

Hare-footed Locoweed Conservation Management Plan



Alberta Species at Risk Conservation Management Plan No.13

Hare-footed Locoweed

Conservation Management Plan

Prepared by:

Cheryl Bradley

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Cover photos: Lorne Fitch

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PREFACE

Albertans are fortunate to share their province with a diversity of wild species. A small number of these species are classified as *Species of Special Concern* because they have characteristics that make them particularly sensitive to human activities or natural events. Special conservation measures are necessary to ensure that these species do not become Endangered or Threatened.

Conservation management plans are developed for *Species of Special Concern* to provide guidance for land and resource management decisions that affect the species and their habitat. These plans are intended to be a resource tool for provincial and regional fish and wildlife, land and resource management staff in Alberta Environment and Parks and other government departments.

Conservation management plans provide background information including species biology, threats to species and habitat, and inventory/monitoring history. Plans also provide a goal, objectives, and actions (management recommendations). Management recommendations are typically categorised into inventory and monitoring needs; habitat management and conservation; education and communication; and additional management considerations as required.

Conservation management plans are generally prepared by an Alberta Environment and Parks fish and wildlife biologist who has been designated as the provincial species lead. Writers from outside the department are occasionally sought to prepare plans for species for which there is little in-house expertise. In order to ensure accuracy and utility, each plan is reviewed by a species expert and a designated provincial representative from forestry or land programs. In some cases there may be additional reviewers from staff, industry, and other agencies.

Conservation management plans are internal guidance documents. They are implemented under the guidance of the species lead and are “living” documents that can be revised at any time as required. Conservation management plans are more succinct than the recovery plans that are prepared for Endangered and Threatened species and do not involve participation of a multi-stakeholder team.

Conservation management plans are approved by the Director of Species at Risk, Non-Game and Wildlife Disease Policy. Plans will be reviewed annually by the species lead and updated if necessary, and a more in-depth review will occur five years after a plan’s approval.

TABLE OF CONTENTS

PREFACE.....	iii
TABLE OF CONTENTS.....	iv
TABLE OF FIGURES.....	iv
LIST OF TABLES.....	iv
ACKNOWLEDGEMENTS.....	v
EXECUTIVE SUMMARY.....	v
1.0 INTRODUCTION.....	1
2.0 SPECIES BIOLOGY.....	1
2.1 Description, Life History and Conservation Biology.....	1
2.2 Distribution, Habitat and Population Size.....	2
3.0 THREATS AND LIMITING FACTORS.....	5
3.1 Direct Threats.....	5
3.2 Indirect Threats.....	13
3.3 Cumulative Environmental Effects.....	13
4.0 GOALS AND OBJECTIVES.....	13
4.1 Goal.....	13
4.2 Objectives.....	13
5.0 MANAGEMENT ACTIONS.....	14
5.1 Inventory and Monitoring.....	14
5.2 Habitat Management.....	15
5.3 Research.....	17
5.4 Information and Outreach.....	18
6.0 SUMMARY.....	18
7.0 LITERATURE CITED.....	19

TABLE OF FIGURES

Figure 1. Hare-footed locoweed distribution in Alberta [from status report].....	4
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LIST OF TABLES

Table 1. Summary of threats to the hare-footed locoweed population.....	6
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EXECUTIVE SUMMARY

The hare-footed locoweed (*Oxytropis lagopus* var. *conjugens*) is a Species of Special Concern in Alberta, as of July 2014, because it has a small distribution and there is a projected decline in quality of habitat. As of May 2014, status of hare-footed locoweed in Canada is Threatened because it occurs in a highly restricted habitat, Alberta occurrences represent a large portion of the global population, and the plants face numerous threats which are contributing to continuing habitat loss and degradation. Planning for conservation of the species is required.

In Alberta (and Canada), hare-footed locoweed is found only within the Foothills Fescue Natural Subregion south of Lethbridge. It occurs on wind-eroded gravelly sites on edges of ancient flat-topped plateau, known as the Del Bonita Plateau and Milk River Ridge, as well as on abandoned gravel terraces of the post-glacial North Milk River and its tributaries. Hare-footed locoweed is found in openings in native foothills rough fescue – Idaho fescue plant community, where grass and forb cover is reduced because of shallow soils with exposed gravels, but where there is continuous ground cover of little club moss and lichens.

Threats to the provincial population of hare-footed locoweed include invasion of habitat by non-native plants and surface disturbance from gravel extraction, crop production, oil and gas development, wind energy development, residential development, vehicle roads/trails and localized loitering of livestock. Fire frequency and intensity outside of its natural range of variation and drought as a result of climate change may be additional threats but effects are not well understood. Although individually each of the threats may not pose significant risk to survival of the provincial population of hare-footed locoweed, together they may.

This plan recommends various actions to maintain current distribution and subpopulations of hare-footed locoweed in Alberta. Estimates for provincial extent of occurrence need to be refined and a protocol for monitoring population trends defined and implemented. Regional and local land use planning and management to avoid surface disturbance of hare-footed locoweed habitat is required as is control of invasive non-native plants. Information and outreach to a variety of audiences will be necessary to accomplish habitat management objectives. A better understanding of the life history and ecology of hare-footed locoweed would assist conservation of the species within Alberta and beyond.

1.0 INTRODUCTION

The hare-footed locoweed (*Oxytropis lagopus* var. *conjugans*) was listed as a *Species of Special Concern* in Alberta due to its small distribution and projected decline in quality of habitat. Alberta is the only province in Canada in which hare-footed locoweed occurs. In May 2014, the species was assessed as *Threatened* in Canada (in a higher risk category than assigned in 1995) because it occurs in a highly restricted habitat, Alberta occurrences represent a large portion of the global population, and the plants face numerous threats which are contributing to continuing habitat loss and degradation (COSEWIC 2014). In Montana the species is a *Species of Concern*.

The Alberta Endangered Species Conservation Committee's (ESCC) Initial Conservation Action Statement (October, 2013) for hare-footed locoweed recommends the following: Hare-footed locoweed should be identified as a *Species of Special Concern* in Alberta. Alberta Environment and Parks should develop and implement a conservation management plan for the hare-footed locoweed in Alberta.

Alberta Environment and Parks should secure new resources to collect reliable information on the population size and population trend of hare-footed locoweed in Alberta.

2.0 SPECIES BIOLOGY

2.1 Description, Life History and Conservation Biology

Hare-footed locoweed (*Oxytropis lagopus* var. *conjugans*) is a tufted, low-growing perennial herbaceous plant growing from a stout taproot crowned by leaves with silvery hairs. It has attractive pink, pea-like flowers.

