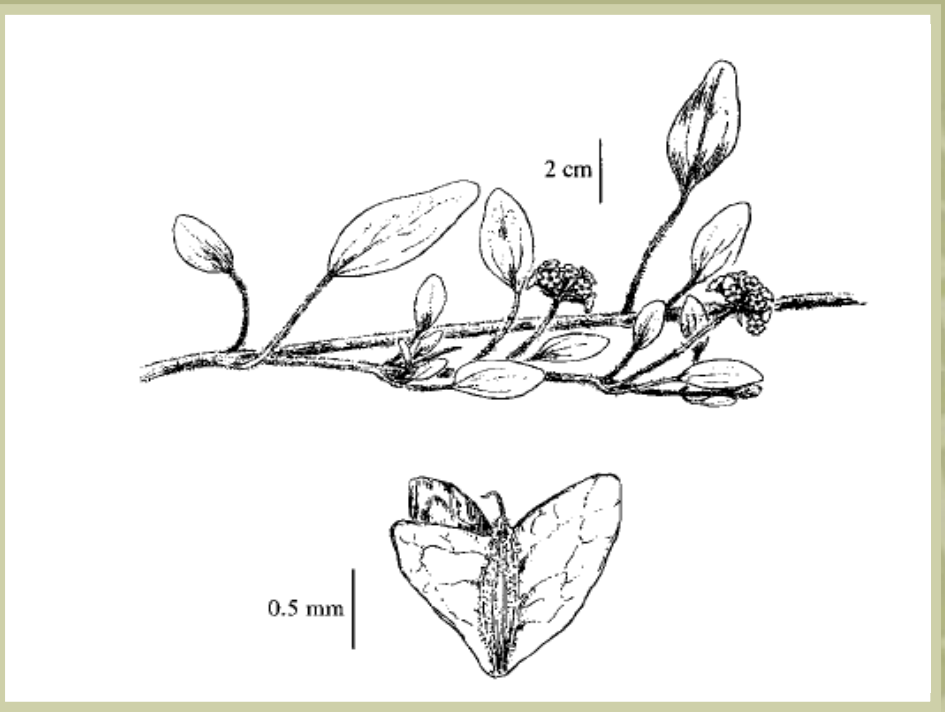
PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Pink Sand-verbena (*Abronia umbellata*) in Canada

Pink Sand-verbena



September 2006

Parks Canada Parcs Canada

Canada

About the Species at Risk Act Recovery Strategy Series

What is the *Species at Risk Act* (SARA)?

SARA is the Act developed by the federal government as a key contribution to the common national effort to protect and conserve species at risk in Canada. SARA came into force in 2003, and one of its purposes is *"to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity."*

What is recovery?

In the context of species at risk conservation, **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 the species' persistence in the wild. A species will be considered **recovered** when its long-term persistence in the wild has been secured.

What is a recovery strategy?

A recovery strategy is a planning document that identifies what needs to be done to arrest or reverse the decline of a species. It sets goals and objectives and identifies the main areas of activities to be undertaken. Detailed planning is done at the action plan stage.

Recovery strategy development is a commitment of all provinces and territories and of three federal agencies—Environment Canada, Parks Canada Agency and Fisheries and Oceans Canada—under the Accord for the Protection of Species at Risk. Sections 37–46 of SARA (http://www.sararegistry.gc.ca/the_act/default_e.cfm) outline both the required content and the process for developing recovery strategies published in this series.

Depending on the status of the species and when it was assessed, a recovery strategy has to be developed within one to two years after the species is added to the List of Wildlife Species at Risk. Three to four years is allowed for those species that were automatically listed when SARA came into force.

What's next?

In most cases, one or more action plans will be developed to define and guide implementation of the recovery strategy. Nevertheless, directions set in the recovery strategy are sufficient to begin involving communities, land users, and conservationists in recovery implementation. Cost-effective measures to prevent the reduction or loss of the species should not be postponed for lack of full scientific certainty.

