Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the California Buttercup (*Ranunculus californicus*) in Canada

California Buttercup

2013

Canada

Recommended citation:

Parks Canada Agency. 2013. Recovery Strategy for the California Buttercup (*Ranunculus californicus*) in Canada. *Species at Risk Act* Recovery Strategy Series. Parks Canada Agency, Ottawa. vi + 24 pp.

For copies of the recovery strategy, or for additional information on species at risk, including COSEWIC Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk Public Registry (http://www.sararegistry.gc.ca).

Cover illustration: California Buttercup, photograph courtesy of Matt Fairbarns.

Également disponible en français sous le titre
« Programme de rétablissement de la renoncule de Californie (*Ranunculus californicus*) au Canada »

ISBN 978-1-100-22450-3
Catalogue no. En3-4/167-2013E-PDF

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 California Buttercup and has prepared this strategy, as per section 37 of SARA. It has been prepared in cooperation with Environment Canada, the provincial government of British Columbia, and the Songhees Nation.

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 Environment Canada, or any other jurisdiction, alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the California Buttercup 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 recovery of California Buttercup will be coordinated with the recovery of at-risk species inhabiting maritime meadows associated with Garry Oak ecosystems (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 initial draft of this recovery strategy. The Garry Oak Ecosystems Recovery Team (GOERT) is the recovery team for the California Buttercup and is thanked for their involvement in the development of this recovery strategy. Thank you to the various landowners who support recovery of this species on their land and provided access for surveys.

EXECUTIVE SUMMARY

The Canadian population of the California Buttercup (*Ranunculus californicus* Benth.) was assessed as Endangered in 2008 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and in February 2011 the population was listed as Endangered under Canada's *Species at Risk Act* (SARA) Schedule 1.

The California Buttercup is a low growing perennial herb with lemon-yellow, flowers (with up to 16 petals), and hairy stems ranging from 15-50 cm tall. It ranges from British Columbia south along the coast to Baja California, but the Canadian population is widely disjunct from the nearest Oregon population. The Canadian population of California Buttercup comprises <1% its global range. In Canada, California Buttercup is known from four confirmed populations, three recently confirmed to be extant, all occurring along the southeast coast of Vancouver Island.

The key factors limiting the recovery and survival of the California Buttercup population in Canada are its specificity to rare maritime meadow habitats, limited dispersal abilities, small area of physical occupancy, and small, highly fragmented populations that constrain genetic diversity. Further, California Buttercup populations are threatened by invasion of alien plants, encroachment by native herbaceous and woody vegetation, potential hybridization, recreational activities, livestock grazing, trampling and habitat conversion.

The population and distribution objectives for California Buttercup in Canada are to maintain the four confirmed extant populations and prevent a decline in distribution while exploring the feasibility of establishing and/or augmenting populations to increase abundance and distribution. Broad strategies to be taken to address the threats to the survival and recovery of the California Buttercup are presented in section 6.1 Strategic Direction for Recovery.

Critical habitat for the recovery of California Buttercup is identified in this recovery strategy. The best available information has been used to identify critical habitat; however, there are significant knowledge gaps. Additional critical habitat will need to be identified in upcoming planning documents to meet the population and distribution objectives.

Further recovery action for California Buttercup will be incorporated into one or more action plans by 2018.

RECOVERY FEASIBILITY SUMMARY

The recovery of the California Buttercup 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. All three populations recently confirmed to be extant support numerous reproductive individuals and seeds could be collected from these populations to be used for restoration.

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

Yes. There is sufficient suitable habitat to support self-sustaining populations and additional suitable habitat could be made available through active habitat stewardship or restoration, if needed.

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

Yes. Further habitat loss can be prevented by relocating recreational use such as camping, picnicking and walking. Although pre-contact First Nations burning regimes may be difficult to restore, and may no longer be effective due to the presence of invasive alien plants, surrogate actions including shrub and tree cutting, and dormant season mowing, may be used as alternatives to fire to control shrub and tree encroachment. Competition, suppression and space pre-emption by invasive alien shrubs, grasses, and forbs may be mitigated using an integrated pest management approach.

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 tied primarily to threat reduction through habitat stewardship, in combination with long-term population monitoring and inventory.

TABLE OF CONTENTS

1. COSEWIC Species Assessment Information

Date of Assessment: November 2008

Common Name: California Buttercup

Scientific Name: *Ranunculus californicus*

COSEWIC Status: Endangered

Reason for Designation: A perennial species restricted to two small island groups adjacent to Victoria, BC. The four small confirmed populations are found within coastal meadow habitats where the extensive spread of invasive plants places the species at risk. Potential impacts on the populations include planned enlargement of communications towers at one site and unauthorized recreational visitors to the island habitats.

Canadian Occurrence: British Columbia

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

2. Species Status Information

The Canadian population of California Buttercup (*Ranunculus californicus*) was assessed as Endangered in 2008 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and in February 2011 the population was listed as Endangered under Canada's *Species at Risk Act* (SARA). Provincial, state, and global conservation ranks for California Buttercup in other jurisdictions where it occurs are provided in Table 1.

The California Buttercup population in Canada comprises less than 1% of its global range.

Table 1. Conservation ranks for California Buttercup. Sources: B.C. Conservation Data Centre 2011, NatureServe 2011.

Location	Rank*	Rank description
Global	G5	Secure
Canada	N2	Imperilled
British Columbia	S1	Critically imperilled
United States	N5	Demonstrably secure
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

California Buttercup is a low-growing, hairy, herbaceous perennial that produces numerous stems from a central root crown. Mature plants bear 2-8 cm long, lobed, long-stalked basal leaves with blunt teeth. The sprawling to erect, 15-50 cm long stems produce several flowers in an open inflorescence. The flowers have numerous (up to 16) shiny lemon-yellow petals, unlike most species of buttercup that typically have only five petals. It is also distinguished from similar buttercup species (such as the Western Buttercup; *Ranunculus occidentalis*) by the noticeably curved beak on the seeds (COSEWIC 2008). California Buttercup may interbreed with Western Buttercup forming plants which are intermediate in appearance (Brayshaw 1989). Further details on the appearance of California Buttercup, and the hybrids it forms with Western Buttercup, are found in the status report (COSEWIC 2008).

3.2. Population and Distribution

California Buttercup occurs from southwestern British Columbia south along the coast to Baja California, including inland areas of California, with a Canadian population that is widely disjunct from the nearest US populations in Oregon (Figure 1; COSEWIC 2008). This severely limits the possibly of a metapopulation dynamic or gene flow with US populations. In Canada, California Buttercup is known only from small island clusters to the south and east of Victoria on the southeastern side of Vancouver Island.