Flowers appear in spring (early May to late June), timing depends on elevation and weather, and fade within a few days of opening. Pollination is accomplished by insects, including bees. Two species of bumble bees (*Bombus huntii* and *Bombus nevadensis*) have been observed on flowers of hare-footed locoweed (Ernst 1998). Fruits (pods) mature within a few weeks of pollination and the small seeds are likely dispersed over short distances facilitated by wind. The longevity of the seed in the soil and the state of the seed bank is unknown.

Populations of hare-footed locoweed appear to be long-lived with overlapping generations. Individual plants likely persist for several years; however, information is lacking on longevity of individuals, reproductive age and age structure within a population. It is not known if plants flower every year or experience prolonged dormancy of the rootstock when conditions are not favourable to flowering (COSEWIC 2014).

Herbivory of the flowers and seed pods of hare-footed locoweed occurs, likely by ground squirrels (Richardson's, *Urocitellus richardsonii*, and/or thirteen-lined, *Ictidomys tridecemlineatus*) and perhaps by deer. Domestic livestock appear to find the plants unpalatable. Growth and survival of hare-footed locoweed may be enhanced by natural

lime accumulation in the substrate, by the species' capacity to fix nitrogen through bacteria in root nodules, and by association with a microbiotic crust (primarily lichens); however, this has yet to be investigated (AESRD and ACA 2012, COSEWIC 2014).

2.2 Distribution, Habitat and Population Size

In Alberta (and Canada), hare-footed locoweed is found within the Foothills Fescue Natural Subregion south of Lethbridge. It occurs on wind-eroded, quartzitic gravel substrates on edges of ancient flat-topped plateau, known as the Del Bonita Plateau and Milk River Ridge, as well as on abandoned gravel terraces of the post-glacial North Milk River and its tributaries. Occurrences range in elevation from 1240 m to 1410 m.

Hare-footed locoweed is associated with the foothills rough fescue (*Festuca campestris*) – Idaho fescue (*Festuca idahoensis*) plant community, as classified by Adams *et al.* (2005[a]), and specifically with open patches. Sites have shallow soils and less than 50% grass and forb cover (AESRD and ACA 2012). There is continuous ground cover of little club moss (*Selaginella densa*) and lichens (70-95% cover) interspersed with exposed gravels (5-30% cover). Suitable habitat has little to no plant litter because of low site productivity and strong eroding winds.

Eleven subpopulations (more than 1 km apart) are known in Alberta and one historical subpopulation (Figure 1, Table 1) (AESRD and ACA 2012). Extant subpopulations vary in size from 1 individual to 19 400 individuals comprising a provincial population estimated to be greater than 36 400 mature individuals. Extent of occurrence is approximately 229 km²; however, the measured area actually occupied is less than 50 ha. It is suspected that area of occupancy has declined, and there is evidence of decline in quality of habitat in 5 of 11 extant subpopulations; however, information on trends in population size is lacking (AESRD and ACA 2012).

Information on the history of surveys for hare-footed locoweed is contained in element occurrence records of the Alberta Conservation Information Management System (ACIMS) and summarized in the provincial status report (AESRD and ACA 2012). Hare-footed locoweed was first reported in Alberta in 1958 on private land 2 km south of the town of Cardston (Cardston subpopulation) and was observed again at this site in 1966 and 1967. In 1983 a second occurrence was reported on public land on the Milk River Ridge that would subsequently be included in the Ross Grassland Natural Area (Ross Grassland NA North subpopulation) and was reaffirmed in 1985 by a provincial government botanist. In 1986 a rare plant survey in the Oldman Regional Plan area of southwestern Alberta, undertaken under contract to the provincial government, documented four additional occurrences (within Whiskey Gap South, Milk River Ridge, Sandstone Ranch and Shanks Lake West subpopulations) but failed to relocate the Cardston subpopulation noting development of a gravel pit at the site (Wallis *et al.* 1986). Known subpopulations were revisited and two new occurrences (Shanks Lake South and Del Bonita East subpopulations) documented in 1993 during preparation of status report on hare-footed locoweed in Canada under contract to COSEWIC (Smith 1995). In 1996, a survey of wildlife habitat by Rangeland Conservation Service for the Alberta government resulted in expansion of the Milk River Ridge subpopulation of hare-footed

locoweed and incidental discovery of a new subpopulation (North Milk River Terrace). Visits were made to the Ross Grassland Natural area by naturalists in 1998, 1999 and 2002 and notes were made on population size and plant vigor (Ernst 1998). In 2007, the Milk River Ridge subpopulation was further expanded and a new subpopulation found (Milk River Ridge NCC) in vegetation and range resource inventory of private properties on the Milk River Ridge secured through conservation easement by Nature Conservancy Canada (NCC 2007). Also in 2007, members of the Alberta Native Plant Council, participating in a Botany Alberta field trip, conducted an inventory of hare-footed locoweed within a portion of the Milk River Ridge subpopulation (Bradley 2008). Survey efforts by volunteers with Adopt A Plant Alberta, a program of the Alberta Native Plant Council, gathered information on the Ross Grassland NA North subpopulation in 2009, and the Sandstone Ranch, Shanks Lake West and Del Bonita East subpopulations in 2010. Occurrence records from these volunteer efforts are included in the ACIMS database.

A systematic survey of known occurrences of hare-footed locoweed in Alberta was undertaken in 2011 to inform preparation of a provincial status report. The work was conducted by a professional botanist contracted by AESRD and ACA. The consultant's documentation of survey methodology, survey effort and results is filed with the ACIMS. Because of time and resource constraints, the 2011 survey did not include two occurrences that are considered extant but which lacked precision as to their exact location (Whiskey Gap South and North Milk River Terrace subpopulations). The area of occupancy of known subpopulations was expanded through the 2011 survey; however, the full extent of three of these subpopulations was not determined (Sandstone Ranch, Shanks Lake West, Shanks Lake South).

Subsequent analysis of all survey information filed with ACIMS resulted in the identification of eleven extant subpopulations, two of which had not been previously reported (Whiskey Gap Northeast and Whiskey Gap North). There may be other subpopulations in sites that have not yet been surveyed; however, the species is restricted to an uncommon habitat type much of which has been searched, so the likelihood of finding large numbers of previously undiscovered subpopulations is low.

There have not been a sufficient number of counts using a standard methodology, comprising subpopulations of hare-footed locoweed over time to reliably determine trends or fluctuation in population size in Alberta. The 2011 survey provides a benchmark and methodology that may be useful for monitoring trends in the future.

