

# RARE VASCULAR PLANTS OF REDBERRY LAKE BIOSPHERE RESERVE

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## Introduction

The loss of biodiversity is now considered a major global concern and some studies suggest that it could rank among the key drivers of ecosystem change in the twenty-first century.<sup>1,2</sup> To help with conservation planning efforts, a greater understanding of biodiversity is needed at regional scales and for different taxonomic groups.<sup>3</sup>

Conservation efforts targeting plant diversity are often hampered by a lack of suitable data for prioritizing conservation action.<sup>4</sup> The first stage of systematic conservation planning prioritizes the compilation of distribution data for rare species as they are usually underrepresented when establishing different types of protected areas.<sup>5</sup>

Redberry Lake Biosphere Reserve (RLBR) is the only protected area of this type in Saskatchewan. The

biosphere reserve was designated by UNESCO in 2000 with a purpose to conserve biodiversity, foster sustainable development, and capacity building through scientific research, monitoring, education, and training.<sup>6</sup> The data on RLBR's biodiversity are rather limited and with a predominant focus on bird species.<sup>7</sup> Thus, the overall objectives of this paper were to provide information on rare plants in the RLBR: (i) species taxonomy, (ii) conservation status, (iii) distribution, and (iv) threats to survival. These data are intended to support evidence-based conservation management in the biosphere reserve.

## Methods

### Study area

Redberry Lake Biosphere Reserve (recently the word 'reserve' in the name of the organization was replaced with the "region"<sup>8</sup>) is located about 60 km northwest of Saskatoon (Figure 1). The biosphere reserve covers 112,200 hectares and is in the Redberry Lake's watershed. It is a saline lake that provides essential habitats for almost 200 bird species, including many

threatened species (UNESCO 2018).<sup>9</sup> The landscape of RLBR is composed of rolling prairie dotted with seasonal ponds and marshes along with aspen woodland and shrub groves. There are small patches of natural mixed prairie which are very rare in this highly grazed and cultivated part of the Canadian Prairies. Many wetlands were drained and transformed into cultivated croplands and pastures (UNESCO 2018).<sup>9</sup>

According to recent studies (Kricsfalusy 2021)<sup>10</sup>, vascular plants of RLBR include 466 taxa, representing approximately 26.3 per cent of Saskatchewan's flora. The first list of the vascular flora of the biosphere reserve, which includes 281 taxa, was compiled by local naturalist M. Finley in 1993–2008, however, it has not been published. Information on nine rare plant species of this region, which was collected by M. Finley, is diffuse and does not include the data where those species occur.

### Data collection

The information on rare plants in the Redberry Lake Biosphere Reserve was compiled from different sources (literature, databases, and herbarium specimens) and field studies conducted by the author. This information includes data on the species taxonomic status, conservation rank, and distribution in Saskatchewan. Information about human land use practices in the biosphere reserve, including livestock grazing, agricultural conversion, and fire suppression was provided by J. Kindrachuk, Executive Director of RLBR.

Herbarium vouchers of rare plants deposited at the W.P. Fraser Herbarium of the University of Saskatchewan (SASK 2018)<sup>11</sup> were examined. Additional information on occurrences of rare plants was obtained through the Saskatchewan Conservation Data Centre (SKCDC 2018)<sup>12</sup> and the HABISask database (2020).<sup>13</sup> The nomenclature of

