PROPOSED

Species at Risk Act
Recovery Strategy Series
Adopted under Section 44 of SARA

Multi-species Recovery Strategy for the Princeton Landscape, including Dwarf Woolly-heads (*Psilocarphus brevissimus*) Southern Mountain Population, Slender Collomia (*Collomia tenella*), and Stoloniferous Pussytoes (*Antennaria flagellaris*) in Canada

Princeton Landscape: Dwarf Woolly-heads Southern Mountain Population, Slender Collomia, and Stoloniferous Pussytoes

2013

Canada

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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 (www.sararegistry.gc.ca).

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« Programme de rétablissement plurispécifique pour le paysage de Princeton visant le psilocarphe nain (*Psilocarphus brevissimus*) - population des montagnes du Sud, le collomia délicat (*Collomia tenella*) et l'antennaire stolonifère (*Antennaria flagellaris*) au Canada [Proposition] »

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MULTI-SPECIES RECOVERY STRATEGY FOR THE PRINCETON LANDSCAPE, INCLUDING DWARF WOOLLY-HEADS (*Psilocarphus brevissimus*) SOUTHERN MOUNTAIN POPULATION, SLENDER COLLOMIA (*Collomia tenella*), AND STOLONIFEROUS PUSSYTOES (*Antennaria flagellaris*) IN CANADA

2013

Under the Accord for the Protection of Species at Risk (1996), the federal, provincial, and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada.

In the spirit of cooperation of the Accord, the Government of British Columbia has given permission to the Government of Canada to adopt the "Multi-species Recovery Strategy for the Princeton Landscape, Including Dwarf Woolly-heads (*Psilocarphus brevissimus* var. *brevissimus*), Slender Collomia (*Collomia tenella*), and Stoloniferous Pussytoes (*Antennaria flagellaris*) in British Columbia" (Part 2) under Section 44 of the *Species at Risk Act.* Environment Canada has included an addition which completes the SARA requirements for this recovery strategy, and excludes the section on Socio-Economic Considerations. Socio-economic factors are not part of the consideration process for federal recovery strategies developed under SARA.

The federal Multi-species Recovery Strategy for the Princeton landscape in Canada consists of two parts:

Part 1: Federal addition to the "Multi-species Recovery Strategy for the Princeton Landscape, Including Dwarf Woolly-heads (*Psilocarphus brevissimus* var. *brevissimus*), Slender Collomia (*Collomia tenella*), and Stoloniferous Pussytoes (*Antennaria flagellaris*) in British Columbia", prepared by Environment Canada.

Part 2: "Multi-species Recovery Strategy for the Princeton Landscape, Including Dwarf Woolly-heads (*Psilocarphus brevissimus* var. *brevissimus*), Slender Collomia (*Collomia tenella*), and Stoloniferous Pussytoes (*Antennaria flagellaris*) in British Columbia", prepared by the Southern Interior Rare Plants Implementation Group, for the British Columbia Ministry of Environment.

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PREFACE

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

The federal Minister of the Environment is the competent minister for the recovery of the Dwarf Woolly-heads - Southern Mountain Population, Slender Collomia, and Stoloniferous Pussytoes and has prepared the federal component of this multi-species recovery strategy (Part 1), as per section 37 of SARA. It has been prepared in cooperation the Province of British Columbia. SARA section 44 allows the Minister to adopt all or part of an existing plan for the species if it meets the requirements under SARA for content (sub-sections 41(1) or (2)). The Province of British Columbia provided the attached multi-species recovery strategy for the Princeton landscape plants Dwarf Woolly-heads - Southern Mountain Population, Slender Collomia, and Stoloniferous Pussytoes (Part 2) as science advice for managing the species in British Columbia. It was prepared in cooperation with Environment Canada.

Success in the recovery of these species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada, or any other jurisdiction, alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Princeton landscape plant species Dwarf Woolly-heads - Southern Mountain population[1], Slender Collomia, and Stoloniferous Pussytoes, 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 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.

[1] In Canada, Dwarf Woolly-heads is known from only the Similkameen Valley south of Princeton in south-central British Columbia (Southern Mountain population), and from southeastern Alberta and southwestern Saskatchewan (Prairie population). The Southern Mountain population (BC) and the Prairie population (AB, SK) are separated by a distance of over 500 km and several mountain ranges, and are treated as different designatable units under SARA. Only the Southern Mountain population of Dwarf Woolly-heads is discussed in the B.C. recovery strategy. Note that *Psilocarphus brevissimus* var. *brevissimus* is the only variety of the species in Canada, and (in contrast with provincial treatment) it is referred to simply as *Psilocarphus brevissimus* in federal documents and databases.

ADDITIONS AND MODIFICATIONS TO THE ADOPTED DOCUMENT

The following sections have been included to address specific requirements of SARA that are not addressed, or which need more detailed comment, in the "Multi-Species Recovery Strategy for the Princeton Landscape, Including Dwarf Woolly-heads (*Psilocarphus brevissimus* var. *brevissimus*), Slender Collomia (*Collomia tenella*), and Stoloniferous Pussytoes (*Antennaria flagellaris*) in British Columbia" (Part 2 of this document, referred to hereafter as "the provincial recovery strategy"). In some cases, these sections may also include updated or modified information from that found in the provincial recovery strategy.

1. Species Status Information

Legal Status: SARA Schedule 1 (Endangered); Dwarf Woolly-heads – Southern Mountain population (2007), Slender Collomia (2005), Stoloniferous Pussytoes (2005). The conservation status for each species is summarized in Table 1.

Table 1. Conservation status (from NatureServe 2011, B.C. Conservation Data Centre 2011, and B.C. Conservation Framework 2011) for Princeton landscape plants Dwarf Woolly-heads, Slender Collomia, and Stoloniferous Pussytoes.

Species	Global (G) Rank	National (N) Rank	Sub-national (S) Rank	COSEWIC Designation	B.C. List	B.C. Conservation Framework
Dwarf Woolly-heads - Southern Mountain population (except for Global Rank)[2]	G4T4?*	Canada (NNR), United States (NNR)	Canada: British Columbia (S1); Alberta (S2S3); United States: California (SNR), Idaho (S2), Montana (S1), Nevada (SNR), Oregon (SNR), Utah (SNR), Washington (SNR), Wyoming (S2)	Endangered (2006)	Red	Highest priority: 1, under Goal 3**
Slender Collomia	G4?	Canada (N1), United States (NNR)	Canada: British Columbia (S1); United States: Idaho (SNR), Nevada (SNR), Oregon (SNR), Utah (S2?), Washington (SNR), Wyoming (S3)	Endangered (2003)	Red	High priority: 2, under Goal 3

[2] The Global (G) Rank reported on NatureServe (2011) for Dwarf Woolly-heads describes the global status of *Psilocarphus brevissimus* var. *brevissimus*, which includes both the Southern Mountain population and the Prairie population in Canada.

Stoloniferous Pussytoes	G5?	Canada (NNR), United States (NNR)	Canada: British Columbia (S1); United States: California (S3.2), Idaho (SNR), Oregon (SNR), Washington (SNR), Wyoming (S2)	Endangered (2004)	Red	Highest priority: 1, under Goal 3

* Rank: 1– critically imperiled; 2– imperiled; 3- vulnerable to extirpation or extinction; 4- apparently secure; 5– secure; H– possibly extirpated; NR – status not ranked. Trinomial (T) Rank after a species' global rank indicates the status of infraspecific taxa (subspecies or varieties).
** The three goals of the B.C. Conservation Framework are: 1. Contribute to global efforts for species and ecosystem conservation; 2. Prevent species and ecosystems from becoming at risk; 3. Maintain the diversity of native species and ecosystems

It is estimated that the percent of the global range in Canada is less than 1%, for each species.

2. Socio-economic Considerations

The provincial recovery strategy contains a short statement on socio-economic considerations. As socio-economic factors are not a consideration in any aspect of the preparation of SARA recovery strategies, (see Section 41(1) of SARA), the Socio-economic Considerations section of the provincial recovery strategy is not considered part of the federal Minister of Environment's recovery strategy for this species. Furthermore, socio-economic factors were excluded from the preparation of all other sections of this federal addition, including Population and Distribution Objectives and Critical Habitat.

3. Recovery Feasibility

This section replaces the "Recovery Feasibility" section in the provincial recovery strategy.

Recovery of these Princeton landscape plants, including Dwarf Woolly-heads (*Psilocarphus brevissimus*) Southern Mountain population, Slender Collomia (*Collomia tenella*), and Stoloniferous Pussytoes (*Antennaria flagellaris*) is considered technically and biologically feasible based on the following four criteria outlined in the draft SARA Policies (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.

Species	Feasible	Rationale
Dwarf Woolly-heads - Southern Mountain population	Yes	Reproductive individuals are available at existing sites. Dwarf Woolly-heads reproduces either by self-pollination or asexual reproduction and produces abundant seed. This is an annual species; a seed bank facilitates year-to-year persistence at sites, and rebound after disturbance.
Slender Collomia	Yes	Reproductive individuals are available at existing sites. Slender Collomia is probably self-compatible, and self-pollinating. This is an annual species; a seed bank facilitates year-to-year persistence at sites.
Stoloniferous Pussytoes	Yes	Reproductive individuals are available at existing sites. Pollination is by wind, and seeds are produced sexually by outcrossing. Plants also reproduce vegetatively by producing stolons that terminate in plantlets.

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

Species	Feasible	Rationale
Dwarf Woolly-heads - Southern Mountain population Slender Collomia Stoloniferous Pussytoes	Yes	There is habitat to support the existing populations in British Columbia, and additional suitable habitat might also be made available through habitat management or restoration.

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

Species	Feasible	Rationale
Dwarf Woolly-heads - Southern Mountain population Slender Collomia Stoloniferous Pussytoes	Yes	Primary threats can be avoided or mitigated in cooperation with landowners and land-managers, through the actions identified in the provincial recovery strategy.

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

Species	Feasible	Rationale
Dwarf Woolly-heads - Southern Mountain population Slender Collomia Stoloniferous Pussytoes	Yes	General recovery methods and techniques to achieve the population and distribution objectives are known. Over the short term, recovery techniques consist primarily of threat mitigation.

4. Population and Distribution Objectives

This section replaces the “Recovery Goal” and “Rationale for the Recovery Goals” sections in the provincial recovery strategy.

Environment Canada has determined the Population and Distribution Objectives for the Princeton landscape plants including Dwarf Woolly-heads - Southern Mountain population, Slender Collomia, and Stoloniferous Pussytoes to be:

Species	Population and Distribution Objective
Dwarf Woolly-heads – Southern Mountain population	*To maintain the distribution, and to maintain or (where feasible) improve the abundance, of the two known extant populations of this species in Canada, as well as any other extant populations that may be identified.*
Slender Collomia	*To maintain the distribution, and to maintain or (where feasible) improve the abundance, of the one known extant population of this species in Canada, as well as any other extant populations that may be identified.*
Stoloniferous Pussytoes	*To maintain the distribution, and to maintain or(where feasible) improve the abundance, of the two known extant populations of this species in Canada, as well as any other extant populations that may be identified.*

Rationale:

The abundance and distribution of these species in Canada have only ever been known to include the two extant populations of Dwarf Woolly-heads - Southern Mountain population (2004 survey), one extant population of Slender Collomia (2003 survey), and two extant populations of Stoloniferous Pussytoes (2003, 2008[3], 2011[4] surveys). There is no information to indicate that these species had a more widespread distribution previously; therefore, an objective to actively increase the number of populations is not warranted. However, if additional naturally occurring populations are discovered, these should also be maintained. Because these species were not known to occur in B.C. prior to 1997, long-term trends in population size and area of occupancy are unknown. It is important to note for future monitoring and/or trend estimation purposes, that the population size of annual species (Dwarf Woolly-heads - Southern Mountain population, Slender Collomia) may characteristically fluctuate between survey years (Bush and Lancaster 2004). Where the best available information and/or long-term monitoring indicates overall population decline, deliberate attempts to improve abundance (e.g., through seeding or change in land use management) are appropriate.

5. Critical Habitat

5.1 Identification of the Species' Critical Habitat

This section replaces the "Identification of the species' critical habitat" section in the provincial recovery strategy.

Section 41 (1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. The provincial recovery strategy noted that critical habitat could not be identified at that time (nor is it required in the provincial process), due to a lack of information about general and site-specific habitat features. This federal document does identify critical habitat to the extent possible for these species; more precise boundaries may be mapped, and additional critical habitat may be added in the future if additional research supports the inclusion of areas beyond those currently identified. A primary consideration in the identification of critical habitat is the amount, quality, and locations of habitat needed to achieve the population and distribution objectives.