The series

This series presents the recovery strategies prepared or adopted by the federal government under SARA. New documents will be added regularly as species get listed and as strategies are updated.

To learn more

To learn more about the Species at Risk Act and recovery initiatives, please consult the SARA Public Registry (http://www.sararegistry.gc.ca/) and the Web site of the Recovery Secretariat (http://www.speciesatrisk.gc.ca/recovery/default_e.cfm).

Recovery Strategy for the Pink Sand-verbena (*Abronia umbellata*) in Canada [Proposed]

September 2006

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PREFACE

This Recovery Strategy addresses the recovery of the Pink Sand-verbena. In Canada, the species occurrence consists of a single occurrence in Pacific Rim National Park Reserve of Canada, on the west coast of Vancouver Island. The species has not been seen at this site since 2001 but it is assumed that the species may still persist as dormant seeds and may produce reproductive plants at some future date.

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. The Species at Risk Act (S.C. 2002, c.29) (SARA) requires the competent minister to prepare recovery strategies for listed Extirpated, Endangered and Threatened species.

The Parks Canada Agency led the preparation of this recovery strategy with the members of the Pink Sand-verbena Recovery Team, and in cooperation and consultation with the Province of British Columbia, Environment Canada/Canadian Wildlife Service, First Nations and landowners.

This strategy will be complemented by one action plan that will provide details regarding specific recovery measures to be taken to support conservation of the species. The Minister of the Environment will take steps to ensure that, to the extent possible, Canadians interested in or directly affected by these measures will be consulted.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy. In the spirit of the Accord for the Protection of Species at Risk in Canada, all Canadians are invited to join in supporting and implementing this strategy for the benefit of the species and Canadian society as a whole. The Minister will report on progress within five years.

STRATEGIC ENVIRONMENTAL ASSESSMENT

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 on non-target species or habitats. The results of the SEA are incorporated directly in the strategy itself, but are also summarized below:

The Recovery Strategy for the Pink Sand-verbena *(Abronia umbellata)* in Canada underwent a strategic environmental assessment (SEA) review in accordance with the 2004 *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. Impact assessment methodology focussed on identification and assessment of actions capable of generating environmental effects. Positive and negative impacts were considered. Scope of the assessment included review and evaluation of all actions proposed in the Recovery Strategy for the Pink Sand-verbena in Canada. Proposals thought to have potential to generate adverse environmental effects were assessed and documented in greater detail. Results of the assessment are briefly discussed here. Please consult the Strategic Environmental Assessment of the Recovery Strategy for the Pink Sand-verbena in Canada (Parks Canada Agency 2006), for more detailed environmental assessment documentation.

The Recovery Strategy identified current threats to the Pink Sand-verbena and its habitat. Knowledge gaps were also identified. Recovery objectives and actions are clearly focused on resolving threats and filling information gaps. Individually and collectively the actions proposed in the recovery strategy have little potential to produce significant adverse environmental effects. Research and monitoring fieldwork activities have the greatest potential to generate negative environmental effects. Existing access trails and other low impact means of access will be employed to reach and traverse study sites whenever possible. This will significantly reduce the potential for impacts while undertaking these activities. Best practices will be employed when conducting fieldwork in areas where the potential for human induced wildlife disturbance exists. The environmental effects of fieldwork activities are avoidable or can be fully mitigated with known technology. Fieldwork impacts are therefore considered to be insignificant and reversible.

Single species recovery planning is intended to benefit an individual species at risk. The recovery strategy was developed with an understanding that some recovery strategy activities might result in environmental effects beyond the intended benefits. Both the recovery strategy and the SEA assessed the potential for the strategy to inadvertently produce adverse effects on other species. Results indicate likely benefits to the Pink Sand-verbena population and other species occupying beachhead habitat.

Recovery strategy implementation is expected to result in a reduction of threats affecting Pink Sand-verbena, and improved understanding of its ecology in coastal British Columbia. This knowledge will help focus current and subsequent recovery planning actions for the species and increase the probability of successful recovery.