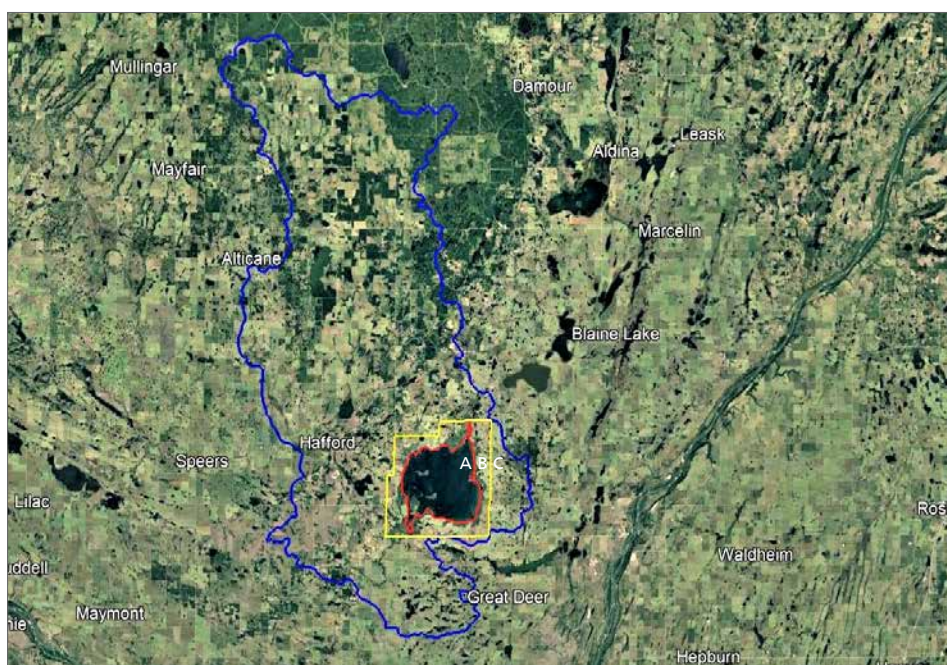


FIGURE 1: A map showing position of Redberry Lake Biosphere Reserve (RLBR) in Saskatchewan. Zoning of RLBR: A - core area, B - buffer zone, and C - transition area.

the taxa follows the VASCAN database (2010).<sup>14</sup> The species conservation ranks are given according to the NatureServe (2012)<sup>15</sup> categories and listing by Saskatchewan Conservation Data Centre (SKCDC 2018).<sup>12</sup>

Data on rare plants in the RLBR (local distribution, population features, and threats to survival) were collected during the general floristic inventories conducted from 2011–2018. Plants were identified *in situ* and a few photos for each species observed were taken. All locations were georeferenced using a GPS unit with an accuracy of 2 m. Whenever possible, the number of individuals was either counted directly (for the rarest and least widely distributed taxa) or estimated from partial counts (for species located at discontinuous sites). To characterize the habitat for each population, the corresponding vegetation surveys were conducted. Representative sampling plots of different size were laid in grassland (1x1m), shrubland (2x2m), and woodland (10x10m) vegetation communities, and transects (2x10m) in wetlands. Daubenmire classes (1 – 0-5%, 2 – 5-25%, 3 – 25-50%, 4 – 50-75%, 5 – 75-95%, 6 – 95-100%) were used to estimate cover for each vascular plant species, as well as for all vegetation layers and soil. Disturbances (litter, trampling/trails, exotics, grazing/browsing, burrowing) were recorded in

four classes (0 – absent, 1 – light, 2 – moderate, 3 – severe). Information on slope, aspect, elevation, legal location, and geographic coordinates were also collected. Vegetation types were identified using the principles of the Ecological Land Classification (Lee et al. 1998)<sup>16</sup>, adapted by the author for Saskatchewan.

## Results and Discussion

As a result of this study 18 vascular plant species were identified in the Redberry Lake Biosphere Reserve as being at risk at the global (1 taxon), national (3 taxa), and subnational (18 taxa) levels. It should be noted that the same species can be placed in all three categories simultaneously.

These rare plants are distributed within the following subnational (provincial) categories (Figure 2): S1– Critically Imperiled/Extremely rare (1 taxon), S2– Imperiled/Very rare (4 taxa), and S3– Vulnerable/Rare to uncommon (13 taxa). In terms of the rare species richness at the subnational level (S1–S3), the top five families are Orchidaceae (4 taxa) and Poaceae (3 taxa), followed by Asteraceae, Chenopodiaceae and Gentianaceae, each including 2 taxa. The rest six families include one taxon only (Figure 3). Thus, the orchid family alone contains 22 per cent of all rare plants of provincial significance in this region.

Yellow twayblade (*Liparis loeselii*) has the highest conservation status at the subnational level as Critically Imperiled (S1) species.

Concerning the rare species richness at the national level (N1–N3), there are only three taxa that belong to two families: Chenopodiaceae (2 taxa) and Ophioglossaceae (1 taxon). Prairie moonwort (*Botrychium campestre*) has the highest national rank (N2 – Imperiled) among all rare plants. It is also the only plant species with a high conservation status at the global level – G3G4 (Vulnerable/Rare, Uncommon).

## Asteraceae – Aster (sunflower) family

*Almutaster pauciflorus* (Nutt.) Á. Löve & D. Löve (= *Aster pauciflorus* Nutt.) – alkali marsh aster, few-flowered aster (Figure 4A)

**Habit:** perennial herb growing a reddish-green glandular stem to heights from 30 to 120 cm. The narrow leaves are linear in shape and up to 10 cm long. The inflorescence is an open array of flower heads containing white to pale purple ray florets and a center of yellow disc florets. The head is lined with phyllaries covered in tiny white resin glands.

**Range:** scattered across Canada (NWT and the Prairie Provinces), the western United States, and northern and central Mexico.

