PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Gray's Desert-parsley (*Lomatium grayi*) in Canada

Gray's Desert-parsley


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Canada

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Cover illustration: Gray's Desert-parsley photograph by Carrina Maslovat.

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[1] http://www.registrelep.gc.ca/default_e.cfm

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.

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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 five years after the publication of the final document on the SAR Public Registry.

The Minister of the Environment and the Minister responsible for the Parks Canada Agency is the competent minister for the recovery of the Gray's Desert-parsley and has prepared this strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with 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 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 Gray's Desert-parsley 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 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 recovery of Gray's Desert-parsley will be coordinated with the recovery of other species inhabiting Garry Oak woodlands (Parks Canada Agency 2006).

Acknowledgments

Thank you to Carrina Maslovat for collecting and compiling the species and habitat information used in preparing this recovery strategy. The Garry Oak Ecosystems Recovery Team is the recovery team for the Gray's Desert-parsley 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. Thank you to all the landowners who support recovery of this species on their land and provided access for surveys.

Executive Summary

The Canadian population of Gray's Desert-parsley (*Lomatium grayi*) was assessed as Threatened in 2008 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and in 2011 the Canadian population was listed as Threatened under Canada's *Species at Risk Act*.

Gray's Desert-parsley is a perennial plant that grows on southwest facing cliffs or steep slopes in areas that are difficult to access by people and herbivores. The Canadian population of Gray's Desert-parsley comprises <1% its global range. In Canada, Gray's Desert-parsley is limited to three populations on two separate Gulf Islands: two on Salt Spring Island and one on Galiano Island.

Several factors limit the survival of Gray's Desert-parsley populations in Canada, including its specificity to rare habitats, limited dispersal abilities, weak competitive ability, predisposition to demographic failure, small area of physical occupancy, and small, highly fragmented populations that constrain genetic diversity. The primary threat to Gray's Desert-parsley is herbivory by mammals that directly consume and trample the plants, flowers and seeds. Further, Gray's Desert-parsley populations are at risk from competition from invasive alien plants, recreational activities (specifically rock climbing), dumping of garbage and garden waste, and horticultural collection.

In the short term, recovery objectives for Gray's Desert-parsley will focus on the maintenance of the three extant populations. Broad strategies to be taken to address the threats to the survival and recovery of the Gray's Desert-parsley are presented in section 6 Broad Strategies and General Approaches to Meet Objectives.

This recovery strategy identifies critical habitat for the Gray's Desert-parsley in Canada, to the extent possible at this time, based on the best available information. Activities likely to result in the destruction of critical habitat have been identified.

Further recovery action for Gray's Desert-parsley will be incorporated into one or more action plans by 2018.

Recovery Feasibility Summary

The recovery of Gray's Desert-parsley in Canada 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. Mature individuals of Gray's Desert-parsley have plentiful seed-set. The seed germinates readily and seedlings have been observed in the wild.

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

   Yes. There is sufficient habitat to support all three existing populations at their current levels and active stewardship and restoration may increase the amount of available habitat to support larger populations as outlined in the broad strategies and general approaches to meet the population and distribution objectives.

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

   Yes. With the cooperation of all responsible jurisdictions and the participation of the private landowner, the primary threats facing Gray's Desert-parsley can be addressed and at least partially mitigated through recovery actions. There are no unavoidable threats to this 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. Recovery success will be closely tied to addressing threats through habitat stewardship and public outreach and education, in combination with long-term population monitoring and inventory.

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1. COSEWIC[2] Species Assessment Information

Date of Assessment: November 2008

Common Name (population): Gray's Desert-parsley

Scientific Name: *Lomatium grayi*

COSEWIC Status: Threatened

Reason for Designation: A highly restricted perennial herb with a small population found on only two sites on the Gulf Islands of British Columbia. The presence of invasive species such as Scotch Broom reduces the quality of the fragile habitat and grazing deer and sheep likely restrict the species' ability to expand beyond its limited area of occupancy.

Canadian Occurrence: British Columbia

COSEWIC Status History: Designated as Threatened in November 2008. Assessment based on a new status report.

2. Species Status Information

The Canadian population of Gray's Desert-parsley (*Lomatium grayi*) was assessed as Threatened in 2008 by the Committee on Status of Endangered Wildlife in Canada (COSEWIC), and in February 2011 the population was listed as Threatened under Canada's *Species at Risk Act* (SARA). Less than 1% of Gray's Desert-parsley range and population occurs within Canada.

Table 1. Conservation ranks for Gray's Desert-parsley (B.C. Conservation Data Centre 2011; NatureServe 2011).

Location	Rank*	Rank description
Global	G5	Secure
Canada	N1	Critically imperilled
British Columbia	S1	Critically imperilled
United States	NNR	Not ranked
California	S1.3	Critically imperilled
Colorado	SNR	Not ranked
Idaho	SNR	Not ranked
Nevada	SNR	Not ranked
New Mexico	S1?	Critically imperilled?
Oregon	SNR	Not ranked
Utah	SNR	Not ranked
Washington	SNR	Not ranked
Wyoming	S3	Vulnerable

*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).

[2] COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

Conservation ranks for Gray's Desert-parsley in other jurisdictions where it occurs are provided in Table 1.

3. Species Information

3.1. Species Description

Gray's Desert-parsley is a large, strong-smelling perennial in the carrot family (Apiaceae). It grows from a deep taproot and usually has a branched stem-base (caudex). The leaves are finely divided and bluish-green in colour. Plants are usually 20-40 cm tall and can be up to 40-50 cm wide. The leafless flowering stems are taller than the foliage and produce large yellow-flowered umbels. The fruits are flattened, elliptical and have wings that are 2/3 the width of the fruit body.

The COSEWIC status report and the Illustrated Flora of B.C. provide more detailed descriptions of the species (COSEWIC 2008; Douglas *et al.* 1998).

3.2. Population and Distribution

Globally, Gray's Desert-parsley is found in northwestern North America between the Cascade/Sierra Nevada Mountains and the Rocky Mountains (Figure 1). It has been recorded in Washington, Idaho, Oregon, Wyoming, Nevada, Utah, Colorado, California, and New Mexico (COSEWIC 2008; NatureServe 2011).

In Canada, Gray's Desert-parsley is at the northern edge of its global range (Figure 2). The Canadian population is separated by 250 km from the closest extant population in the U.S and there have not been any taxonomic or genetic studies on the Canadian plants.

There are three known Gray's Desert-parsley populations in Canada, one on Galiano Island and two on Salt Spring Island. Recent surveys concluded that the single Salt Spring Island population listed in the status report (COSEWIC 2008) should be considered two populations (Maxwell Point and Mount Maxwell), because the two locations are separated by more than 1 kilometre (Maslovat 2010).

