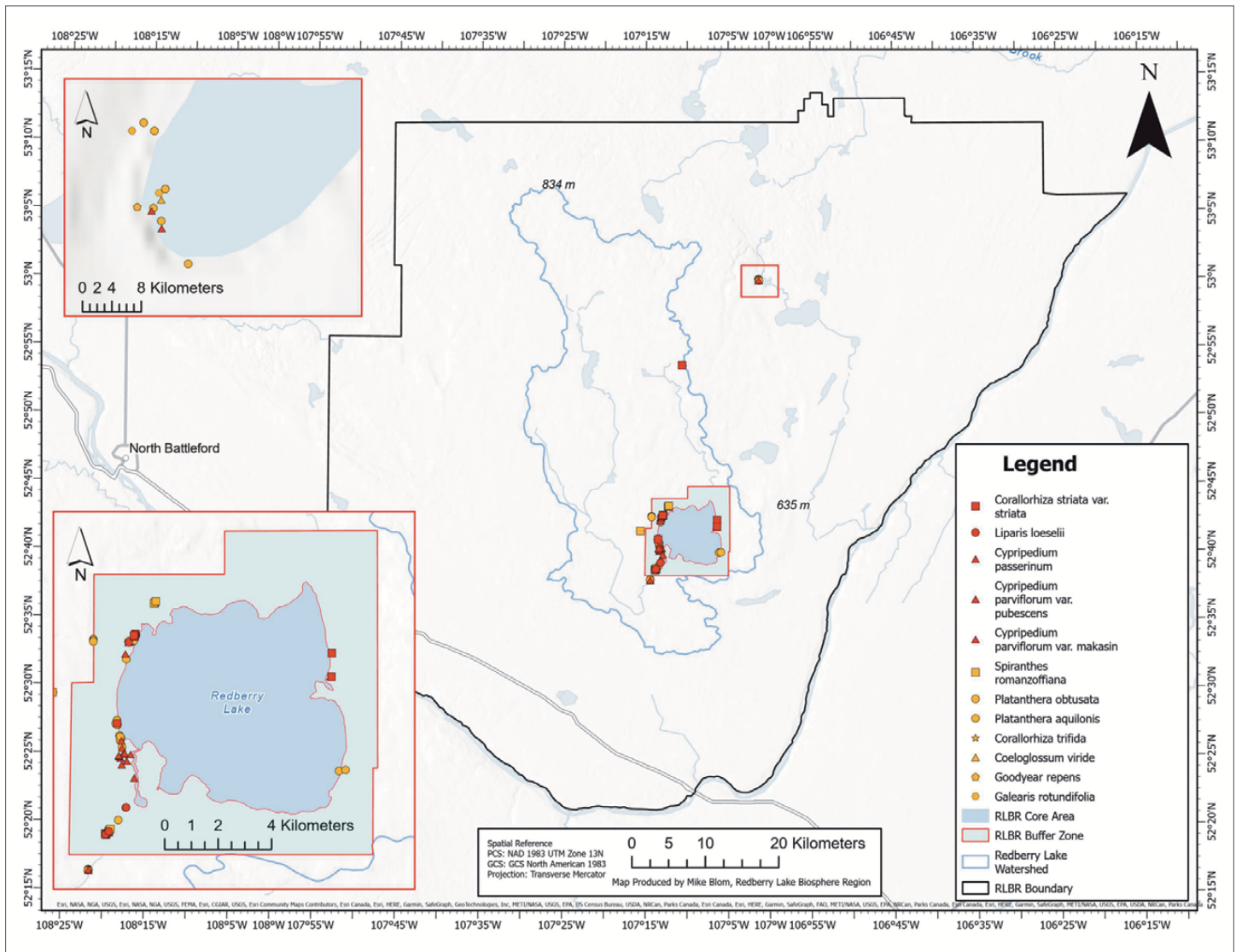


FIGURE 15. A distribution map of orchids in the Redberry Lake Biosphere Region. Species occurrences are shown in dots.

(18.75 per cent) possessed 5-6 species, respectively.

The general distribution patterns of orchids in the biosphere region analysed by different means (species occurrences, locations, and grid cells) are shown in Figure 17. These patterns in orchid abundances are manifested by the tendency of common species to occur in higher densities compared to rare species restricted in their distribution. Overall, despite the intensive field surveys conducted to detect orchid species, it seems that the territory of the RLBR remains rather unexplored, particularly in the recently acquired areas in the Boreal Transition and Aspen Parkland ecoregions.