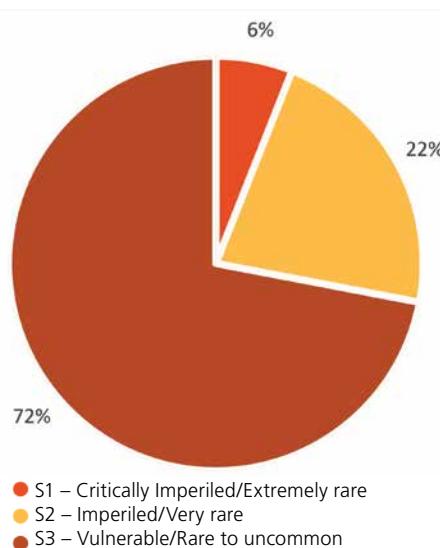


FIGURE 2: Rare plants distribution per subnational (provincial) conservation rank (S1–S3) in the Redberry Lake Biosphere Reserve.

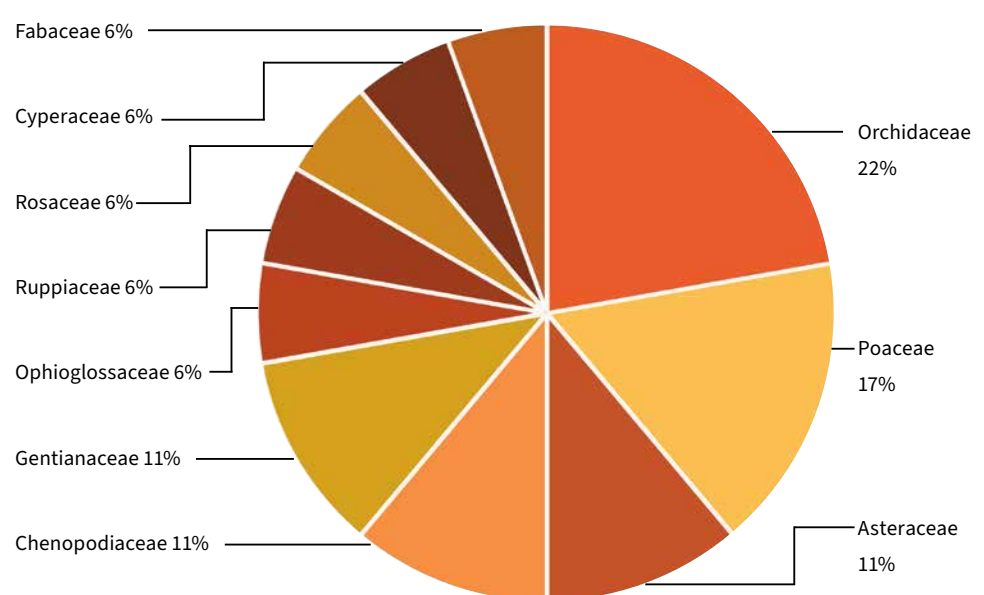


FIGURE 3: Rare plants distribution per family in the flora of Redberry Lake Biosphere Reserve.





**FIGURE 4:** Rare plants of Redberry Lake Biosphere Reserve (Photo V. Kricsfalusy): A – alkali marsh aster (*Almutaster pauciflorus*), B – devil's beggarticks (*Bidens frondosa*), C – American bugseed (*Corispermum americanum* var. *americanum*)

**Distribution in SK:** Cypress Hills, Mixed Grassland, Moist Mixed Grassland, Aspen Parkland, and Boreal Transition ecoregions. RLBR – two locations.

**Habitat:** inland salt marshes and saline flats.

**Conservation Status:** S3 N4 G4.

*Bidens frondosa* L. – devil's beggarticks, common beggarticks (Figure 4B)

**Habit:** annual herb usually about 20 to 60 cm tall, but it can reach 1.8 m at times. The stems are square in cross-section and may branch near the top. The leaves are pinnate, divided into a few toothed triangular or lance-shaped leaflets usually up to 6 or 8 cm long. The inflorescence is often a solitary flower head, but there may be pairs or arrays of several heads. The head contains many orange disc florets.

**Range:** widespread across much of Canada, the United States, and Mexico. It is known as an introduced species in Europe, Asia, North Africa, and New Zealand.

**Distribution in SK:** Mixed Grassland, Moist Mixed Grassland, Aspen Parkland, Boreal Transition, and Mid-Boreal Upland ecoregions. RLBR – three locations.

**Habitat:** moist woods, meadows, thickets, fields, roadsides, railroads, borders of streams, ponds, sloughs,

swamps, and ditches.