Some recovery strategy actions, such vegetative translocation, may require project-level environmental assessment as required under the *Canadian Environmental Assessment Act (CEAA)*. For all activities that do trigger the *CEAA*, the environmental effects of those undertakings will be assessed pursuant to the provisions of the Act.

EXECUTIVE SUMMARY

Background

Pink Sand-verbena was assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as an endangered species in Canada in May 2004 and added to Schedule 1 of the *Species at Risk Act* in July 2005. It is an endemic species of the central west coast of North America and has been designated a species of Special Concern in the U.S. Its current Canadian range consists of a single population in Pacific Rim National Park Reserve, on the west coast of Vancouver Island. It has not been seen there since 2001, despite annual surveys at the precise location where it was last observed. The most serious threat it faces is a high probability of demographic collapse, since the population has never been large and is either extirpated or now consists of buried seeds. Recreational activities associated with the West Coast Trail, winter storms which rework sandy beaches in the upper foreshore environments where it grows and increased log deposition also threaten the population. Invasive grasses, which have colonized other beaches in the area, present an impending threat.

There are significant knowledge gaps. The size, nature and distribution of the soil seedbank (if one exists) at the only recently recorded occurrence is not known. Re-introduction techniques developed for the species elsewhere in its range have not been tested in Canada. Demographic patterns have not been described, although they likely hold the key to effective long-term management. There are no records of extant populations elsewhere in or near its historical range in Canada but past survey efforts may have been inadequate.

Recovery Feasibility

Recovery is considered feasible. The last-observed population may still be extant as banked seeds and even if this is not the case there is a small amount of seed collected on site in 2001. Techniques have been developed to propagate the plants and re-introduce them to suitable habitat; these techniques are likely transferable to Canada. The habitat at the most recently-observed occurrence is relatively intact, as are several other similar beaches in the historic range of the species. There are no unavoidable threats to the species or its habitat that preclude recovery.

Recovery Goal and Objectives

The goal of the Pink Sand-verbena recovery strategy is to establish three viable populations, spread across the historic range in Canada. This goal will be achieved by increasing the population size at the most recently-observed occurrence, removing beach logs that threaten the habitat, increasing public awareness of the species, establishing permanent protection for historic occurrences, engaging all implicated landowners, and identifying promising translocation sites, restoring their proper functioning condition, and successfully establishing two further populations.

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SPECIES INFORMATION

Common Name: Pink Sand-verbena
Scientific Name: *Abronia umbellata*
Assessment Summary:
COSEWIC Status: Endangered
Reason for designation: A herb of maritime beach habitats last seen at a single site along the west coast of Vancouver Island with losses of two historic populations. The site of the last documented population is greatly disjunct from other small populations in Oregon. The species is characteristically found in low numbers and tends to persist in the seed-bed of its beach and foredune habitats, sporadically producing flowering plants. The species was last recorded in 2001 with only several plants present. It is assumed that the species may still persist as dormant seeds and may produce reproductive plants at some future date. The expansion of exotic beach grasses has reduced the quality and availability of its upper beach and foredune habitats at a number of sites within its historic range.
Canadian Occurrence: BC
COSEWIC Status History: Assessed as Endangered May 2004. Assessment based on a new status report.

1 BACKGROUND

1.1 Description

1.1.1 Description of the species

The species

"*Abronia umbellata* is a perennial herb from a thick, deep taproot. Canadian plants have trailing stems up to 1.5 m long with short branches and opposite, thick, fleshy, densely glandular leaves. The leaves are lanceolate to narrowly egg-shaped, 2–6 cm long, 0.8–3.5 cm wide with stalks 2.5–7 cm long. The many-flowered, rounded heads occur on stout, 2–4 cm stalks. The flowers consist of a 6–8 mm long, greenish to pinkish perianth tubes that flare into pink, 5-lobed limbs 5–6 mm wide. The fruits consist of 10–12 mm long achenes that are prominently 3- or 4-winged. The wings of the achenes are wider than the achenes. Each achene has a single, brown, seed approximately 1.5 mm wide and 3 mm long" (COSEWIC 2004).