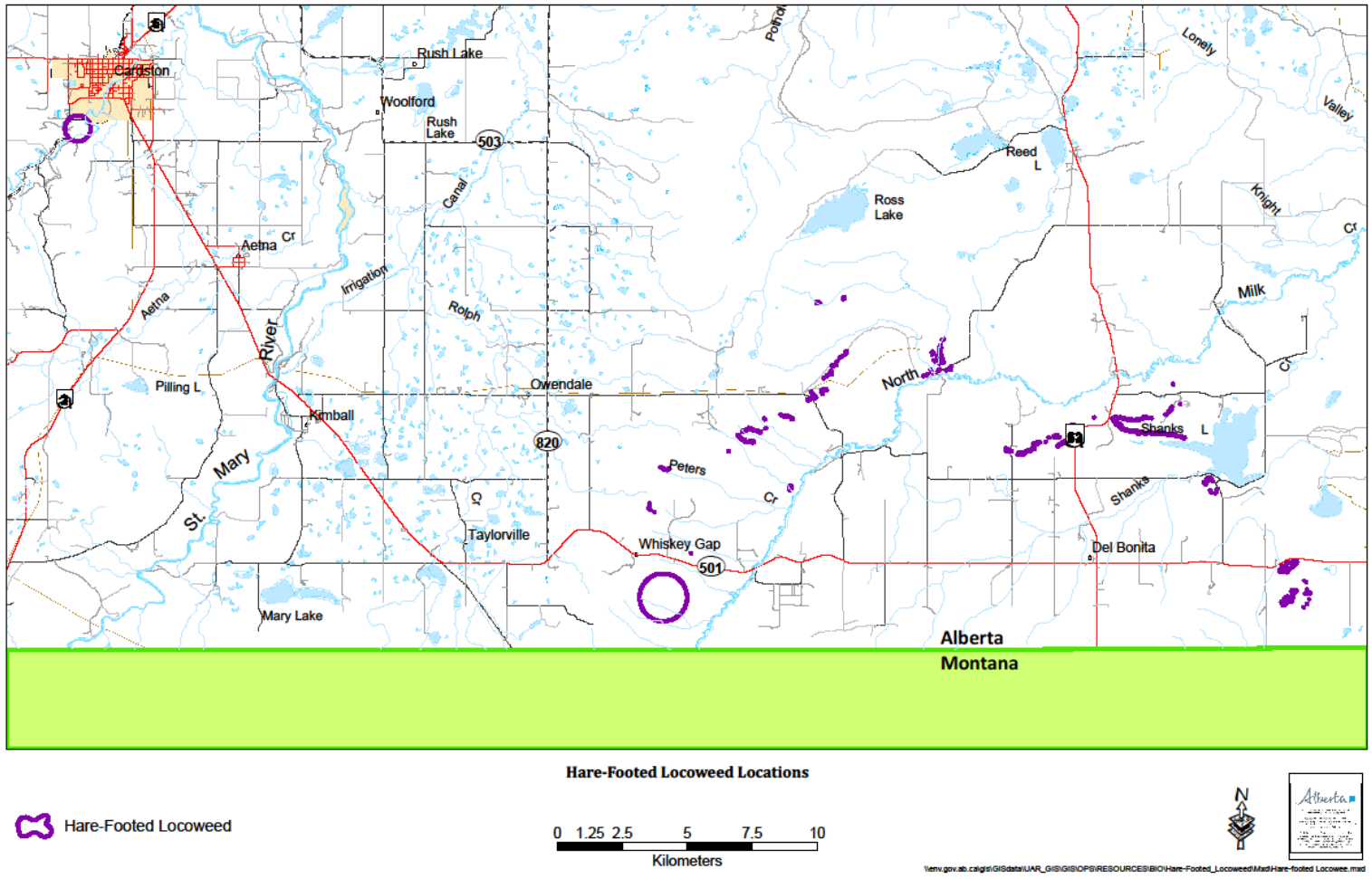


Figure 1. Hare-footed locoweed distribution in Alberta (points indicate subpopulations separated by at least 1 km as defined by the Alberta Conservation Information Management System)

3.0 Threats and limiting factors

Hare-footed locoweed variety *conjugans* is endemic to western Montana and southwestern Alberta with a narrow habitat range. This fact alone could place the Alberta population at risk because of low genetic diversity within the population. The taxon is naturally a habitat specialist, occurring in a habitat that is rare in the landscape often with wide separation between similar habitats. Whether there is gene flow among subpopulations of hare-footed locoweed (e.g., by bee pollinators) remains to be determined.

Five of 11 extant subpopulations now occur, at least partly, on land that is in a provincial protected area or protected by a land conservation trust on private land – Milk River Ridge NCC, Milk River Ridge, Ross Grassland NA North, North Milk River Terrace, and Sandstone Ranch. Stewardship of these areas can be expected to mitigate against habitat loss and degradation, provided protection of rare plant species is a management goal. Transferring provincial public lands with hare-footed locoweed to other levels of government, where subsequently the land could become privatized with accompanying changes in land use, would increase threat to the provincial population.

3.1 Direct Threats

Direct threats are the proximate human activities or processes that have caused, are causing, or may cause the destruction, degradation, and/or impairment of biodiversity targets (Salafsky *et al.* 2008). Direct threats to hare-footed locoweed are classified according to the IUCN–CMP Unified Classification of Direct Threats (Version 3.2) (IUCN 2012). Information on direct threats to hare-footed locoweed in Alberta is drawn from two main sources, both authored by the primary author of this report – Cheryl Bradley: 1) the provincial status report for hare-footed locoweed (AESRD and ACA 2012) and 2) a natural area conservation plan for the Milk River Ridge by Nature Conservancy of Canada (NCC 2013). Table 1 represents current known threats; new types of development may pose threats to this plant species and should be evaluated accordingly.

The impact of each threat to the provincial population of hare-footed locoweed was assessed by the author considering three criteria – scope, scale and timing – over a 10-year period (Master *et al.* 2009). Scope is the proportion of the target (spatially for ecosystems) that can reasonably be expected to be affected by the threat within ten years. Severity is, within the scope, the level of damage to the target from the threat that can reasonably be expected given the continuation of current circumstances and trends. Timing measures whether a threat is occurred mainly in the past, is occurring in the present, or is predicted to occur in the future; timing is not used directly in calculation of threat impact. Four categories of rating were considered for each criterion – very high, high, medium and low.