Canadian populations are presumed to be independent with little gene flow or potential for rescue effect from US populations and have shown the ability for long-term persistence prior to the influence of human activity (COSEWIC 2008). Further, the two island groups where the species is confirmed are about 6 km apart, and seed dispersal across the intersecting ocean is unlikely (COSEWIC 2008). Loss and degradation of Garry Oak ecosystems has also created a highly fragmented habitat (GOERT 2002; Lea 2006) which further limits seed dispersal between suitable habitats. For the purposes of this recovery strategy, populations separated by 1 km or more, are considered a separate population.

California Buttercup is restricted to a very small area in Canada (<20 km^2). Four California Buttercup populations have been confirmed in Canada, at Trial Islands, Discovery Island, West Chatham Island, and Alpha/Griffin Islands (Figure 2). A potential fifth population, reported from Saturna Island, requires further inspection because there is debate regarding the species identity (COSEWIC 2008) and plants could not be verified in 2010 because they did not flower. Population information for the four confirmed populations, collected in 2005 (provided in the status report), supplemented with information gathered in 2010, suggest that the Canadian populations of California Buttercup fluctuate between 3,077 to 12,508 mature plants in total (Table 2). Population sizes differ widely in their historic numbers, some sites only have tens of plants, others have a few hundred, and in the case of Griffin Island, several thousand.

In 2010, buttercup plants with “extra” petals were observed at two locations not noted in the COSEWIC status report (2008): Beacon Hill Park and Uplands Park on Vancouver Island. The identity of plants at these two locations could not be determined because of insufficient

identifiable characteristics. These two populations are not included in (Table 2) because further investigation is required before they are accepted as California Buttercup populations.

There are not sufficient data to directly determine a trend in the number of mature individuals or the area occupied by the Canadian population. Overall, a decline in the species abundance in Canada is inferred, based on indirect evidence (a decline in habitat quality) (COSEWIC 2008).

Table 2. General location, population size and land tenure for California Buttercup in Canada with population number corresponding to numbers on map in Figure 2.

Population[1]	General location	Population size (year counted)	Land Tenure
1.1	Trial Island	10 (2005) 0-50 plants[2] (2010)	Non-federal land
1.2	Lesser Trial Island	170-180 (2005) 68 (2010)	Non-federal land
2	Discovery Island	35 (2005) 30-40 (2010)	Non-federal land
3.1	Alpha Islet	400-600 (2005) 5,250-5,350 (2010)	Non-federal land
3.2	Griffin Island	1,900-2,100 (2005) 6,000-7,000 (2010)	Non-federal land
4	West Chatham Island	570-590 (2005) No data (2010)	Federal lands
5	Saturna Island	< 50 (2005) identity requires confirmation Failed to find[3] (2010)	Non-federal land

[1] First number indicates population and number in decimal place indicates the subpopulation.
[2] Approximately 50 plants were found with $\geq$ 8 petals per flower; most species of buttercup that typically have only five petals. However, California Buttercup has a curved beak on the seeds; confirmation of species identity was not possible because fruit did not mature.
[3] Four non-flowering plants were found which could have been California Buttercup, Western Buttercup or a hybrid between the two.

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

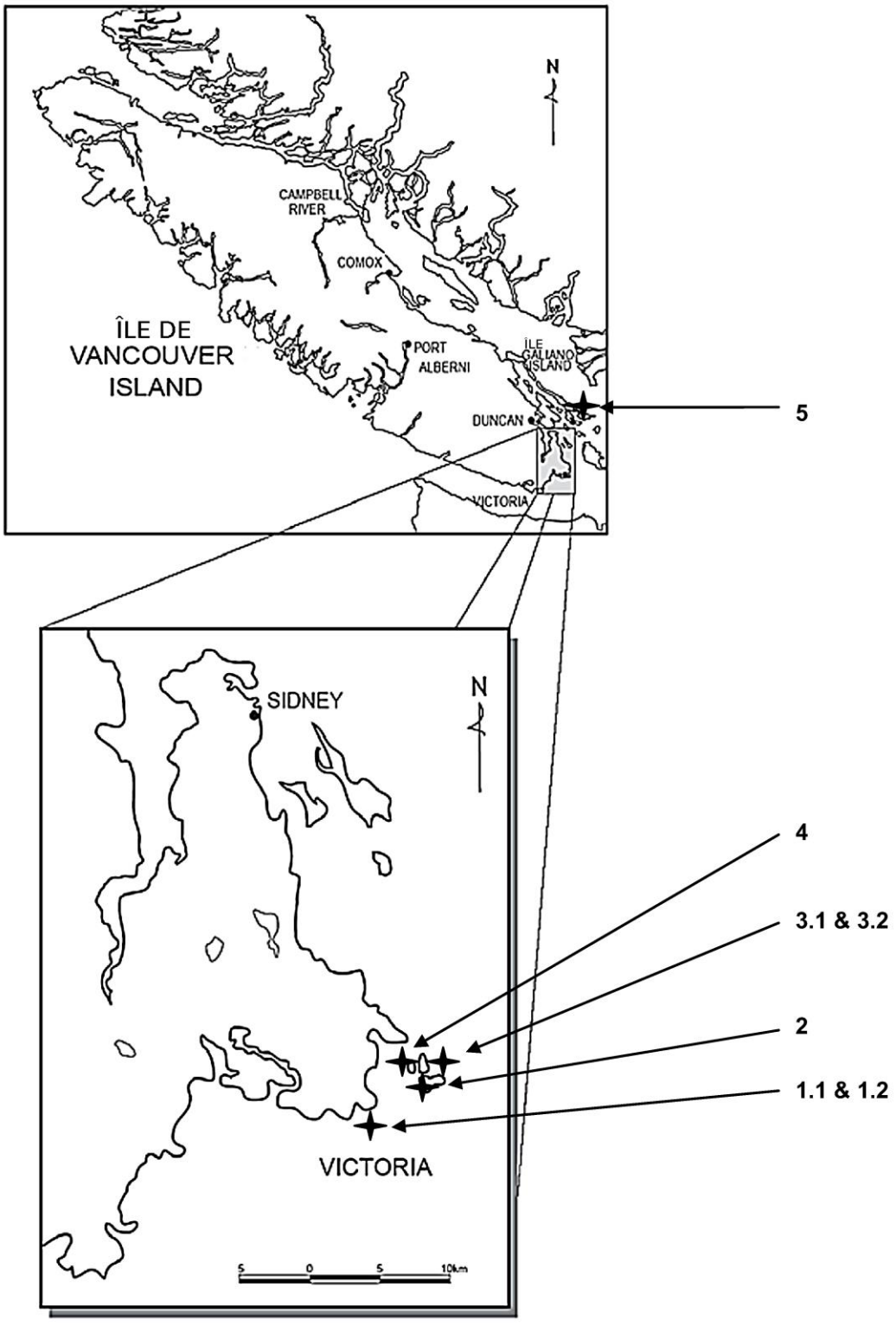

Figure 2. Distribution of California Buttercup in Canada (adapted from COSEWIC 2008). Stars indicate confirmed populations (#1-4) and a potential fifth population on Saturna Island (#5). Numbers refer to the populations and subpopulations listed in Table 2.