Ecological attributes of the Princeton landscape plants are outlined in the provincial recovery strategy and in the COSEWIC status reports for Dwarf Woolly-heads - Southern Mountain population (COSEWIC 2006), Slender Collomia (COSEWIC 2003), and Stoloniferous Pussytoes (COSEWIC 2004):

[3] Björk, C. 2008. Noteworthy Vascular Plants from the Cascade Lee, British Columbia. Botanical Electronic News. No. 401.November 25, 2008. Available online at: http://www.ou.edu/cas/botany-micro/ben/ben401.html

[4] One of the two Stoloniferous Pussytoes populations was confirmed and re-surveyed June 7, 2011: observers Kella Sadler (Environment Canada), Andrew Robinson (Environment Canada), Terry McIntosh (consultant), Orville Dyer (B.C. Ministry of Natural Resource Operations), Kirk Safford (B.C. Ministry of Environment)

1. All plants occur near Princeton, BC, in the Interior Douglas-fir Okanagan very dry hot Biogeoclimatic Zone (IDFxh1); conditions are continental, characterized by warm, dry summers, a fairly long growing season, and cool winters.
2. Within this environment, the area where the target plants occur is at the western edge of the distribution of open shrub/grassland; Big Sagebrush (*Artemisia tridentata*) with scattered Ponderosa Pine (*Pinus ponderosa*), and Douglas-fir (*Pseudotsuga menziesii*) trees dominate the vegetation of the landscape. The habitat is associated with unusual soils, predominantly characterized as Roany - Solodic Dark Gray. Green and Lord (1979) describe this soil type as: moderately coarse, medium, and fine-textured, moderately alkaline materials that include glacial till and colluvial[5] deposits composed mainly of tertiary sandstones and shales, on steeply-sloping escarpments and valley slopes. Soils are well-drained and contain betonitic clay, which comes from the underlying Princeton sediments. Steep slopes and slow permeability of the underlying materials cause these soils to erode readily.
3. Within the area described, species- and site-specific microhabitat requirements and ecological associations that have been noted include vernal pools[6], eroding slopes with spring seepage, and dry, eroded sandy ridge slopes:

Species	Microhabitat	Associations
Dwarf Woolly-heads – Southern Mountain population	Vernal pools and at edges of ephemeral ponds. Occupied sites have calcareous clay bottoms; the soil is wet in the spring, and dry, hard, and cracked in the summer. It is considered a vernal pool specialist, the tolerance of inundation allows the species to outcompete grassland perennials, while its tolerance of soil desiccation and heat during summer drought allows it to proliferate where aquatic/wetland species cannot.	The vernal pools occur in large forest openings and are dominated by species of Popcornflower (*Plagiobothrys* spp.) and Knotweed (*Polygonum polygaloides*). Other species that occur near the vernal pools include One-spike Oatgrass (*Danthonia unispicata*), Tiny Mousetail (*Myosurus minimus*), Carolina Meadow-foxtail (*Alopecurus carolinianus*) Lowland Cudweed (*Gnaphalium palustre*), and Annual Hairgrass (*Deschampsia danthonioides*).
Slender Collomia	Eroded, steeply-sloped, southeast-facing sections of a sandy ridge. The sandy ridge, formed by fluvial processes during the last glaciation, consists of fine-textured sands. The eroded sections of the slopes are sparsely vegetated with about 20% cover.	Associated vegetation includes the shrub Saskatoon (*Amelanchier alnifolia*), as well as a variety of herbs: Timber Milk-vetch (*Astragalus miser*), Narrow-leaved Collomia (*Collomia linearis*), Thread-leaved Phacelia (*Phacelia linearis*), Dalmatian Toadflax (*Linaria genistifolia* ssp. *dalmatica*), Cheatgrass (*Bromus tectorum*), and Bluebunch Wheatgrass (*Pseudoroegneria spicata*). Scattered Douglas fir (*Pseudotsuga menziesii*) and Ponderosa Pine (*Pinus ponderosa*) trees occur on the ridge.

[5] Colluvial material comprises sediments, broken rock fragments and debris which, as a consequence of erosion and gravity, fall down-slope and accumulate.
[6] Vernal pools are small, temporary pools that retain water on a seasonal basis. They are dry for part of the year, and generally at peak depth in spring, after water has collected from winter rains or snowmelt.

Stoloniferous Pussytoes	Moderate slopes with southerly aspects. Occupied sites have a distinct hydrology, characterized by ephemeral winter seepage, followed by drying in the early summer. The soil moisture regime is associated with erosion in the form of slow, downslope soil movement.	Associated with slope erosion; as a result, occupied sites have exposed mineral soil, and are sparsely vegetated. Associated vegetation includes scattered Ponderosa Pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) trees, with Big Sagebrush (*Artemisia tridentata*), Bluebunch Wheatgrass (*Pseudoroegneria spicata*), Nevada Bluegrass (*Poa secunda* ssp. *juncifolia*), One-spike Oatgrass (*Danthonia unispicata*), Fleabane (*Erigeron* spp.), Desert-parsley (*Lomatium* spp.), Thread-leaved Sandwort (*Arenaria capillaris*)

Critical habitat for Princeton landscape plants Dwarf Woolly-heads – Southern Mountain population (two populations), Slender Collomia (one population), and Stoloniferous Pussytoes (two populations) is identified as the area occupied by individual plants or patches of plants, including the associated potential location error from GPS units (ranging from 5 m to 150 m uncertainty distance), plus an additional 50 meters (i.e., critical function zone distance[7]) to encompass immediately adjacent areas. Critical habitat also includes the entire portion of distinct ecological features[8] which are associated with, and are integral to, the production and maintenance of suitable habitat conditions, and which provide ecological context for occupied microhabitats. Distinct ecological features identified as critical habitat for target plants include: drainage for vernal pools (for Dwarf Woolly-heads – Southern Mountain population), and portions of associated slopes (Slender Collomia, and Stoloniferous Pussytoes). Where occurrences of individual plants or patches of plants are in close proximity (location uncertainty plus critical function zone boundaries are less than 100 m apart), and/or where they occur in association with the same distinct ecological feature, showing continuous suitable habitat characteristics between them, connective habitat (i.e., the area in-between occurrences) is identified as critical habitat.

Given that existing anthropogenic features (including active roads, houses, and the associated developed urban and residential landscape) do not possess the biophysical attributes required for Dwarf Woolly-heads – Southern Mountain population, Slender Collomia and Stoloniferous Pussytoes, they are not included as critical habitat, even when they occur within the minimum critical function zone distance (i.e., 50 m) of the plant occurrence. The areas containing critical habitat are shown in Appendix 1. Detailed methods and decision-making processes relating to critical habitat identification are archived in a supporting document.

[7] Critical function zone distance has been defined as the threshold habitat fragment size required for maintaining constituent microhabitat properties for a species (e.g., critical light, moisture, humidity levels necessary for survival). Existing research provides a logical basis for suggesting a minimum critical function zone distance of 50 m is identified as critical habitat for all rare plant species occurrences.

[8] "Distinct" ecological, or landscape features are here referred to as those that are distinguishable at a landscape scale (through use of detailed ecosystem mapping or aerial photos), which, at that scale, appear as ecologically contiguous features with relatively distinct boundaries (e.g., cliffs, banks, or slopes, drainage basins, seepage plateaus, or distinct vegetation assemblages), and which comprise the context for a species occurrence.

5.2 Schedule of Studies to Identify Critical Habitat

This section replaces the "Schedule of studies to identify critical habitat" section in the provincial recovery strategy.

The critical habitat identified for the Princeton landscape plants Dwarf Woolly-heads – Southern Mountain population, Slender Collomia, and Stoloniferous Pussytoes is sufficient to meet the population and distribution objectives; therefore a schedule of studies is not required.

5.3 Examples of Activities Likely to Result in Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single or multiple activities at one point in time or from the cumulative effects of one or more activities over time. The provincial recovery strategy provides a detailed description of limitations and potential threats to the Princeton landscape plants. Activities described in Table 2 include those likely to cause destruction of critical habitat for target species; destructive activities are not limited to those listed.

Table 2. Examples of activities likely to result in destruction of critical habitat for Princeton landscape plants Dwarf Woolly-heads – Southern Mountain population, Slender Collomia, and Stoloniferous Pussytoes.

Activity	Description of activity resulting in or contributing to the destruction of critical habitat	Threat level
Conversion of natural landscape for human use: -Residential and industrial development -Resource extraction (mining) -Construction of roads -Hydrological development (drilling of wells, irrigation systems, diverting streams	Conversion of natural landscape results in direct habitat loss by removal, or burial, of extant occurrences or the associated seed bank. Landscape development can also cause indirect loss by disrupting natural ecological processes and dynamics required for perpetuating the availability of critical habitat (e.g., surface erosion, changes in hydrological drainage patterns), and/or pollution of surface waters, to the extent that Princeton landscape plants are unable to persist.	High to Moderate
Use of all-terrain vehicles (ATVs) and dirt bikes	ATVs and dirt bikes cause surface ruts from tires, substratum displacement, and soil compaction. These effects result in direct loss of critical habitat by removal, or burial, of extant occurrences or the associated seed bank. This activity can also cause indirect loss by disrupting natural ecological processes required for perpetuating the availability of critical habitat (e.g., surface erosion, changes in hydrological drainage patterns) to the extent that Princeton landscape plants are unable to persist.	High to Moderate

Inappropriate levels[9] of livestock grazing	Intense grazing pressure causes soil and vegetation disturbance and/or removal, substratum displacement, soil compaction, and excessive deposition of feces. These effects result in direct loss of critical habitat by removal, or burial, of extant occurrences or the associated seed bank. Intense grazing can also cause indirect loss by disrupting natural ecological processes and dynamics required for perpetuating the availability of critical habitat (e.g., surface erosion, changes in hydrological drainage patterns), and pollution of surface waters, to the extent that Princeton landscape plants are unable to persist.	Moderate
Deliberate introduction of alien invasive plants, or efforts to control existing invasive species	Alien invasive species cause direct reduction of habitat available for Princeton landscape plants, and indirect effects, e.g., alteration of shade, water, and nutrients available to exclude niche range of Princeton landscape plants. Efforts to control invasive plants through mechanical or chemical means (non-specific herbicides) can likewise result in habitat alteration such that it is no longer suitable for Princeton landscape plants.	Low

Activities most likely to result in destruction of critical habitat include habitat loss through development, resource extraction, or recreational activities, inappropriate levels of grazing, and weed control.

Conversion of the natural landscape for human use within the Princeton landscape may result in loss of critical habitat. Economically important coal bed methane resources underlie the Princeton critical habitat areas identified for Dwarf Woolly-heads – Southern Mountain population, Slender Collomia, and Stoloniferous Pussytoes. Extraction activities, if undertaken, would be extremely destructive to populations, both directly and also indirectly, for example by burial under reclamation disposal of “drill mud”, and by disrupting groundwater hydrology, and polluting surface water. Other development activities, such as for residence, road-building, irrigation, or recreation, may likewise damage critical habitat by damaging existing populations and/or disrupting natural ecological processes and dynamics required for the species to persist in the landscape. Seasonally wet or moist microsites (i.e., vernal pools required by the species) are most at risk from ATV and bicycle damage. Soil disturbance and rutting can alter the soil moisture regime or alter the pattern of erosion, resulting in alteration (and thereby loss) of critical habitat.

Livestock use is ongoing within critical habitat areas identified. Cattle grazing can cause destruction of critical habitat by soil compaction, and other damaging physical alterations of habitats by trampling, and pollution or burial by feces. However, the effects of current cattle grazing regimes on existing populations is currently unknown and/or inconclusive, owing to a lack of population trend data, and knowledge of historical use of these properties. It is likely that multiple years of inappropriately intensive livestock use would be detrimental by causing permanent destruction of habitat required by plants and their propagules (including seed bank conditions, for annual plants) such that populations are unable to persist or recover within the landscape.

[9] Livestock grazing is (and has been, historically) common in the habitats where most of the Princeton landscape plant populations are found. It is possible that some level of grazing may be necessary for maintaining the early-successional habitats critical for the persistence of Princeton landscape plants, such that complete livestock exclusion may be inappropriate. Additional research is required to determine the relationship between the intensity of livestock use, and long-term population trends.

Invasive alien species represent a potential threat to these populations of species at risk. Many noxious weeds and invasive alien species occur in the area, e.g., Dalmatian Toadflax (*Linaria genistifolia* ssp. *dalmatica*), Cheatgrass (*Bromus tectorum*), and the proliferation of these species can degrade habitat through competitive exclusion. Some weed control substances that kill noxious weeks and alien invasive plants may also destroy habitat for populations of species at risk, by making conditions unsuitable for their survival.

6. Statement on Action Plans

This section replaces the "Statement on Action Plans" section in the provincial recovery strategy.

One or more action plans for Dwarf Woolly-heads – Southern Mountain population, Slender Collomia, and Stoloniferous Pussytoes will be posted on the Species at Risk Public Registry by 2018.