Table 1. Summary of current threats to the hare-footed locoweed population

Threat	Impact
Native plant community invasion by non-native invasive plants and noxious weeds	Low
Crops planted for food and forage	Low
Unsustainable livestock grazing	Low
Oil and gas exploration and development	Low
Surface disturbance from gravel extraction	Low
Wind energy development	Low
Existing and new roads and vehicle trails	Low
Rural subdivision and residential development	Low
Recreational motorized use	Low
Fire frequency and intensity outside of its natural range of variation	Unknown
Climate change - droughts	Unknown
Overall threat rating	Medium

Threat impact reflects a reduction of a species population or decline. The median rate of population reduction or decline for each combination of scope and severity corresponds to the following classes of threat impact:

Very high – The threat is likely to reduce the species by a median rate of 75%

High – The threat is likely to reduce the species by a median rate of 40%

Medium – The threat is likely to reduce the species by a median rate of 15%

Low – The threat is likely to reduce the species by a median rate of 3%

Unknown – The threat’s impact on biodiversity target is unknown.

The overall threat rating takes into account the cumulative effect of all known threats, hence the overall rating of medium.

Native plant community invasion by non-native invasive plants and noxious weeds; Low (IUCN category: 8.1 Invasive Non-Native/Alien Species)

Invasion by non-native plant species, primarily crested wheat grass (*Agropyron cristatum*), is occurring within five subpopulations of hare-footed locoweed (Whiskey Gap North, Milk River Ridge, Sandstone Ranch, Shanks Lake West, Shanks Lake South) and at several sites within some of these subpopulations. Sites where hare-footed locoweed habitat is being invaded are associated with land use disturbances where crested wheatgrass was deliberately planted for tame pasture or reclamation. Since 2000, crested wheatgrass has generally not been included in reclamation seed mixes in Alberta because of its persistence and invasive character; however it may still be planted by livestock producers for forage or spring pasture.

Crested wheat grass is long-lived (15-20 years), drought-tolerant and has an extensive root system (Henderson and Naeth 2005, Operation Grassland Community 2011). It

forms monotypic stands and inhibits growth of native species as well as reduces soil organic matter. Crested wheatgrass spreads primarily via seed, but may also spread via rhizomes (underground stems). Rates of spread by seed into native mixed grass prairie are up to 2 m/year with median rate of spread at individual sites of 0.2m/year to 0.8 m/year (Henderson and Naeth 2005). Wind and motorized vehicles are key vectors (Henderson 2007). Early detection and control of new infestations of crested wheatgrass into native prairie is recommended (Operation Grassland Community 2011, Saskatchewan Watershed Authority n.d.).

Other invasive non-native plants, such as spotted knapweed (*Centaurea stoebe ssp. micranthos*) and dalmation toadflax (*Linaria dalmatica*), are able to establish in gravelly sites on the Milk River Ridge. Once these species get a foothold they are also very difficult to control. Spotted knapweed (listed as ‘prohibited noxious’ under the *Alberta Weed Control Regulation*), Dalmatian toadflax (listed as ‘noxious’) and crested wheatgrass (not currently listed) are key invasive plant species of concern for the Milk River Watershed Council Canada in their efforts to maintain and improve watersheds (MRWCC 2013).

Crops planted for food and forage: Low
(IUCN category: 2.1 Annual & Perennial Non-Timber Crops)

Cultivation of land for crops has occurred in four known subpopulations of hare-footed locoweed (Whiskey Gap North, Milk River Ridge south of the Ross Grassland Natural Area, Shanks Lake West and Shanks Lake South). Plants persist in narrow bands of native grassland between cultivated fields on the upland and upper valley slopes. Drift of herbicides applied to cropland also is a threat to hare-footed locoweed.

Extensive cultivation has occurred and continues to occur on level areas of the Del Bonita Plateau (MRWCC 2013). Limitations to crop production on the Del Bonita Plateau and Milk River Ridge include steep or rolling topography, low precipitation, short growing season and stoniness, particularly in unglaciated areas (Brierley et al. 1991). Barley is the most common annual crop and some cultivation has been seeded to tame pasture, including use of invasive crested wheat grass (*Agropyron cristatum*).

In the Milk River watershed and the County of Cardston, the footprint of cereal and forage crops is projected to remain stable or decline slightly along with a decrease in the number of farm operations and an increase in average farm size (Silvatech Consulting Ltd. 2011, MRWCC 2013). A 15% increase in tame pasture is predicted due to unintentional degradation of native grassland by invasive plant species and direct conversion of native grasslands (Silvatech Consulting Ltd. 2011). Risk of additional cultivation in hare-footed locoweed habitat is highest on level areas of private land not under a conservation easement.

Restoration of rough fescue grasslands, once disturbed, is notably difficult (Kestrel Research Inc. and Gramineae Services Ltd. 2011).

Unsustainable livestock grazing; Low
(IUCN category: 2.3 Livestock Farming & Ranching)

Livestock ranching (cattle or bison) occurs within all subpopulations of hare-footed locoweed. In four subpopulations there is localized heavy use where livestock congregate at the edge of the plateau. Within two subpopulations (Whiskey Gap North and Shanks Lake West) corrals are located adjacent to hare-footed locoweed habitat resulting in heavy trampling of vegetation and soil disturbance. In addition, within three subpopulations (Whiskey Gap Northeast, Milk River Ridge and Shanks Lake West) there are several sites where disturbance of ground cover and soil instability is occurring as a result of frequent use of trails or loitering by livestock, both cattle and bison, in hare-footed locoweed habitat. Hare-footed locoweed plants are present at these disturbed sites; however, effect on survival of plants and on success of regeneration are unknown.

Hare-footed locoweed evolved with free-ranging large grazers (bison, mule deer, elk and pronghorn). European settlement and replacement of bison by domestic livestock has resulted in enclosed pastures where management dictates pattern, timing and intensity of grazing. Generally in southern Alberta sustainable grazing management is practiced to maintain healthy rangelands, including native plant communities, hydrologic function, nutrient cycling and site stability (Adams *et al.* 2005[b]). Rangeland health assessments on public rangelands in the Milk River watershed in Alberta indicate that 63% of sites are healthy, 29% are healthy with problems, and 8% are unhealthy (MRWCC 2013). Rough fescue grasslands are sensitive to heavy grazing pressure during the growing season but are very tolerant of winter grazing (Dormaar and Willms 1998, Willms and Rode 1998).

Locoweeds are frequently unpalatable to livestock and may increase under grazing pressure. However, repeated, heavy livestock use in hare-footed locoweed habitat, may damage rootstocks through hoof action and reduce soil water content by disturbing the ground vegetation, generally a microbiotic crust of lichens and little club moss. This threat can be addressed through grazing management strategies that avoid repeated and frequent loitering and travel of livestock in hare-footed locoweed habitat.

