Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Rayless Goldfields (*Lasthenia glaberrima*) in Canada

Rayless Goldfields

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Canada

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PREFACE

The federal, provincial, and territorial government signatories under the *Accord for the Protection of Species at Risk* (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years.

The Minister of the Environment and the Minister responsible for the Parks Canada Agency is the competent minister for the recovery of the Rayless Goldfields and has prepared this strategy, as per section 37 of SARA. It has been prepared in cooperation with Environment Canada and the provincial government of British Columbia.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada or the Parks Canada Agency, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Rayless Goldfields and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment Canada and/or the Parks Canada Agency and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

The Rayless Goldfields is a species that inhabits vernal pools associated with Garry Oak ecosystems and recovery of this species will be integrated with the recovery of species in the Recovery Strategy for Multi-Species at Risk in Vernal Pools and Other Ephemeral Wet Areas in Garry Oak and Associated Ecosystems in Canada (Parks Canada Agency 2006).

RECOMMENDATION AND APPROVAL STATEMENT

The Parks Canada Agency led the development of this federal recovery strategy, working together with the other competent minister(s) for this species under the Species at Risk Act. The Chief Executive Officer, upon recommendation of the relevant Park Superintendent(s) and Field Unit Superintendent(s), hereby approves this document indicating that Species at Risk Act requirements related to recovery strategy development have been fulfilled in accordance with the Act.

Recommended by:

Helen Davies
Field Unit Superintendent, Coastal BC, Parks Canada Agency

Approved by:

Alan Latourelle
Chief Executive Officer, Parks Canada Agency

ACKNOWLEDGMENTS

Thank you to Matt Fairbarns for writing the draft recovery strategy. The Garry Oak Ecosystems Recovery Team is the recovery team for the Rayless Goldfields and was involved in the development of this recovery strategy. Further revision was the result of comments and edits provided by a number of organizations: the Province of British Columbia, Parks Canada Agency, and Environment Canada.

EXECUTIVE SUMMARY

The Canadian population of the Rayless Goldfields (*Lasthenia glaberrima*) was assessed as Endangered in 2008 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and in February 2010 the population was listed as Endangered under Canada's *Species at Risk Act* (SARA) affording it legal protection.

Rayless Goldfields is a low, sprawling annual plant with bright yellow, tansy-like flowers. The range of this species extends from Vancouver Island south to central California, west of the Cascade Mountains. In Canada, a single Rayless Goldfields population is known in southwestern British Columbia, near Victoria (COSEWIC 2008). It is estimated that the Canadian population of Rayless Goldfields comprises <1% of its global range.

The key factors limiting the recovery and survival of the Rayless Goldfields population in Canada are its specificity to rare vernal habitats, a small single isolated Canadian population and limited dispersal abilities and seed bank. The Rayless Goldfields population is threatened by encroachment of invasive alien species, grazing by vertebrate herbivores, trampling by park visitors and climate change as it relates to reduced precipitation and moisture.

In the short term, recovery activities for Rayless Goldfields will focus on the maintenance of habitat at the single known location while the feasibility of population restoration is assessed. Broad strategies to be taken to address the threats to the survival and recovery of the Rayless Goldfields are presented in section 6 Broad Strategies and General Approaches to Meet Objectives.

Critical habitat believed to be sufficient for the recovery for Rayless Goldfields is identified in this recovery strategy to the extent possible based on best available information.

Further recovery action for Rayless Goldfields will be incorporated into one or more action plans by September 2017.

RECOVERY FEASIBILITY SUMMARY

Recovery of this species is considered feasible based on the criteria outlined by the Government of Canada (2009):

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.

Yes. The single Canadian population is presumed to persist in the soil seed bank with a potential to germinate and produce viable seed, which can be used for recovery purposes. Even if the seed bank disappears, the species is ranked as globally secure (G5) and seed could be collected from populations in an adjacent jurisdiction and used to restore the population.

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

Yes. The habitat of the sole Canadian population is still capable of supporting the species and its carrying capacity for Rayless Goldfields could be improved by taking appropriate measures to control invasive alien plant species.

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

Yes. Threats to sole site, such as competition from invasive alien plant species and trampling, can be reduced by a regular program to maintain the site. Other threats, such effects of climate change will be more difficult to mitigate. However, at the present there is no evidence of unavoidable threats to the species or its habitat that preclude recovery.

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

Yes. There are effective techniques for controlling invasive alien herbaceous and shrubby species; as well, park users and vertebrate grazers can be excluded from populations of rare plants. It is possible to mitigate the loss of populations as a result of climate change by saving seed and population establishment techniques have been developed for remaining habitats in adjacent jurisdictions suited to the species (Anon 2003).