7. Effects on the Environment and Other Species

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

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

The recovery actions proposed are not expected to negatively affect any other species. Any efforts to conserve Princeton landscape plants Dwarf Woolly-heads – Southern Mountain population, Slender Collomia, and Stoloniferous Pussytoes are anticipated to have neutral effects or indirectly benefit other species in the area. The target Princeton landscape plants occur in an ecologically unique area, where several provincially rare plant species are known to occur: Carolina Meadow-foxtail (*Alopecurus carolinianus*), Close-flowered Knotweed (*Polygonum polygaloides* ssp. *confertiflorum*), Cusick's Paintbrush (*Castilleja cusickii*), Dark Lamb's-quarters (*Chenopodium atrovirens*), Dwarf Groundsmoke (*Gayophytum humile*), Kellogg's Knotweed (*Polygonum polygaloides* ssp. *kellogii*), Oniongrass (*Melica bulbosa* var. *bulbosa*), and Valley Sedge (*Carex vallicola* var. *vallicola*). In his 2008 survey[10], Curtis Björk noted additional provincially rare plant species, in association with one of the Stoloniferous Pussytoes sites: Hairy-stemmed Willowherb (*Epilobium mirabile*), Harkness' Linanthus (*Leptosiphon harknessii*), Columbia Lewisia (*Lewisia*

[10] Björk, C. 2008. Noteworthy Vascular Plants from the Cascade Lee, British Columbia. Botanical Electronic News. No. 401.November 25, 2008. Available online at: http://www.ou.edu/cas/botany-micro/ben/ben401.html

columbiana var. *columbiana*), Idaho Saxifrage (*Micranthes idahoensis*), and Short-flowered Monkey-flower (*Mimulus breviflorus*).

In acknowledgement of the high potential for shared habitat among local rare species, large-scale management actions, such as invasive species removal or the use of herbicides, should be planned and implemented carefully. All on-site activities (surveys, research, and management), to aid recovery may pose a threat to co-occurring species (e.g., via trampling, increased herbivory, or inadvertent dispersal of alien species during disposal), unless care is taken to avoid damage.

8. References

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Appendix 1. Maps of Critical Habitat for Princeton landscape plants Dwarf Woolly-heads – Southern Mountain population, Slender Collomia, and Stoloniferous Pussytoes in Canada

In Canada, Princeton landscape plants Dwarf Woolly-heads – Southern Mountain population (two populations), Slender Collomia (one population), and Stoloniferous Pussytoes (two populations) occur on non-federal land at Princeton, B.C. (Figures A1-A5).

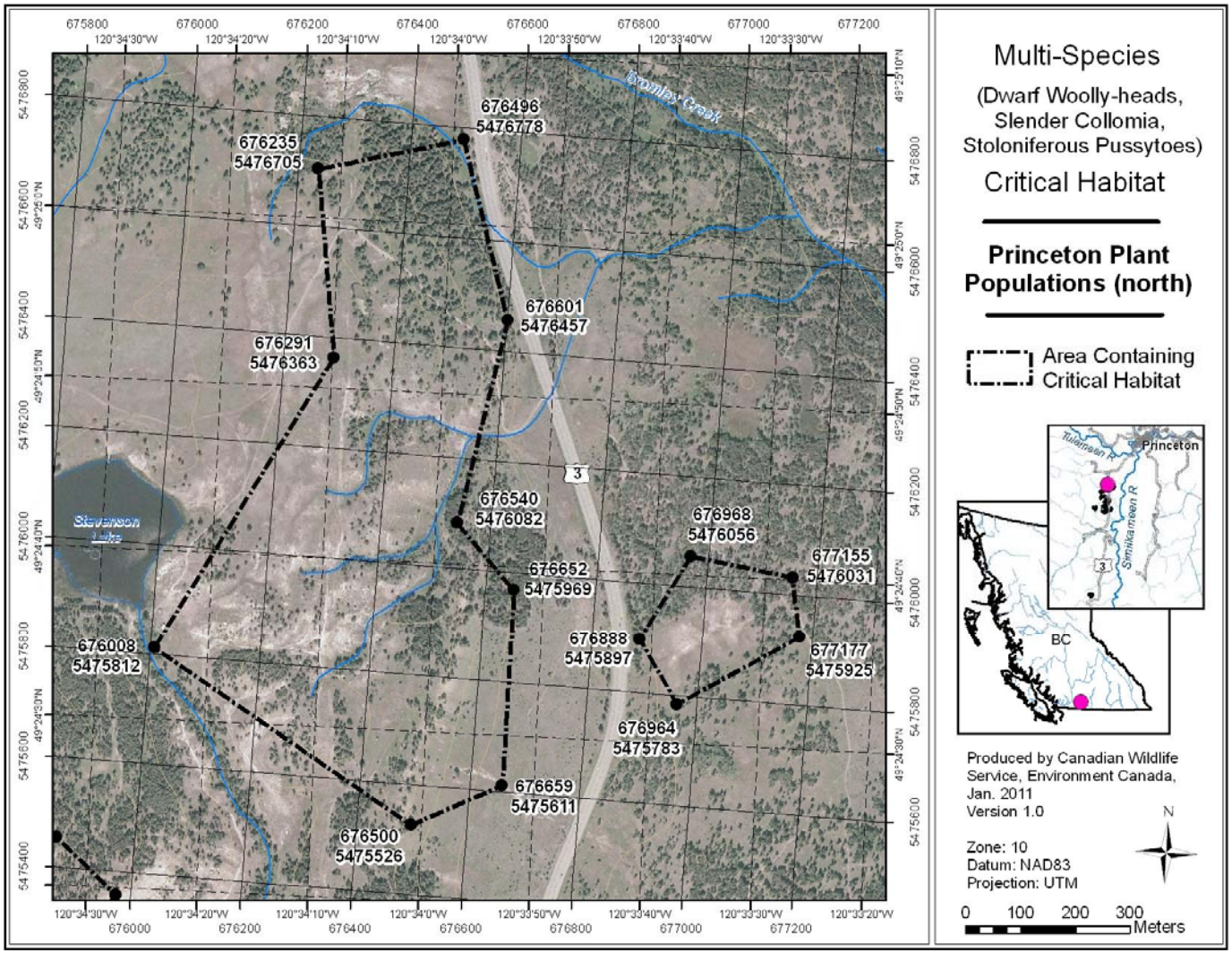

Figure A1. Areas containing critical habitat for Princeton plants (north populations). Whole polygons indicate areas of 46.9 ha (containing Stoloniferous Pussytoes and Slender Collomia), and 4.9 ha (containing Dwarf Woolly-heads), comprising 51.9 ha in total. Existing anthropogenic features within the indicated polygons, including active roads, are not identified as critical habitat.

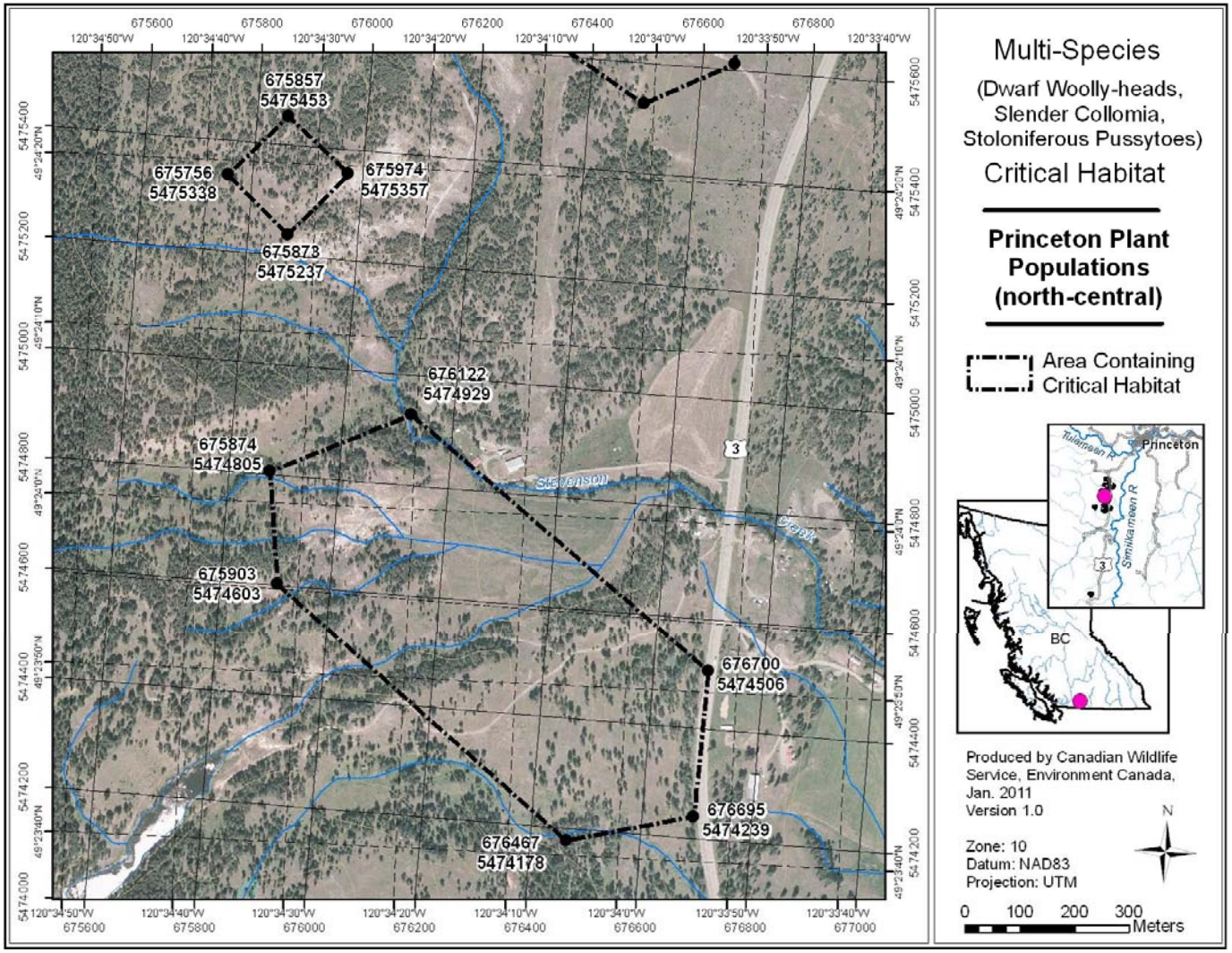

Figure A2. Areas containing critical habitat for Princeton landscape plants (north-central populations). Whole polygons indicate areas of 2.4 ha, (containing Slender Collomia) and 34.0 ha (containing Stoloniferous Pussytoes), comprising 36.3 ha in total. Existing anthropogenic features within the indicated polygons, including active roads, are not identified as critical habitat.

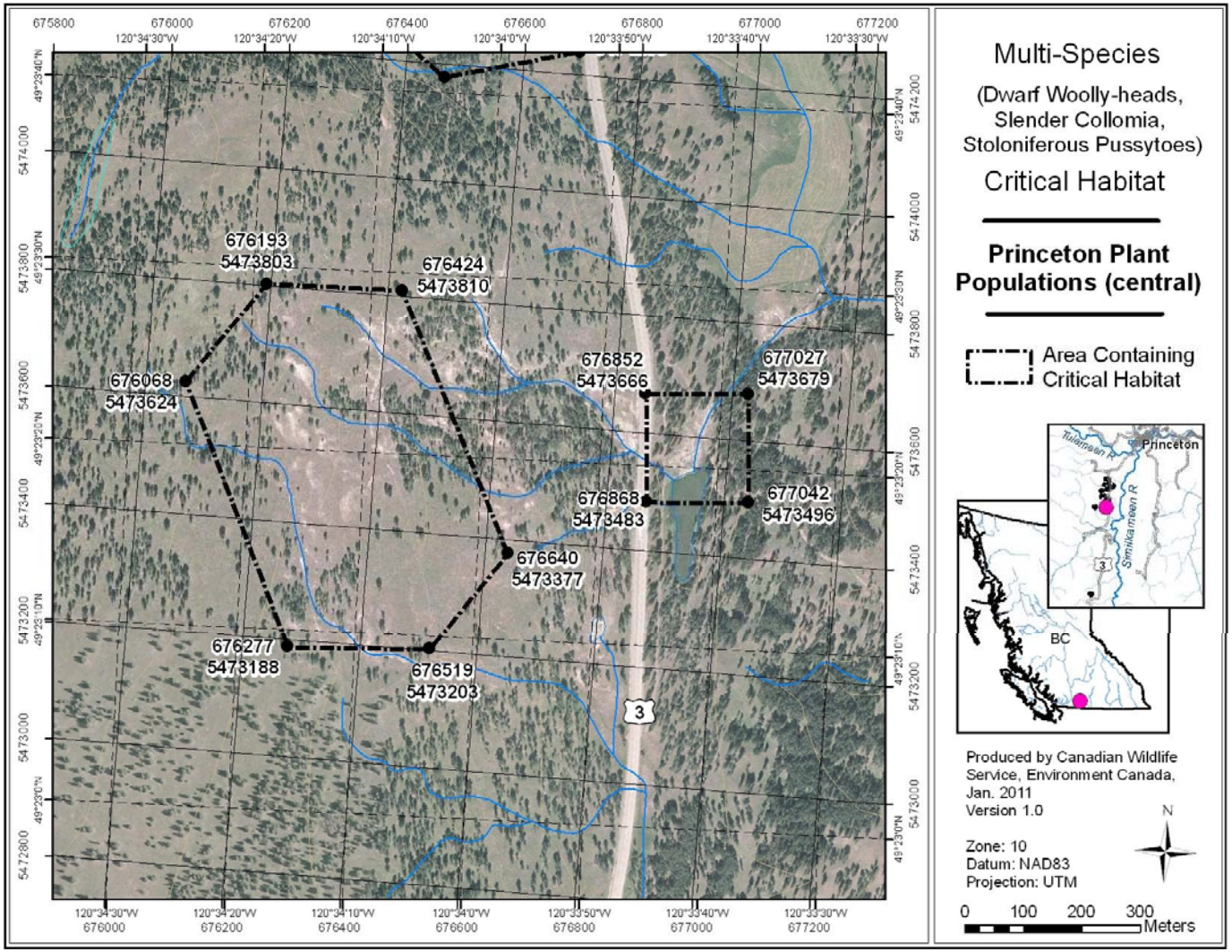

Figure A3. Areas containing critical habitat for Princeton landscape plants (central populations). Whole polygons indicate areas of 23.7 (containing Dwarf Woolly-heads and Stoloniferous Pussytoes), and 3.2 ha (containing Dwarf Woolly-heads), comprising 26.9 ha in total. Existing anthropogenic features within the indicated polygons, including active roads, are not identified as critical habitat.