From 2002/2004 to 2010 the abundance of all three populations has increased (except for one subpopulation) and the proportion of flowering plants has remained constant (Janszen and Roemer 2002; COSEWIC 2008; Maslovat 2010, Table 2). Surveys of the three subpopulations at Maxwell Point in 2010 found the number of flowering plants is similar to previous surveys, but the number of non-flowering plants is much higher. In comparison, both the number of flowering and non-flowering plants at Mount Maxwell was higher in 2010 than previously counted in 2002. The Mount Maxwell non-flowering plants included large plants that appeared mature but most were small seedlings found in soil at the base of the cliffs. Some of the 10 subpopulations identified in 2002 were determined to be contiguous in 2010 since plants were found between the previously isolated points. Contiguous subpopulations were, therefore, amalgamated into six subpopulations. Because plants were found between the previously identified subpopulations at Mount Maxwell, it is possible that these represent patches that were present but were missed during previous surveys. Alternatively, a release from the previous grazing pressure from feral livestock may be allowing plants to expand in the area. Lastly, the Galiano population count in

2010 had no margin of error since surveys were conducted from both the top and bottom of the cliff (Maslovat 2010).

Long-term trends are not available for this species. Although there is no physical evidence that the range of Gray's Desert-parsley has changed since historic times (COSEWIC 2008), Gray's Desert-parsley habitat is closely associated with Garry Oak ecosystems which have seen a decline of more than 95% in the Victoria area (Lea 2006). Further, the remaining ecosystems fragments are affected by broad changes in ecological dynamics (e.g., fire suppression, and increased grazing and browsing). It is unknown whether threats have reduced population sizes below historic levels.



Figure 1. Global distribution of Gray's Desert-parsley, shaded regions indicate the species' range (from COSEWIC 2008).

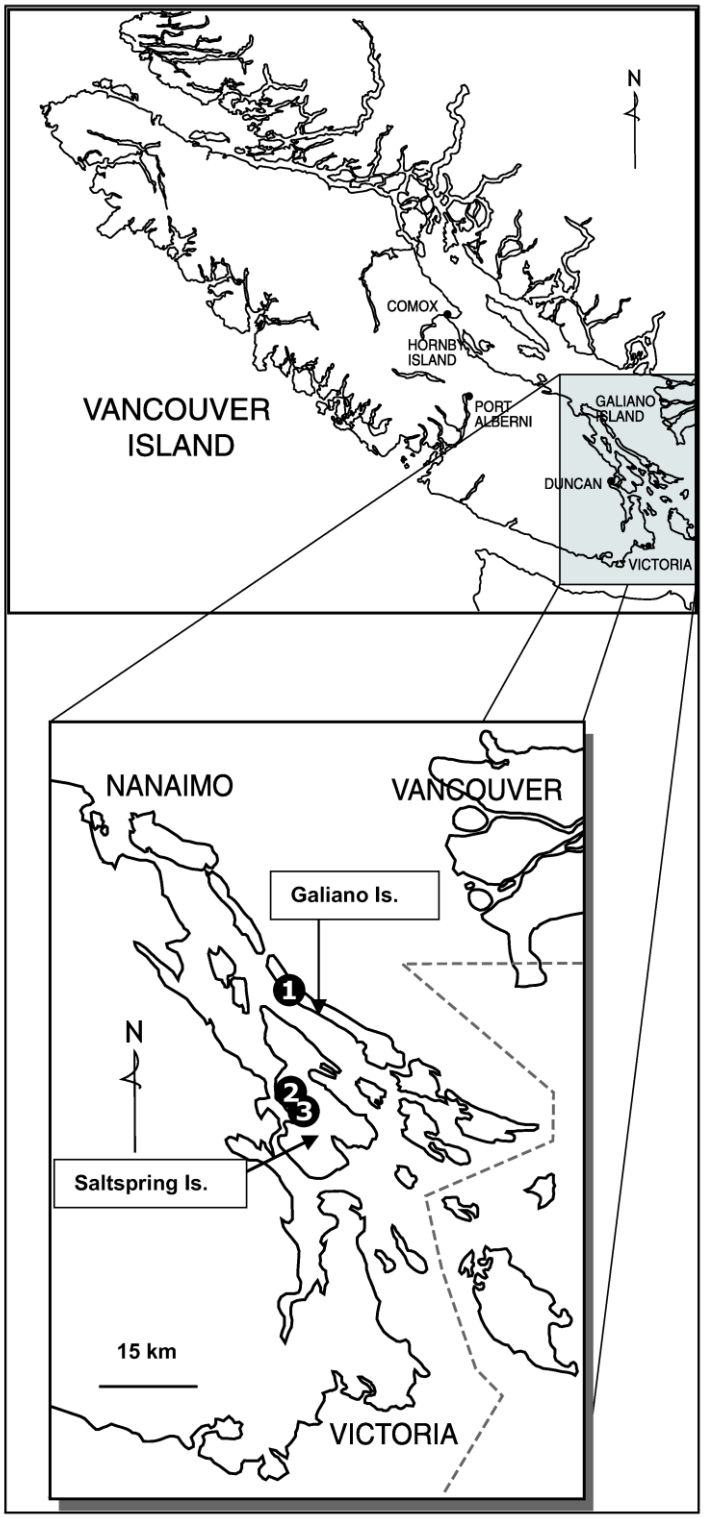


Figure 2. Distribution of Gray's Desert-parsley in Canada (adapted from COSEWIC 2008). Large closed circles indicate extant populations and the numbers refer to locations listed in Table 2.

Table 2. General location, status, most recent population count, and land tenure for extant populations of Gray's Desert-parsley in Canada.

Number on map	General location	Population size, description and year counted	Land Tenure
1	Galiano Island (2 subpopulations)	**2002:** 1650 plants +/-100 plants (1/2 to 2/3 flowering) **2010:** 1738 plants (926 flowering and 812 non-flowering)	Non-federal land
2	Maxwell Point (3 subpopulations)	**2004:** 40 plants (1/2 to 2/3 flowering) -estimated 50 plants due to habitat inaccessibility **2010:** 69 plants (19 flowering and 50 non-flowering) -estimated total of 85 plants due to habitat inaccessibility	Non-federal land
3	Mount Maxwell (6 subpopulations)	**2002:** 150 plants (1/2 to 2/3 flowering) -estimated 190 plants due to habitat inaccessibility **2010:** 359 plants (187 flowering and 172 non-flowering) -estimated total of 450 plants due to habitat inaccessibility	Non-federal land

3.3. Needs of the Gray's Desert-parsley

Throughout its range Gray's Desert-parsley is found in a range of dry, rocky habitats including sagebrush slopes, rocky talus slopes, knolls, cliffs, open grassland, and dry stream beds. In Canada, Gray's Desert-parsley is found in Garry Oak and associated ecosystems in the dry Coastal Douglas-fir Biogeoclimatic Zone on the Gulf Islands adjacent to southeastern Vancouver Island. This species grows in shallow, well-drained, rocky soils primarily on southwest facing cliff faces or in extremely steep terrain. The plants establish on rock ledges, under rock overhangs, in crevices, or on accumulations of loose talus that are surrounded by rock (Figure 3). Some sites have spring seepage along adjacent rock walls, usually wet in the fall, winter, and spring and dry in the summer months. In Canada, Gray's Desert-parsley is found from sea level to 600 m elevation, whereas in the United States it occurs from lowlands to near alpine elevations. The species is tolerant of partial shade produced by scattered, stunted trees and shrubs. There are no consistent plant communities associated with Gray's Desert-parsley and species combinations depend on which other species are able to establish in the adjacent habitat (COSEWIC 2008; Maslovat 2010).