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1. COSEWIC Species Assessment Information

Date of Assessment: April 2008

Common Name: Rayless Goldfields

Scientific Name: *Lasthenia glaberrima*

COSEWIC Status: Endangered

Reason for Designation: A single very small population of an annual flowering plant that is at continued risk from a number of limiting factors including the spread of invasive alien plants.

Canadian Occurrence: British Columbia

COSEWIC Status History: Designated Endangered in April 2008. Assessment based on a new status report.

2. Species Status Information

The Canadian population of the Rayless Goldfields (*Lasthenia glaberrima*) was assessed as Endangered in 2008 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and in February 2010 the population was listed as Endangered under Canada's *Species at Risk Act* (SARA) affording it legal protection. Conservation ranks for Rayless Goldfields in other jurisdictions where it occurs are provided in Table 1.

There is no estimate of global abundance but the ranking suggests that the Canadian population constitutes < 1% of the global population.

Table 1.Conservation ranks for Rayless Goldfields. Sources: B.C. Conservation Data Centre 2010, NatureServe 2010.

Location	Rank*	Rank description
Global	G5	Secure
Canada	N1	Critically imperilled
British Columbia	S1	Critically imperilled
United States	NNR	Not ranked
California	SNR	Not ranked
Oregon	SNR	Not ranked
Washington	S1	Critically imperilled

*NatureServe Conservation ranks are based on a one to five scale, ranging from critically imperilled (1) to demonstrably secure (5). Status is assessed and documented at three distinct geographic scales global (G), national (N), and state/province (S).

3. Species Information

3.1. Species Description

Rayless Goldfields is a low, sprawling annual plant with bright yellow, tansy-like flowers. A detailed description of the species is provided in the status report (COSEWIC 2008).

3.2. Population and Distribution

Globally, Rayless Goldfields range from Vancouver Island south, mostly west of the Cascade Mountains, to central California (Figure 1). The nearest United States record is from Klickitat County (Washington State) about 300 km to the south.

In Canada, Rayless Goldfields is known from a single site, Creyke Point, near Victoria, British Columbia (Figure 2). The Canadian population has fluctuated between 0 and 200 plants since it was discovered in 2003, and has never occupied an area of more than 40 m^2 (Fairbarns pers. comm. 2010). The species has not been observed at the Canadian site since 2007 but may persist in the soil seed bank (Fairbarns pers. comm. 2010). Further information on the population is provided in the status report (COSEWIC 2008).

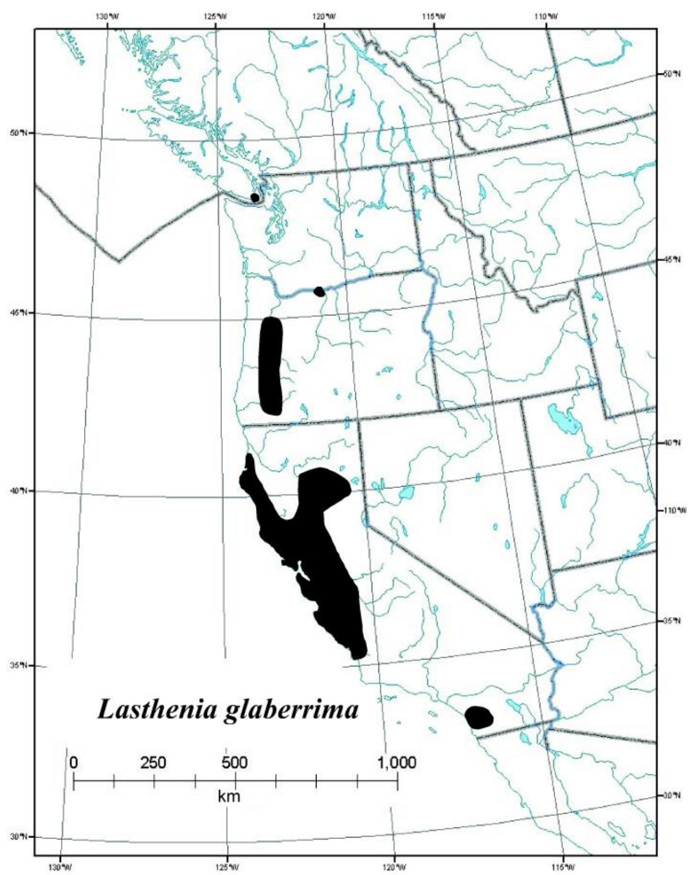

Figure 1. Distribution of Rayless Goldfields in North America (from COSEWIC 2008). Solid black regions indicate native species range.