3.3. Needs of the California Buttercup

California Buttercup is intrinsically rare in Canada due to the limited area capable of supporting the species (COSEWIC 2008) as well as certain factors that may limit its survival. In Canada, California Buttercup is restricted to maritime meadow habitats associated with Garry Oak ecosystems (Figure 3). It is further restricted to locations within 100 m of the ocean, in the mildest and driest portion of islands near southeastern Vancouver Island. It is possibly intolerant of moderate to heavy shading and competition from trees and shrubs. It is also intolerant of prolonged seepage or inundation.

Figure 3. Habitat of California Buttercup at Lesser Trial Island. Photo by Matt Fairbarns.

A number of factors may limit the survival and recovery of California Buttercup in Canada:

- Dependence on highly specific maritime meadow habitats associated with Garry Oak 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 long-distance dispersal of seeds or fruits limits the potential for local rescue effects or establishment in unoccupied habitat areas (COSEWIC 2008).

- Extremely small population sizes (<100 plants in some cases) may constrain the species' genetic diversity, and increase its vulnerability to extirpation due to demographic stochasticity and chance events including those which operate at a small scale.

4. Threats

4.1. Threat Assessment

Table 3. Threat Assessment Table

Threat	Level of Concern[1]	Extent	Occurrence	Frequency	Severity[2]	Causal Certainty[3]
Alien, invasive or introduced species						
Encroachment by invasive alien plants	High	Widespread	Current	Continuous	High	Medium
Changes in ecological dynamics or ecological processes						
Encroachment of native herbaceous and woody vegetation	High	Widespread	Current	Continuous	High	Medium
Hybridization with Western Buttercup	Low	Localized	Unknown	Unknown	Unknown	Low
Disturbance or harm						
Recreational activities	Medium	Localized	Recurrent	Seasonal	Unknown	Low
Livestock grazing and trampling	Low	Localized	Historic / Unknown	Unknown	Unknown	Medium
Habitat loss or degradation						
Habitat conversion	Medium	Localized	Anticipated	Recurrent	Medium	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

One of the most serious and immediate threats to California Buttercup (Table 3) is posed by the encroachment of invasive alien plants (Fairbarns 2010). A large number of invasive alien plant species have encroached into habitats necessary for the survival and recovery of California Buttercup. The most serious invasive shrubs are Scotch Broom (*Cytisus scoparius*), and Himalayan Blackberry (*Rubus armeniacus*). Problematic invasive medium-height and tall grasses include Sweet Vernal Grass (*Anthoxanthum odoratum*), Barren Brome (*Bromus sterilis*), and Common Velvetgrass (*Holcus lanatus*). Frequently occurring, low-growing invasive grasses

include Cheatgrass (*Bromus tectorum*), Ripgut Brome (*Bromus rigidus*), Canada Bluegrass (*Poa compressa*), and Kentucky Bluegrass (*Poa pratensis*). Common medium-height and tall invasive forbs include Bull Thistle (*Cirsium vulgare*), and Sow Thistle (*Sonchus oleraceus*). Low growing invasive forbs include Stork's-bill (*Erodium cicutarium*), Dovefoot Geranium (*Geranium molle*), Hairy Cat's-ear (*Hypochaeris radicata*), Ribwort Plantain (*Plantago lanceolata*), Sheep Sorrel (*Rumex acetosella*), Dandelion (*Taraxacum officinale*), Little Vetch (*Vicia hirsuta*), and Common Vetch (*Vicia sativa*). One invasive vine, English Ivy (*Hedera helix*), forms a dense, spreading mat in some habitat favoured by California Buttercup (Fairbarns 2010).

Invasive alien plants impede the survival and recovery of California Buttercup through suppression, competition, and pre-emption of space. Suppression occurs when shrubs and medium to tall grasses and forbs reduce the amount of light reaching the leaves of California Buttercup, thereby reducing its ability to produce food. Competition occurs when the roots of invasive alien plants capture moisture and nutrients and thereby reduce the availability of these resources to California Buttercup. The availability of safe germination sites suited to California Buttercup is directly reduced when invasive alien plants (particularly perennial rosette and mat-forming species) pre-empt space. The availability of safe germination sites may also be indirectly reduced by alien species when the litter they produce creates an impenetrable thatch (Fairbarns 2010).

Many alien grasses and forbs are successful invaders because they produce abundant seed and thereby saturate germination sites in their vicinity, to the detriment of native species (Fairbarns 2010). This facility is of particular concern in areas where suitable germination sites develop as the result of meso scale (> 50 cm diameter) disturbances and is discussed in the subsequent discussion of changes in ecological dynamics or natural processes. As invasive alien plants are widespread, compete directly with California Buttercup, and can potentially alter the habitat, this threat is of high concern.

4.2.2. Changes in ecological dynamics or natural processes

Encroachment by native herbaceous and woody plant species, may impede the survival and recovery of California Buttercup through suppression (shading out the buttercups), competition (for moisture, nutrients and other shared resources), and the pre-emption of space just as do invasive species. The persistence of California Buttercup, however, indicates that a balance once existed between it and other native plants. Historically, First Nations in the area used fire to stimulate the growth of food species and possibly to improve forage for game species (e.g., elk and deer) (Turner 1999; Gedalof *et al.* 2006). The cessation of First Nations burning may have decreased the supply of suitable habitat for California Buttercup germination and growth. Fire effects change in a wide variety of habitat characteristics including the amount of organic matter, nutrient cycling, soil moisture, and soil biota (Barbour *et al.* 1999). Fire suppression has allowed fire-intolerant native woody trees such as Red Alder (*Alnus rubra*), Trembling Aspen (*Populus tremuloides*) and Douglas-fir (*Pseudotsuga menziesii*)[1] to expand into areas where they were

[1] While mature Douglas-fir are quite tolerant of fire, young seedlings and saplings are not. Frequent burns, conducted in order to maintain the productivity of camas populations, would have prevented Douglas-firs from surviving long enough to become fire-tolerant.

previously excluded. Similarly, native shrubs such as Common Snowberry (*Symphoricarpos albus*) and Nootka Rose (*Rosa nutkana*) have benefitted from fire suppression[2]. Native woody species have reduced the amount of light reaching the herb layer where California Buttercup grows, and also compete for moisture and nutrients as well as changing the physical properties of the soil (Broersma 1973). Some of the islands where California Buttercup occurs show signs of forest encroachment, as evidenced by the juxtaposition of abundant small Douglas-firs with the scarcity of older trees. Even the Trial Islands, which show no signs of tree encroachment, have extensive shrub thickets on sites which were likely burned regularly in order to maintain an easily accessed camas (*Camassia* spp.) crop[3] (COSEWIC 2008). Consequently, encroachment by native plants through ecological succession is considered a high level of concern.