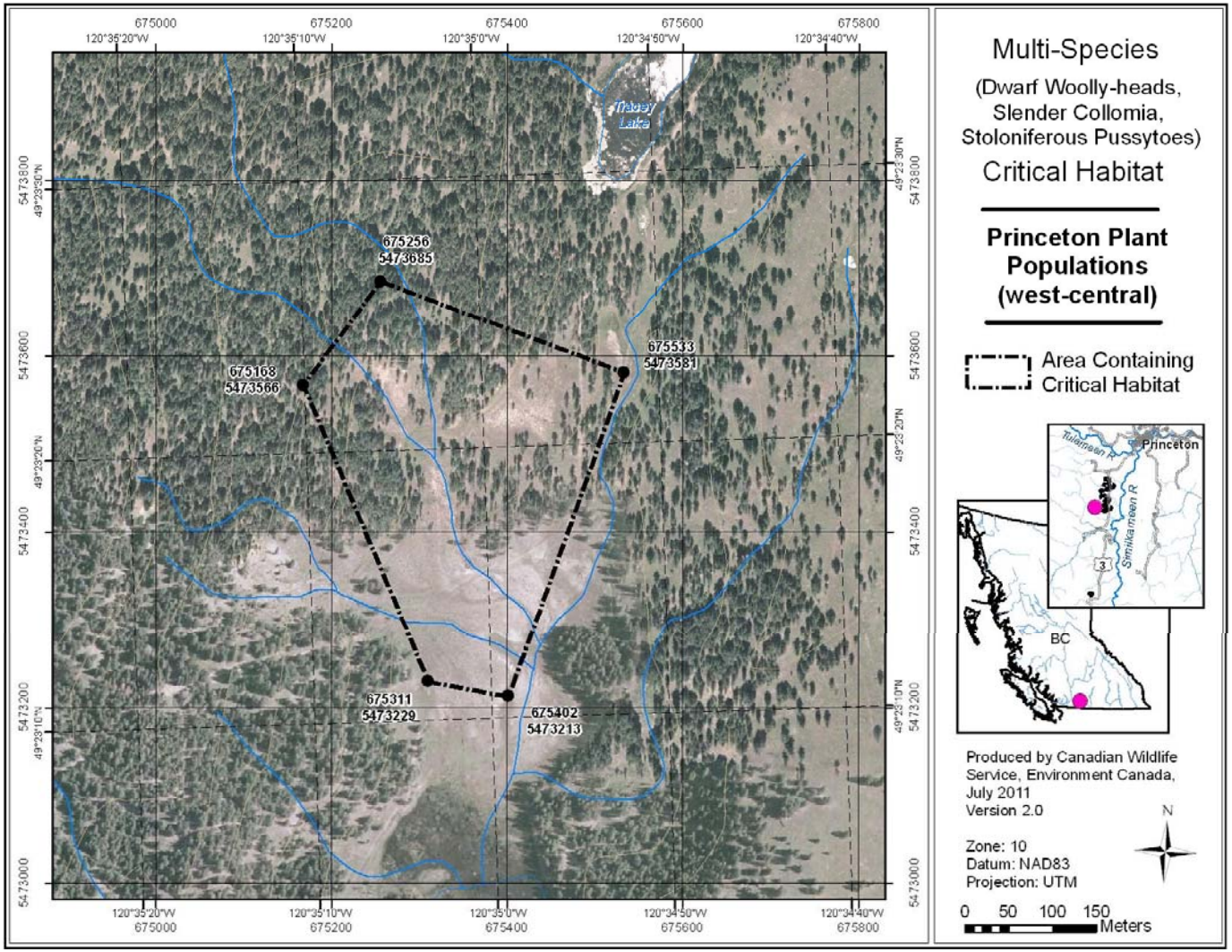

Figure A4. Area containing critical habitat for Princeton landscape plants (west-central populations). The polygon indicates an area of 10.2 ha, containing Stoloniferous Pussytoes. Existing anthropogenic features within the indicated polygon, including active roads, are not identified as critical habitat.

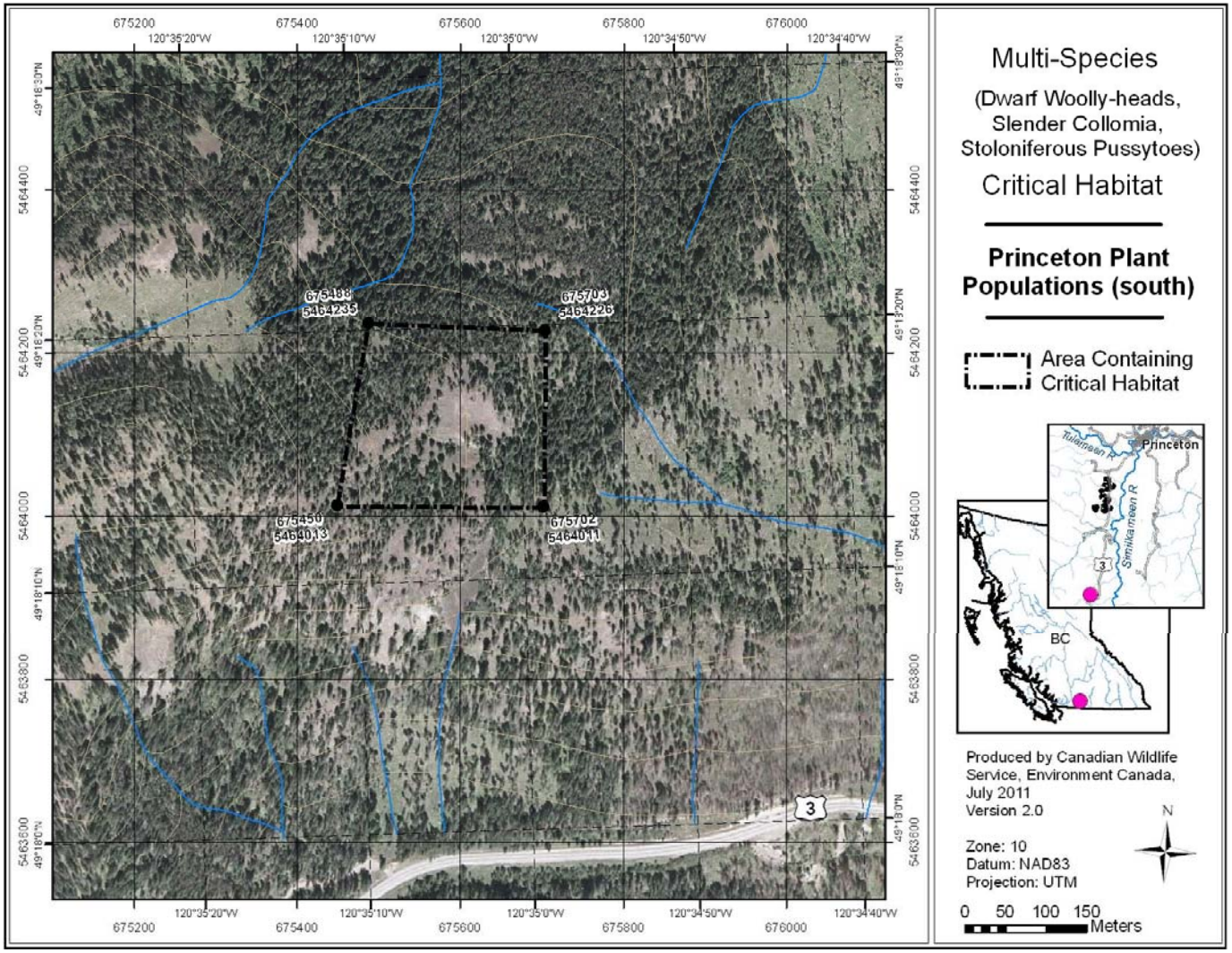

Figure A5. Area containing critical habitat for Princeton landscape plants (south populations). The polygon indicates an area of 5.1 ha, containing Stoloniferous Pussytoes. Existing anthropogenic features within the indicated polygon, including active roads, are not identified as critical habitat.

PART 2: Multi-species Recovery Strategy for the Princeton Landscape, Including Dwarf Woolly-heads (*Psilocarphus brevissimus* var. *brevissimus*), Slender Collomia (*Collomia tenella*), and Stoloniferous Pussytoes (*Antennaria flagellaris*) in British Columbia, prepared by the Southern Interior Rare Plants Implementation Group, for the British Columbia Ministry of Environment

Multi-species Recovery Strategy for the Princeton Landscape, Including Dwarf Woolly-heads (*Psilocarphus brevissimus* var. *brevissimus*), Slender Collomia (*Collomia tenella*), and Stoloniferous Pussytoes (*Antennaria flagellaris*) in British Columbia

Prepared by the Southern Interior Rare Plants Recovery Implementation Group

BRITISH COLUMBIA
The Best Place on Earth

Ministry of Environment

June 2008

About the British Columbia Recovery Strategy Series

This series presents the recovery strategies that are prepared as advice to the Province of British Columbia on the general strategic approach required to recover species at risk. The Province prepares recovery strategies to meet its commitments to recover species at risk under the *Accord for the Protection of Species at Risk in Canada*, and the *Canada – British Columbia Agreement on Species at Risk*.

What is recovery?

Species at risk recovery is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of a species' persistence in the wild.

What is a recovery strategy?

A recovery strategy represents the best available scientific knowledge on what is required to achieve recovery of a species or ecosystem. A recovery strategy outlines what is and what is not known about a species or ecosystem; it also identifies threats to the species or ecosystem, and what should be done to mitigate those threats. Recovery strategies set recovery goals and objectives, and recommend approaches to recover the species or ecosystem.

Recovery strategies are usually prepared by a recovery team with members from agencies responsible for the management of the species or ecosystem, experts from other agencies, universities, conservation groups, aboriginal groups, and stakeholder groups as appropriate.

What's next?

In most cases, one or more action plan(s) will be developed to define and guide implementation of the recovery strategy. Action plans include more detailed information about what needs to be done to meet the objectives of the recovery strategy. However, the recovery strategy provides valuable information on threats to the species and their recovery needs that may be used by individuals, communities, land users, and conservationists interested in species at risk recovery.

For more information

To learn more about species at risk recovery in British Columbia, please visit the Ministry of Environment Recovery Planning webpage at:

<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>

Multi-species Recovery Strategy for the Princeton Landscape, Including Dwarf Woolly-heads (*Psilocarphus brevissimus* var. *brevissimus*), Slender Collomia (*Collomia tenella*), and Stoloniferous Pussytoes (*Antennaria flagellaris*) in British Columbia

Prepared by the Southern Interior Rare Plants Recovery Implementation Group

June 2008

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Cover illustration/photograph

Terry McIntosh

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Disclaimer

This multi-species recovery strategy has been prepared by the Southern Interior Rare Plants Recovery Implementation Group, as advice to the responsible jurisdictions and organizations that may be involved in recovering the species. The British Columbia Ministry of Environment has received this advice as part of fulfilling its commitments under the *Accord for the Protection of Species at Risk in Canada*, and the *Canada – British Columbia Agreement on Species at Risk*.

This document identifies the recovery strategies that are deemed necessary, based on the best available scientific and traditional information, to recover dwarf woolly-heads, slender collomia, and stoloniferous pussytoes populations in British Columbia. Recovery actions to achieve the goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations. These goals, objectives, and recovery approaches may be modified in the future to accommodate new objectives and findings.

The responsible jurisdictions and all members of the recovery team have had an opportunity to review this document. However, this document does not necessarily represent the official positions of the agencies or the personal views of all individuals on the recovery team.

Success in the recovery of these species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this strategy. The Ministry of Environment encourages all British Columbians to participate in the recovery of stoloniferous pussytoes, slender collomia, and dwarf woolly-heads.

RECOVERY TEAM MEMBERS

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RESPONSIBLE JURISDICTIONS

The British Columbia Ministry of Environment is responsible for producing a recovery strategy for dwarf woolly-heads, slender collomia, and stoloniferous pussytoes under the *Accord for the Protection of Species at Risk in Canada*. Environment Canada's Canadian Wildlife Service participated in the preparation of this recovery strategy.