There are two subspecies (*umbellata* and *breviflora*) but only the latter occurs in Canada (Kaye 2002, Hitchcock 1964). Pink Sand-verbena is used as the English name for both subspecies. Throughout this recovery strategy Pink Sand-verbena is used to refer to *Abronia umbellata* ssp. *breviflora.*

Populations and distribution

Pink Sand-verbena is restricted to the Pacific shorelines of North America (Figure 1) ranging from central Vancouver Island south to central California (Kaye 2002).

Conservation ranks are provided in Table 1. Subspecies *breviflora* is ranked globally threatened. In Washington it has been reported from four sites (all in the northwest corner of the state) and has not been seen recently, so it is now ranked as extirpated for that state. Kaye (2003a) reports sixteen Oregon populations which have been observed during extensive surveys between 1998 and 2003 but thirteen of these populations were introduced as part of a recovery program. Between 1993 and 2003 three to five natural populations occurred in any given year. While there are more numerous populations in California, the subspecies has been listed as a Species of Concern by the US Fish and Wildlife Service (Kaye 2003a). According to this listing, additional information is needed to support a proposal to list under the United States Endangered Species Act (Oregon Natural Heritage Information Center 2004).

Figure 1. Distribution of Pink Sand-verbena (*Abronia umbellata* ssp. *breviflora*) in North America (from COSEWIC 2004).

In Canada, populations of Pink Sand-verbena have been recorded at Clo-oose Bay, Ahousat and Pachena Bay (Figure 2, Table 2). Table 2 provides more accurate locational information than was contained in the COSEWIC status report (2004).

The Ahousat and Pachena Bay populations are probably extirpated. The earliest record of the Clo-oose Bay population was a sighting in about 1940. Over the next few years as many as 10–12 plants were observed in any given year (Delcie Cox pers. comm. 2005, Jim Hamilton pers. comm. 2005), information which was not presented in the COSEWIC status report. Jim Hamilton reported the population to the BC Conservation Data Centre in 2000 and a specimen (Douglas #13339) was collected later that year. It is not clear whether the population was extant during the intervening years. Two plants were seen in 2000 and three plants were seen in 2001. It has not been seen since then despite careful surveys in 2002, 2003, 2004 and 2005 (Jim Hamilton pers. comm. 2005, Matt Fairbarns pers. obs.) but the species may remain in a local seedbank (see Section 1.1.2: Biological needs, ecological role and limiting factors).

Table 1. Conservation ranks for Pink Sand-verbena (*Abronia umbellata* ssp. *breviflora*) Source: NatureServe 2005, BC Conservation Data Centre 2005, Washington Natural Heritage Program 2005, California Department of Fish and Game, Natural Diversity Database. July 2005.

Global	BC	WA	OR	CA
G4G5T2	S1	SX	S1	S2.1[1]

[1] California subdivides S2 taxa according to the degree of threat they face, with S2.1 taxa facing a greater degree of threat than all other S2 taxa.