**Conservation Status:** S3 N5 G5.

### **Chenopodiaceae – Goosefoot family**

*Corispermum americanum* (Nutt.) Nutt. var. *americanum* (= *C. hyssopifolium* var. *americanum* Nutt.) – American bugseed (Figure 4C)

The name *C. americanum* has been misapplied to the Eurasian species, hyssop-leaved bugseed (*C. hyssopifolium* L.), which differs primarily in lacking wings on fruits, and having rounder, non-spotted fruits, respectively.

**Habit:** short, bushy annual plant, up to 50 cm tall and nearly as wide; many leaf-tips possessing dark, non-green points; inflorescence elongate-linear and loosely-flowered; fruits obovate, spotted, extending beyond thin perianth with conspicuous, papery, 0.25 to 0.60 mm wide wings.

**Range:** rare across North America except the southeastern region and northern Mexico.

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

**Habitat:** Dunes, sandy prairies and hills and dry waste places.

**Conservation Status:** S3 N3 N4 G5?T5?

*Corispermum pallasii* Steven (= *C. hyssopifolium* L. var. *leptopterum* Ascherson.) – Pallas' bugseed, Siberian bugseed

According to recent studies<sup>17</sup>, the hypothesis of the native status of *C. pallasii* in North America seems to be preferable; the secondary introduction of some populations from Europe is also not improbable.

**Habit:** branched, 10 to 45 cm tall annual forb of dunes and beaches; leaves less than 4.0 mm wide, tipped with a sharp, non-green tip less than 0.5 mm long; inflorescence densely flowered except at base; fruit winged, greater than 2.3 mm wide.

**Range:** native to Siberia but naturalized in Europe. Native to Canada, and the Great Lakes Region of the United States.

**Distribution in SK:** Mixed Grassland, Moist Mixed Grassland, Aspen Parkland, and Boreal Transition ecoregions. RLBR – one location; two other species locations (SKCDC 2018)<sup>12</sup> were not confirmed by our field surveys.

**Habitat:** full sun on dry, well-drained sandy soil. Found on dunes and rarely in disturbed, sandy sites.

**Conservation Status:** S2 N3 N4 G4?

### **Cyperaceae – Sedge family**

*Amphiscirpus nevadensis* (S. Watson) Oteng-Yeboah



**FIGURE 5:** Rare plants of Redberry Lake Biosphere Reserve (Photo V. Kricsfalusy): A – Nevada bulrush (*Amphiscirpus nevadensis*), B – Macoun's fringed gentian (*Gentianopsis virgata* subsp. *macounii*), C - marsh felwort (*Lomatogonium rotatum*).

(= *Scirpus nevadensis* S. Watson) – Nevada bulrush (Figure 5A)

**Habit:** perennial herb with erect stems that are stiff, ridged, and cylindrical, not three-angled. It lacks aerenchyma, a trait that makes it different from many of its relatives. The stems are sheathed by tough long leaves. The inflorescence is a head-like cluster of a few cone-shaped spikelets accompanied by a long, stiff bract that looks like an extension of the stem.

**Range:** Western North America, including the western Canadian provinces and the northwestern United States, as well as southern South America.

**Distribution in SK:** Mixed Grassland, Moist Mixed Grassland, Aspen Parkland. RLBR – one location.

**Habitat:** wet and seasonally wet habitat, often on saline and alkaline soils.

**Conservation Status:** S3 NNR G4.

**Fabaceae (Leguminosae) – Legume (pea) family**

*Astragalus australis* (L.) Lamark var. *glabriusculus* (Hooker) Isely (= *A. richardsonii* E. Sheldon, *A. aboriginorum* Richardson) – aboriginal milk-vetch

**Habit:** perennial herb from a woody taproot and much-branched stem-base; stems few to several, tufted, decumbent to ascending, 10-40

cm long/tall, with short or long, unbranched hairs, or nearly glabrous.

**Range:** circumpolar species found in North America but also in Europe and northwest Asia. In North America occurs from Alaska through most of Canada except for the extreme east and in the US from the state of Washington to Nevada.

**Distribution in SK:** Cypress Hills, Moist Mixed Grassland, Aspen Parkland, Boreal Transition, and Mid-Boreal Upland ecoregions. RLBR – may occur in the area (SKCDC 2018).<sup>12</sup>

**Habitat:** mesic to dry, open bluffs, grassy or rocky slopes, streambanks, meadows, ridges, tundra and forest openings from the steppe to alpine zones.

**Conservation Status:** S3 N5 G5.

**Gentianaceae – Gentian family**

*Gentianopsis virgata* (Rafinesque) Holub subsp. *macounii* (Holm) J.S. Pringle (= *Gentiana macounii* (Holm) Iltis) – Macoun's fringed gentian (Figure 5B)

**Habit:** erect, annual/biennial, 30-70 cm tall forb, often branched near the top. Upper leaves long and narrow, less than 1 cm wide. Flowers blue, 4-parted, 3-5 cm wide, funnel-shaped, long-stalked, petals toothed at the ends and fringed at the sides, with no folds between; solitary on long stalks.