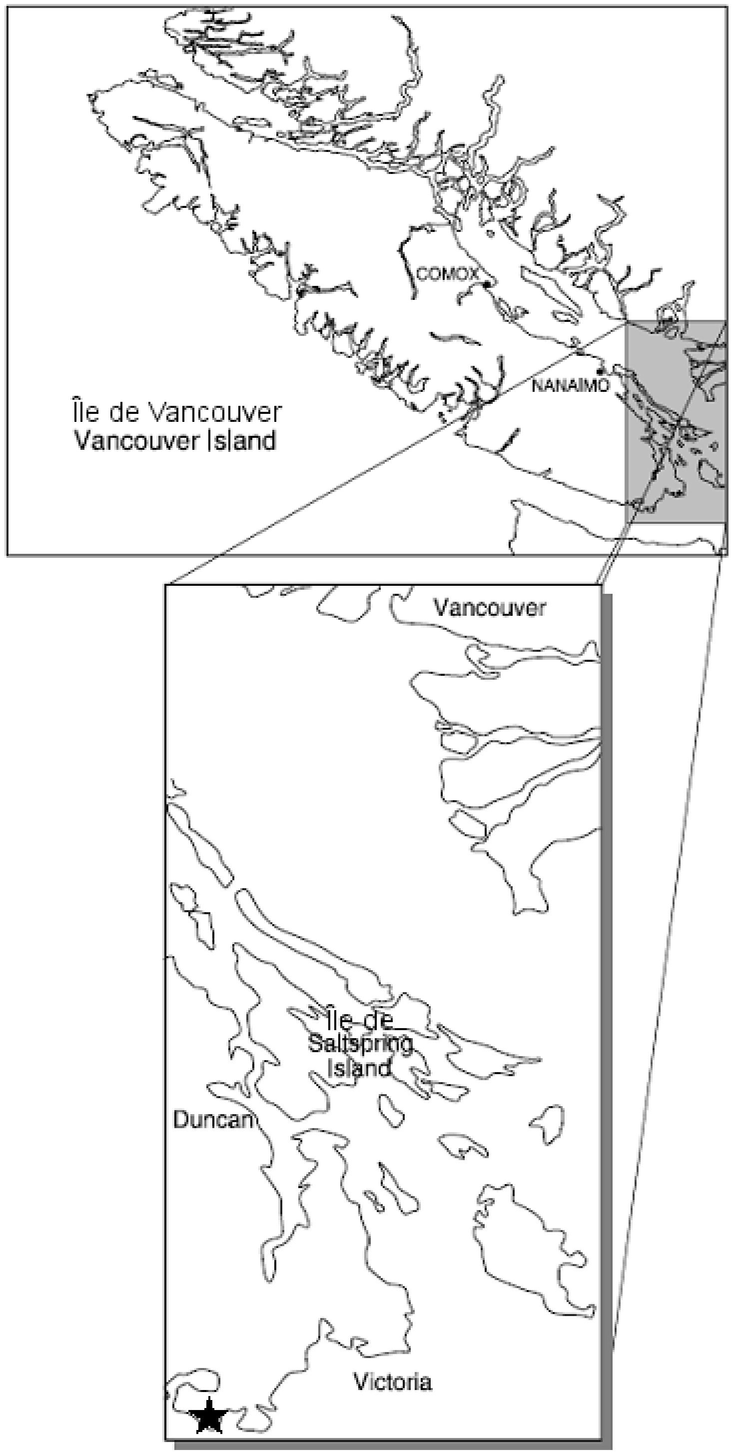

Figure 2. Range of Rayless Goldfields in Canada (from COSEWIC 2008). Star indicates location of single site for Rayless Goldfields in Canada.

3.3. Needs of the Rayless Goldfields

Rayless Goldfields generally occur in wet open places, often in muddy vernal pools or on muddy ground on perched water tables (Peck 1941; Hitchcock *et al.* 1955; Ornduff 1993; Segotta pers. comm. 2004). The single British Columbia site is a rock-bound vernal pool on a rocky shoreline bluff about 15 m above sea level (Figure 3). The vernal pool has a thin layer of medium-textured soil above gneissic bedrock. It begins to moisten with the first rains in late summer or early fall and remains saturated or inundated for long periods throughout the winter and early spring. The soil gradually dries out with the onset of summer drought and is quite dry from mid-June to late August or early September. Annual herbaceous species, including Large Water-starwort *(Callitriche heterophylla*), Slender Plantain (*Plantago elongata*), and Rayless Goldfields itself, dominate the site.