Hybridization with Western Buttercup is known to occur, producing less fertile intergrades of California Buttercup and Western Buttercup, however, no molecular studies of Canadian populations of California Buttercup have been conducted (Brayshaw 1989; Wilken 1993). Brayshaw (1989) indicates that while there is strong introgression with Western Buttercup, the hybrid plants have less chance of producing viable seeds. California Buttercup is not overwhelmed by Western Buttercup, but rather the two seem to be in balance, perhaps because the site conditions favour California Buttercup close to the ocean where salt spray is a factor. While artificial hybrids can occur in habitats occupied by these two species, further taxonomic and molecular studies are needed to confirm evidence of a threat to California Buttercup survival. Consequently, hybridization frequency and severity are unknown and therefore represent an unknown or low level of concern at this time.

4.2.3. Disturbance or harm

Recreational activities, such as camping, hiking and picnicking, is of medium concern for the Discovery Island population where areas are formally designated for recreational activities. The populations on Alpha Islet and Griffin Island and much of the Trial Islands occur within Provincial Ecological Reserves where visitor use is discouraged. Signs are posted at the aforementioned Ecological Reserves either prohibiting access or encouraging visitors to remain on existing trails. However, visitors do not always comply with prohibitions. In addition, these locations are difficult to access for regular patrols by B.C. Parks to ensure compliance from visitors and boaters. Similarly, the California Buttercup population on West Chatham Island occurs on an Indian Reserve and, while visitors are prohibited from visiting the reserve without permission, compliance is not always followed.

The pressures of recreational use are greatest on the Discovery Island Marine Provincial Park, where the population of California Buttercup extends into a campground. In the past, California Buttercup plants have been disturbed by mowing to create a low turf where tents may be easily erected. Although this no longer occurs, current camper activities do continue to trample plants in the area. Mowing, camping and trampling are activities that can cause physiological stress, damage to individuals, and reduced reproduction and fitness (COSEWIC 2008). Elsewhere on

[2] Common Snowberry and Nootka Rose can resprout from buried rhizomes after a fire destroys above-ground plant parts but frequent, regular burning will greatly reduce or eliminate them.
[3] Camas was historically managed for the growth as a traditional food crop among First Nations.

Discovery Island, the population is bisected by walking trails which continue to lead to soil compaction and serve as conduits for the introduction of invasive plants.

There is much less recreational use on the Trial Islands, Alpha Islet, Griffin Island, and West Chatham Islands; campers rarely, if ever, set tents up on these locations. There are numerous well-defined walking trails on the main Trial Island while the other islands and islets receive light recreational use.

In the past, livestock grazing and trampling occurred on portions of the Discovery Island, Griffin Island, Alpha Islet, and the Trial Islands now occupied by California Buttercup. When grazing and trampling occurred on these islands it likely had a negative impact on the California Buttercup populations, but this threat disappeared with the removal of livestock and they are unlikely to be re-introduced to any of these sites. Nevertheless, it is likely that the areas that were most heavily grazed (especially Discovery Island) are no longer able to support California Buttercup as they have been so heavily modified by the introduction of agronomic grasses.

It is not clear what grazing and trampling pressures affect the potential Saturna Island population but nearby meadow areas have been heavily altered by livestock, most notably feral goats. As the current threat of grazing and trampling may only occur at a single potential population, this threat is considered a low level of concern.

4.2.4. Habitat loss or degradation

Habitat conversion appears to present a moderate level of threat to the habitat of extant populations of California Buttercup. The locations supporting California Buttercup in Canada have potential for further habitat loss and degradation due to a range of potential activities such as habitat conversion (i.e., residential development, development and maintenance or modification of existing structures), industrial and commercial activities such as excavation, and potential impacts from ongoing use and operation of existing facilities. If habitat conversion does occur it can disrupt life cycle processes and cause physiological stress to the plant populations. This threat is a medium level of concern.

5. Population and Distribution Objectives

In Canada, California Buttercup is found in maritime meadow habitats associated with Garry Oak ecosystems and as such had a naturally, highly restricted range. Within this range, significant habitat loss since European settlement (Lea 2006) has likely resulted in population reductions. Encroachment of vegetation and effects resulting from recreational activities continue to exacerbate the situation (COSEWIC 2008). There are currently four confirmed California Buttercup populations in Canada (COSEWIC 2008, Fairbarns 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) 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 California Buttercup, 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. At this time it is possible to set short-term objectives that focus on maintaining the four confirmed extant populations and preventing a decline in distribution while exploring the feasibility of establishing and/or augmenting populations to increase abundance and distribution:

Objective 1: Maintain the four confirmed extant populations (1-4 in Table 2) of California Buttercup.

Objective 2: Prevent a decline from the 2008 distribution[4] of California Buttercup in Canada.

Objective 3: Establish and/or augment populations to increase abundance and distribution[5] if determined to be feasible and biologically appropriate for California Buttercup.

6. Broad Strategies and General Approaches to Meet Objectives

Broad strategies and approaches to meet the population and distribution objectives for California Buttercup include:

- Stewardship: foster landowner understanding , appreciation, and involvement in work towards the survival and recovery of California Buttercup;
- Habitat and species protection: protect populations and habitat from destruction (e.g., from land conversion) by developing mechanisms/instruments for protection;
- Public education and outreach: increase public awareness of the species, its needs and conservation value;
- Population monitoring: gather information to make decisions and fill knowledge gaps pertaining to species distribution, population dynamics, and population trends;
- Population restoration: restore extant populations and establish new population(s) to recover the Canadian population of the species;
- Population research: address critical knowledge gaps;

[4] Distribution is measured by the extent of occurrence (currently about 20km^2) and area of occupancy (currently estimated at 2 ha; COSEWIC 2008). If new populations are discovered, these baseline figures should be updated as required.