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Ksenia Barton prepared this document on behalf of the Southern Interior Rare Plants Recovery Implementation Group. Lucy Reiss, Ted Lea, and Brenda Costanzo offered valuable comments and suggestions during the development of this report. The B.C. Conservation Data Centre provided most of the rare plant information. The structure of this report is based in part on those of other multi-species recovery strategies (authors: Mike Miller, Carrina Maslovat, Matt Fairbarns, George Douglas, and Shyanne Smith). The following people provided useful information and advice: Curtis Björk, Matt Fairbarns, Dave Fraser, Joyce Gould, Gordon Humphrey, Frank Lomer, Terry McIntosh, Jenifer Penny, Allison Sanger, Rolf Schmitt, Madelon Schouten, Thayne Tuason, and George Wooten (affiliations noted in the Contacts list). Terry McIntosh, James Reveal, Mark Turner, and Carol Witham provided photographs. Environment Canada funded the preparation of this document.

EXECUTIVE SUMMARY

This multi-species recovery strategy has been developed to guide the recovery of plant species at risk that occur in a landscape south of Princeton, BC. The target species at risk are dwarf woolly-heads, southern mountain population (*Psilocarphus brevissimus* var. *brevissimus*), slender collomia (*Collomia tenella*), and stoloniferous pussytoes (*Antennaria flagellaris*). These species' ranges extend south into the western United States.

The area consists of approximately 5 km^2 and has been described as one of the most important rare plant sites in British Columbia. In addition to the three nationally endangered species that grow there, at least nine additional provincially rare plant species have also been found within the area. This document addresses the recovery of the three target species at risk, and also recommends the recovery of the associated ecosystem.

The site occurs at the western edge of the distribution of open shrub/grassland at that elevation. Big sagebrush (*Artemisia tridentata*) dominates the vegetation of the landscape, which also features scattered ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) trees. The habitat features unusual soils, perhaps explaining the unique species assemblage that occurs at the site. Important microsites in the landscape include vernal pools; eroding slopes with spring seepage; and dry, eroded sandy ridge slopes.

The target species are at risk due to a number of broad categories of threats such as habitat loss or degradation, invasive alien species, changes in ecological dynamics or natural processes, and disturbance. Other threats include stochastic events (e.g., wildfires and sustained drought), climate change, and natural disasters. Main concerns are from resource extraction, habitat degradation from recreation and cattle grazing, invasive alien species, and biological factors including demography and genetics. Intrinsic limiting factors include limited dispersal, poor recruitment or reproduction, population fluctuations, inbreeding, and restricted range. The recovery of the three target species at risk is considered technically and biologically feasible.

The recovery goals for each of dwarf woolly-heads, slender collomia, and stoloniferous pussytoes are:

1. To maintain population(s) with the current area of occupancy; and
2. To maintain any newly located additional population(s).

The recovery objectives for each of dwarf woolly-heads, slender collomia, and stoloniferous pussytoes are:

1. Increase protection[1] for all extant occurrences by 2012;
2. Confirm the distribution of these three species and update population and distribution objectives as needed by 2011;

[1] This may involve protection in any form including stewardship agreements and conservation covenants on private lands; land use designations on Crown lands; and protection in federal, provincial, and local government protected areas.

3. Reliably determine population trends by 2012;
4. Assess the severity of the main threats to the populations (habitat loss or degradation, exotic species, changes in ecological dynamics or natural processes) by 2012;
5. Determine the ecological factors necessary for population maintenance by 2012; and
6. Determine the feasibility and necessity of restoring populations in suitable habitat areas by 2012.

Broad strategies to address the threats and meet the recovery objectives include communication and outreach, habitat protection and stewardship, site management, inventory, monitoring, scientific research, and population enhancement.

Critical habitat cannot be identified at this time due to a lack of general and site-specific information about the habitat requirements of the species. It will be identified in a recovery action plan.

Recovery actions could affect the following socioeconomic sectors: private land development, petroleum natural gas exploration and extraction, coal exploration and extraction, livestock grazing, some agricultural management, and off-road vehicle recreation. The expected magnitude of these effects is unknown and will be further addressed in the recovery action plan.

The following knowledge gaps exist concerning the target species at risk which, if filled, could influence recovery planning and actions:

- confirmation of the persistence of slender collomia individuals in Canada, in the form of reproducing individuals or a seed bank;
- detailed characteristics and delineation of suitable habitat;
- research on species biology including life history, demography, genetics, pollinators, and impacts of invasive species;
- seed bank dynamics;
- response to disturbances (current and projected);
- effects of changes to hydrological regimes; and
- effects of climate change.

An action plan will be drafted by April 2011.

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BACKGROUND

Introduction

This multi-species recovery strategy has been developed to guide the recovery of three plant species at risk that occur in a landscape south of Princeton, British Columbia (B.C.). The target species at risk are dwarf woolly-heads, southern mountain population (*Psilocarphus brevissimus* var. *brevissimus*) (henceforth referred to as dwarf woolly-heads), slender collomia (*Collomia tenella*), and stoloniferous pussytoes (*Antennaria flagellaris*) (status summarized in Table 1). All known occurrences of the target species at risk in B.C. are within the Princeton area, and the species face a number of common threats and limitations, including: the extraction of coalbed methane; the development of transportation, housing, recreation, and tourism infrastructure; and habitat degradation. General recovery approaches are outlined to reduce the risk of extirpation of the target species in Canada.

In addition to addressing the recovery of the three target species at risk, this recovery strategy recommends the recovery of the associated ecosystem. This habitat-based approach addresses not only the nationally endangered species that are present, but also aims to protect other non-target species within the landscape, including a number of provincially rare plant species (some of which are candidates for COSEWIC assessment; see Table 3).

This report starts with a description of the Princeton landscape, followed by detailed information about each target species. The multi-species approach addresses common threats and limitations, knowledge gaps, and actions already completed or underway. Finally, the recovery section outlines the recovery goals and objectives, and approach for recovery implementation. Nomenclature for species follows Douglas *et al.* (1998b, 1999).

Table 1. Summary of target species at risk addressed in recovery strategy.

Species	COSEWIC status	Date of COSEWIC designation	Global and provincial ranks [a]	% of global range in Canada
Dwarf woolly-heads (*Psilocarphus brevissimus* var. *brevissimus*)	Endangered	Nov. 2003, confirmed 2006	G4T4? S1 (Red list)	<1%
Slender collomia (*Collomia tenella*)	Endangered	Nov. 2003	G4? S1 (Red list)	<1%
Stoloniferous pussytoes (*Antennaria flagellaris*)	Endangered	May 2004	G5? S1 (Red list)	<1%

Based on COSEWIC (2003a, 2003b, 2004, 2006), Douglas *et al.* (2003, 2004), Douglas and Penny (2003), and Natureserve (2007).

[a] For more information, see "Populations and distribution" section for each species.

The three species are found in the Similkameen watershed, in the Southern Interior of B.C. The Similkameen watershed, along with the South Okanagan watershed, has been recognized for its ecological importance as a biodiversity hotspot (SOSCP 2003). These watersheds act as species migration corridors between the dry grasslands of the B.C. Southern Interior and the sagebrush steppe areas of the western United States (SOSCP 2003).

Frank Lomer discovered the botanical importance of this landscape in 1997. Within an area that he describes as one of the most important rare plant sites in B.C., Lomer (pers. comm., 2005) documented several rare vascular plant species occurrences, some of which were the first discoveries in Canada (Douglas *et al.* 1998a). He delineated the area (approximately 5 km^2) that he considered to be excellent rare plant habitat, based on the occurrence of provincially Red- and Blue-listed species.

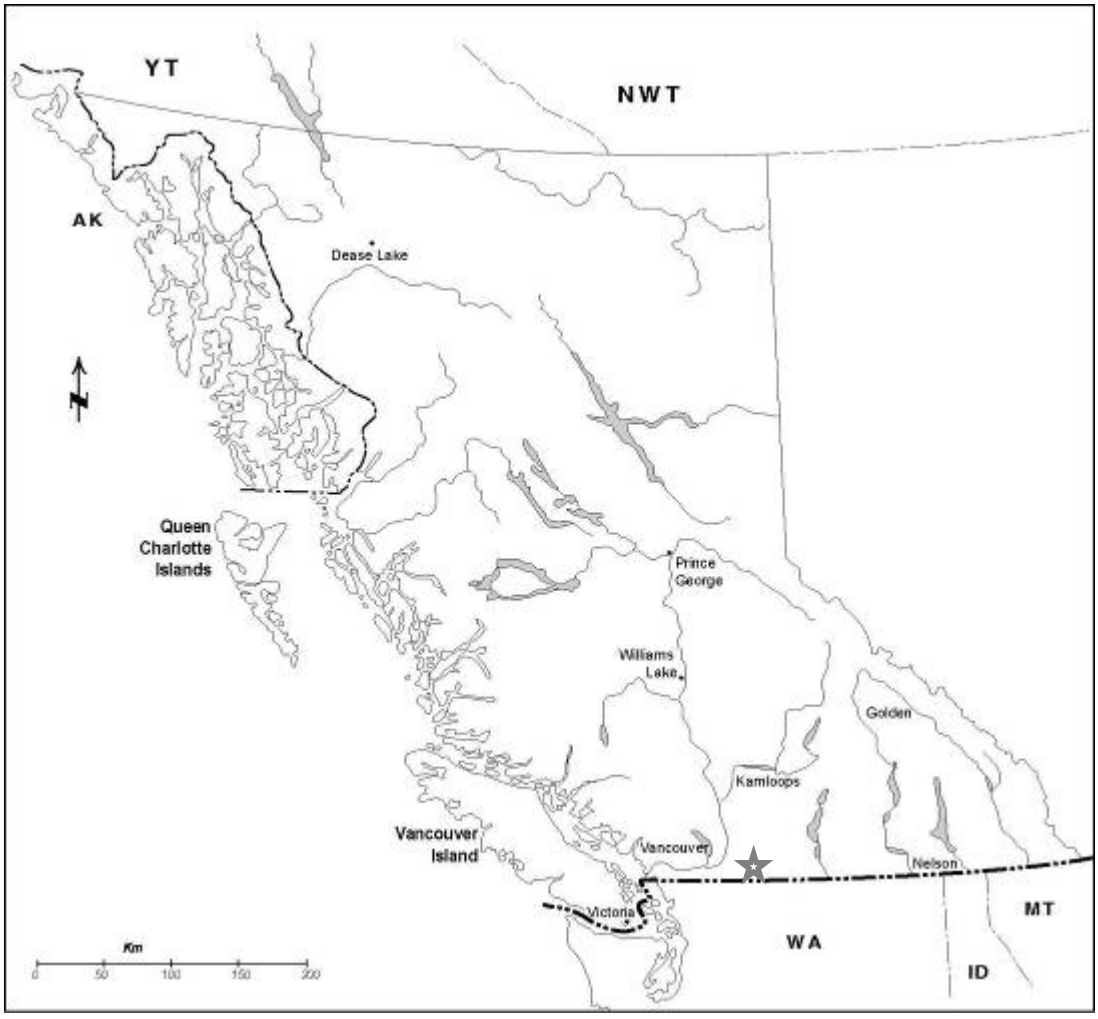

Figure 1. Princeton location in B.C., indicated by a star.

The target species at risk occurrences are located along Highway 3, near the town of Princeton, approximately 1 km west of the Similkameen River, and north of Whipsaw Creek. The landscape occurs in the gradual transition zone between the North Cascades Mountains and the Thompson Plateau (Holland 1964). This physiographic region is part of the Dry Ecodomain, Semi-arid Steppe-highland Ecodivision, also known as the Columbia Basin, of the western United States between the Sierras and the Rocky Mountains (SOSCP 2003).

The climate of the area is classified within the Interior Douglas-fir Okanagan very dry hot biogeoclimatic zone (IDFxh1; Lloyd *et al.* 1990). Climatic conditions in the IDFxh1 are continental, characterized by hot, dry summers, a fairly long growing season, and cool winters.

The site occurs at the western edge of the distribution of open shrub/grassland at that elevation. Big sagebrush (*Artemisia tridentata*) with scattered ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) trees dominates vegetation of the landscape (Douglas *et al.* 2004).

This small area not only provides habitat for these three nationally endangered species (populations summarized in Table 2) but also at least eight provincially rare plant species (Table 3). The B.C. Conservation Data Centre does not have any records of non-plant COSEWIC Red- or Blue-listed species for the area.

Table 2. Canadian population information for target species at risk.

Species	Population	Est. popn. size	Last. obs.	Land tenure	Source
Dwarf woolly-heads (*Psilocarphus brevissimus* var. *brevissimus*)	Princeton 1	7200 ± 500	2004	private	B.C. CDC 2008
	Princeton 2	11 775 2 patches	2004	private	B.C. CDC 2008
Slender collomia (*Collomia tenella*)	Princeton 3	127*	2003	private	B.C. CDC 2008
Stoloniferous pussytoes (*Antennaria flagellaris*)	Princeton 4	1.4 million** ± 100 000 11 subpopulations	2003	private	B.C. CDC 2008
	Princeton 5	5000 5 subpopulations	2003	private	Douglas *et al.* 2004

* no plants observed in 2004 (B.C. CDC 2008)
** 2002 estimate

Table 3. Additional provincially rare species that occur in the Princeton area.