A number of factors may limit the survival and recovery of Gray's Desert-parsley in Canada:

- Dependence on highly specific habitats associated with Garry Oak and associated ecosystems, most of which have been lost or damaged by habitat conversion (i.e., the loss of suitable habitat, often as a result of urban development), forest encroachment, and/or a shift to ecosystem dominance by invasive alien plants.
- A lack of special structures to aid in the long-distance dispersal of seeds limits the potential for local rescue effects or establishment in unoccupied habitat areas.
- Apparently weak competitive ability, especially with respect to invasive alien plants.
- Predisposition to demographic failure because its annual life cycle may result in high juvenile mortality if the late spring/early summer drought arrives early.
- Very small area of physical occupancy, which leaves it susceptible to chance events including those which operate at a small scale.
- Extremely small population sizes, which may constrain the species' genetic diversity, and increase its vulnerability to extirpation due to demographic stochasticity.



Figure 3. Gray's Desert-parsley habitat at Mount Maxwell, Salt Spring Island. Photo by Carrina Maslovat.

4. Threats

4.1. Threat Assessment

Table 3. Threat Assessment Table.

Threat	Level of Concern[1]	Extent	Occurrence	Frequency	Severity[2]	Causal Certainty[3]
Disturbance or harm						
Grazing	Medium	Widespread	Current	Continuous	Medium	Medium
Recreational activities	Low	Localized	Current	Seasonal	Medium	Medium
***A*lien, invasive or introduced species**						
Encroachment by invasive alien plants	Low	Widespread	Current	Continuous	Low	Medium
Pollution						
Dumping garden waste or garbage	Low	Localized	Unknown	Unknown	Low	Medium
Biological Resource Use						
Horticultural collection	Low	Localized	Unknown	Unknown	Low	Low

[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, Medium, Low, and 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. Disturbance or harm

Grazing is the biggest threat to Gray's Desert-parsley. Gray's Desert-parsley plants grow almost exclusively on steep, inaccessible terrain that cannot be reached by grazing mammals. Despite growing on deeper soil, the few plants that are accessible to herbivores are small because grazing limits either their long-term survival or prevents them from reaching full size (COSEWIC 2008). Flowering plants growing in deeper soil were found in only one location where the deeper soil habitat could not be accessed by deer (Maslovat 2010).

Both historic grazing by feral livestock and contemporary grazing by native herbivores at increased abundances are considered threats to Gray's Desert-parsley. Feral livestock have been present on both Galiano and Salt Spring Islands. Feral goats (*Capra hircus*) were on Galiano Island from 1920 until at least 1960 (Geist 1960). Neither feral goats nor domestic sheep (*Ovis aries*) are currently on Galiano Island (Crowe pers. comm. 2010). Feral goats were on Salt Spring from the 1920s until 1957 but goats have not been observed on Mount Maxwell in recent years (Geist, 1960; Linton pers. comm. 2010). It is unlikely sheep are still present on Mount Maxwell: two sheep were seen two years ago but have not seen since (Linton pers. comm. 2010). Native Black-tailed Deer (*Odocoileus hemionus columbianus*) are abundant on both Galiano and

Salt Spring Islands and increased habitation by people has limited predator populations and increased the abundance of native herbivores. In addition to direct consumption, herbivores may cause damage by trampling or dislodging plants.

Small herbivores may also be a threat. Cultivated Gray's Desert-parsley specimens are eaten by mice, rats, and cottontail rabbits on both Galiano and Salt Spring Islands; however, it is not known whether rodents eat wild Gray's Desert-parsley plants (COSEWIC 2008). Seed predation by insects has also been observed but the species responsible has not been identified. Evidence of defoliation by Anise Swallowtail Butterfly larvae was observed in the Mount Maxwell population (COSEWIC 2008).

The effect of herbivory on seed production and reproduction is unknown. Frequent loss of small numbers of seeds will have a smaller impact on population dynamics than larger, more infrequent grazing (Menges *et al.* 2004). This threat is considered a medium level of concern because while all three populations showed some evidence of grazing, with either leaves or flowering stems missing, not all subpopulations showed evidence of grazing (Maslovat 2010).

The recreational activities of rock climbing and hiking threaten subpopulations of Gray's Desert-parsley on Salt Spring Island. The steep cliffs of Mount Maxwell on Salt Spring Island are a popular for recreational rock climbing (Gessinger pers. comm. 2010). Hiking and rock climbing may trample plants, dislodge plants, compact the soil, and increase erosion. A climbing rope was attached to a tree within the habitat of one Gray's Desert-parsley subpopulation on Mount Maxwell, Salt Spring Island. This is the only location where fewer plants were found in 2010 than in previous surveys (19 compared to 45) (Maslovat 2010). Although rock climbing may occur at other locations with Gray's Desert-parsley, there was no direct evidence of this during 2010 surveys. There is also no evidence of rock climbing in Gray's Desert-parsley habitat on Galiano Island (Millard pers. comm. 2010 and Crowe pers. comm. 2010). Consequently, this threat is considered a low level of concern.

4.2.2. Alien, invasive or introduced species

Habitat degradation caused by invasive alien plants may threaten Gray's Desert-parsley, although the steep and rocky habitat generally has few microsites where invasive alien plants can establish. The invasive alien shrub, Scotch Broom (*Cytisus scoparius*), is present in large numbers at the top of the ridge above Gray's Desert-parsley occurrences on Galiano Island and is present in low numbers in one subpopulation on Mount Maxwell, Salt Spring Island (COSEWIC 2008; Millard pers. comm. 2010; Maslovat 2010). Invasive alien herbaceous species are also present including grasses: Barren Brome (*Bromus sterilis*), Sweet Vernal Grass (*Anthoxanthum odoratum*) and Hedgehog Dogtail (*Cynosurus echinatus*); and forbs: Tower Mustard (*Arabis glabra*), Spreading Hedge-parsley (*Torilis arvensis*) and Common Vetch (*Vicia sativa*). The establishment of invasive alien plants in the small microsites where Gray's Desert-parsley occurs may pre-empt germination and seedling growth, limiting future recruitment. Establishment of invasive alien shrubs in adjacent areas may also increase shade in the habitat and further limit Gray's Desert-parsley growth and recruitment. Overall, this threat is considered a low level of concern.