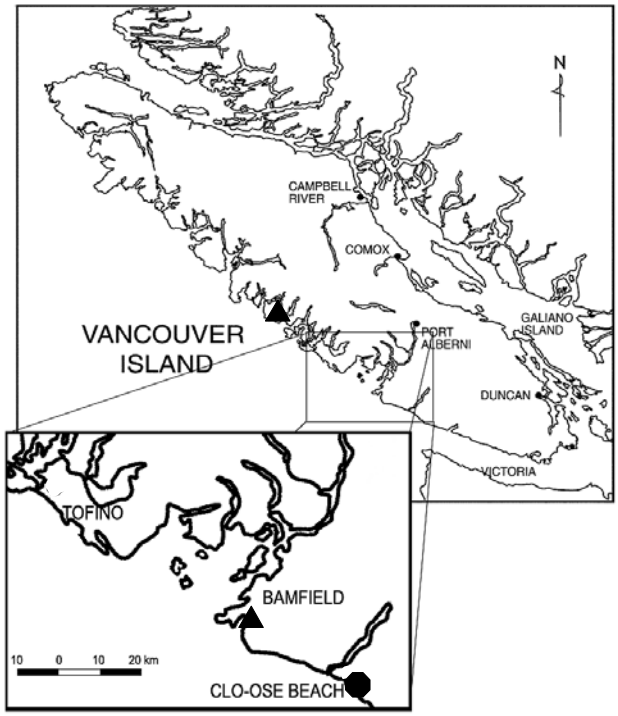

Figure 2. Distribution of Pink Sand-verbena (*Abronia umbellata* ssp. b*reviflora*) in Canada. Inset highlights populations south of Barkley Sound. Circle represents the recently observed (2001) population at Clo-oose Bay, triangles represent historic populations at Ahousat and Pachena Bay. This figure supersedes that in the COSEWIC status report (2004) which contained an error in the location of the Ahousat population.

Table 2. Summary of populations of Pink Sand-verbena (*Abronia umbellata* ssp. *breviflora*) in Canada

Population (Tenure)	Location*				Status and Description
	Zone	Easting	Northing	Notes	
Clo-oose Bay (Parks Canada)	10U	366887	5390570	±10m NAD 83	Possibly extirpated, last seen in 2001 (3 plants), may persist in seedbank. In 1940s it occurred in scattered locations south of the Cheewhat River along Clo-oose Bay beach.
Ahousat (Unknown)					Apparently extirpated, not recorded since 1915. No population estimates available.
Pachena Bay (Parks Canada)	10U	344280	5406778	± 500m NAD83	Potentially extirpated, not recorded since 1927. No population estimates available.

* Locations are in Universal Transverse Mercator (UTM) coordinates. Coordinates are only provided for federal land.

The COSEWIC status report (2004) did not provide estimates of the extent of occurrence or area of occupancy. The three populations form a triangle measuring about 112 km^2 but about 30% of the triangle covers open ocean, leaving a corrected historical extent of occurrence of about 80km^2. If one assumes that the Clo-oose Bay population is extant while the other two populations have become extirpated, then the contemporary extent of occurrence is only a few square metres, defined by the contemporary area of occupancy. The historic area of occupancy is unknown. The extent of occurrence in Canada represents far less than 5% of the species global range. The Canadian area of occupancy and population size in 2001 represent far less than 1% of the global values for ssp. *breviflora*.

1.1.2 Description of the species' needs

Biological needs, ecological role and limiting factors

Pink Sand-verbena does not reproduce from cuttings or pieces of the plants (Kaye 1998); thus dispersal of the species is dependent on seeds. While Pink Sand-verbena is capable of perennating, the exposed habitat of most sites results in the loss of established plants each year during winter storms. The Canadian populations are replenished by recruitment from a local seedbank and/or by long-distance dispersal from southern populations. Seedbanks may be particularly important to the persistence of populations. The seeds remain viable for prolonged periods under laboratory conditions and rates of germination are very low until the fruit enclosing the seed has been completely abraded. Low germination rates have been observed among untreated fruits scattered along natural beaches but contrary to what is stated in the COSEWIC status report (2004), there have been no similar studies using cleaned seed (Kaye 1999a, Kaye et al. 1998, Kaye pers comm. 2005). The distribution of banked seeds is unknown but they may be buried on site (some seeds may be deeply buried and unable to germinate until sand is reworked, bringing them up to shallow depths) or in habitats unsuited to germination, growth, and maturation, e.g., in nearby off-shore sand deposits or above the storm-tide line (COSEWIC 2004, Tom Kaye pers. comm. 2005).

Populations may be quite small and periodically disappear and re-appear at a site (Kaye 2004), as has occurred at Clo-oose Bay. While this may be due to periodic 'rescue' by seeds transported north from Oregon populations, the appearance at the same locations on the same beach at Clo-oose Bay suggests that populations are probably recruited from a local seedbank rather than by long-distance immigration.