	Common name	Scientific name	Provincial status	Source	Comments
1.	Carolina meadow-foxtail	Alopecurus carolinianus	S2 (Red list)	B.C. CDC 2008	3 populations, vernally moist meadows/pools
2.	Close-flowered knotweed	*Polygonum polygaloides* ssp. *confertiflorum*	S1 (Red list)	B.C. CDC 2008	Vernally wet meadow
3.	Cusick's paintbrush	*Castilleja cusickii*	S1 (Red list)	B.C. CDC 2008	Vernally moist meadow
4.	Dark lamb's-quarters	*Chenopodium atrovirens*	S1 (Red list)	B.C. CDC 2008	On dry, eroding slope
5.	Dwarf groundsmoke*	*Gayophytum humile*	S2S3 (Blue list)	B.C. CDC 2008	
6.	Kellogg's knotweed	*Polygonum polygaloides* ssp. *kelloggii*	S2S3 (Blue list)	B.C. CDC 2008	3 populations, vernally wet meadow, seep, and depression
7.	Oniongrass*	*Melica bulbosa* var. *bulbosa*	S2 (Red list)	B.C. CDC 2008	
8.	Valley sedge*	*Carex vallicola* var. *vallicola*	S1 (Red list)	B.C. CDC 2008	

* Species potentially at risk in Canada; candidates for COSEWIC assessment (B.C. CDC 2005).

Important microsites in the landscape feature distinct soil moisture regimes:

- vernal pools that support populations of the dwarf woolly-heads and other species that specialize on this type of microhabitat (Table 3);
- eroding slopes with spring seepage followed by summer drying that provide habitat for stoloniferous pussytoes and other species (Table 3); and
- dry, eroded sandy ridge slopes that support the single slender collomia population.

Dwarf Woolly-Heads

Species assessment information from COSEWIC

Date of assessment: April 2006

Common name (population): dwarf woolly-heads, southern mountain population

Scientific name: *Psilocarphus brevissimus* var. *brevissimus*

COSEWIC status: Endangered

COSEWIC Status history: Designated Endangered in November 2003. Renamed Dwarf Woolly-heads (Southern Mountain population) in April 2006 and designated Endangered. Last assessment based on an update status report.

Canadian occurrence: British Columbia

Reason for designation: An annual herb restricted to a very small range and present at only three small sites on private lands within the COSEWIC Southern Mountain Ecological Area of British Columbia. Population size is subject to extreme fluctuations in the number of mature individuals due to variation in precipitation levels. The population is at risk from such factors as increased land development in the region and land use practices.

Summary from COSEWIC (2006).

Description

Dwarf woolly-heads is an herb with 8–20 cm long branched, woolly-hairy stems that are prostrate and matted (dwarfed forms may have simple, erect stems) and have a short taproot (Figure 2). Stem leaves are opposite, lance-linear, lance-oblong, or lance-triangular, and whitish woolly-hairy. Leaves are 4–15 mm long and 1.5 mm wide. Basal leaves are lacking. The flower heads are disciform (round and flattened), and occur singly in leaf axils or at tips of branches. The heads lack involucres (circles of bracts surrounding the flower head), and have hooded and balloon-like receptacular bracts (carried on the receptacle) that are 2.5–4.0 mm long at maturity. Heads usually have 50–80 female flowers (rarely as few as 20 in dwarfed forms) (Douglas *et al.* 1998b).

Figure 2. Dwarf woolly-heads (Photo by Carol Witham).

Populations and distribution

In Canada, the dwarf woolly-heads reaches the northern limits of its range in southern British Columbia, Alberta, and Saskatchewan. In British Columbia, the species is restricted to the Similkameen Valley, south of Princeton (see Figure 1; Douglas *et al.* 1998a, 2003). In the Canadian prairies, dwarf woolly-heads occurs in the extreme southeastern corner of Alberta and the extreme southwestern corner of Saskatchewan (populations previously identified as *Psilocarphus elatior*; Douglas *et al.* 2001; J. Gould, pers. comm., 2005).

Globally, *Psilocarphus brevissimus* var. *brevissimus* is restricted to western North America. In the United States, the plant occurs in California, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming (Cronquist *et al.* 1994).

In Washington State, dwarf woolly-heads is common in vernal pools on the Columbia Plateau (Björk and Dunwiddie 2004). The nearest known U.S. population to the individuals in B.C. is in Lincoln County, approximately 250 hundred kilometres to the south (Douglas *et al.* 2003). In Montana, dwarf woolly-heads is rare. The nearest known U.S. population to the Alberta–Saskatchewan populations is located near Great Falls, Montana, approximately 170 km to the southwest (Montana Natural Heritage Program 2005).

The global, national, and subnational conservation status of dwarf woolly-heads are as follows: globally G4T4? (apparently secure); in Canada, NNR (not yet assessed); in the United States, NNR (not yet assessed). In B.C., the species is ranked S1 (critically imperiled), and in Alberta, S2

(imperiled). In the United States, it was assessed in only Idaho, Montana, and Wyoming as S2. It has not yet been assessed in California, Nevada, Oregon, Utah, and Washington. Status is based on Natureserve (2007), COSEWIC (2003a), Vujnovic and Gould (2002), and Douglas *et al.* (2001).

Two populations of dwarf woolly-heads have been recorded in B.C. (Table 2) (B.C. CDC 2008). Population sizes of this annual herb are strongly tied to annual precipitation patterns (Bauder 2000). This is typical of vernal pool plants (Griggs and Jain 1983). The first population, "Princeton 1", is separated into two patches. It increased in size from 450 plants in 2003 to approximately 7200 plants in 2004 (B.C. CDC 2008). The second population, "Princeton 2", has fluctuated dramatically in size in recent years. In 1997, the population size was described as "a few thousand plants" and it increased to 10,000+ plants in 2000. By 2002, it had grown to "one to two million plants". In 2003, a drought year, the population declined to "several hundred plants". In 2004, the population size increased to 11 775 plants (B.C. CDC 2008).

Because this species was not known to occur in B.C. before 1997 (Douglas *et al.* 1998a), long-term trends are unknown. The species may have been overlooked in the past, possibly due to fluctuating population sizes of mature individuals due to its annual reproductive strategy. If this were the case, the trends in the population size and area of occupancy cannot be known.

Needs of dwarf woolly-heads

Habitat and biological needs

Dwarf woolly-heads grows in "dried beds of vernal pools" (Hitchcock and Cronquist 1973). Keeley and Zedler (1998) define vernal pools as "precipitation-filled seasonal wetlands inundated during periods when temperature is sufficient for plant growth, followed by a brief waterlogged-terrestrial stage and culminating in extreme desiccating soil conditions of extended duration."

In B.C., populations of dwarf woolly-heads occur in vernal pools and at the edges of ephemeral ponds. Sites have calcareous clay bottoms; the soil is wet in the spring and dry, hard, and cracked in the summer (Douglas *et al.* 2003; F. Lomer, pers. comm., 2005). The vernal pools occur in large forest openings and are dominated by Scouler's popcornflower (*Plagiobothrys scouleri*) and close-flowered knotweed (*Polygonum polygaloides* ssp. *confertiflorum*). Other species that occur near the vernal pools include one-spike oatgrass (*Danthonia unispicata*), tiny mousetail (*Myosurus minimus*), Carolina meadow-foxtail (*Alopecurus carolinianus*), lowland cudweed (*Gnaphalium palustre*), and annual hairgrass (*Deschampsia danthonioides*) (Douglas *et al.* 2003).

Dwarf woolly-heads is considered a vernal pool specialist (Schlising and Sanders 1982; Keeley and Zedler 1998; Bauder 2000). Dwarf woolly-heads' tolerance of inundation allows the species to outcompete grassland perennials, while its tolerance of soil desiccation and heat during summer drought allows it to proliferate where aquatic/wetland species cannot (Bauder 2000). Experimental studies have demonstrated, however, that the species grows best in areas of bare ground or with less competition from other species (Moore *et al.* 2001).

This annual species is assumed to reproduce either by self-pollination (Douglas *et al.* 2003) or through asexual reproduction (Cronquist 1950). Keeley and Zedler (1998) recognize four stages in the annual vernal pool cycle: (1) a wetting phase; (2) an aquatic or inundation phase; (3) a waterlogged-terrestrial phase, and (4) a drought phase. In vernal pool species, germination is typically initiated during the wetting or inundation phases. Flowering is initiated during the transition to the waterlogged-terrestrial phase, which occurs in June in the Princeton area. Fruiting follows during the drought phase (Douglas *et al.* 2003).

This annual species relies on a seed bank for its persistence in vernal pool sites. The importance of the seed bank in allowing dwarf woolly-heads populations to rebound after disturbances has been illustrated experimentally (Cox and Austin 1990). Birds are the most likely agents of seed dispersal for the species over longer distances (Silveira 1998).

Slender Collomia

Species assessment information from COSEWIC

Date of assessment: November 2003

Common name: Slender collomia

Scientific name: *Collomia tenella*

COSEWIC status: Endangered

COSEWIC Status history: Designated Endangered in November 2003. Assessment based on a new status report.

Canadian occurrence: British Columbia

Reason for designation: An annual herb present at a single sandy site near Princeton, BC. The population fluctuates widely from year to year. At risk to stochastic events, roadside development, sand removal, and invasion by alien species.

Summary from COSEWIC (2003b).

Description

Slender collomia is an annual herb from a taproot, with ascending to spreading, freely branched stems up to 15 cm tall, with stalked glands at least on the upper part (Figure 3). The alternate, linear, entire leaves are 1–5 cm long and 1–5 mm wide. Flowers occur singly or in pairs along and at the ends of the branches (appearing to be borne in the forks of branches and in leaf axils). The corollas are pinkish to white and 4–6 mm long. The short corolla tubes spread to five lobes. The calyces are one-half to one-third as long as the corollas and they bow out, often forming purplish knobs at the sinuses. Calyces have 1–2 mm long triangular teeth. Capsules have one-seeded chambers that release seeds that become sticky when moistened (Douglas *et al.* [eds.] 1999).

Figure 3. Slender collomia (Photo by James L. Reveal).

Populations and distribution

In Canada, slender collomia reaches the northern limit of its range in B.C., where it is rare. The plant is restricted to the Similkameen Valley, south of Princeton (see Figure1; Douglas *et al.* 1998a; Douglas and Penny 2003).

Globally, slender collomia is restricted to western North America. In the United States, the plant occurs in Idaho, Nevada, Oregon, Utah, Washington, and Wyoming (Natureserve 2007).

In Washington State, slender collomia is uncommon, but widespread and localized. One population occurs along the Lost River Trail, near the confluence with the Methow River, in open conifer forest (G. Wooten, pers. comm., 2005). This population is approximately 70 km to the south of the Canadian population at the Princeton site. Washington populations of this species could theoretically contribute to a rescue effect for Canadian populations if the sticky seeds were transported by an animal or vehicle.

The global, national, and subnational conservation status of slender collomia is summarized as follows. Global status is G4? (apparently secure), national status in Canada is N1 (critically imperiled), and in the United States the status has not yet been assessed. Status in B.C. is S1 (critically imperiled). The rank in Utah is S2? (imperiled) and in Wyoming S3 (vulnerable). The status has not yet been assessed in Idaho, Nevada, Oregon, and Washington. Status is based on Natureserve (2007).

One population (Princeton Population 3) of slender collomia has been found in Canada (Table 2), but no individuals were observed in 2004 (B.C. CDC 2008). Long-term trends are unknown as this species was not known to occur in B.C. before 1997 (Douglas *et al.* 1998a). The population size of this annual species has been fluctuating in recent years (Table 4) (Douglas and Penny 2003; B.C. CDC 2008).

Table 4. Slender collomia population sizes (1997–2004) (Douglas and Penny 2003; B.C. CDC 2008).

Year	Population size
1997	10
2000	1
2002	0
2003	127
2004	0

Needs of slender collomia

Habitat and biological needs

Douglas and Penny (2003) describe the B.C. habitat of slender collomia as:

> "Eroded, steeply-sloped, southeast-facing sections of a sandy ridge. The sandy ridge, formed by fluvial processes during the last glaciation, consists of fine-textured sands. The eroded sections of the slopes are sparsely vegetated with about 20% cover."

The associated vegetation includes the shrub saskatoon (*Amelanchier alnifolia*), as well as a variety of herbs: arrowleaf balsamroot (*Balsamorhiza sagittata*), timber milk-vetch (*Astragalus miser*), narrow-leaved collomia (*Collomia linearis*), thread-leaved phacelia (*Phacelia linearis*), silky lupine (*Lupinus sericeus*), Dalmatian toadflax* (*Linaria genistifolia* ssp. *dalmatica*), cheatgrass* (*Bromus tectorum*), and bluebunch wheatgrass (*Pseudoroegneria spicata*). Scattered Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*) trees occur on the ridge (Douglas and Penny 2003).