[5] The intent is to increase the area of occupancy and maintain the extent of occurrence.

6.1. Strategic Direction for Recovery

Table 4. Recovery Planning Table

Threat or Limitation	Priority	Broad Strategy to Recovery	General Description of Research and Management Approaches
Threat: Habitat conversion Threat: Recreational activities Threat: Encroachment by invasive alien plants Threat: Encroachment of native herbaceous and woody vegetation Limitation: habitat specificity, small populations	High	Stewardship	• Prepare Best (Beneficial) Management Practices guidelines for California Buttercup to support landowners, land managers and First Nations in stewardship activities. • Engage landowners, land managers and First Nations in recovery decisions and activities. • Develop and implement site-specific plans for managing woody plant encroachment and invasion by alien plants species, and monitoring their impacts on non-target species, communities, and ecological processes.
	High	Habitat and species protection	• Identify protection mechanisms/instruments for the species and its critical habitat.
	Medium	Public education and outreach	• Increase public awareness of the existence, conservation value, threats and harm reduction measures for California Buttercup and associated species at risk.
Knowledge Gap: Population size, extent and habitat requirement	Medium	Population monitoring	• Design and implement an inventory and monitoring program to track populations for 10 successive years, with subsequent monitoring as required. • Report on population trends, area of occupancy, habitat condition, and threats every 2 years. • Monitor populations at Saturna, Beacon Hill Park, and Uplands Park to confirm whether they are California Buttercup or not. • Monitor success and impacts of potential population establishment on non-target species, communities and ecological processes.
Knowledge Gap: Population size and propagation techniques Knowledge gaps and limitations regarding population demography Limitation: habitat specificity, lack of long-distance dispersal, and small populations,	High	Population research and restoration	• Identify suitable sites for the restoration/establishment of California Buttercup population(s). • Develop population restoration techniques and priorities to maintain known populations. • Determine conditions necessary for germination, establishment, growth and reproduction. • 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., recruitment, growth, hybridization, survival) necessary for population growth.

6.2. Narrative to Support the Recovery Planning Table

Protecting and maintaining habitat at the known sites supporting California Buttercup is essential to its recovery in Canada (Table 4). The successful implementation of habitat protection initiatives and stewardship plans relies upon establishing strong relationships with land owners, land managers, and recreational land users. The threat of most concern is encroachment of invasive alien plants and woody shade plants into California Buttercup habitat. Continued maintenance by land managers is important in order to mitigate key threats such as native and non-native plant encroachment and the effects of ongoing fire suppression. Collaboration between government, land managers, environmental groups and others is key to recovery of California Buttercup populations. An effective monitoring program is also essential to evaluate the success of site protection and stewardship measures.

It will be important to develop population augmentation techniques for California Buttercup to improve the long-term viability of this species in Canada by reducing the risks associated with stochastic events or other potential impacts to an extant population. Identifying additional habitat for the establishment of an experimental population may also provide a range of benefits as workers test habitat suitability models, propagation methods, and conduct monitoring that will provide opportunities for further insights into the species' life history. New populations are unlikely to become established without human intervention, even if suitable habitat is available. Development of any experimental populations will require the development of a translocation plan and its careful implementation in a precautionary, adaptive management framework. There are also risks associated with translocations which must be accompanied by a program to monitor not only the success of translocations, but the impacts of translocation on non-target species, communities, and ecological processes. Suitable habitat may also require additional stewardship and management actions (e.g., invasive alien species control) prior to establishing new populations of California Buttercup.

Site protection and stewardship will not, by themselves, guarantee the persistence of existing populations: due to their small size some populations may require augmentation. A population may also collapse as the result of other factors, not all of them predictable. Demographic studies will help identify whether populations are inherently self-sustaining and may indicate which life stages are most at risk.

7. Critical Habitat

Areas of critical habitat for California Buttercup 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 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 California Buttercup is identified in this recovery strategy to the extent possible based on best available information. It is recognized that the critical habitat identified below is insufficient to achieve the population and distribution objectives. Critical habitat has been fully identified for three of four known populations (at five locations listed in Table 2: Trial Island, Lesser Trial Island, Discovery Island, Alpha Islet, and Griffin Island), further study is required (see below) in order to identify critical habitat for the West Chatham Island population. The schedule of studies section (Section 7.2; Table 5) outlines activities required to identify additional critical habitat necessary to support the population and distribution objectives of the species.

Attributes of critical habitat follow; the critical habitat attributes below cover the range of attributes found at studied sites and may not reflect attributes at new or unstudied sites:

- Sunny areas with short or sparse vegetation (trees are absent and the cover of shrubs is never substantial).
- Elevations between 0 to 20 m above sea level.
- Terraces and low slopes (0-10%).
- Shallow soils (< 5 cm organic surface layer) over bedrock with very small amounts of exposed mineral soil and fine litter.
- Moderately well drained soil that is moist early in the growing season (October to March) with water deficits by early summer.

The habitat of California Buttercup in Canada generally occurs in coastal meadows on small islands and islets along the southeast coast of Vancouver Island in Garry Oak and associated ecosystems. The habitat is characterized as open areas without tall vegetation, reliant on seasonal seepage, and have thin soils stressed by summer droughts (COSEWIC 2008). Field investigations at Trial Island, Lesser Trial Island, Discovery Island, Alpha Islet, and Griffin Island were used to further characterize the habitat of California Buttercup (Fairbarns 2010).

The California Buttercup depends directly on canopy openings to provide certain habitat attributes. Although California Buttercup plants have been found growing in shaded areas (one subpopulation on Discovery Island) these are not optimum growing conditions for California Buttercup. Minimum canopy openings must be large enough that California Buttercup plants are not sheltered by surrounding vegetation, nor smothered by fallen trees. When tall vegetation falls

it will cover an area of ground for a distance equal to its height. The minimum size of openings can be determined based on the height of vegetation able to grow in the area and cast shade or smother the California Buttercup (Spittlehouse *et al.* 2004). The presence of surrounding vegetation (e.g., trees and shrubs) within these canopy openings will also compete with California Buttercup for water and nutrients.

California Buttercup is a conspicuous perennial plant but, as is the case with many species, it may not produce flowers every year. In non-flowering years it is essentially indistinguishable from the closely related Western Buttercup, which is a widespread and abundant species of similar habitats on southeastern Vancouver Island. Consequently, only flowering plants surveyed in 2010 could be identified as California Buttercup and used to identify critical habitat. Since species identification is difficult, known California Buttercup plant locations require further surveys to ensure the entire population is captured.