Habitats of orchids

Our research provides useful information about the habitat affinities of orchids in the Redberry Lake Biosphere Region (Figure 18). The obtained results indicate that the habitat preferences of orchids are as follows: forested swamps or tree dominated wetlands (eight species, 14 occurrences), wetlands (five species, 43 occurrences), woodlands (five species, 23 occurrences), and grasslands (one species, six occurrences). As we can see, orchid plants more likely to be found in wet habitat conditions (forested swamps and open wetlands), less in woodlands and significantly less expected in grasslands.

Most orchids occur in the RLBR on dominantly alkaline soils (moderately saline Gleysolic, Meadow saline) and neutral soils (Orthic Dark Gray). The soils range from coarse to medium texture and vary from fine clay to sandy loam. In relation to soil pH, most orchids belong to basophytes (prefer soils with neutral pH 6.5 to 7.5) and calciphytes (prefer soils with alkaline pH over 7.5). A few orchids with a wide ecological amplitude grow on both types of soils. The studied orchids represent hemisciophytes (prefer forests and woodlands) to sciophytes (prefer wetlands and grasslands), which are mainly bound to moderately warm habitats in lower positions on slopes or lowland areas.

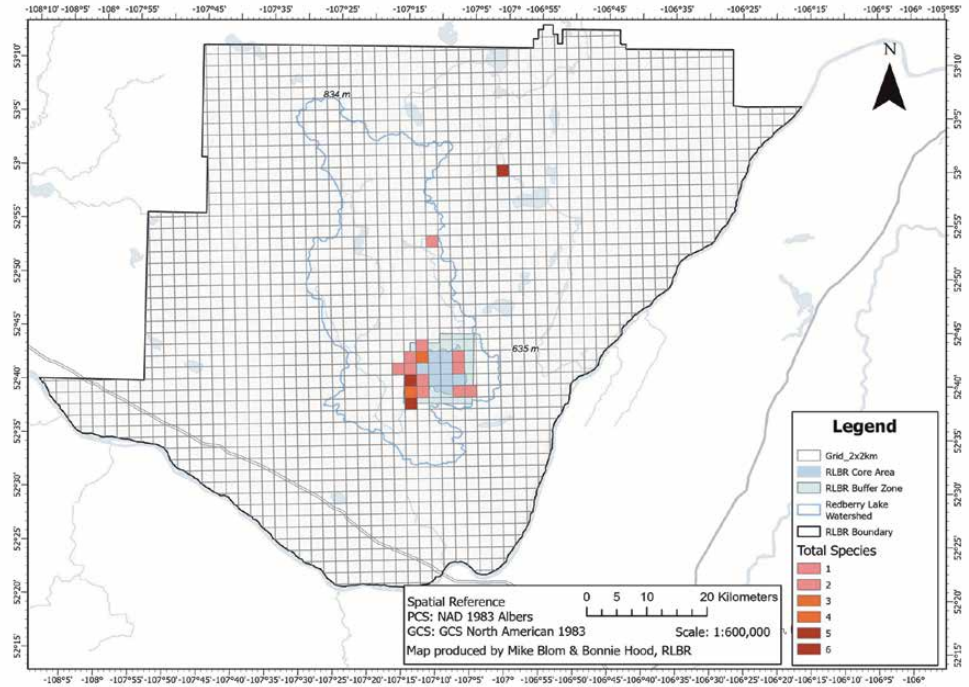


FIGURE 16. A distribution map of orchids in the Redberry Lake Biosphere Region. Species are shown within grid cells 2 km x 2 km.