Oil and gas exploration and development; Low
(IUCN category: 3.1 Oil & Gas Drilling)

Facilities for oil and gas development occur within two subpopulations of hare-footed locoweed, specifically two well sites. One well site, on public land now part of the Sandstone Ranch, appears to have been constructed using minimum disturbance techniques and has a small footprint. The other well site, on the Milk River Ridge south of the Ross Grassland Natural Area, has a much larger disturbance footprint and adjacent habitat is being invaded by non-native species (crested wheat grass).

In the Milk River watershed, exploration and production of hydrocarbon energy is projected to increase along with the disturbance footprint (Silvatech Consulting Ltd. 2011, MRWCC 2013). Over the past decade there has been elevated interest in drilling exploration wells for oil in shale/mudstone beds of the Mississippian Exshaw formation

(referred to as the Upper Bakken pool) along the Alberta/Montana border near Del Bonita, requiring multistage fracturing of the wellbore to extract petroleum (Zaitlin *et al.* 2011, Stonehouse 2013, MRWCC 2013, Alberta Energy Regulator 2014[a]).

Seismic exploration poses little direct harm to native habitats if completed using current industry standards for minimal disturbance. Drilling activity, however, involves developing access routes and well pads for heavy equipment and drill rigs as well as for workers' vehicles; activities that destroy and fragment habitats. Completion and production of oil and gas wells results in additional surface disturbance footprint for installation of infrastructure such as pump-jacks, pipe valves, pipelines, compressor stations and long-term access trails or roads. Besides direct loss of habitat there are on-going adverse effects of operational activities, habitat fragmentation and increased risk of spread of non-native plant species (Bradley 2003).

Once disturbed, habitat for hare-footed locoweed would be difficult, if not impossible, to restore. Proponents of activities that will cause surface disturbance in native prairie and particularly in foothills fescue grasslands are expected to adhere to principles and guidelines set out by the Alberta Energy Regulator (AER 2014[b]) and in Government of Alberta's *Information Letter 2010-02: Foothills Fescue Grassland Principles for Minimizing Surface Disturbance* and detailed guidelines regarding appropriate practice (ASRD 2010, Government of Alberta 2010).

Surface disturbance from gravel extraction; Low
(IUCN category: 3.2. Mining & Quarrying)

Gravel extraction has occurred within three subpopulations of hare-footed locoweed. The one extirpated population south of Cardston may have been lost as a result of gravel extraction, which occurs in the vicinity of the occurrence. One gravel pit, on public land in the Ross Grassland Natural Area, has been abandoned. The other gravel pit in hare-footed locoweed habitat, on private land northwest of Shanks Lake, continues to be active and is expanding.

Gravel pits and leases in the region are associated with extensive gravel deposits of preglacial age on the Del Bonita Plateau and Milk River Ridge as well as with more recent fluvial deposits in the valley of the North Milk River and its tributaries. These gravel deposits are predicted to become an increasingly important source of granular material as population and travel networks grow and gravel sources closer to major population centres are exhausted (Shetsen 1980).

Gravel extraction involves removal of vegetation, soil and overburden and screening and washing to remove finer materials. Gravel extraction can adversely affect ground and surface water. Restoration of larger sites to native plant communities is likely to be problematic, especially when non-native plant species are present.

The abandoned gravel pit in the Ross Grassland Natural Area appears to be on a path towards restoration of rough fescue community, perhaps partly due to its dryness that

mitigates against invasion of non-native species and reclamation that included use of native seed harvested from adjacent grasslands (Willms 2008). Hare-footed locoweed occurs on the edge of the disturbed area, but no plants have been yet found on the disturbed area.

Wind energy development; Low

(IUCN category: 3.3 Renewable Energy)

Wind energy projects have not yet occurred in subpopulations of hare-footed locoweed.

Development of wind power is a relatively new and rapidly expanding land use in southern Alberta. The Del Bonita plateau and Milk River Ridge have high potential for wind power generation (Southern Alberta Alternative Energy Partnership 2009, CanWEA 2013). There are wind farms built (Magrath) or proposed (Old Elm & Pothole Creek) just north of the Milk River Ridge (AESO 2013[a], CanWEA 2015). The Enbridge Montana-Alberta Tie-Line, 300-megawatt, 230-kilovolt electrical transmission line that can support development of wind-powered generation, has recently been completed passing just east of the Milk River Ridge (AESO 2013[b]). In addition, a transmission line is proposed from Pincher Creek south through Mountain View then eastward passing just west and north of the Milk River Ridge to Etzikom (Altalink 240 KV Goose Lake to Etzikom Coulee Transmission Project). This project has been temporarily put on hold by the Alberta Electric System Operator (AESO 2014).

Wind energy projects are recognized as having impacts on native prairie and on wildlife (Foothills Restoration Forum 2010, Government of Alberta 2011[a]). Surface disturbance is estimated to be 0.5–1.5 ha per turbine including area for excavation of foundations and temporary work space during construction, access routes, cables, substations and transmission lines. Besides direct loss of habitat from construction activities, there is potential of invasion of native prairie by non-native plant species from these surface disturbances and ongoing operations.

Principles and guidelines to minimize disturbance have been developed and recommended by a variety of interests in southern Alberta (Foothills Restoration Forum and Native Prairie Working Group 2011). Guidelines used by provincial wildlife managers in reviewing applications for wind energy development include avoidance of native grasslands and other important wildlife habitats, including habitats for Species at Risk (Government of Alberta 2011). Wind energy development is not allowed on public land; however, that provincial policy is being reviewed.

Existing and new roads and vehicle trails; Low

(IUCN category: 4.1. Roads & Railroads)

There are existing roads and trails, used by vehicles, at several sites within five subpopulations of hare-footed locoweed (Whiskey Gap North, Milk River Ridge, Sandstone Ranch, Shanks Lake West, Shanks Lake South). Hare-footed locoweed is not growing on the graded road beds or travel tracks, but plants were observed in the

disturbed gravels along the edges of vehicle trails. Whether there is long-term survival of plants and successful regeneration is a matter for further study.

Road and truck trail density in the Milk River watershed in Alberta is approximately 0.60 km/km² (MRWCC 2013). This density is predicted to increase, with most increase in the area occupied by smaller access roads, private roads and driveways (Silvatech Consulting Ltd. 2011, MRWCC 2013). The extent of increase in roads in hare-footed locoweed habitat is dependent on growth in rural subdivision, country residences, and industrial development (agriculture, oil and gas, wind energy, gravel extraction).