**Range:** scattered across North America from Yukon to Quebec, south to British Columbia, Montana, and North Dakota.

**Distribution in SK:** Aspen Parkland, Boreal Transition, and Athabasca Plain, and Tazin Lake Upland ecoregions. RLBR – one location.

**Habitat:** wet to moist meadows, shores; in limey, rocky soil.

**Conservation Status:** S3 N5 G5.

*Lomatogonium rotatum* (L.) Fries var. *fontanum* (A. Nelson) J.S.

Pringle – marsh felwort (Figure 5C)

**Habit:** grows as tall as 35 cm from fibrous roots. Has a slender, simple or branched stem. The basal leaves are spatula-shaped and soon wither away. The stem leaves are mostly linear and are purplish-green in colour. The flowers are clustered in heads at the top of the stem or in the leaf axils. The sepals are deeply divided, and the lobes are almost equal to the petals. The petals are purple and widely spreading. Each petal lobe has a pair of scale like appendages near the base. The fruit is a capsule.

**Range:** has a circumboreal and alpine distribution, and in North America is found across Alaska, Canada and the Rockies, entering New England with a few populations in Maine.

**Distribution in SK:** Mixed Grassland, Moist Mixed Grassland, Aspen





**FIGURE 6:** Rare plants of Redberry Lake Biosphere Reserve (Photo V. Kricsfalusy): A – prairie moonwort (*Botrychium campestre*), B – striped coral root (*Corallorhiza striata* var. *striata*), C – small yellow lady's slipper (*Cypripedium parviflorum* var. *makasin*).

Parkland, and Sothern Boreal Forest ecoregions. RLBR – one location.  
**Habitat:** wet to moist fens, meadows and shorelines.  
 Conservation Status: **S3** N5? G5.

### Lemnaceae – Arum family

*Lemna* sp. – duckweed

Most plants collected in Saskatchewan are now recognized as common duckweed (*L. turionifera* E. Landolt) (Harms et al 2018).<sup>18</sup> M. Finley identified the specimen collected him in the RLBR in 2000 as lesser duckweed (*L. minor* L.). The poor quality of this specimen did not allow me to make a conclusive decision about its taxonomic status. As such, *L. minor* is not included in the list of rare species of RLBR.

**Habit:** floating freshwater aquatic plant, with one, two or three leaves each with a single root hanging in the water; as more leaves grow, the plants divide and become separate individuals. The root is 1-2 cm long. The leaves are oval, 1-8 mm long and 0.6-5 mm broad, light green, with three (rarely five) veins, and small air spaces to assist flotation.

**Range:** has a subcosmopolitan distribution, native throughout most of North America, Africa, Asia, and Europe.

**Distribution in SK:** It is most likely that *L. turionifera* occurs in the RLBR (see my comment above).

**Habitat:** occurring everywhere that freshwater ponds and slow-moving streams occur, except for arctic and subarctic climates.

**Conservation Status:** *L. minor* – **S1** N5 G5; *L. turionifera* – G5 N5 S4.

### Ophioglossaceae – Adder's-tongue family

*Botrychium campestre* W.H.

Wagner & Farrar – prairie moonwort (Figure 6A)

**Habit:** Plant has one leaf, with the sterile and fertile blades coming from the same stalk. The sterile blade is sessile to the common stalk and is only up to 4 cm long. When the plant is in the vegetative stage, the sterile blade is folded lengthwise. This blade is fleshy, with a bluish tinge and has up to five pairs of lobes. The lobes may be well-spaced. The fertile blade is 1 to 1.5 times longer than the sterile blade.

**Range:** Great Lakes region, Iowa, and Minnesota, ranging into Nebraska, North Dakota, Saskatchewan, and Alberta, with isolated disjunct occurrences known in New York and eastern Canada.

**Distribution in SK:** Mixed Grassland, Moist Mixed Grassland, and Aspen Parkland ecoregion. RLBR – one location (Kricsfalusy 2021).<sup>19</sup>

**Habitat:** grasslands, sand dunes, and sometimes in open woodlands.  
 Conservation Status: **S3 N2 G3G4**.

### Orchidaceae – Orchid family

*Corallorhiza striata* Lindl. var. *striata*

- striped coral root, hooded coralroot (Figure 6B)

**Habit:** lives off decaying organic matter in the soil and therefore does not need to have chlorophyll to obtain food. The stems are purplish to yellowish-brown and the leaves are reduced to small bracts. The flowers are 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 three to five darker purple veins. The lip has deep red margins and a white or yellow centre striped with purple. The column is slender and yellow.