Figure 3. The Habitat of Rayless Goldfields at Creyke Point: Left, vernal pool drying out (Rayless Goldfields are at the back of the vernal pool behind the packsack); Middle, muddy edge of vernal pool with Rayless Goldfields in flower; Right, vernal pool after the soil has dried out and Rayless Goldfields has withered and died.

Rayless Goldfields is well-adapted to the strong seasonal fluctuations in moisture regime characteristic of rock-bound vernal pools. It is tolerant of the saturated conditions that prevail during its period of germination and early growth, conditions that limit the growth of competing perennial vegetation. It conducts its early growth as a submerged plant but as the pool dries, the aerial stems grow rapidly. Like many other vernal pool annuals, at least some species of Goldfields tend to vary considerably depending on fluctuations in precipitation. Plants may be small, few-leaved and few-flowered in a dry year and immense and highly branched in a more favourable year. Further habitat information is provided in the status report (COSEWIC 2008).

Factors that limit the survival and recovery of the Canadian population of Rayless Goldfields include:

- Fruits and seeds are poorly adapted for long distance dispersal.
- There are no U.S. populations within 300 km of Canada, which severely limits the potential for a rescue effect.
- Annual life cycle, and the possibility that seed banks are short-lived predispose the population to collapse or complete failure if the dry spring/summer period arrives early, before the plants can produce sufficient seed to replenish the transitory seed bank.
- Very small area of physical occupancy leaves it susceptible to extirpation through chance events that would not pose a risk to larger or more extensive populations.

4. Threats

4.1. Threat Assessment

Table 2. Threat Assessment Table

Threat	Level of Concern[1]	Extent	Occurrence	Frequency	Severity[2]	Causal Certainty[3]
Alien, invasive or introduced species						
Invasion by invasive alien herbaceous plants	High	Localized	Current	Continuous	High	Medium
Invasion by invasive alien shrubs	Medium-low	Localized	Anticipated	Unknown	High	Medium
Natural processes or activities						
Grazing by vertebrates	Medium	Localized	Current	Recurrent	Medium / Low	Medium
Disturbance or harm						
Trampling by park visitors	Medium	Localized	Current	Recurrent	Medium / Low	Medium
Climate and natural disasters						
Changes in hydrology, specifically drought	Medium	Localized	Anticipated	Seasonal	Unknown	Medium

[1] Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the recovery of the species, consistent with the population and distribution objectives. This criterion considers the assessment of all the information in the table).
[2] Severity: reflects the population-level effect (High: very large population-level effect, Moderate, Low, Unknown).
[3] Causal certainty: reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability; Medium: there is a correlation between the threat and population viability e.g., expert opinion; Low: the threat is assumed or plausible).

4.2. Description of Threats

4.2.1. Alien, invasive or introduced species

The most serious threat to Rayless Goldfields is the competitive pressure exerted by invasive, alien, herbaceous plants that pre-empt space where it might otherwise germinate and grow (Table 2). These invasive alien plants compete for space, and late season nutrients of the Rayless Goldfields. The most abundant of these invasive alien plant species, at present, are four grasses: Creeping Bentgrass (*Agrostis stolonifera*), Water Meadow-foxtail (*Alopecurus geniculatus*), Sweet Vernal Grass (*Anthoxanthum odoratum*), and Annual Bluegrass (*Poa annua*) and two forbs: Hairy Cat's-ear (*Hypochaeris radicata*) and Sheep Sorrel (*Rumex acetosella*). Creeping Bentgrass and Water Meadow-foxtail pose the greatest threat because they occupy much of the preferred habitat for Rayless Goldfields. The other four species prefer slightly drier sites where Rayless Goldfields is less likely to flourish, except in unusually favourable (i.e., wet) years. Accordingly, this threat is considered to be a 'high' level of concern.

A threat of lower concern is invasive alien shrubs such as Scotch Broom (*Cytisus scoparius*) growing in adjacent habitat and shading the micro-site occupied by Rayless Goldfields. Shading caused by adjacent Scotch Broom growth can result in increased mortality, reduced growth, and lower reproductive success for Rayless Goldfields. Scotch Broom is currently present in the vicinity of the population, but not yet affecting it. The threat posed by Scotch Broom may decline if projected increases in summer moisture deficits come to pass (Rodenhuis *et al.* 2007), since site conditions are already marginal for the species. This threat is considered to be of 'medium to low' level of concern.