Roads and vehicle trails and their associated edges have major impacts in terms of alteration of hydrologic function, fragmentation of ecosystems, and spread of invasive species as a result of introduction of propagules by vehicles travelling on these routes (Forman and Alexander 1998).

Rural subdivision and residential development; Low
(IUCN category: 1.1 Housing & Urban Areas)

A rural residence and outbuildings as well as an access road, developed a few decades ago, occur in one subpopulation of hare-footed locoweed (Shanks Lake West). Disturbance of soil and vegetation has occurred from building and road construction, although it is not known if hare-footed locoweed plants were destroyed. Invasion of habitat by non-native species is occurring at the site.

Rural population in Cardston County is predicted to remain relatively stable or even decline over the next few decades; however, some subdivision activity continues (Oldman River Regional Services Commission 2011). Plateau edges provide attractive views for rural residential development, although exposure to strong winds may make these sites less attractive. The remoteness from urban centres also mitigates against this threat.

Hare-footed locoweed habitat impacted by residential development is unlikely to be restored.

Recreational motorized use; Low
(IUCN category: 6.1 Recreational Activities)

Motorized access for recreational use of rangelands within subpopulations of hare-footed locoweed is currently at low levels. This is likely because of a low resident human population, lack of popular attractions and restrictions on access placed by private landowners and leaseholders of public lands. Fall access for hunting big game and game birds is likely the largest demand currently. Generally, use of vehicle trails is for the purpose of resource management and by permission only; travel off of designated trails generally does not occur, except for management purposes.

Demand for motorized recreational use may grow as population in nearby urban centres, such as Lethbridge, increases.

Potential impact on hare-footed locoweed from recreational motorized use is direct harm to plants, surface disturbance and spread of invasive plants.

Fire frequency and intensity outside of its natural range of variation; Unknown
(IUCN category: 7.1 Fire & Fire Suppression)

All subpopulations of hare-footed locoweed are subject to fire and fire suppression. Historically fire was a common disturbance agent in prairie that interacted with grazing disturbance to produce a complex mosaic of habitats (Henderson 2006, Romo 2007). The northern Great Plains have been ascribed fire return intervals ranging from 0 to 35 years (Hardy et al. 1999) with great variation across the landscape depending on climate, topography, vegetation, fuel loadings, and ignition by indigenous humans. A recent study estimates a mean fire return interval of 15-20 years in northern Montana during the period 1650-1850 (Guyette *et al.* 2010).

Although the natural fire regime of the Del Bonita plateau and Milk River Ridge is not precisely known, it has been significantly altered today due to changes in land cover and use as well as fire suppression programs of provincial and municipal governments to protect humans and property. Reduced frequency results in higher fuel loadings and more intense fires when they do burn (Zedler 2007). This was recently evidenced by large and intense grassland fires on the eastern portion of the Milk River Ridge in November 2011 and September 2012, caused by accidental ignition during dry conditions accompanied by severe wind (MRWCC 2013).

Habitat for hare-footed locoweed is characterized by low productivity and low litter, hence likely at low risk for intense fire. If unusually intense fires do occur, individual plants may be killed by burning of the root crowns. Fire may help maintain hare-footed locoweed habitat by reducing cover of grasses and forbs that compete for resources; however, this requires further investigation. Hard seeds of hare-footed locoweed stored in the soil may be scarified by fire and released for germination as reportedly occurs in white locoweed (*Oxytropis sericea*) (Gill 1981).

Droughts; Unknown
(IUCN category: 11.2 Climate Change & Severe Weather: Droughts)

Climate change has been identified as one of the key threats to prairie biodiversity (James *et al.* 2001). Scenarios have been developed to evaluate how climate change may affect southern Alberta (Barrow and Yu 2005, Henderson and Sauchyn 2008, TNC 2011). In the area encompassing hare-footed locoweed habitat over the next few decades, mean annual temperature is predicted to increase and, although mean annual precipitation may remain relatively stable, summer precipitation is projected to decrease resulting in greater moisture stress during the growing season.

Specific implications of climate change for hare-footed locoweed subpopulations are unknown. Hare-footed locoweed has obviously survived prolonged periods of drought historically; however, it may not be physiologically tolerant to the extent of moisture stress predicted with warming global climate. Subpopulations may decline or disappear, particularly because of the species' specialized habitat; there is no option to move to higher elevations or northward with shifting natural regions. Alternatively, drought stress may allow hare-footed locoweed to locally expand its habitat if adjacent native plant communities experience decline in cover of grasses and forbs that may currently compete with hare-footed locoweed.

3.2 Indirect Threats

Indirect threats are contributing factors with negative effect(s). Decline of pollinators may be a factor adversely affecting survival of hare-footed locoweed. The species is reliant on native bumble bees (*Bombus* spp.) for pollination, but other insects may be involved as well. Dramatic rangewide population declines of some species of bumble bees in North America have been quantified, whereas the rangewide population of other species has been determined to be stable (Cameron et al. 2011). Climate change, urbanization, agricultural intensification and pathogen pressure have been postulated as the causes for widespread declines in bumble bees.

3.3 Cumulative Environmental Effects

Cumulative effects arise when unmitigated environmental effects from a variety of human activities overlap in time or in space with environmental effects from other activities. Although individually each of the threats identified in the previous sections may not pose significant risk to survival of the provincial population of hare-footed locoweed, together they do.

4.0 Goals and Objectives

4.1 Goal

Maintain current distribution and subpopulations of hare-footed locoweed in Alberta.

4.2 Objectives

1. Inventory and monitoring: Refine estimates for provincial extent of occurrence and population size and design and implement a protocol to monitor population trends
2. Habitat management: Develop and implement a strategy to protect habitat for hare-footed locoweed from surface disturbances resulting from a variety of land uses. Additionally support regional approaches to land use planning that address cumulative environmental effects; develop and implement a plan for control of invasive non-native plants; and, address localized heavy livestock use.
3. Research: Define and resource research on life history and ecology of hare-footed locoweed that advances conservation and management approaches.

4. Information and Outreach: Prepare information materials on hare-footed locoweed and deliver to appropriate audiences through appropriate mechanisms.

5.0 Management Actions

5.1 Inventory and Monitoring

This section identifies management actions related to inventory and monitoring of the provincial population that are required to conserve hare-footed locoweed. If and when hare-footed locoweed is added to the *List of Wildlife Species at Risk* (Schedule 1) under the federal *Species at Risk Act* as Threatened (based on the May 2014 assessment by COSEWIC), then inventory and monitoring activities could be coordinated through a recovery team set up under the federal species at risk program. This cooperation and coordination would help ensure effective and efficient use of funds and labour.