4.2.3. Pollution

Pollution caused by dumping of garden waste material or garbage over cliffs where Gray's Desert-parsley grows can threaten this species. The top of some of the steep cliffs occupied by Gray's Desert-parsley are easily accessed by roads. One subpopulation on Mount Maxwell, Salt Spring Island is littered with garbage (including bicycles, appliances, beer bottles, etc.) that has been dumped from the summit. Although the garbage lands primarily on the slope below the plants, it may dislodge or damage plants as it ricochets off the cliff face or smother the plants if it lands directly on them. This subpopulation is the same one at risk from rock climbing and is the only population to have a smaller total number of plants than in previous surveys. A small part of the Galiano population occurs on private property and it is possible, although unlikely, that garden waste could be dumped over the top of the cliffs that support Gray's Desert-parsley. Garden waste may contain invasive alien plants, seeds, or insects and can spread these species into the habitat of Gray's Desert-parsley. Gray's Desert-parsley plants could also be smothered by garden waste thereby inhibiting growth and potentially killing the plants. Consequently, this threat poses a low level of concern.

4.2.4. Biological Resource Use

Collection of Gray's Desert-parsley for horticultural purposes poses a minor threat to this species' survival. Gray's Desert-parsley is an attractive plant that does well in ornamental gardens. It is not known whether seeds or plants are being currently collected for horticulture. Unless this practice is initiated by a nursery or other large-scale propagator, it is unlikely to have a serious negative effect on the population. Therefore, this threat is a considered a low level of concern.

5. Population and Distribution Objectives

In Canada, Gray's Desert-parsley grows in shallow, well-drained, rocky soils primarily on southwest facing cliffs or in extremely steep terrain in Garry Oak and associated ecosystems and as such had a naturally highly restricted range. Within this range, herbivory, encroachment of invasive alien plants, and human disturbance has likely resulted in population reductions (COSEWIC 2008; Maslovat 2010). There are currently three known Gray's Desert-parsley populations in Canada, all of which have over 50 individuals (COSEWIC 2008; Maslovat 2010).

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) habitat, 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 Gray's Desert-parsley, it is currently not possible to determine to what extent recovery is feasible 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. There is no evidence to suggest that any populations of Gray's Desert-parsley have been lost over time, especially since the species is distinctive and relatively easy to identify. Therefore, there is no justification for the recovery objectives to include establishing new populations. At this time it is possible to set short-term objectives that focus on maintaining the three extant Canadian populations:

Objective 1: Maintain the three extant populations of Gray's Desert-parsley.

Objective 2: Prevent declines in the known distribution[3] of Gray's Desert-parsley populations in Canada.

6. Broad Strategies and General Approaches to Meet Objectives

The following are broad strategies and approaches to meet the population and distribution objectives for Gray's Desert-parsley:

- Population research and monitoring: monitor population trends, habitat attributes, and threats, and conduct population demographic research;
- Population restoration: restore extant populations to recover the Canadian population of the species;
- Habitat and species protection: protect existing populations and their habitat from destruction by developing mechanisms/instruments for protection;
- Stewardship: engage and involve landowners and land managers in recovery activities and decisions for Gray's Desert-parsley; and
- Public education and outreach: increase public awareness of the species, its needs and conservation value.

[3] Distribution is measured by the extent of occurrence (currently about 50km^2) and area of occupancy (currently estimated at 2km^2; COSEWIC 2008). If new populations are discovered, these baseline figures should be updated as required.

6.1. Strategic Direction for Recovery

Table 4. Recovery Planning Table.

Threat or Limitation	Priority[4]	Broad Strategy to Recovery	General Description of Research and Management Approaches
Knowledge gaps concerning population trends and augmentation techniques.	High	Population Monitoring	• Design and implement an inventory and monitoring program to track population size, distribution and habitat trends for 10 years, with subsequent monitoring as required. • Monitor impacts of recovery activities on non-target species, communities, and ecological processes. • Report on population trends, area of occupancy, and habitat condition every 2 years.
	High	Population restoration	• Determine appropriate site-specific restoration and adaptive management techniques (including the use of grazing enclosures) for existing populations of Gray's Desert-parsley and its habitat. • Determine if population augmentation is required and develop necessary augmentation techniques. • Determine conditions necessary for germination, establishment, growth and reproduction.
Knowledge gaps and limitations regarding population demography Encroachment by invasive alien plants Grazing by vertebrates	High	Research	• Determine species-specific population thresholds and targets suitable for long-term population objectives. • Identify the demographic criteria that would trigger immediate re-evaluation of recovery priorities and activities, and incorporate them into the management plans. • Conduct demographic research in order to identify critical life stages (e.g., pollination/reproduction, dispersal, seed production, recruitment, and recruit survival) necessary for population growth. • Determine impacts of grazing and invasive alien plants on Gray's Desert-parsley and appropriate restoration and management techniques to address these threats.
Encroachment by invasive alien plants Recreational activities Dumping garden waste	High	Stewardship	• Prepare Best (Beneficial) Management Practices guidelines for Gray's Desert-parsley to support landowners, and land managers in stewardship activities. • Engage landowners and land managers in recovery decisions and activities.

[4] "Priority" reflects the degree to which the approach contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species.

Threat or Limitation	Priority[4]	Broad Strategy to Recovery	General Description of Research and Management Approaches
or garbage Grazing by vertebrates Horticultural collection	Medium	Public education and outreach	• Engage landowners through the development and delivery of public education and outreach materials concerning Gray's Desert-parsley and its management. • Increase public awareness of the existence, conservation value, threats and harm reduction measures for Gray's Desert-parsley and associated Garry Oak Ecosystem species at risk.
	Medium	Habitat and species protection	• Identify protection mechanisms/instruments for the species and its critical habitat. • Describe habitat for Gray's Desert-parsley and refine critical habitat attributes.

6.2. Narrative to Support the Recovery Planning Table

Gray's Desert-parsley is extremely rare in Canada and a first priority for recovery will be to conserve and restore existing populations and their habitat. Diligence must be exercised in preventing extirpations due to preventable causes. A top priority of recovery will be to steward the land to ensure proper environmental conditions for plant growth and establishment as this is the most straightforward and cost-effective way of ensuring the species' persistence. Stewardship activities include following best management practices to control invasive alien plants and grazing and to manage recreational activities. In addition, further research is required to better understand the degree of threat from grazing and invasive alien plants and to refine techniques for effective management and restoration of Gray's Desert-parsley habitat. Population restoration through augmentation will only be considered if population and distribution objectives cannot be met through stewardship.