Within the geographical boundaries identified in Figure 4 and Figure 5, critical habitat required for the survival of each California Buttercup patch[6] is the minimum canopy openings supporting the plants and was mapped by Fairbarns (2010).

At West Chatham Island, no recent surveys have been conducted to confirm the presence of suitable habitat or plants in over five years so data is currently unavailable upon which to define critical habitat.

[6] Patch is a term used to refer to a single plant or group of several plants in close proximity. A specific mapping scale and minimum separation distance have not been used to quantitatively define a patch; the identification of patches is based on survey work performed by a biologist familiar with the species. Lacking any detailed information on seed bank extent, the seed bank is assumed to be included within each patch: the only information pertaining to the spatial extent of the California Buttercup seed bank is derived from the physical characteristics of the seeds, and dispersal distance is probably very limited (COSEWIC 2008).

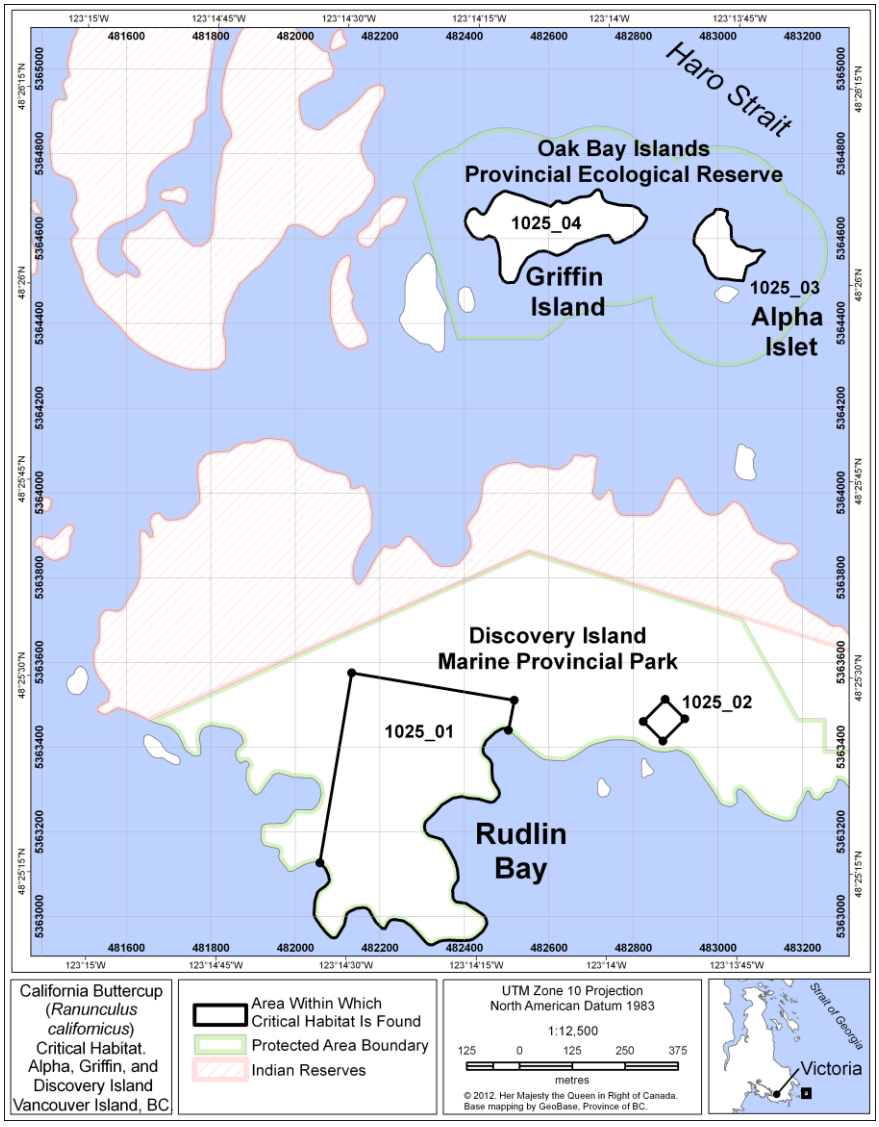

Figure 4. Areas (~26ha) within which critical habitat for California Buttercup is found on Discovery Island (within Discovery Island Marine Provincial Park), Alpha Islet and Griffin Island (within Oak Bay Islands Provincial Ecological Reserve).