4.2.2. Natural processes or activities

Grazing removed some or all of the flower heads from eight of twenty plants in 2005 and two of twenty-one plants in 2006, thereby reducing reproductive success (Fairbarns pers. obs.). No data are available for any other years. The identity of the grazers is unknown but the most likely species are the native Columbia Black-tailed Deer (*Odocoileus hemionus columbianus*) and/or the alien Eastern Cottontail Rabbit (*Sylvilagus floridanus*), both of which occur in the area. A split-rail fence established in 2005 (Figure 4) to protect the population may have reduced grazing pressure, but this has not been investigated. Based on the observations cited above, this threat is considered to be a 'medium' level of concern.

4.2.3. Disturbance or harm

Prior to the 2006 growing season, park visitors frequently trampled the population, which occurs at a viewpoint at the end of a short hiking trail. The trampling damage was most severe during the period when seeds were forming, by which time standing water had disappeared and the habitat was reduced to a shallow lens of mud above bedrock. Low rock outcrops on either side of the population funnelled walkers right through the population once standing water had disappeared. The split-rail fence, signed with a notice requesting that visitors avoid the area in order to spare a recovering ecosystem, appears to have greatly reduced foot traffic (Figure 4).

Based on the observations cited above, this threat is considered to be a 'medium' level of concern.

4.2.4. Climate and natural disasters

Climate change has the potential to cause devastating effects on vernal pool environments. The small vernal pool which supports Rayless Goldfields lacks the capacity to buffer changes in hydrology which might arise from decreasing rainfall or increasing temperatures. Research predicts warmer conditions and drier summers in southwestern British Columbia as part of a broader pattern of global climate change (Rodenhuis *et al.* 2007). Moisture deficits, which may arise in early May, result in plants dying from moisture stress by late May or June. The vernal pool provides no alternative habitat if conditions become drier than they are now and there are no similar pools within the normal dispersal distance of the fruits. Consequently, future changes in hydrology as a result of global climate change may become the dominant threat to Rayless Goldfields in Canada. Accordingly, this threat is considered to be a 'medium' level of concern.

5. Population and Distribution Objectives

In Canada, Rayless Goldfields has only been known to exist in a single vernal pool associated with Garry Oak ecosystems and as such has a naturally, highly restricted range. It is possible that other populations existed historically but were lost as a result of significant habitat loss since European settlement (Lea 2006). Invasive alien herbaceous plants and shrubs, and trampling pose current threats to the persistence of the species (COSEWIC 2008).

In general, it is believed that multiple populations and thousands of individuals are likely required to attain a high probability of long-term persistence for a species (Reed 2005, Brook *et al.* 2006, and Traill *et al.* 2009). In an analysis of several published estimates of minimum viable population (MVP) sizes, Traill *et al.* (2007) found that the median population size required for plants to achieve a 99% probability of persistence over 40 generations was approximately 4,800 individuals (but see Flather *et al.* 2011, Garnett and Zander 2011, and Jamieson and Allendorf 2012 for critical evaluations of the analyses and the applicability of the results). Such information provides a useful guide, but developing specific quantitative and feasible objectives must consider more than just generalized population viability estimates, including the historic number of populations and individuals, the carrying capacity of extant (and potential) sites, the needs of other species at risk that share the same habitat, and whether it is possible to establish and augment populations of the species (Parks Canada Agency 2006, Flather *et al.* 2011, Jamieson and Allendorf 2012). Because not enough of this information is available for Rayless Goldfields, it is currently not possible to determine to would constitute recovery and therefore it is not possible to establish quantitative long-term objectives. Recovery planning approaches (see Section 6) are designed to respond to knowledge gaps so that long-term, feasible, and quantitative recovery objectives regarding size and number of populations can be set in the future. At this time it is possible to set a short-term objective that focuses on maintaining habitat at Creyke Point while the feasibility of population restoration is assessed:

Objective 1: Maintain the habitat at the Creyke Point site while the feasibility of population restoration is assessed for Rayless Goldfields.

6. Broad Strategies and General Approaches to Meet Objectives

Broad strategies and approaches to meet the population distribution objectives for Rayless Goldfields include:

- Habitat and species protection: protect the single documented population and habitat from destruction (e.g., land conversion, tramping, and grazing) by developing mechanisms/instruments for protection;
- Stewardship: engage and involve landowners in recovery activities and decisions for Rayless Goldfields;
- Population restoration: develop and test population reintroduction/augmentation techniques to recover the species;
- Population monitoring: monitor population and habitat trends and threats;
- Research: address knowledge gaps pertaining to seed bank longevity, gene conservation, determination of the carrying capacity of the vernal pool, and threats.