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

**Distribution in SK:** Cypress Hills, Aspen Parkland, Boreal Transition, and Southern Boreal Forest ecoregions. RLBR – one location.

**Habitat:** lives in dry, decaying plant matter on the ground in forests and woodlands, and it obtains its nutrients from fungi via mycoheterotrophy.  
 Conservation Status: **S3** N5 G5T5.

*Cypripedium parviflorum* Salisb.

var. *makasin* (Farwell) Sheviak

(= *C. pubescens* Willd. var.

*makasin* Farwell) – small yellow lady's slipper, hairy yellow lady slipper (Figure 6C)



**FIGURE 7:** Rare plants of Redberry Lake Biosphere Reserve (Photo V. Kricsfalusy):

A – large yellow lady's slipper (*Cypripedium parviflorum* var. *pubescens*), B – yellow twayblade (*Liparis loeselii*), C – plains rough fescue (*Festuca hallii*).

**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.

**Distribution in SK:** Cypress Hills, Moist Mixed Grassland, Aspen Parkland, and Southern Boreal Forest. RLBR – one location (Kricsfalusy 2021).<sup>10</sup>

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

**Conservation Status:** S3 N4N5 G5T4T5.

*Cypripedium parviflorum* Salisb.  
var. *pubescens* (Willdenow)

Knight (= *C. calceolus* L.

var. *pubescens* (Willdenow) Correll – large yellow lady's slipper (Figure 7A)

**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.

**Distribution in SK:** Aspen Parkland, and Southern Boreal Forest. RLBR – four locations.

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

**Conservation Status:** S2 N5 G5T5.

*Liparis loeselii* (L.) Rich. – yellow twayblade, fen orchid (Figure 7B)

**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.

**Distribution in SK:** Moist Mixed Grassland, Aspen Parkland, and Southern Boreal Forest ecoregions. RLBR – one location.

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

**Conservation Status:** S1 N5 G5.

## Poaceae (Gramineae) – Grass family

*Danthonia californica* Bolander (= *D. californica* var. *americana* (Scribner) Hitchcock) – California oatgrass

**Habit:** perennial grass; caespitose. Culms 30–100 cm long; disarticulating at the nodes. Leaf-sheaths glabrous on the surface. Leaf-sheath oral hairs ciliate. Ligule a fringe of hairs. Leaf-blades flat, or involute; 10–20 cm long; 1–3 mm wide.

**Range:** occurs from British Columbia to southern California and eastward through the Rocky Mountain States and Provinces. A portion of the species range is located in Chile.

**Distribution in SK:** Cypress Hills, Mixed Grassland and sometimes in Aspen Parkland. RLBR – may occur in the area (SKCDC 2018).<sup>12</sup>

**Habitat:** woodland, shrubland, grassland, and transitional wetland habitats.

**Conservation Status:** S3 NNR G5TNRQ.

*Festuca hallii* (Vasey) Piper (= *F. altaica* Trin. var. *hallii* (Vasey) Harms) – plains rough fescue (Figure 7C)

**Habit:** perennial grass; clumped densely. Culms erect; 30–90 cm long; 2-noded. Culm-internodes smooth, or scaberrulous. Leaf-sheaths tight; antrorsely scabrous. Leaf-sheath auricles absent. Ligule a ciliate membrane. Leaf-blades involute; 10–50

cm long; 1-2 mm wide; stiff. Leaf-blade surface scabrous. Leaf-blade apex acute; pungent.

**Range:** occurs across Great Plains in the United States and Canadian Prairie Provinces and scattered through Aspen Parkland to Ontario.

**Distribution in SK:** Cypress Hills, Mixed Grassland, Moist Mixed Grassland, Aspen Parkland, and Southern Boreal Forest. RLBR – nine locations.

**Habitat:** dry and mesic grasslands.

**Conservation Status:** S3 N5 G4.

### *Piptatheropsis canadensis*

(Poiret) Romaschenko, P.M.

Peterson & Soreng (= *Oryzopsis canadensis* (Poiret) Torr.) – Canada ricegrass

**Habit:** perennial grass; caespitose. Culms erect; 30-70 cm long. Ligule an eciliate membrane; 2 mm long. Leaf-blades flat, or involute; 5-20 cm long; 1-1.5 mm wide; coriaceous; stiff. Leaf-blade surface ribbed; scabrous. Leaf-blade apex attenuate.

**Range:** occurs in Canada from British Columbia to Newfoundland and adjacent areas of the United States, and Great Lakes region.