Refine estimates for provincial extent of occurrence and population size

Completing a baseline survey of potential hare-footed locoweed habitat to address gaps in the 2011 survey would refine estimates for provincial extent of occurrence and population size. It would also provide a more complete understanding of threats. Focus would be on the following:

- a) Re-locate two occurrences that are considered extant but which lack precision as to their exact location - Whiskey Gap South, last visited in 1992, and North Milk River Terrace, last visited in 1996
- b) Define the full extent of three subpopulations - Sandstone Ranch, Shanks Lake West and Shanks Lake South – by expanding the search beyond the area surveyed in 2011.
- c) Search for new occurrences. Use models (e.g., habitat suitability and/or species distribution models) to predict priority search areas for new subpopulations. Potentially suitable habitat may occur on gravel, or shallow to gravel and limy soils (as defined by the Grassland Vegetation Inventory) on the east side of the North Milk River valley north of the international boundary, along the Shanks Creek valley, and along the west side of an unnamed valley southeast of Del Bonita.

Building on the methodology and findings in the 2011 survey would ensure consistency in data collected to serve as a benchmark for future monitoring. The 2011 methodology was informed by standardized guidelines for occupancy surveys for plant species at risk (Henderson 2010).

To assist provincial survey effort, partnerships with Alberta Conservation Association and Nature Conservancy Canada may be considered for land trust property within the North Milk River Terrace and Sandstone Ranch subpopulations. Rare plant surveys by companies proposing development within the extent of occurrence of hare-footed locoweed may also assist the provincial effort, provided surveys are conducted according to the guidelines for rare vascular plant surveys in Alberta (ANPC 2012) and the results are filed with ACIMS including information on areas and search effort where no rare plants were detected.

Develop and implement a protocol to monitor population trends

Repeated surveys in known subpopulations are needed to establish population trends. A monitoring protocol includes the sampling design, data collection methods, data analysis methods, and reporting structure (Vesely *et al.* 2006). Relevant population measures may include extent of occurrence, frequency of occurrence (presence/absence), density, or total population size (a complete census). Permanent plots (or transects) monitored over a long term are likely appropriate for hare-footed locoweed. Sampling design must consider the sample size that will meet the desired levels of precision and power for detecting a significant change (e.g., 95% confident of detecting a 30% change) (Elzinga *et al.* 1998). Other considerations include the size, shape, and spacing of sampling units. Preferred timing of sampling of the hare-footed locoweed population is late spring (mid-May to mid-June) when plants are in flower. Since individual plants are discernible and likely long-lived (>5 years) sampling may need to occur every year for the first few years (to assess if there is prolonged dormancy of the rootstock) and then every 5-10 years; unless a major environmental change is suspected. Cost efficiency (e.g., ease of access) may be a consideration when selecting sites to be sampled. Responsibility for data storage (e.g., ACIMS database) and analysis would need to be defined.

5.2 Habitat Management

Develop and implement a strategy to protect habitat of hare-footed locoweed from further surface disturbance resulting from land use

Surface disturbance in and near habitat of hare-footed locoweed is caused by a variety of land uses including gravel extraction, cultivation for crops, oil and gas development, wind energy development, residential development, and vehicle access roads and trails. A list of components to be considered in a strategy to protect habitat from further surface disturbance follows. Many of these measures could be applied to conservation strategies for other prairie plant species at risk, a natural region approach that would help ensure consistency in approach and effective and efficient use of funds and labour.

- Incorporating occurrences of hare-footed locoweed into Environment and Park's Landscape Analysis Tool, a web-enabled spatial tool that assists users to plan activities on public land (AESRD 2014). Operational constraints that may apply to an activity in or near habitat for hare-footed locoweed can then be identified by the proponent prior to making an application.
- Provide effective protection for this species and other rare plants, i.e., regulations
- Defining and implementing activity set-back distance guidelines for hare-footed locoweed as is recommended for selected wildlife species provincially (Government of Alberta 2011[b]) and for prairie plant species at risk federally (Henderson 2011). These guidelines apply on both public and private land.
- Identifying any parcels of public land with hare-footed locoweed habitat that may be eligible for transfer to the municipality (i.e., tax recovery land) and ensuring these are maintained under ownership of the crown.
- Reviewing protective notations (PNTs) placed on foothills fescue grassland on public land for inclusion of hare-footed locoweed habitat and address any gaps.

- Working with land trust organizations (e.g., Nature Conservancy Canada) to identify private land parcels where conservation easements will be explored.
- Ensuring provincial and municipal government staff, responsible for reviewing applications for developments in or near habitat for hare-footed locoweed on public and private lands, are aware of, and guided by, the principles regarding avoiding and minimizing disturbance of native prairie contained in Government of Alberta *Information Letter 2010-02* associated with the foothills fescue PNTs (Government of Alberta 2010), in Alberta Energy Regulator *Manual 007: Principles for Minimizing Surface Disturbance in Native Prairie and Parkland Areas* (AER 2014), and in Government of Alberta *Wildlife Guidelines for Alberta Wind Energy Projects* (Government of Alberta 2011[a]). The *Recommended Principles and Guidelines for Minimizing Disturbance of Native Prairie from Wind Energy Development* (Foothills Restoration Forum and Native Prairie Working Group 2011) also provide sound guidance.
- Engaging local landowners, infrastructure managers who manage construction and maintenance of roadways at various scales (counties, cities, towns as well as Alberta Transportation), local/rural municipalities that are involved with gravel extraction, and Alberta Environment and Parks land and environment managers who are responsible for codes of practice related to gravel/aggregate extraction on private lands in order to explore ways to minimize threats to hare-footed locoweed populations and habitat
- Working with Cardston County and County of Warner to ensure avoidance of habitat for hare-footed locoweed is considered in making decisions about rural residential subdivision and development.
- Identifying where access management plans that avoid vehicle use in habitat for hare-footed locoweed are needed and working with land managers and users to define these.

Support regional approaches to land use planning that address cumulative environmental effects

Conservation of the provincial population of hare-footed locoweed, and other prairie plant species at risk, would benefit from regional approaches to land use planning particularly on the Milk River Ridge (Prairie Conservation Forum 2011, NCC 2013, Government of Alberta 2014). Directions of the South Saskatchewan Regional Plan 2014-2024, Biodiversity and Ecosystems section, that contribute to conservation of hare-footed locoweed habitat include: 1) Maintaining intact native grasslands and habitat; 2) Creating an interconnected network of conservation areas on Crown land and conservation efforts on private land; 3) Minimizing linear footprint disturbance through linear footprint management planning; and, 4) Recovering species at risk. There may be opportunity to address conservation of hare-footed locoweed during implementation of the South Saskatchewan Region Biodiversity Management Framework.