6.1. Actions Already Completed or Currently Underway

General actions to protect and recover species at risk on southern Vancouver Island and the Gulf Islands are underway as part of the umbrella recovery program of the Garry Oak Ecosystems Recovery Team (GOERT; http://www.goert.ca). The landowner, Capital Regional District (CRD) Parks, has established a fence around the vernal pool at Creyke Point, where the population exists, to protect it from visitor traffic (Figure 4). The Rayless Goldfields population was protected during fence construction by conducting the work after the plants had withered and by covering the occupied habitat with a protective cloth to ensure that no materials were placed on the top. A volunteer effort has been initiated to conduct annual visits to count population size and note evidence of threats and limiting factors. CRD Parks staff have also been presented with training on species at risk management with specific reference to the Rayless Goldfields population.

Figure 4. Crew constructing fence around vernal pool.

6.2. Strategic Direction for Recovery

Table 3. Recovery Planning Table

Threat or Limitation	Priority	Broad Strategy to Recovery	General Description of Research and Management Approaches
Invasion by invasive alien herbaceous plants Invasion by invasive alien shrubs Trampling by park visitors	High	Habitat and species protection	• Describe habitat for Rayless Goldfields (especially the habitat attributes associated with extant U.S. populations of Rayless Goldfields nearest to the species range in Canada) and refine critical habitat attributes. • Establish protection mechanisms/instruments for critical habitat.
	High	Stewardship	• Prepare site specific Best (Beneficial) Management Practices guidelines for Rayless Goldfields to assist CRD park staff in stewardship activities in response to current and expanding threats. • Engage landowners and land managers in recovery decisions and activities.
	Medium	Population restoration	• Develop and implement a population restoration plan for the habitat of the existing population (including a monitoring component). • Determine long-term species-specific population thresholds and targets. • Determine the carrying capacity of the vernal pool for this species.
Changes to hydrology, specifically drought Population size and extent knowledge gaps	Medium	Population Monitoring	• Design and implement a monitoring program consistent with COSEWIC assessment protocols to track population and habitat trends for 10 successive years, with subsequent monitoring as required. • Identify the demographic criteria that would trigger immediate re-evaluation of recovery priorities and activities.
Grazing by invertebrates/vertebrates Knowledge gaps concerning genetic diversity, seed bank pollination and population size	Low	Research	• Design and implement soil seed bank studies. • Assess and conserve genetic diversity of extant population of Rayless Goldfields in Canada. • Investigate potential herbivory effects by insects or vertebrate grazers on the population. • Investigate pollination mechanism and limitations.

6.3. Narrative to Support the Recovery Planning Table

Stewardship and habitat protection are critical to maximize the carrying capacity of the existing Rayless Goldfields site (Table 3). Stewardship involves developing best management practices to increase awareness and engage the CRD Parks staff in recovery decisions and activities. Effective best management practices must also be adaptive, and therefore, monitored, evaluated, and adjusted if necessary. Given the small size of the population, current and expanding threats to the habitat and population must be reduced at the existing site.

Monitoring and research will guide the protection and restoration of the Canadian population of Rayless Goldfields by providing basic demographic information on the species. Initial steps will address knowledge gaps related to the species' habitat requirements, population biology, potential population size, and propagation requirements. The most important priorities include: analysis of monitoring data to determine if the population is stable, declining, or increasing over time; identification of life stages most prone to mortality; determination of soil seed bank longevity; determination of necessary conditions for germination and establishment; and identification of the population size necessary for long-term persistence within the vernal pool and/or the habitat limits on maximum population size in the existing habitat. Population restoration techniques must also be developed so that the existing population can be augmented or, should it become extirpated, replaced. Lastly, recovery of Rayless Goldfields will benefit greatly from an analysis of habitat conditions associated with the nearest extant U.S. populations of Rayless Goldfields.

Design of the monitoring program is an important consideration, especially for rare annual plants which are likely to exhibit population fluctuations or rely on seed banks (Bush and Lancaster 2004). Data should be collected regularly over several years to account for population fluctuations. Further data should be collected in years when plants are absent as well as when they are present to provide information on the species responses to environmental conditions. When seed banks are involved, they are an important part of the lifecycle and must be considered in estimates of population size—the presence of even one individual may indicate a viable seed bank is present (Bush and Lancaster 2004).