Careful monitoring is also an important component of recovery for a number of reasons. Monitoring is necessary to ensure the effects of restoration and management techniques are contributing to recovery and are not unduly affecting on non-target species, communities, or ecological processes. Further, additional monitoring data is required to determine long term population objectives for Gray's Desert-parsley and to identify population criteria (size/distribution) that would trigger immediate re-evaluation of recovery priorities and activities. In addition, regular population monitoring is needed to track the current viability of the species and its response to threats.

There are significant knowledge gaps related to population dynamics including seed bank longevity, demography, reproduction, and recruitment rates of Canadian populations of Gray's Desert-parsley and these knowledge gaps hamper the ability to set long term objectives. Further research is required so that long-term, feasible, and quantitative recovery objectives regarding size and number of populations can be set in the future. It is also unknown whether there are more Galiano subpopulations that could not be observed by boat surveys and require additional surveys of the cliff faces where access is challenging and additional surveys would be beneficial to accurately determine the size and viability of the current population.

7. Critical Habitat

Areas of critical habitat for Gray's Desert-parsley are 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 a 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

7.1.1. Geographical Location

Critical habitat for Gray's Desert-parsley is identified in this recovery strategy to the extent possible based on the best available information. This habitat is believed to be sufficient for the recovery of the Gray's Desert-parsley. However, more precise boundaries may be mapped (in particular if grazing pressure is removed), and additional critical habitat may be added in the future if additional research supports the inclusion of areas beyond those currently identified.

Within the geographical boundaries identified in Figures 5 through 8, critical habitat for the survival of Gray's Desert-parsley populations consists of the slope (Maslovat 2010) matching the biophysical attributes described in Section 7.1.2. The entire cliff face is required to maintain the seed banks, and dispersal sites required for the survival of the population.

7.1.2. Biophysical Attributes

The habitat of Gray's Desert-parsley in Canada occurs in Garry Oak and associated ecosystems on the Gulf Islands along the southeast coast of British Columbia. The habitat is characterized as open areas with an occasional stunted tree or shrub and Gray's Desert-parsley plants usually occur in small pockets of soil or crevices scattered throughout steep or vertical, southwest facing cliffs (COSEWIC 2008). Field investigations at Galiano Island, Maxwell Point, and Mount Maxwell (Salt Spring Island) were used to further characterize the habitat of Gray's Desert-parsley (Maslovat 2010).

The habitat for Gray's Desert-parsley is based on locations where the plants currently grow, but may be different from the habitat preferred by this species if grazing pressure were removed. Consequently, it is difficult to provide a description of critical habitat attributes for Gray's Desert-parsley that is both inclusive and specific. The critical habitat attributes below cover the range attributes found at the known locations and may not exclude some habitat types that are unsuited to the species. Therefore, critical habitat identification is based on the recorded Gray's Desert-parsley patches not the presence of the following attributes:

- Full sun to part shade (plants are tolerant of shade cast by trees and shrubs growing in adjacent deeper soils).
- Southwest facing slopes (cliff faces or extremely steep terrain; aspect 190º-310º).
- Low elevation (0 to 600 metres above sea level).
- Shallow, well-drained, rocky soil or talus (Gray's Desert-parsley establishes on rock ledges, under rock overhangs, in crevices or on accumulations of loose talus).

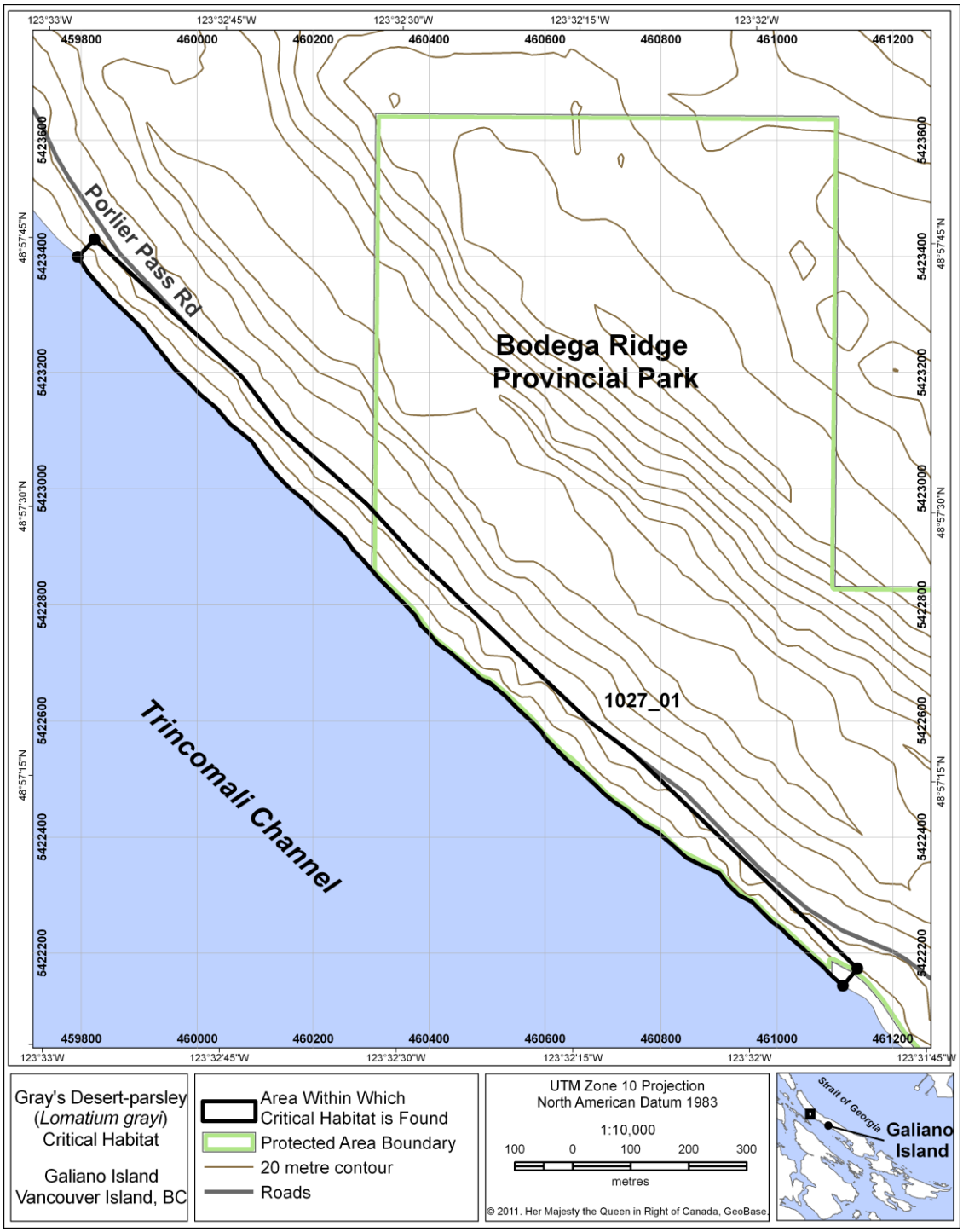


Figure 4. Area 1027_01 (~11.6 ha) within which critical habitat for Gray's Desert-parsley is found at Galiano Island, on non-federal lands. The identified critical habitat within this area is ~ 3.9 ha. Critical habitat parcel 1027_01 is rectangular in shape with the following four corners: 459823, 5423429; 461139, 5422174; and 461114, 5422144 (NAD 1983, Zone 10, North Azimuth). The southern the boundary follows the high tide line and the northern boundary partially follows Porlier Pass Rd (all areas north of Porlier Pass Rd are excluded).