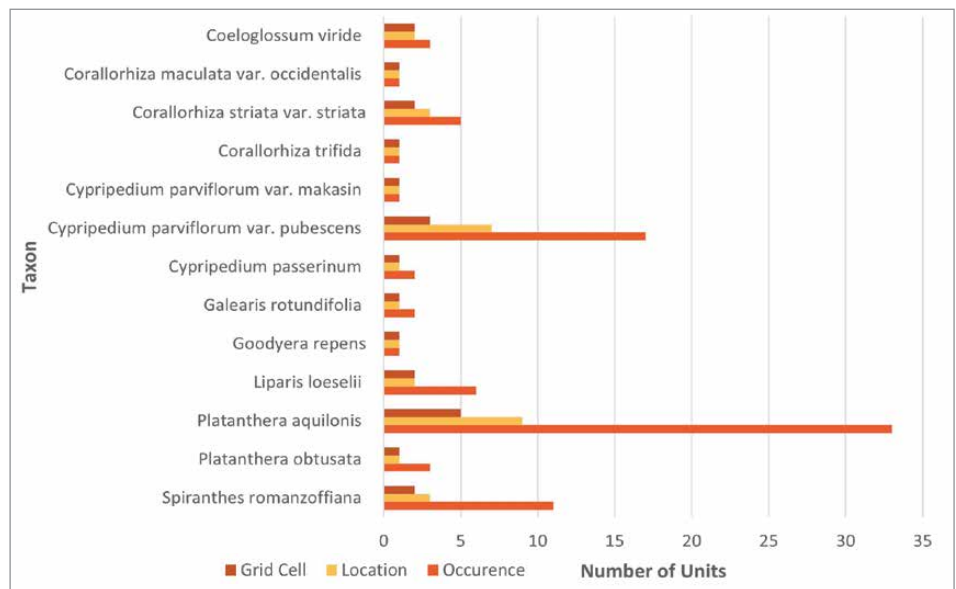


FIGURE 17. Detected mapping units (occurrences, locations, and grid cells) having orchids in the Redberry Lake Biosphere Region.

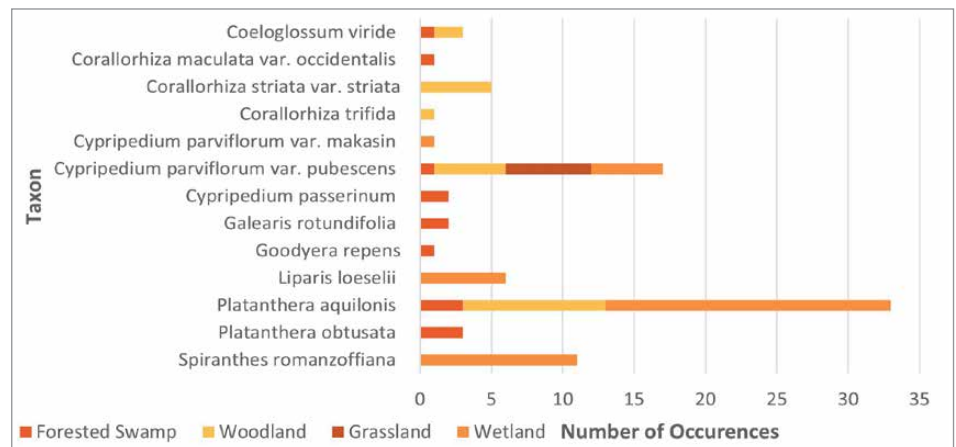


FIGURE 18. Habitat requirements of orchids in the Redberry Lake Biosphere Region.

The two most severe threats estimated to face orchids are successional overgrowth (*Cypripedium parviflorum* var. *pubescens*, *Liparis loeselii*, *Platanthera aquilonis*, *Spiranthes romanzoffiana*), and habitat destruction caused by wetland desiccation due to drainage (*Cypripedium parviflorum* var. *pubescens*, *Liparis loeselii*, *Platanthera aquilonis*). A less common, but also increasing threat is recreation, especially physical destruction of orchids at the golf course and cottage area in the Redberry Lake Regional Park (*Corallorhiza striata* var. *striata*, *Cypripedium parviflorum* var. *pubescens*, *Platanthera aquilonis*, *Spiranthes romanzoffiana*).

Most orchids are affected by one or two main threats, whereas *Cypripedium parviflorum* var. *pubescens* is in the extreme situation facing three threats. All these threats are resulting from a lack of management.

Conservation of orchids

According to SKCDC,¹⁴ the subnational (provincial) status of orchids occurring in the Redberry Lake Biosphere Region can be identified as follows (Table 1, Figure 19): S2—Imperiled/Very rare (one taxon), and S3—Vulnerable/Rare to uncommon (4 taxa), S4—Apparently Secure (seven taxa), and S5—Secure/Common (one taxon). *Cypripedium passerinum* is the only species out of 27 rare plants in the flora of RLBR designated as VU—Vulnerable, according to The IUCN Red List of Threatened Species.³⁴ In total, the

orchid family contains five rare species of subnational significance (S2–S3) or 18.5 per cent of all rare plants of the biosphere region.