**Distribution in SK:** Moist Mixed Grassland, Aspen Parkland, and Southern Boreal Forest. RLBR – may occur in the area (SKCDC 2018).<sup>12</sup>

**Habitat:** dry-fresh grasslands, sandy open aspen woods, rocky slopes.

**Conservation Status:** S2 N5 G5.

### **Rosaceae – Rose family**

*Potentilla rubricaulis* Lehmann – red-stemmed cinquefoil, Rocky Mountain cinquefoil

**Habit:** relatively large plants with open 4–20-flowered inflorescences. Leaflet teeth (4)5–8 per side; leaflets green to grayish-green adaxially hypanthium 4–6 mm diam. Stems ascending to nearly erect, 1.5–4 dm. Basal leaves often both ternate and palmate on the same plant, rarely subpalmate, 4–10 cm; petiole 2.5–7 cm, long hairs sparse to common, loosely appressed to ascending-spreading.

**Range:** Subarctic Alaska and Canada to the west and central United States.

**Distribution in SK:** Mixed Grassland, Moist Mixed Grassland, Aspen Parkland, Boreal Transition, and Athabasca Plain. RLBR – one location.

**Habitat:** sandy lake shores, open sandy forests, dry grassy slopes, sandy and loamy bluffs.

**Conservation Status:** S3 NNR GNR.

### **Ruppiaceae – Ditch-grass family**

*Ruppia cirrhosa* (Petagna) Grande (= *R. occidentalis* S. Watson) – western ditchgrass, spiral ditchgrass

**Habit:** it is a thread-thin, grass-like perennial herb that grows from a rhizome anchored in the wet substrate. It produces a long, narrow inflorescence tipped with two tiny flowers. As the fruit develops the peduncle of the inflorescence curls into a neat spiral.

**Range:** an aquatic plant native to the Americas and Europe.

**Distribution in SK:** Mixed Grassland, Aspen Parkland, Boreal Transition, and Mid-Boreal Upland. RLBR – one location.

**Habitat:** freshwater bodies, such as lakes.

**Conservation Status:** S3 N5 G5.

### **Distribution and habitat**

The research undertaken for this study has substantially enlarged the number of rare plants and their locations in the Redberry Lake Biosphere Reserve. In total, 10 out of 18 taxa were identified as new for the biosphere reserve. In addition to that, distribution areas were updated with new locations for 12 rare plants, such as plains rough fescue (five locations), large yellow lady's slipper (three locations), few-flowered aster (two locations) and other species. As a result of our field surveys, six species-rich sites that possess more than one rare species were identified: 4 taxa (two sites), 3 taxa (one site), 2 taxa (three sites).

The obtained results indicate that

the habitat preferences of rare plants are as follows: wetland/riparian (8 taxa), grassland (4 taxa), woodland (4 taxa), and sand dune (2 taxa). As we can see, rare plants more likely to be found in wet and dry habitat conditions, and significantly less expected in disturbed areas. Such patterns may be explained by local natural history. This part of Saskatchewan has been subjected to intense agricultural pressure which resulted in extensive habitat alteration.<sup>20</sup> Because of the dramatic transition from natural to agricultural ecosystems, most of the prairies (which are dry open habitats) have been wiped out.

The two most severe threats estimated to face the studied rare plants are successional overgrowth (affecting a total of 11 taxa and six sites), and recreation, especially physical destruction of plants (affecting a total of 6 taxa and three sites). Both these threats are resulting from a lack of management. A less common, but also dramatic threat is habitat destruction caused by wetland desiccation due to drainage, which targets two rare species. Most of the rare plants are affected by one or two main threats, whereas large yellow lady's slipper is in the most extreme situation facing three threats.

### **Conservation management**

It was to be expected that habitat loss and the fragmentation of populations would be two of the key mechanisms for the loss of biodiversity in the Redberry Lake Biosphere Reserve. As mentioned above, the overgrowth of woody species during natural succession is having the most negative impact on habitats of rare species and their populations. Habitats of large yellow lady's slipper, small yellow lady's slipper, prairie moonwort, and striped coral root are particularly vulnerable to the successional overgrowth.

There are a few historical records of American bugseed and Pallas' bugseed



indicating the occurrence of these species on two islands in Redberry Lake and in the shore zone around the lake (SKCDC 2018).<sup>12</sup> Recent survey efforts in 2017 did not confirm previously documented locations on those islands. It has been found that sand dune habitat is declining there because of vegetation succession, particularly shrub and low tree growth.

Plains rough fescue has disjunct occurrences across the biosphere reserve. The species has declined due to human land use practices, including livestock grazing, agricultural conversion, and fire suppression. Great concern exists because these habitats are being invaded by aggressive exotic species.