In Washington State, slender collomia grows along lightly disturbed trails and slopes in the lower montane zone. Habitats are similar to those of small-flowered blue-eyed Mary (*Collinsia parviflora*) and the wooded slopes, thickets, and open places where Great Basin nemophila (*Nemophila breviflora*) grows (Hitchcock *et al.* 1959; G. Wooten, pers. comm., 2005).

Other annual members of the *Collomia* genus are self-compatible and self-pollinating (Wilken 1993). Seeds are sticky when moistened and may, therefore, be animal-dispersed (Douglas and Penny 2003). This annual species relies on a seed bank for its persistence in sites.

Little is known about slender collomia habitats, and habitat needs of the species in Canada cannot be generalized.

* Non-native species.

Stoloniferous Pussytoes

Species assessment information from COSEWIC

Date of assessment: May 2004

Common name: Stoloniferous pussytoes

Scientific name: *Antennaria flagellaris*

COSEWIC status: Endangered

Status history: Designated Endangered in May 2004. Assessment based on a new status report.

Canadian occurrence: British Columbia

Reason for designation: A short-lived perennial plant present at only three geographically restricted localities occupying very small areas of specialized habitat of ephemerally moist seepage sites on private lands. It is at greatest risk from ATV use that currently is evident close to the populations. It may also be impacted by changes in ground water hydrology and surface impacts from increased development activities in the area such as the proposed production of coalbed methane.

Summary from COSEWIC (2004).

Description

Stoloniferous pussytoes is a short-lived perennial herb that grows from a fibrous root; its several simple, silky woolly-hairy, erect to ascending stems are 0.5–3.5 cm tall (Figure 4). The plant produces slender stolons up to 10 cm long that are naked (except for the tips). The unstalked basal leaves are linear to linear-oblanceolate, silky woolly-hairy, and 1–3 cm long by 0.5–2 mm wide. The stem leaves are similar, but are slightly reduced upwards. The flowers occur in solitary, terminal heads. Female involucres (circles of bracts surrounding the flower head) are 7–13 mm tall, with lanceolate, brown- or reddish-brown-tinged involucral bracts that are thinly woolly-hairy below. Male involucres are 4–7 mm tall, with translucent, brownish-tipped involucral bracts. Female flowers are 5–7 mm tall, while male ones are 3–4.5 mm tall. Fruits are warty, elliptic achenes that are 2–3 mm long. The 6–8 mm tall pappus (scales, bristles, or hairs at the apex of the seed) is white with hairlike bristles (Douglas *et al.* 1998b).

Figure 4. Stoloniferous pussytoes (Photo by Mark Turner).

Populations and distribution

In Canada, stoloniferous pussytoes reaches the northern limit of its range in B.C., where it is rare. The plant is restricted to the Similkameen Valley, south of Princeton (see Figure 1; Douglas *et al.* 1998a, 2004).

Globally, the species is restricted to western North America. In the United States, the plant occurs in California, Idaho, Nevada, Oregon, Washington, and Wyoming (Cronquist *et al.* [eds.] 1994). In Washington State, stoloniferous pussytoes occurs widely but in locally common patches (G. Wooten, pers. comm., 2005). The nearest known U.S. population occurs approximately 70 km to the south of the Canadian populations, 8 km northeast of Mazama, WA, in red bed volcanic marine deposits (G. Wooten, pers. comm., 2005). This population of this wind-dispersed species may possibly contribute to a rescue effect for Canadian populations. Such a rescue effect was previously thought to be unlikely for because the nearest known U.S. location was as much as 190 km to the south of Canadian populations (Douglas *et al.* 2004).

The global, national, and subnational conservation status of stoloniferous pussytoes is as follows: global status is G5? (secure), and status in Canada and the United States is NNR (not yet assessed). In British Columbia, the species is ranked S1 (critically imperiled), in California, S3 (vulnerable), and in Wyoming, S1S2 (critically imperiled to imperiled). The status has not yet been assessed for Idaho, Oregon, and Washington, and is not listed as occurring in Nevada (NatureServe 2007).

Three Canadian populations of stoloniferous pussytoes were originally identified in the COSEWIC status report (Douglas *et al.* 2004). Since then, the B.C. Conservation Data Centre reinterpreted the population information and defined two populations for the species in Canada (Table 2; B.C. CDC 2008).). The first population, “Princeton 4”, consisted of approximately 1.4 million individuals in 11 subpopulations in 2003. The second population, “Princeton 5”, consisted of approximately 5000 individuals in 5 subpopulations in the same year. Although some populations have been visited more than once, short-term trends cannot be assessed due to different survey methods (B.C. CDC 2008).

As this species was not found in B.C. before 1997 (Douglas *et al.* 1998a), long-term trends are unknown. The species may have been overlooked in the past, possibly due to its occurring on private land, or because of fluctuating population sizes of mature individuals due to its short generation times, in which case the trends in the population size and area of occupancy are unknown.

Needs of stoloniferous pussytoes

Habitat and biological needs

In B.C., stoloniferous pussytoes populations occur in a matrix of level to gently sloping big sagebrush (*Artemisia tridentata*) shrub/grassland with scattered ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*). Stoloniferous pussytoes grows on moderate slopes with southerly aspects. The sites have a distinct hydrology, characterized by ephemeral winter seepage followed by drying in the early summer. The soil moisture regime is associated with erosion in the

form of slow, downslope soil movement. As a result, the sites have exposed mineral soil and are sparsely vegetated (Douglas *et al.* 2004).

In Washington State, stoloniferous pussytoes is found “in dry rocky soils, open areas, vernal-wet in sagebrush-steppe” (Turner and Gustafson 2006).

The species is dioecious, with male and female structures on separate plants. Pollination is by wind, and seeds are produced sexually by outcrossing (Bayer 1996). The numerous hair-like bristles of the mature achenes facilitate its dispersal by wind. Plants also reproduce vegetatively by producing stolons that terminate in plantlets. Initially, the mother plant provides the plantlet with nutrients via the stolon. The genetically identical plantlets eventually become independent plants, as stolons are naturally severed over time. This mode of reproduction results in very restricted dispersal, as stolons only reach 10 cm long (Douglas *et al.* 1998b).

Genetically, some functional inbreeding has been observed in Oregon and California populations of the species. Those populations were found to have relatively high intra- and inter-population genetic diversity. The peripheral populations from California are not genetically differentiated from the central Oregon ones (Bayer 1990).

Based on habitats where the species has been observed in Canada and elsewhere, stoloniferous pussytoes appears to thrive on gently sloping sagebrush sites with vernally wet soils that dry out in summer. Vegetation cover tends to be low. Transplantation studies in California indicate that soil chemistry and characteristics may be important to the species’ habitat needs (Grant 1989, 1990).

Limiting Factors

Limited dispersal may explain the very small extent of occurrence of these three species at risk in Canada. Poor dispersal reduces the likelihood that populations will be bolstered by immigrant propagules, or that new populations will become established in suitable habitats.

Poor recruitment and reproduction and population fluctuations are limiting factors relevant to the persistence of slender collomia in Canada, as no reproducing individuals were found in 2004 and it is unknown whether individuals emerged in 2005. Unless plants germinate from the seed bank, the species will be extirpated in Canada. The duration of viability of seeds in the seed bank is unknown. Dwarf woolly-heads and stoloniferous pussytoes population sizes tend to fluctuate according to climatic conditions and poor recruitment/reproduction likely occur in drought years, though seed banking is expected to offset fluctuations to some degree in these annual/short-lived species.

As both species are assumed to reproduce by self-pollination, inbreeding poses a potential risk to the persistence of dwarf woolly-heads and slender collomia in Canada. Population genetic studies would be required to assess the degree of this concern. U.S. populations of stoloniferous pussytoes have exhibited some functional inbreeding as well (Bayer 1990). All three target species at risk have restricted ranges in Canada. Small or restricted ranges increase the likelihood of catastrophic events extirpating all occurrences of species in this jurisdiction.

Threats

These three species are at risk due to a number of current and potential threats and limitations. Table 5 summarizes the threats and their potential risks and effects on recovery. The threats are described in more detail in the following sections.

Table 5. Threats to habitat and survival of target species at risk.

Threat	**Potential effect of threat on individual species**			**Potential effect of threat on target species at risk**				
	Dwarf woolly-heads	Slender collomia	Stoloniferous pussytoes	Nature of impact[1]	Risk of threat	Potential effect on recovery	Biological and technical potential to alleviate impact	Overall threat priority[2]
HABITAT LOSS OR DEGRADATION								
Resource extraction								
• Petroleum natural gas	high	high	high	S, H	med?	high	high	v. high
• Coal	high	high	high	S, H	low?	high	high	high
Property development								
Tourism and recreation	high	high	high	S, H	med?	high	high	v. high
Residential	high	high	high	S, H	low?	high	high	high
Recreational activities								
• Off-road vehicle use	high	high	high	S, H	med?	high	high	v. high
Grazing	med?	low?	low?	S, H	high	low?	high	high
Soil extraction/deposition	high	high	high	S, H	low?	high	high	high
INVASIVE ALIEN SPECIES								
Competition	low	med?	med?	S, H	med?	med?	low	low
Use of non-specific herbicides	high	high	high	S	high	high	high	high
CHANGES IN ECOLOGICAL DYNAMICS OR NATURAL PROCESSES								
Hydrological alterations	high	low?	high?	S, H	low?	high	high	high
Secondary succession								
• Encroachment by native vegetation (due to fire suppression)	low	med?	med?	H	low?	med?	med	low
Stochastic events								
• Wildfires	med?	med?	med?	S	low?	high?	low	low
• Sustained drought	med?	low?	med?	S	med?	high?	no	low
CLIMATE AND NATURAL DISASTERS								
Global climate change	med?	low?	med?	S, H	med?	low?	no	v. low

1. S = impact on survival, H = impact on habitat
2. Based on scoring scheme:
   overall score (v. high = 8–9, high = 7, medium = 6, low = 5, very low = 0–4) =
   score for risk of threat + score for potential effect on recovery + score for likelihood of success (high = 3, medium = 2, low = 1, no = 0)

Threat classification

Habitat loss or degradation

Resource extraction: Economically important coalbed methane resources underlie the Princeton habitats of the target species at risk (R. Schmitt, pers. comm., 2005; G. Humphrey, pers. comm., 2005). Extraction of those resources is perhaps the greatest threat facing the three species. Concerns associated with coalbed methane extraction include the clearing of large areas of vegetation for wells (approximately 1 ha; R. Schmitt, pers. comm., 2005), the disruption of groundwater with potential changes in surface hydrology (Smith 2005), potential pollution of surface waters (Smith 2005), vegetation disruption associated with access routes, and reclamation activities (which may involve disposing of "drill mud" over large areas; R. Schmitt, pers. comm., 2005).

Property development: While not necessarily imminent, the threat of habitat loss and degradation due to property development activities could be significant. Development activities could destroy species habitat, with effects essentially irreversible or requiring long-term recovery or mitigation.

Recreational activities: In 2002, field surveyors observed evidence of all-terrain vehicle and dirt bike use near the sites. For example, some tracks passed within several metres of the "Princeton 4" population of stoloniferous pussytoes (Douglas *et al.* 2004). The lack of fences (except on the south side) allows for easy access to the area. Seasonally moist or wet microsites are most at risk from vehicle damage. Soil disturbance and rutting could alter the soil moisture regime or alter the pattern of erosion, either of which could contribute to the degradation of target species at risk habitats (Douglas *et al.* 2004). A study of vernal pool ecosystem invasibility has demonstrated that vehicle disturbance promotes the proliferation of invasive alien species in those habitats (Björk 2005).

Grazing: Cattle grazing poses a potential threat of habitat degradation, primarily by the mechanisms of soil compaction, mechanical damage of microbiotic crusts, and physical alteration of habitats (Kauffman and Krueger 1984; Elmore 1992; van Woudenberg 1999). Cattle heavily trampled the "Princeton 1" population of dwarf woolly-heads at the site in the past (B.C. CDC 2008). Findings from studies designed to assess the impacts of grazing on vernal pool systems have typically been inconclusive and contradictory. For example, impacts on plant species can vary significantly depending on the timing of grazing (Borgias 2004). Grazing can control vigorous growth of vegetation which can stifle germination. On the other hand, cattle grazing has been demonstrated to increase the proliferation of alien species in vernal pool ecosystems (Björk 2005). Slender collomia and stoloniferous pussytoes grow in sparsely vegetated microsites and do not seem to be affected by cattle activities (F. Lomer, pers. comm., 2005).

Soil extraction/deposition: Potential soil removal or deposition would also contribute to habitat degradation, through changes in soil characteristics or soil nutrient regime. This type of disturbance is not known to be an imminent threat.

Changes in ecological dynamics or natural processes

Hydrological alteration: Changes in hydrology represent a potential threat to target species at risk, and to dwarf woolly-heads in particular. Drilling of wells, irrigation systems, roads, soil removal or fill, and stream diversions all have the potential to alter the hydrological regimes of the microsites that support the target species at risk, resulting in habitat degradation that could contribute to population decline. Off-site activities can thus have significant detrimental effects on target species at risk habitats.