It was to be expected that habitat alteration would be the key factors threatening orchids in the RLBR. As mentioned above, the most negative impact on orchid habitats has the overgrowth of woody species during natural succession (four taxa) and wetland drainage (three taxa). It was unexpected to observe increased frequency and strength of threats caused by recreation affecting four orchid species. Overall, habitat conservation would have more significant effects than individual protection of orchids. The different threats faced by their populations can be averted by different means of restoration, with the most relevant being the management of bushes and trees, preventing wetland degradation and regulating recreational activities.

To better understand the environmental preferences of orchids, we suggest continued monitoring and assessment of their population trends in the RLBR. The obtained demographic, ecological, and phytosociological data will inform successful orchid conservation and management. A great opportunity exists in the biosphere region for establishing long-term monitoring based on participatory approach which could engage volunteers and students from local schools.

Combined with professional support and coordination it could comprise a highly effective way for monitoring orchid populations and conservation interventions, as well as further develop citizen science.

Conducted surveys revealed that most of orchid populations are located in the buffer zone of the RLBR. However, some populations which belong to three out of five orchid species with subnational conservation status are scattered throughout the transition area of the biosphere region. Because the transition area is not intended for biodiversity conservation it cannot provide effective protection of rare species. Therefore, areas for orchids conservation need to be established in the RLBR. This goal could be achieved through extending the existing buffer zone as well as establishing other effective area-based conservation measures (OECMs) and Important Plant Areas (IPAs) within the biosphere region.

Conclusions

The comprehensive information on orchid species diversity and distribution in the Redberry Lake Biosphere Region provided by this study can contribute to various conservation initiatives. Understanding the distribution patterns of orchid species, identifying their critical hotspots and the key threats provide significant insight into their conservation status and help ensure orchid survival. Monitoring known populations would help to determine whether these species are spreading or declining through time which is of great importance in orchid conservation biology.

Orchid habitats are vulnerable to threats such as vegetation overgrowth, wetland loss and recreational activities. In the absence of traditional land management practices, such as mowing or grazing, orchids growing in fen communities are particularly endangered due to habitat overgrowth with bushes and trees. Agricultural intensification and unregulated recreation also seem to be closely associated with the alteration of orchid habitats. We believe that our results can be applied to set up specific

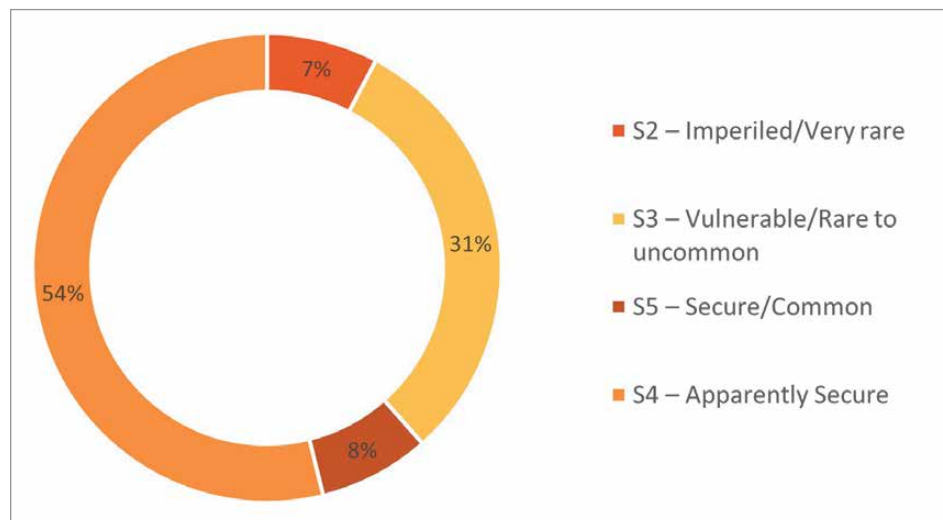


FIGURE 19. Subnational conservation ranks (S2–S5) of orchids of the Redberry Lake Biosphere Region.

conservation measures that are needed either to prevent decline in rare orchids or the recovery of specific populations. Conservation management such as gentle shrub removing and moderate grazing are needed in many of orchid habitats in the near future.

These conservation strategies are important for raising public awareness and prompting political action. They could be reinforced by developing long-term orchid conservation program using community-based participatory approach to engage the local volunteers in smaller-scale actions. Given that the main purpose of the RLBR is to conserve biodiversity, foster sustainable development, and capacity building through scientific research, monitoring, education, and training, it seems like achievable goal.

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