Thus, we can declare the higher significance of habitat conservation than individual conservation for the protection of these rare plants. The different threats faced by the populations can be averted by different means of restoration, with the most relevant being the clearing of bushes and trees, restorative mowing and control of invasive exotic species. In addition to these measures, the introduction of grazing and fire should be investigated in certain sites, as it is ultimately one of the few means to ensure the long-term persistence of the species.

## Conclusions

It is a matter of concern that only two out of six species-rich sites found in the Redberry Lake Biosphere Reserve are included in the biosphere reserve's core zone. These two sites are securely protected for conserving biological diversity because of the existing zoning. In terms of species protection, only five out of 18 rare plants occur at the sites located in the core zone of the biosphere reserve. However, the majority of rare plant species are located within the buffer zone of RLBR in which human impact is less intensive than in the transition zone.

Conservation management such as grazing, clearing, and mowing is

needed in the majority of rare species habitats in the near future. Monitoring known populations of rare species would help to determine whether they are declining.

This information will serve to designate the future priorities for the conservation of rare plants in the RLBR. These conservation strategies are important for raising public awareness and prompting political action but smaller-scale actions are also needed by local conservation practitioners.

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1. Hooper D, Adair EC, Cardinale BJ et al (2012) A global synthesis reveals biodiversity loss as a major driver of ecosystem change. *Nature* 486:105–108.
2. Ceballos G, Ehrlich PR, Barnosky AD et al (2015) Accelerated modern human-induced species losses: entering the sixth mass extinction. *Science Advances* 1: e1400253. PMID: 26601195 DOI: 10.1126/sciadv.1400253
3. Thuiller W, Albert C, Araújo MB et al (2008). Predicting global change impacts on plant species distributions: future challenges. *Perspectives in Plant Ecology, Evolution and Systematics* 9:137–152.
4. Kricsfalusy V, Trevisan N (2014) Prioritizing regionally rare plant species for conservation using herbarium data. *Biodiversity and Conservation* 23:39–61.
5. Margules CR, Pressey RL (2000) Systematic conservation planning. *Nature* 405:243–253.
6. [RLBR] Redberry Lake Biosphere Reserve. <http://redberrylake.ca/> (accessed 15 January 2019)

7. Kricsfalusy V, Kindrachuk J (2018) German iris – a new naturalized plant species for Saskatchewan. *Blue Jay* 76(4):21–25.

8. Redberry Lake Biosphere Region. <https://redberrylake.ca/> (accessed 53 May 2021)

9. UNESCO. Redberry Lake Biosphere Reserve, Canada. 2018. <https://en.unesco.org/biosphere/eu-na/redberry-lake> (accessed 11 November 2020)

10. Kricsfalusy V (2021) The vascular flora of Redberry Lake Biosphere Reserve, Saskatchewan, Canada. *Biodiversity Data Journal* (in press).

11. [SASK] W. P. Fraser Herbarium at the University of Saskatchewan. <http://herbarium.usask.ca> (accessed 12 January 2018)

12. [SKCDC] Saskatchewan Conservation Data Centre. <http://www.biodiversity.sk.ca/splist.htm> (accessed 21 September 2018)

13. HABISask. Hunting, angling and biodiversity information. Government of Saskatchewan. <https://gisappl.saskatchewan.ca/Html5Ext/?viewer=habisask> (accessed 19 February 2018)

14. Brouillet L, Coursol F, Meades SJ et al (2010) VASCAN, the database of vascular plants of Canada. <http://data.canadensys.net/vascan/> (accessed 19 February 2018)

15. NatureServe (2012). Faber-Langendoen DJ, Nichols L, Master K et al. NatureServe conservation status assessments: methodology for assigning ranks. NatureServe, Arlington, VA. 45 pp.

16. Lee H, Bakowsky W, Riley J et al (1998) Ecological land classification for southern Ontario: First approximation and its application. Southcentral Science Section, Ontario Ministry of Natural Resources, North Bay, ON. 225 pp.

17. Mosyakin SL (2020). *Corispermum*. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico [Online]. New York and Oxford. Vol. 4. <http://floranorthamerica.org/Corispermum> (accessed 5 May 2021)

18. Harms VL, Leighton AL, Vetter MA (2018) Flora of Saskatchewan. Fascicle 6. Rushes, bulrushes, and pondweeds. Flora of Saskatchewan Association and Nature Saskatchewan. Regina, SK. 432 pp.

19. Kricsfalusy V (2021) Distribution, habitat affinities, and conservation of prairie moonwort (*Botrychium campestre*) on its northern range limit. *Western North American Naturalist*, 81(4): 529–543.

20. Riley JL, Green SE, Brodribb KE (2007) A Conservation Blueprint for Canada's Prairies and Parklands. Nature Conservancy of Canada, Toronto, ON. 226 pp. 