Secondary succession: Encroachment by native vegetation through secondary succession is not known to affect these three target species at risk populations, but is a potential risk.

Stochastic events: Due to the small ranges of the target species at risk in Canada, catastrophic stochastic events such as severe wildfires or sustained droughts could result in the extirpation of the species in Canada.

Invasive alien species

Invasive alien species are not known to be a serious threat to target species at risk populations currently, but they represent a potential threat. The B.C. Ministry of Agriculture and Lands has designated 21 plant species as "noxious weeds" in the South Okanagan–Similkameen (SOSCP 2003). Many other invasive alien species also occur in the area. The proliferation of invasive species can degrade habitat through competitive exclusion of native species.

Weed control activities also constitute a threat to target species at risk. Under the *Weed Control Act*, an occupier must control noxious weeds growing or located on land and premises (Province of British Columbia 2004). Marginally specific chemical weed control substances that kill broad-leaved plant species would likely kill individuals or populations of species at risk. The risk of this occurring is generally low, except along the transmission corridor, where the risk is higher.

Climate and natural disasters

Climate change, a potential threat to target species at risk populations, could result in population declines, because the species are already growing in marginal climatic conditions at the northernmost extents of their ranges. Climate change could also have detrimental effects on metapopulation dynamics if peripheral populations become increasingly isolated due to loss of habitat in the centers of species' ranges.

Actions Already Completed or Underway

A broad range of organizations and programs are currently involved in the conservation of natural biodiversity of the South Okanagan and lower Similkameen watersheds (see SOSCP 2003 for more detail). Recovery work is intended to build on these efforts. Recovery actions specific to the target species at risk have yet to begin, although some landowner contact has been initiated.

Knowledge Gaps

Knowledge gaps exist concerning the target species at risk which, if filled, could influence recovery planning and actions. They include:

- confirmation of the persistence of slender collomia individuals in Canada, in the form of reproducing individuals or a seed bank;
- detailed habitat characteristics and delineation of suitable habitat;
- research on species biology including life history, demography, genetics, pollinators and impacts of invasive species;
- seed bank dynamics;
- response to disturbances (current and projected);
- effects of changes to hydrological regimes; and
- effects of climate change.

RECOVERY

Recovery Feasibility

The recovery of the three target species at risk is considered technically and biologically feasible. There are extant sites for each species. The habitat at the currently occupied sites is suitable, and additional suitable habitat may also be available. Recovery actions such as stewardship and cooperation with landowners and land managers can mitigate major threats. Presently, recovery techniques are believed to be sufficient to protect the species.

Table 6 outlines the criteria (Environment Canada *et al.* 2005) used to determine recovery feasibility.

Table 6. Recovery feasibility of target species at risk.

Feasibility criteria	Dwarf woolly-heads	Slender collomia	Stoloniferous pussytoes
Are individuals capable of reproduction available to support recovery?	yes	yes[a]	yes
Is habitat available for recovery or could it be made available through recovery actions?	yes	yes	yes
Can significant threats to the species or its habitat be avoided or mitigated through recovery actions?	yes	yes	yes
Do the necessary recovery techniques exist and are they known to be effective?	yes	yes	yes

[a] No reproductive individuals were known to occur in Canada in 2004 (Douglas, unpubl. data.). However the species is an annual plant and thus is expected to have a viable seed bank (Douglas and Penny 2003).

Recovery Goal

The recovery goals for each of dwarf woolly-heads, slender collomia, and stoloniferous pussytoes are:

1. To maintain population(s) with the current area of occupancy; and
2. To maintain any newly located additional population(s).

Rationale for the Recovery Goals

As the species have only been documented since 1997 and as there are no trend data for the populations for any of these species, historical trends in distribution and population sizes are unknown. It is likely that these species are naturally rare in the province and will continue to be so.

Additional surveys for new populations for all the species is necessary, as is monitoring of extant populations to determine population trends. As the species are annuals, and a short-lived perennial, population sizes fluctuate yearly. Therefore, determining a quantitative population target for any of these species is not possible at this time.

Recovery Objectives

The recovery objectives for each of dwarf woolly-heads, slender collomia, and stoloniferous pussytoes are:

1. Increase protection[2] for all extant occurrences by 2012;
2. Confirm the distribution of these three species and update population and distribution objectives as needed by 2011;
3. Reliably determine population trends by 2012;
4. Assess the severity of the main threats to the populations (habitat loss or degradation, exotic species, changes in ecological dynamics or natural processes) by 2012;
5. Determine the ecological factors necessary for population maintenance by 2012; and
6. Determine the feasibility and necessity of restoring populations in suitable habitat by 2012.

Approaches Recommended to Meet Recovery Objectives

Recovery planning table

Table 7 details the recommended approaches for effecting recovery of the three species.

[2] This may involve protection in any form including stewardship agreements and conservation covenants on private lands; land use designations on Crown lands; and protection in federal, provincial, and local government protected areas.

Table 7. Recovery planning table.

Priority	Obj. no.	Broad approach	Threat addressed	Recommended approaches
Urgent	1	Communication and outreach	Habitat loss or degradation	▪ develop and implement communications plans for engaging the cooperation of landholders and other stakeholders ▪ request that coal and petroleum natural gas tenures be flagged for target species at risk and rare element concerns
Urgent	1	Habitat protection and stewardship	Habitat loss and degradation	▪ determine appropriate protection strategy in cooperation with landowners ▪ identify and contact organizations that can implement protection strategy
Necessary	1, 4	Site management	Habitat loss and degradation; invasive alien species, secondary succession; stochastic events (wildfire)	▪ monitor sites to assess threat impacts to populations ▪ develop, implement, and adapt a management plan as necessary in cooperation with landowners and managers ▪ monitor sites to observe species and habitat responses ▪ report on management plan and outcomes
Necessary	2	Mapping/surveying	N/A	▪ survey landscape and adjacent areas for target species at risk and Red- and Blue-listed species to ensure that all rare elements have been identified ▪ complete detailed mapping of the landscape and associated rare elements and site features ▪ identify and map areas of good potential habitat for target species at risk in region ▪ survey potential habitat for target species at risk in Canada
Necessary	1, 3	Monitoring	All	▪ develop and implement standardized monitoring protocol ▪ report monitoring results annually and assess trends in populations, area of occupancy, and habitat condition every 5 years ▪ monitor sites to assess the effects of actions and adapt management in response to observed results ▪ submit all data to B.C. CDC
Necessary	3, 5	Ecological research	N/A	▪ conduct research to characterize: target species at risk pollinators,

Priority	Obj. no.	Broad approach	Threat addressed	Recommended approaches
				dispersal potential, seed bank characteristics, and germination requirements
Beneficial	1, 6	Population enhancement	N/A	▪ use information gained through ecological research to enhance critical life history stages as required by recovery goals (particularly for slender collomia) ▪ establish reintroductions (if deemed feasible) in suitable habitat sites

Performance Measures

The measure of success of recovery activities in achieving recovery goals will be accomplished primarily through regular target species at risk population monitoring. Recovery objectives must also be evaluated to ensure that the recovery strategy has been adequately implemented. Evaluation criteria are outlined below:

- Protection achieved for extant sites (Objective 1)
- Proportion of potential habitat for target species at risk surveyed and proportion of new target species at risk localities protected. (Objectives 1 and 2)
- Distribution of species is confirmed and population numbers updated (Objective 2)
- Populations have been monitored and population trends established (Objective 3)
- Site-specific threats to the populations have been assessed and mitigated (Objective 4)
- Risks associated with intrinsic threats to target species at risk are characterized. (Objective 4)
- Ecological factors for population maintenance for each species, including detailed habitat attributed have been determined (Objective 5)
- If assessing for reintroduction, mapping of potential habitat for target species at risk completed (Objective 6)
- The slender collomia population is re-established from seed bank with reproducing individuals. (Objectives 5 and 6)
- Dwarf woolly-heads and stoloniferous pussytoes populations are maintained or increased. (Objectives 5 and 6)

Critical Habitat

Critical habitat means “the 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” (Environment Canada *et al.* 2004).

Identification of the species' critical habitat

No critical habitat can be identified for the three species at risk at this time, due to a lack of information about general and site-specific habitat features. It is expected that critical habitat will be identified within a recovery action plan following: (1) consultation and development of stewardship options with affected landowners and organizations; and (2) completion of outstanding work required to quantify specific habitat and area requirements for the species. A schedule of studies outlining work necessary to identify critical habitat is found below.

Schedule of studies to identify critical habitat

1. Using established survey and mapping techniques (applied during phenologically appropriate periods), delimit the boundaries of all occupied habitats. Timeframe: 2011-2012.
2. Describe habitat attributes of all occupied habitats (e.g., soil texture, moisture regime, length of inundation and exposure, soil chemical properties, plant cover) and identify all occupied habitat. Timeframe: 2011-2012.
3. Identify, map, and describe all intact sites of potential habitat that are currently unoccupied by species at risk. Rate these habitats for their potential to support these three species, as well as other species at risk. Timeframe: 2011-2012.

Existing and Recommended Approaches to Habitat Protection

Currently, all B.C. occurrences of the target species at risk occur in the Princeton Landscape, on private land.

The stewardship and protection of target species at risk habitat could be managed by the landowner contact program of the South Okanagan–Similkameen Stewardship Program (SOS Stewardship Program) as administered by The Land Conservancy (TLC). TLC is presently involved in the conservation of natural biodiversity of the south Okanagan and lower Similkameen watersheds (see SOSCP 2003 for more detail). Many successful programs have already been initiated and completed in the south Okanagan and lower Similkameen areas; therefore, the present recovery strategy should be integrated into other conservation efforts.

Habitat protection for the target species at risk should be initiated cooperatively with the private landowners. The involvement of the owners of target species at risk localities is critical for the recovery of these species, which do not occur on public lands. Stakeholders such as resource tenure holders, local residents, and other interested parties should also be encouraged to join the process.

Stewardship approach
For successful implementation in protecting species at risk, there will be a strong need to engage in stewardship on various land tenures. Stewardship involves the voluntary cooperation of landowners to protect species at risk and the ecosystems they rely on. The preamble to the federal *Species at Risk Act* (SARA) states that "stewardship activities contributing to the conservation of wildlife species and their habitat should be supported" and that "all Canadians have a role to play

in the conservation of wildlife in this country, including the prevention of wildlife species from becoming extirpated or extinct." The Bilateral Agreement on Species at Risk, between British Columbia and Canada, states that "stewardship by land and water owners and users is fundamental to preventing species from becoming at risk and in protecting and recovering species that are at risk" and that "cooperative, voluntary measures are the first approach to securing the protection and recovery of species at risk."

Stewardship approach for private lands
Additional populations of the target species may occur on private lands. As with other species at risk found on private property, stewardship efforts will be the key. To successfully protect many species at risk in British Columbia, there will have to be voluntary initiatives by landowners to help maintain areas of natural ecosystems that support these species of risk. This stewardship approach will cover many different kinds of activities, such as: following guidelines or best management practices to support species at risk; voluntarily protecting important areas of habitat on private property; creating conservation covenants on property titles; eco-gifting property, in whole or in part, to protect certain ecosystems or species at risk; or selling their property for conservation. Both government and non-governmental organizations have had good success in conserving lands in the province.

Effects on Other Species

Recovery activities for the target species at risk are anticipated to have neutral or beneficial effects on populations of Red- and Blue-listed vascular plant species that occur within the landscape (listed in Table 3), since the latter are at risk due to similar threats.

According to the B.C. Conservation Data Centre, no rare species other than plants have been recorded within the area. While the area presumably provides some habitat for more common wildlife species, no information is currently available on this topic.

Socioeconomic Considerations

Recovery actions could affect the following socioeconomic sectors: private land development; coal resource exploration and extraction; livestock grazing; agricultural management activities; and off-road vehicle recreation. The expected magnitude of these effects is unknown and will be further addressed in the recovery action plan. The extent of the area covered by the species is very small.

Recommended Approach for Recovery Implementation

The recommended approach for recovery implementation is a multi-species approach involving the South Okanagan–Similkameen Conservation Program.

Recovery activities in the South Okanagan and Similkameen watersheds need to consider the numerous species that are nationally and provincially at risk within the area, as well as pressures from the growing human population. Landscape-level approaches to conservation are preferred to

prevent unnecessary duplication, conflicts, omissions, and inefficiency associated with species-specific approaches (SOSCP 2003).

The species addressed in this recovery strategy — dwarf woolly-heads, slender collomia, and stoloniferous pussytoes — have several characteristics in common, including:

- Canadian populations are restricted in distribution to a small area south of Princeton, BC;
- each species has annual or very short life cycles;
- each species is a colonist of low-competition microsites;
- all populations are peripheral populations at the northernmost extent of their ranges;
- none of the species are considered to be at risk in Washington State;
- populations and individuals of the three species can be easily overlooked by non-botanists; and
- all three species are subjected to similar general threats.

These commonalities suggest justify a multi-species approach would be appropriate to facilitate recovery and management decisions in this systems, that is more efficient than treating these species in isolation, given limited conservation resources.

Statement on Action Plans

It is recommended that a recovery action plan be completed by April 2011.

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