7. Critical Habitat

An area of critical habitat for Rayless Goldfields is identified in this recovery strategy. Critical habitat is defined in the *Species at Risk Act* as "...habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species" [Subsection 2(1)]. Habitat for a terrestrial wildlife species is defined in the *Species at Risk Act* as "…the area or type of site where an individual or wildlife species naturally occurs or depends on directly or indirectly in order to carry out its life processes or formerly occurred and has the potential to be reintroduced" (Subsection 2(1)).

7.1. Identification of the Species' Critical Habitat

Critical habitat for Rayless Goldfields is identified in this recovery strategy to the extent possible based on best available information. This habitat is believed to be sufficient for the recovery of the Rayless Goldfields; however, more precise boundaries may be mapped, and additional critical habitat may be added in the future if additional research supports the inclusion of areas beyond those currently identified.

The habitat of Rayless Goldfields is characterized as moist open areas such as vernal pools or perched water tables on muddy ground (COSEWIC 2008). To further characterize habitat of Rayless Goldfields, site and vegetation data were collected in 2009 at the single site where it was last observed (Fairbarns unpublished data 2009). Some habitat attributes which currently exist at the location are unlikely to reflect the desired conditions for the species.

Specific hydrological characteristics are critical to the survival of this species. These hydrological characteristics are directly tied to rainfall (Graham 2004). Rayless Goldfields grows in level or depressional open areas that collect water from the surrounding area, called the catchment area. Surface water flow and subsurface seepage from this catchment area is essential to the survival of the Rayless Goldfields. This catchment area is small and isolated within the landscape scale catchment.

Within the geographic boundary identified in Figure 5, critical habitat is the seasonally wet depression where Rayless Goldfields was most recently observed and the catchment area which captures, stores, and releases rainwater into the depression (Fairbarns unpublished data 2009). The catchment area is delineated by following the high point of land which divides water flowing into the depression from water flowing away from the depression. The critical habitat attributes listed below represent the single known Canadian site, but may not exclude some habitat types that are unsuited to the species.

Critical habitat attributes at this site are as follows:

- Shallow vernally wet depression (2 m x 20 m) located on a rocky bluff approximately 15 m above sea level within a small catchment area (approximately 100 m^2).
- Cool temperatures moderated by maritime conditions.
- Seasonal flooding during winter and early spring with the soil likely saturated during these times and drying as rainfall decreases.
- Rayless Goldfields grows on the periphery of the depression in a 2-8 cm thick layer of soil, whereas the centre of depression, which remains flooded for a much longer period, has less than 1 cm of soil.
- California Oatgrass (*Danthonia californica*) is the only associated native grass growing on the edge of the depression.