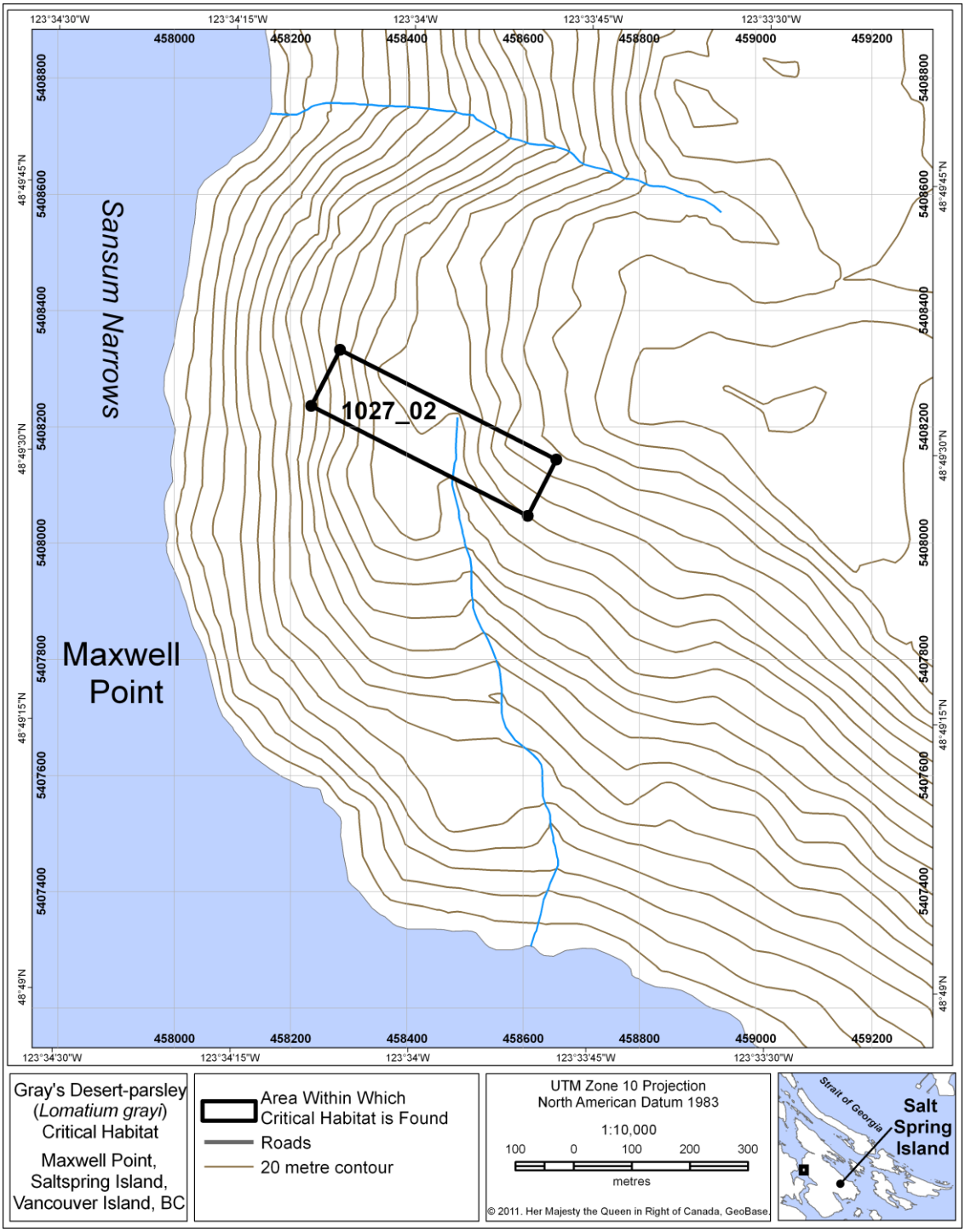


Figure 5. Area 1027_02 (~4.5 ha) within which critical habitat for Gray's Desert-parsley is found at Maxwell Point, on non-federal lands. The identified critical habitat within this area is ~ 0.26 ha. Critical habitat parcel 1027_02 is a rectangle with the following four corners: 458285, 5408333; 458657, 5408144; and 458608, 5408047 (NAD 1983, Zone 10, North Azimuth).