Develop and implement a plan for control of invasive non-native plants in and near habitat for hare-footed locoweed.

A plan to control invasive non-native plants in and near hare-footed locoweed habitat may include the following components:

- Mapping the extent of infestation of crested wheat grass and other invasive species and assess level of threat at known locations of hare-footed locoweed (within the Whiskey Gap North, Milk River Ridge, Sandstone Ranch, Shanks Lake West and Shanks Lake South subpopulations). This task may be combined with survey to inventory and monitor trends in the population of hare-footed locoweed.
- Prioritizing locations for attempting control of invasion using criteria such as proximity of invasive species to hare-footed locoweed habitat and feasibility of implementing control measures. For example, a long-term process of grazing/mowing and or burning prior to seed set over at least five years followed by spot application of herbicide are the recommended management techniques for control of crested wheatgrass (Operation Grassland Community 2011, Saskatchewan Watershed Authority n.d.).
- Identifying and engaging partners with a common interest to implement control measures (landowners, municipal agricultural fieldmen, conservation organizations (ACA, NCC, MULTISAR), Alberta Invasive Species Council, industry interests,). An example of such a cooperative effort is control of baby's breath in habitat for tiny cryptanthus (national and provincial listed species at risk) in Medicine Hat (Allen 2013).

Work with livestock producers to address issues of heavy livestock use at specific locations in habitat for hare-footed locoweed

There are a small number of locations where large numbers of livestock are repeatedly loitering in habitat for hare-footed locoweed. Animals may be seeking cooling breezes and relief from biting insects or regularly travelling through to access salt blocks and corrals. Although locoweeds are generally unpalatable to livestock and have evolved with extensive grazing pressure, intense hoof action harms individual plants and destroys the microbiotic crust that may be important in retaining moisture and nutrients for hare-footed locoweed. This threat may be addressed through informing relevant livestock producers of the issues and assisting with implementing alternative livestock management to avoid heavy livestock use in hare-footed locoweed habitat. Experienced, non-government organizations that may assist in this effort include MULTISAR and NCC.

5.3 Research

Work with appropriate research interests to define and resource research on various aspects of the life history and ecology of hare-footed locoweed that will inform conservation management. Conservation of hare-footed locoweed would benefit from research regarding various aspects of its life history and ecology, including:

- Longevity of individual plants, age of first reproduction, frequency of flowering (is there prolonged dormancy of the rootstock?), and age structure of population. Long-term monitoring of permanent plots may be required.
- Pollinating agents.

- Seed predation.
- Size of seed bank and longevity of viable seed.
- Association with nitrogen-fixing bacteria, rhizobia.
- Influence of microbiotic crust of lichens and little club moss on hare-footed locoweed.
- Fire effects on plants and seed.
- Genetic variation between and within hare-footed locoweed subpopulations.
- Connectivity and gene flow among subpopulations.

Research interests include faculty and students in universities and colleges, government agencies with a responsibility for monitoring biodiversity, (e.g., Alberta Biodiversity Monitoring Institute) and non-government organizations interested in prairie conservation including Alberta Conservation Association, MULTISAR, Foothills Restoration Forum, Prairie Conservation Forum and Alberta Native Plant Council.

5.4 Information and Outreach

Prepare information materials on hare-footed locoweed and deliver to appropriate audiences through appropriate mechanisms.

Define information that needs to be communicated related to the status, biology, habitat, threats and recovery of hare-footed locoweed. Deliver this information through a variety of mechanisms (informal conversations, formal presentations, written correspondence, articles in newsletters and newspapers, factsheets, website postings, written reports) to relevant audiences including affected landowners and grazing leaseholders, public land managers and regional planners, regulatory agencies, industries operating in or near habitat, prairie conservation organizations and the interested public. Where appropriate, deliver this information together with information on other species-at-risk in fescue grasslands on the Milk River Ridge. Consider introducing training about rare plant identification during Public Lands training days. Outreach efforts would benefit from involvement of non-government organizations with experience in working with rural landowners on ranch management planning that considers species at risk (e.g., MULTISAR).

6.0 Summary

This conservation management plan for hare-footed locoweed, a *Species of Special Concern* in Alberta, provides guidance for land and resource management decisions that affect the species and its habitat.

Hare-footed locoweed (*Oxytropis lagopus* var. *conjugens*) occurs in a highly specialized habitat on the Milk River Ridge and Del Bonita Plateau. Eleven subpopulations and one historical subpopulation are known (extent of occurrence is estimated to be 230 km²). Cumulatively, a variety of land uses pose a threat to the hare-footed locoweed population in Alberta.

Management actions recommended to maintain current distribution and subpopulations of hare-footed locoweed in Alberta include the following:

1. Inventory and monitoring: Refine estimates for provincial extent of occurrence and population size and design and implement a protocol to monitor population trends.
2. Habitat management: Develop and implement a strategy to protect habitat for hare-footed locoweed from surface disturbances resulting from a variety of land uses. Additionally support regional approaches to land use planning that address cumulative environmental effects; develop and implement a plan for control of invasive non-native plants; and, address localized heavy livestock use.
3. Research: Define and resource research on life history and ecology of hare-footed locoweed.
4. Information and Outreach: Prepare information materials on hare-footed locoweed and deliver to appropriate audiences through appropriate mechanisms.

This management plan will be reviewed in five years, and may be updated prior to that time if new relevant information becomes available.

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(as of May 2016)

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- No. 2 Sprague's Pipit Conservation Management Plan, 2010-2015.
- No. 3 Long-billed Curlew Conservation Management Plan, 2010-2015.
- No. 4 Harlequin Duck Conservation Management Plan, 2010-2015.
- No. 5 Weidemeyer's Admiral Conservation Management Plan, 2012-2017
- No. 6 Western Small-footed Bat Conservation Management Plan, 2012-2017
- No. 7 White-winged Scoter Conservation Management Plan, 2012-2017
- No. 8 Bull Trout Conservation Management Plan, 2012-2017
- No. 9 Prairie Falcon Conservation Management Plan, 2012-2017.
- No. 10 Black-throated Green Warbler, Bay-breasted and Cape May Warbler Conservation Management Plan, 2014-2019.
- No. 11 Great Plains Toad Conservation Management Plan, 2015-2020.
- No. 12 Prairie Rattlesnake Conservation Management Plan, 2015-2020.
- No. 13. Hare-footed Locoweed Conservation Management Plan (2016).