Habitat Needs

Suitable habitat in British Columbia is restricted to upper sand beaches, just below the driftwood zone, along the outer coast in the Coastal Western Hemlock Biogeoclimatic Zone (very wet hypermaritime subzone, southern variant). These gently-sloping, west-facing sites are scoured by high tides and winter storms. Few plants are adapted to this drought-prone, ephemeral habitat and only scattered specimens of European searocket (*Cakile maritime*), a European introduction, occur along this area of the beach (COSEWIC 2004, Matt Fairbarns pers. obs.).

Imper (1987) describes Pink Sand-verbena habitat in California north of Big Lagoon: fine sand beaches with no soil development, unstabilized free flowing sand, low, broad beach with 15–23 meters between normal high water and the foredune, an elevational difference of less than 1.5–3 meters between normal high water and the base of the foredune, and a foredune less than 2 meters with a rolling rather than abrupt face. It is also noted that Pink Sand-verbena seems to do best around the mouth of small creeks. Though it does exist in sand dunes in the southern portion of its range, Pink Sand-verbena appears restricted to sand beaches (below the foredune) from northern California to British Columbia (Tillet 1967, Wilson 1972, Imper 1987, Kaye 2004).

Suitable sand beach habitat is uncommon on the outer coast of British Columbia. Three beaches have records of former occurrences of Pink Sand-verbena and a number of other beaches are potential sites for the latter species since they support, or have supported, Yellow Sand-verbena (*Abronia latifolia*), a species with similar habitat requirements. While habitat is regionally uncommon it is not a limiting factor for recovery of this species.

Areas above the storm-tide line and off-shore sand deposits may play an important role in storing and releasing seed during storms. Winter storms may play a necessary role by exposing deeply-buried seed, restricting the establishment of competing vegetation, and establishing suitable germination conditions (Kaye 2002, COSEWIC 2004, Matt Fairbarns pers. obs.).

Residence

SARA defines residence as: "*a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating*" **[SARA S2(1)]**.

Individual Pink Sand-verbena plants do not use a dwelling place similar to a nest or den, and therefore do not qualify under SARA for having a residence. There would be no additional legal protection not already afforded by protection of the individual and its critical habitat.

1.2 Threats

1.2.1 Threat 1: Demographic collapse

The greatest apparent threat comes from the small size of the population, which disposes it to stochastic events and demographic collapse (populations may become too small to sustain themselves). It is not clear that the seedbank contains sufficient seeds to perpetuate the population, especially since there has been no seed production for several years.

1.2.2 Threat 2: Recreation

The Clo-oose Bay population occurs along the edge of the West Coast Trail and large numbers of hikers visit the beach during the summer months (Matt Fairbarns pers. obs.). They may cause direct damage to Pink Sand-verbena by trampling on or brushing against plants while they are hiking, camping, or collecting firewood. Hikers may also damage the plants by gathering the attractive flowers. The threat from recreational activity is ranked more highly here than it was in the original COSEWIC status report (2004) based on a review of the literature and discussions with Jim Hamilton (Matt Fairbarns pers. comm. 2005).

1.2.3 Threat 3: Winter storms

Winter storms are both a threat to individuals and a necessary process which maintains habitat for the population. The sand beach habitats of Pink Sand-verbena are usually scoured by high tides and winter storms thus few, if any, plants in this zone ever persist over winter. These storms also alter beach and sand dune morphology, altering the availability of suitable germination sites and perhaps bringing buried seeds close to the surface (Tom Kaye pers. comm. 2005). Natural shoreline geomorphic processes associated with winter storms are likely to restore suitable substrates for germination and growth every year.

1.2.4 Threat 4: Increased log debris

The impacts of winter storms may be exacerbated by elevated inputs of driftwood (due to timber harvesting and log booming along the coast) that may serve to increase beach scour and occupy potential growing sites. Driftwood also modifies the flow of sand in the ecosystem and increased deposition of wood from anthropogenic sources may eliminate the Pink Sand-verbena habitat. Some anthropogenic log mediated changes have already occurred at the Clo-oose Bay site. Further research is required to determine the ultimate effect of increased log deposition on Pink Sand-verbena habitat.