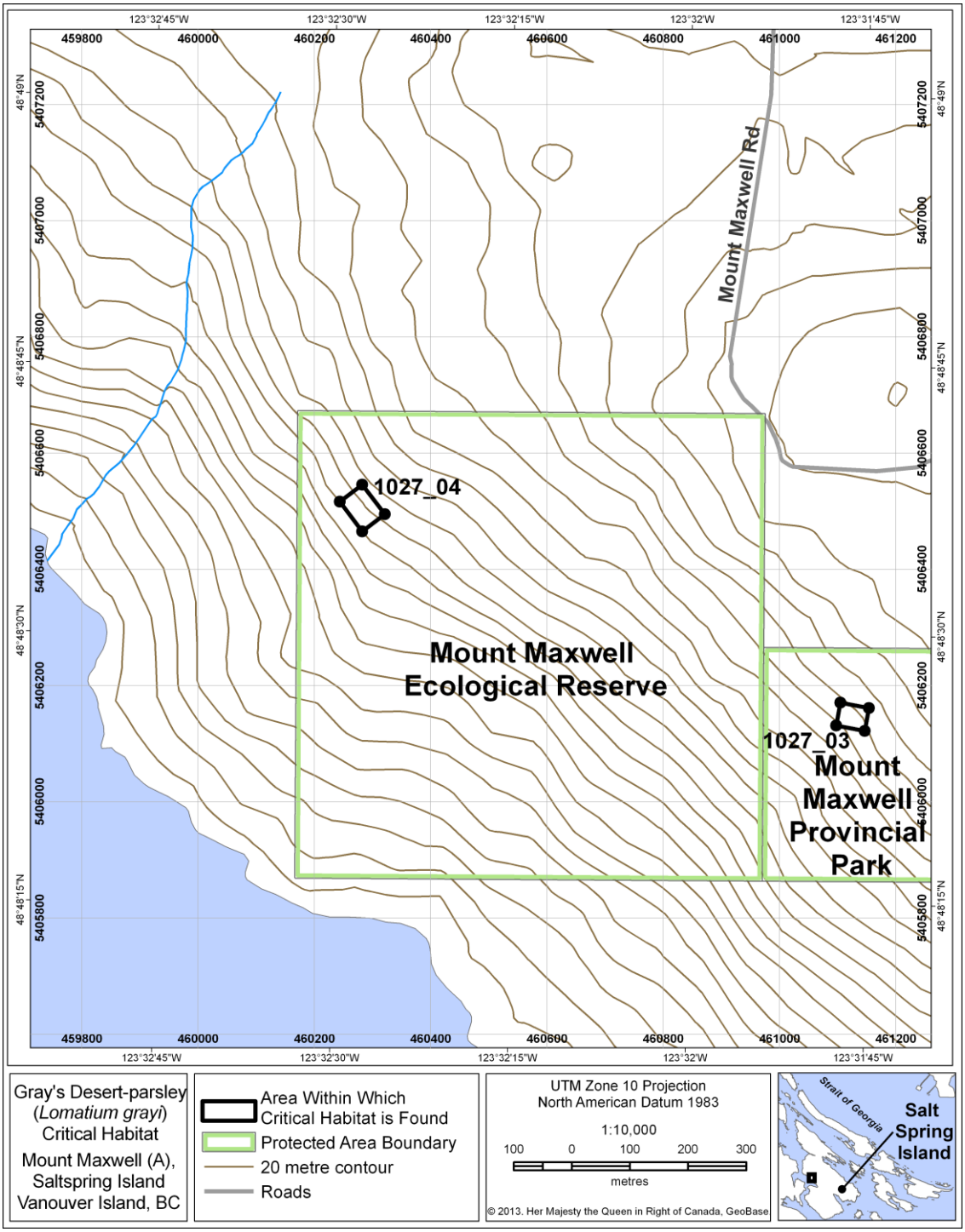


Figure 6. Areas 1027_03 (~0.2 ha) and 1027_04 (0.31 ha) within which critical habitat for Gray's Desert-parsley is found at Mount Maxwell, on non-federal lands. The identified critical habitat within these areas is 0.01 ha and 0.04 ha, respectively. Critical habitat parcel 1027_03 is a rectangle with the following four corners: 461105, 5406171; 461154, 5406161; and 461146, 5406122. Critical habitat parcel 1027_04 is a rectangle with the following four corners: 460282, 5406546; 460321, 5406495; and 460282, 5406465. (NAD 1983, Zone 10, North Azimuth).

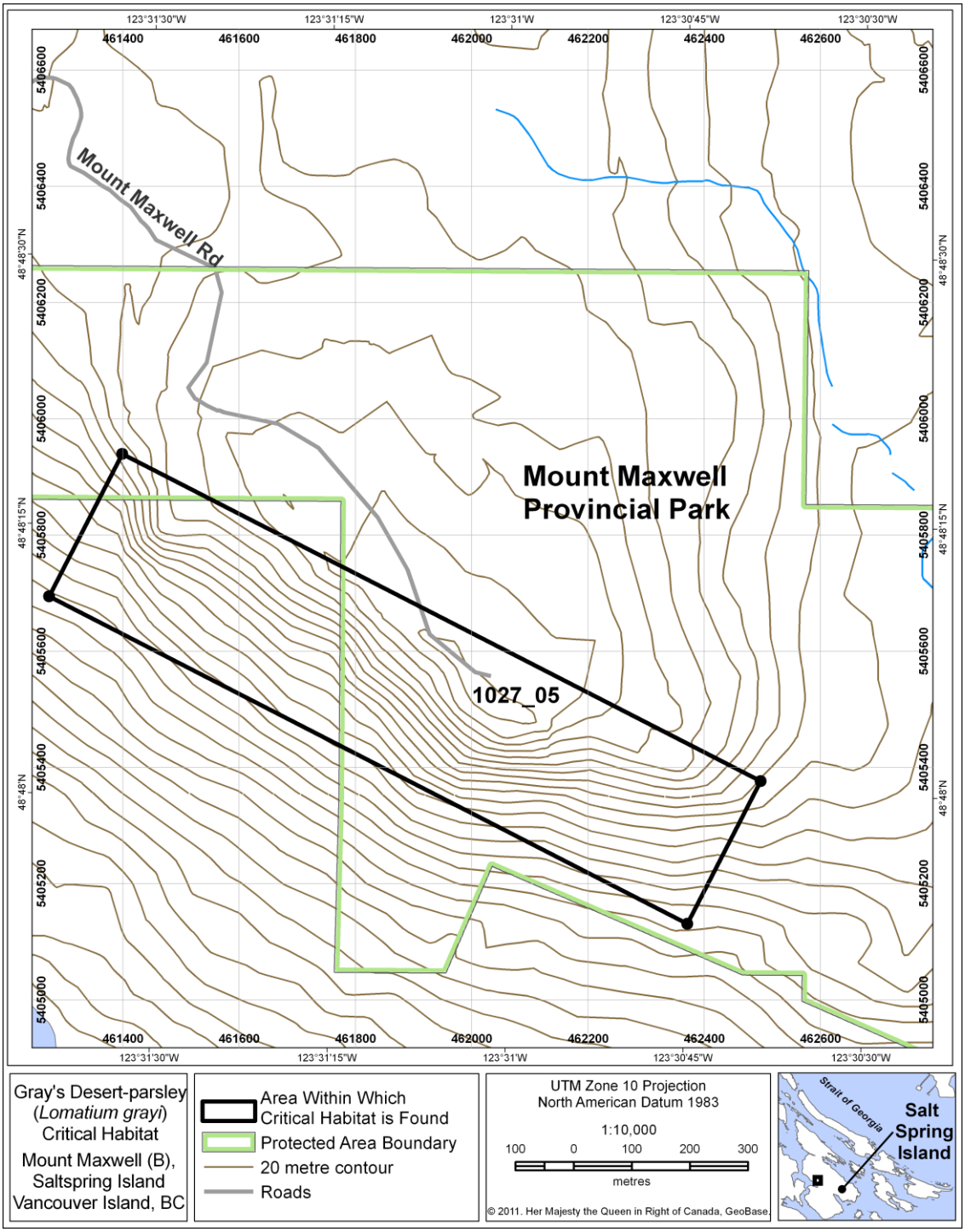


Figure 7. Area 1027_05 (~34 ha) within which critical habitat for Gray's Desert-parsley is found at Mount Maxwell, on non-federal lands. The identified critical habitat within this area is ~ 4.6 ha. Critical habitat parcel 1027_05 is a rectangle with the following four corners: 461399, 5405940; 462497, 5405377; and 462371, 5405131. (NAD 1983, Zone 10, North Azimuth).

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

Examples of activities likely to destroy critical habitat are provided below (Table 5). 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 5. Examples of activities likely to result in destruction of critical habitat.