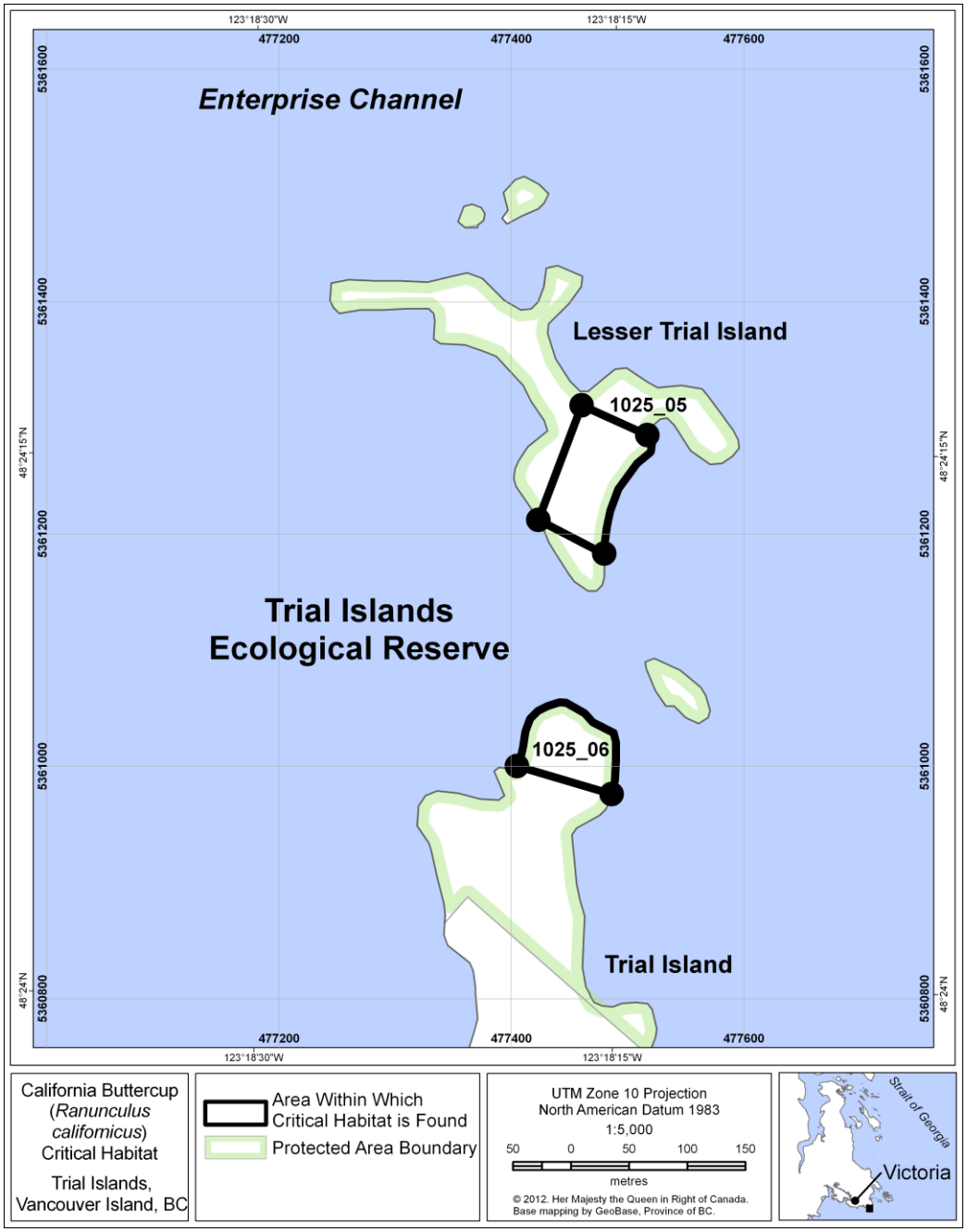

Figure 5. Area (~ 1.1 ha) within which critical habitat for California Buttercup is found on Trial Island and Lesser Trial Island within the Trial Islands Ecological Reserve. The known critical habitat for the two subpopulations, occurring within the two parcels, is approximately 0.3 ha.

7.2. Schedule of Studies to Identify Critical Habitat

Table 5. Schedule of Studies

Description of Activity	Rationale	Timeline
Confirm the presence and location of the species and/or habitat at West Chatham Island.	Required to identify critical habitat for this population.	2013
Multi-year surveys to examine suitable habitat of all known populations.	Identification of full extent of critical habitat for Trial Island subpopulation. Identification of critical habitat suitable for increasing the size of existing populations.	2017
Identification of sites with a potential for establishment of additional populations of California Buttercup.	Required to meet population and distribution objectives.	2014
Attempt to establish, maintain, and monitor California Buttercup individuals in an experimental manner.	Confirm the suitability of habitat.	2016
If suitability tests are successful, test the potential for establishing new self sustaining populations or expanding existing populations through introduction of seeds or seedlings into suitable habitats. Seed bank viability must be determined to facilitate restoration and introductions.		2017 onwards
Undertake analyses to determine the amount and configuration of habitat needed to achieve the recovery objectives.		Dependent upon previous steps

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

Examples of activities likely to destroy critical habitat are provided below, but are not limited to those in Table 6. 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 6. Examples of Activities Likely to Result in the Destruction of Critical Habitat.

Activity	Effect of activity on critical habitat	Most likely sites
Land conversion for human development (e.g., residential development, development and maintenance or modification of existing structures)	This activity can destroy habitat outright, or cause soil compaction, 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). Disturbance of seed bank potentially burying seeds. Plants may become stressed and die or be unable to germinate due to impaired ability of the habitat to provide suitable soil moisture or light availability.	Discovery Island
Damaging recreational use (e.g., camping, picnicking, and hiker traffic)	Soil compaction leading to altered habitat attributes. Plants may become stressed and die or be unable to germinate due to impaired ability of the habitat to provide suitable soil moisture. In addition, this activity is likely to introduce or spread invasive alien plant species. Invasive alien plant species compete with California Buttercup 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 California Buttercup.	Discovery 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 California Buttercup in Canada will be assessed using the following measures:

Objective 1: Maintain the four confirmed extant populations (1-4 in Table 2) of California Buttercup.

- By 2018 best management practices are developed and implemented at two or more sites.
- The populations remain extant.
- By 2023, all populations show a stable or increasing trend in population size.

Objective 2: Prevent a decline from the 2008 distribution of California Buttercup in Canada.

- There is no decrease in the known distribution (extent of occurrence and area of occupancy) of California Buttercup in Canada.

Objective 3: Establish and/or augment populations to increase abundance and distribution if determined to be feasible and biologically appropriate for California Buttercup.

- By 2018, additional sites have been identified for establishment or restoration of California Buttercup population(s).
- By 2018, propagation techniques have been developed.
- By 2023, one or more (re)introduction or augmentation experiments are underway at suitable site(s).

9. Statement on Action Plans

One or more action plans will be completed by 2018.

10. References

B.C. Conservation Data Centre. 2011. BC Species and Ecosystems Explorer. B.C. Ministry Of Environment Victoria, B.C. Web site: http://a100.gov.bc.ca/pub/eswp/ [accessed September 19, 2011].

Barbour, M. G, J. H. Burk, W. D. Pitts, F. S. Gilliam, and M. W. Schwartz. 1999. Terrestrial Plant Ecology: Third Edition. Benjamin/Cummings, an imprint of Addison Wesley Longman, Inc., Menlo Park, California. xiv + 649 pp.

Brayshaw, T.C. 1989. Buttercups, waterlilies, and their relatives (the Order Ranales) in British Columbia, Victoria. Royal British Columbia Museum Memoir 1. Royal British Columbia Museum, Victoria, British Columbia.

Broersma, K. 1973. Dark soils of the Victoria area, British Columbia. M.Sc. Thesis. Department of Soil Science, University of British Columbia. Vancouver, B.C. 110 pp.

Brook, B.W., L.W. Traill, and J.A. Bradshaw. 2006. Minimum viable population sizes and global extinction risk are unrelated. Ecology Letters 9:375-382.

COSEWIC. 2008. COSEWIC assessment and status report on the California Buttercup *Ranunculus californicus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 24 pp.

COSEWIC. 2010. COSEWIC's Assessment Process and Criteria. Committee on the Status of Endangered Wildlife in Canada, Ottawa. 19 pp. Web site: http://www.cosewic.gc.ca/pdf/assessment_process_e.pdf [accessed February 2012].