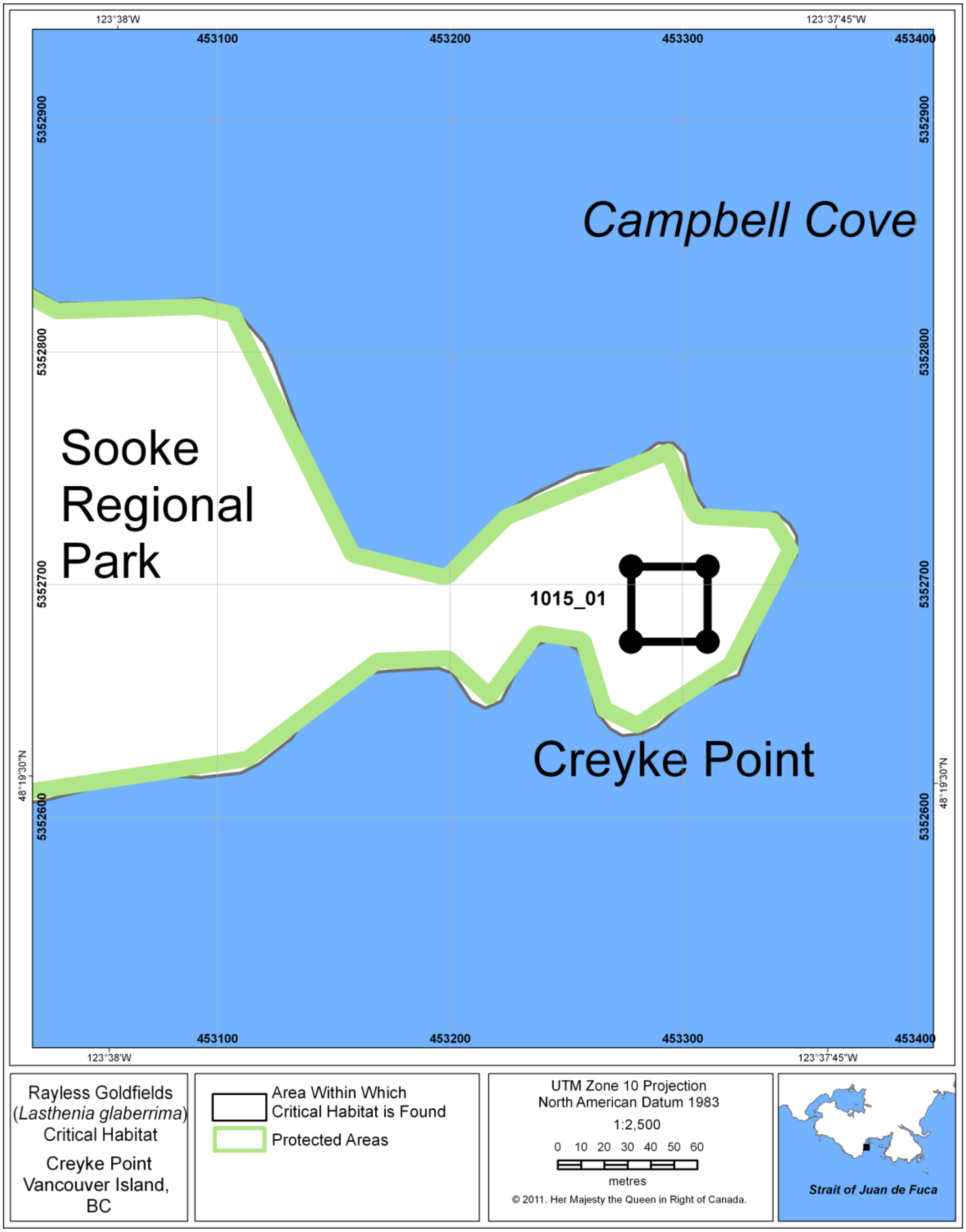

Figure 5. Area (~0.1 ha) within which critical habitat for Rayless Goldfields is found at Creyke Point and located entirely on regional park lands. The area of critical habitat within this area is approximately 0.01 ha.

7.2. Activities Likely to Result in the Destruction of Critical Habitat

The capacity of the critical habitat to support the population of Rayless Goldfields is likely to be diminished or destroyed by the activities provided below (Table 4). It is important to note that some activities have the potential to destroy critical habitat from outside the critical habitat. Destruction of critical habitat will result if any part of the critical habitat is degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from single or multiple activities at one point in time or from the cumulative effects of one or more activities over time.

Table 4. Examples of activities likely to result in the destruction of critical habitat.

Activity	Effect of activity on critical habitat	Most likely sites
Foot traffic by park visitors	Direct impacts include soil compaction and soil loss in the location where the plants and seed bank occur. Indirect impacts can lead to changes in hydrology (such as decreased infiltration and increased runoff; see trail maintenance and development below). Habitat is likely to be directly lost due to increased erosion and plants may become stressed and die due to impaired ability of the habitat to provide a suitable moisture regime.	Creyke Point
Trail maintenance and development	Direct impacts include soil compaction and soil loss and can directly destroy plants and the seed bank. Indirect impacts can alter the hydrological regime and can lead to changes in the ability of the vernal pool to capture water. For instance, decreased late season capture of water may accelerate withering and death of plants and thereby reduce seed production. On the other hand, increased early-season capture may retard germination and thereby shorten the growing period and reduce seed production.	Creyke Point

8. Measuring Progress

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives. Progress towards recovering Rayless Goldfields in Canada will be assessed using the following measures:

Objective 1: Maintain the habitat at the Creyke Point site while the feasibility of population restoration is assessed for Rayless Goldfields.

- By 2017 best management practices are developed and implemented.
- Habitat suitable for Rayless Goldfields remains extant at Creyke Point.
- By 2022, if necessary reintroduction or augmentation experiments are underway at the Creyke Point site.

9. Statement on Action Plans

One or more action plans will be completed by September 2017.

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APPENDIX A: EFFECTS ON THE ENVIRONMENT AND OTHER SPECIES

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process, based on national guidelines, directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

The small vernal pool where Rayless Goldfields occurs does not appear to play an important role for any at-risk plant or vertebrate species, so the approaches proposed in this document will have no significant direct impacts on existing populations of native plants or vertebrates. Further recovery actions in this small hydrologically isolated pool are unlikely to have any significant effect on the surrounding environment or ecological processes.