Activity	Effect of activity on critical habitat	Most likely locations
Damaging recreational use (e.g., rock climbing, hiking)	Increased erosion, loss of growing substrate for existing and future plants. Soil compaction leading to altered moisture availability (decreased infiltration and increased runoff). In addition, this activity is likely to introduce or spread invasive alien plant species. Invasive alien plants compete with Gray's Desert-parsley and alter the availability of light, water, and nutrients in the habitat, such that the habitat would not provide the necessary habitat conditions required by Gray's Desert-parsley.	Mount Maxwell
Land conversion by human development (e.g., development or modification of existing structures and roads)	Indirect effects of shading (e.g., by introduced plants or nearby structures), and altered moisture regime (e.g., impounded drainage, or reduced water flow to the plants through ditching or diversion of subsurface water by built structures) can alter the habitat of Gray's Desert-parsley.	Galiano Island
Dumping of garbage or garden waste	Dumped material can cover habitat needed for germination and growth resulting in a loss of growing substrate for existing and future plants. Depending on the nature of the dumped items, pollutants may also be introduced into the environment, making it unsuitable for Gray's Desert-parsley. Dumped garden waste is likely to introduce invasive alien plants and may introduce alien insects. Invasive alien plants compete with Gray's Desert-parsley and alter the availability of light, water, and nutrients in the habitat. Alien insects could consume and/or damage Gray's Desert-parsley plants.	Mount Maxwell Galiano Island

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 Gray's Desert-parsley in Canada will be assessed using the following measures for each of the population and distribution objectives:

Objective 1: Maintain the three extant populations of Gray's Desert-parsley.

- By 2018, best management practices are developed and implemented for all populations.
- The populations remain extant.
- By 2023, all three existing populations show a stable or increasing trend in population size.

Objective 2: Prevent declines in the known distribution of Gray's Desert-parsley populations in Canada.

- There is no decrease in the known distribution (extent of occurrence and area of occupancy) of Gray's Desert-parsley in Canada.

9. Statement on Action Plans

One or more action plans will be completed by 2018.

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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 and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy's[5] goals and targets.

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 range of Gray's Desert-parsley overlaps with a suite of other rare and at risk plants and invertebrates, the totality of which comprise one of the most unique species assemblages known in Canada (GOERT 2002, Table 6). Actions taken to recover Gray's Desert-parsley should also benefit these species by improving habitat for them. Restoration of the habitat of Gray's Desert-parsley will be beneficial to species associated with this habitat, which are also affected by competition from invasive alien plants, grazing pressures, and/or recreational activities. Actions taken to aid in the recovery of this species should, if conducted in an appropriate manner (e.g., in an open, informative manner), provide benefits for all at risk species and habitats. This can be accomplished by increasing public awareness of the negative environmental consequences associated with invasive alien species, the threats recreational activities can pose to species at risk, the need to maintain natural ecological processes (e.g., if fire is identified as being a component of the management for some locations that Gray's Desert-parsley occurs), and of the need to protect natural habitats from the impacts of adjacent developments.

However, actions to assist in the recovery of Gray's Desert-parsley could negatively impact other species at risk if the actions result in excessive disturbance of the Gray's Desert-parsley habitat (e.g., when removing invasive alien plants or installing fencing to exclude grazers). Any on-site activity has the potential to affect other species at risk through trampling or the inadvertent translocation of invasive alien plant seeds; therefore, care must be taken to avoid indirect impacts. If fire is identified as being a necessary component of the restoration of habitat at some locations where Gray's Desert-parsley occurs, care must be taken to ensure that the natural disturbance is contained within a targeted area and the fire does not inadvertently promote the growth of an invasive alien plant species.

The potential for negative effects can be mitigated or eliminated at the project level phase through proper field procedures and/or strong collaboration with key conservation partners such

[5] http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1

Table 6. Partial list of rare species known to occur within the Canadian range of Gray's Desert-parsley and potentially affected by recovery strategies. Sources: B.C. Conservation Data Centre 2011; NatureServe 2010.

Scientific name	Common name	B. C. provincial rank*	COSEWIC status	SARA status	Location	Probability of being affected
Allium amplectens	Slimleaf Onion	S3	Not assessed	Not assessed	Mount Maxwell Maxwell Point	Possible
Callophrys mossii mossii	Moss' Elfin	S2S3	Not assessed	Not assessed	Mount Maxwell Maxwell Point	Unlikely
Clarkia purpurea ssp. *quadrivulnera*	Small-flowered Godetia	S1	Upcoming assessment	Not assessed	Mount Maxwell Maxwell Point	Unlikely
Entosthodon fascicularis	Banded Cord-moss	S2S3	Special Concern	Special Concern	Mount Maxwell Maxwell Point	Unlikely
Erynnis propertius	Propertius Duskywing	S2S3	Not assessed	Not assessed	Mount Maxwell Maxwell Point Galiano Island	Unlikely
Idahoa scapigera	Scalepod	S2	Not assessed	Not assessed	Mount Maxwell Maxwell Point	Possible
Lomatium dissectum var. *dissectum*	Fern-leaved Desert-parsley	S1	Not assessed	Not assessed	Mount Maxwell Maxwell Point	Possible
Plagiobothrys tenellus	Slender Popcornflower	S1	Threatened	Threatened	Galiano Island	Unlikely
Syntrichia laevipila	Twisted Oak Moss	S2S3	Special Concern	Special Concern	Mount Maxwell Maxwell Point	Unlikely
Viola praemorsa ssp. *praemorsa*	Yellow Montane Violet	S2	Endangered	Endangered	Mount Maxwell Maxwell Point	Unlikely
Yabea microcarpa	California Hedge-parsley	S1S2	Not assessed	Not assessed	Mount Maxwell Maxwell Point	Unlikely except possible at Maxwell Point.

*NatureServe Conservation ranks are based on a one to five scale, ranging from critically imperilled (1) to demonstrably secure (5).

as the Garry Oak Ecosystems Recovery Team and appropriate government agencies. Some recovery strategy activities may require project level environmental assessment under the *Canadian Environmental Assessment Act*. Any activities found to require project-level environmental assessments will be assessed at that time pursuant to the provisions of the *Act*.

This recovery strategy benefits the environment by promoting the conservation and recovery of the Gray's Desert-parsley, a natural component of biodiversity. Activities required to meet recovery objectives are unlikely to result in any important negative environmental effects, as they are limited to habitat rehabilitation, research activities, fostering stewardship, increasing public awareness, improving knowledge on habitat requirements and population threats, and conducting habitat/species mapping, inventory, and restoration. In addition, it is likely that habitat restoration for Gray's Desert-parsley will benefit other co-occurring native species which occupy the same habitat.

In summary, the SEA process has concluded that this recovery strategy will likely have several positive effects on the environment and other species. There are no obvious adverse environmental effects anticipated with the implementation of this recovery strategy.