Flather, Curtis H., Gregory D. Hayward, Steven R. Beissinger, and Philip A. Stephens. 2011. Minimum viable populations: is there a 'magic number' for conservation practitioners? Trends in Ecology and Evolution 26:307-316.

Fairbarns, M. 2010. Towards a recovery strategy for the California Buttercup (*Ranunculus californicus*) in Canada. Parks Canada Agency, Victoria, B.C. v + 28 pp.

Garnett, S.T., and K.K. Zander. 2011. Minimum viable population limitations ignore evolutionary history. Trends in Ecology and Evolution 26(12): 618-619.

Gedalof, Z., D.J. Smith, and M.G. Pellatt. 2006. From prairie to forest: three centuries of environmental change at Rocky Point, Vancouver Island, B.C. Northwest Science 80:34-46.

GOERT. 2002. Recovery strategy for Garry Oak and associated ecosystems and their associated species at risk in Canada: 2001-2006, Draft 20 February 2002. Garry Oak Ecosystems Recovery Team, Victoria, B.C. x + 191 pp.

Government of Canada. 2009. Species at Risk Act Policies: Overarching Policy Framework [Draft]. Pp ii+ 38pp. in Species at Risk Act Policies and Guidelines Series, Environment

Canada. Web site: http://www.sararegistry.gc.ca/document/default_e.cfm?documentID=1916 [accessed June 2010].

Jamieson, I.G., and F. W. Allendorf. 2012. How does the 50/500 rule apply to MVPs? Trends in Ecology and Evolution, 1566: 1-7.

Lea, T. 2006. Historical Garry Oak Ecosystems of Vancouver Island, British Columbia, pre-European Contact to the Present. Davidsonia 17:34-50.

NatureServe. 2011. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1, NatureServe, Arlington, Virginia. Web site: http://www.natureserve.org/explorer [accessed: September 19, 2011].

Parks Canada Agency. 2006. Recovery Strategy for Multi-Species at Risk in Maritime Meadows associated with Garry Oak Ecosystems in Canada. xii + 93pp, in Government of Canada. *Species at Risk Act* Recovery Strategy Series, Ottawa, Ontario.

Reed, D.H. 2005. Relationship between population size and fitness. Conservation Biology 19:563-568.

Spittlehouse, D. L., R.S. Adams, and R.D. Winkler. 2004. Forest, edge and opening microclimate at Sicamous Creek: Research Report 24. British Columbia Ministry of Forests, Research Branch, Victoria, B.C. vii+ 43 pp. Web site: http://www.for.gov.bc.ca/hfd/pubs/Docs/Rr/Rr24.htm [accessed January 2013].

Traill, L.W., C.J.A. Bradshaw, and B.W. Brook. 2007. Minimum viable population size; A meta-analysis of 30 years of published estimates. Biological Conservation 139:159-166.

Traill, L.W., B.W. Brook, R.R. Frankham, and C.J.A. Bradshaw. 2009. Pragmatic population viability targets in a rapidly changing world. Biological Conservation 143:28-34.

Turner, N.J. 1999. "Time to burn:" Traditional use of fire to enhance resource production by aboriginal peoples in British Columbia. Pp 185-218. in R. Boyd (ed.). Indians, Fire and the Land in the Pacific Northwest, Oregon State University Press, Corvallis, OR.

Wilken, D. 1993. *Ranunculus.* Pp. 913-928. in Hickman, J.C. (ed.). The Jepson Manual: Higher Plants of California, University of California Press, Berkeley.

APPENDIX A: Effects on the Environment and Other Species

The majority of the proposed recovery activities will lead to better site protection, broader public appreciation of rare species, reduced human impacts and reduced pressure from non-native species. Accordingly, they will have positive effects on most non-target native species, natural communities and ecological processes. Recovery activities aimed to reduce the impacts associated with encroachment from native trees and shrubs (see section 4.2.2, Changes in ecological dynamics or natural processes), which have occurred as the result of fire suppression, will have negative impacts on the targeted woody species themselves as well as plant and animal species which rely upon them.

A number of species at risk and provincially rare species occur within or adjacent to populations of California Buttercup (Table 7). Most recovery activities proposed for California Buttercup can be expected to have a net positive effect on the habitat of these other non-target species and communities. Nevertheless, it is possible that specific management actions carried out during the course of California Buttercup recovery (e.g., weed removal, shrub clearing, population augmentation, and species translocations) could have unforeseen collateral impacts on co-occurring non-target species. While probably slight, the chances of negative impacts accruing due to recovery activities must be duly considered. One method of mitigating such negative effects is to monitor the results of California Buttercup management. In keeping with the principles of adaptive management, an important component of recovery action planning will be anticipating, monitoring and mitigating collateral impacts (both positive and negative) on non-target species, communities, and ecological processes.

Table 7. Partial list of species at risk and vulnerable species potentially affected by Garry Oak Ecosystem Recovery Team (GOERT) and/or SARA recovery activities. Sources: B.C. Conservation Data Centre 2011, NatureServe 2011.

Species and Common Name	British Columbia provincial rank	COSEWIC designation	SARA status
Allium amplectens Slim-leaf Onion	S3 Blue	Not assessed	Not assessed
Callitriche marginata Winged Water-starwort	S1 Red	Not assessed	Not assessed
Castilleja levisecta Golden Paintbrush	S1 Red	Endangered	Endangered
Castilleja victoriae Victoria's Owl-clover	S1 Red	Endangered	Not assessed
Coenonympha tullia insulana Common Ringlet – insulana subspecies	S1Red	Not assessed	Not assessed
Entosthodon fascicularis Banded Cord Moss	S2S3 Blue	Special Concern	Special Concern
Limnanthes macounii Macoun's Meadowfoam	S2 Red	Threatened	Threatened
Lomatium dissectum var. dissectum Fernleaf Desert-parsley	S1 Red	Not assessed	Not assessed
Lotus formosissimus Seaside Birds-foot Lotus	S1 Red	Status pending	Not assessed
Lupinus densiflorus	S1 Red	Endangered	Endangered

Dense-flowered Lupine			
Orthocarpus bracteosus Rosy Owl-clover	S1 Red	Endangered	Endangered
Sanicula arctopoides Bear's-foot Sanicle	S1 Red	Endangered	Endangered
Sanicula bipinnatifida Purple Sanicle	S2 Red	Threatened	Threatened
Sericocarpus rigidus White-top Aster	S2 Red	Special Concern	Special Concern
Silene scouleri ssp. grandis Coastal Scouler's Catchfly	S1 Red	Endangered	Endangered
Triphysaria versicolor ssp. *versicolor* Bearded Owl-clover	S1 Red	Endangered	Endangered