1.2.5 Threat 5: Invasive species – Beachgrass

The COSEWIC status report (2004) states that the greatest threat to the persistence of populations of Pink Sand-verbena is posed by invasive grasses such as Beachgrass (*Ammophila arenaria* and *A. breviligulata*). These robust grasses alter sand dune dynamics and, according to the status report, are capable of intruding onto upper sand beaches (the natural habitat of Pink Sand-verbena at Clo-oose Bay; COSEWIC 2004). In Oregon, Beachgrass abundance is significantly correlated with decreases in Pink Sand-verbena size and reproduction (Kaye 2004). These grasses do not occur at Clo-oose Bay at present but may represent a serious long-term threat because they are present 'nearby' along the west coast and capable of long-distance dispersal. However, it has been proposed that the habitat at Clo-oose and Pachena Bays is not suitable for Beachgrass and that these species do not pose a threat at these locations (Nick Page pers. comm. 2005). Beachgrasses also threaten Pink Sand-verbena survival because it is likely that they presently occupy and make unavailable potential dispersal habitat. The preceding threats are more immediate.

1.3 Critical Habitat

1.3.1 Identification of the species' critical habitat

Critical habitat is proposed in accordance with the recovery goals presented in Section 2. Only "survival habitat" required by the single presumed extant population is identified in this recovery strategy. The upcoming action plan is expected to propose additional critical habitat necessary for the re-establishment or replacement of two extirpated populations along the west coast of Vancouver Island ("recovery habitat").

Plants belonging to the Clo-oose Bay population have been observed along the upper beach from south of the Cheewhat Indian Reserve 4a southwards to the end of the beach (Jim Hamilton pers. comm. 2005); this constitutes the core area critical to the survival of the population. The storm tide zone above the upper beach, as well as the lower beach and shallow off-shore zone, are also critical to the species' survival because of the role these areas play in determining beach dynamics. Further habitat needs are detailed in Section 1.1.2. Based on the above species needs and expert consultations, the beach from the southern edge of the Cheewhat Indian Reserve 4a southwards to the end of the sand beach including a buffer of 30 metres on either side of the mean high tide mark should be considered critical habitat at Clo-oose Bay (see Table 2 for UTM locality). The 30 metre buffer is based on expert advice to protect the upper beach as well as the lower beach and shallow off-shore zone (Matt Fairbarns pers. comm. 2005).

At this time proposed critical habitat is NOT sufficient for the recovery of this species. Habitat critical to the recovery of populations elsewhere cannot be defined until suitable sites have been identified. Further work is required to identify critical habitat comprehensively, and is outlined in the schedule of studies, below. Future action plans will likely identify additional parcels of critical habitat deemed necessary and sufficient to support recovery of the species.

1.3.2 Examples of activities that are likely to result in the destruction of the critical habitat

Critical habitat may be destroyed by beach developments or introduction of non-native invasive plant species (e.g., grasses), both of which can occupy habitat directly and/or alter shoreline dynamics and sand flow. Alteration in the flow of sand through the habitat can have a dramatic effect on beach morphology to the point that the specific attributes required by Pink Sand-verbena (see Section 1.1.2) are eliminated. Specific activities which threaten recovery habitat cannot be determined until that habitat has been identified.

1.3.3 Existing and recommended approaches to habitat protection

The existing habitat at Clo-oose Bay lies within Pacific Rim National Park Reserve and is protected by provisions of the *Canada National Parks Act* and the *Species at Risk Act*.

1.3.4 Schedule of studies to identify critical habitat

Habitat suitability mapping: Sand beaches along the west coast of Vancouver Island, between Port Renfrew and Estevan Point should be mapped, field-assessed, and evaluated for suitability as sites for reintroduction. This should be completed by 2008.

Surveys: Apparently suitable sites should be surveyed during late August or early September to search for unreported populations. A single year of survey of a given site is insufficient because the plant may fail to germinate and grow for several years in a row. Accordingly, all potential sites should be surveyed in at least three separate years between 2006 and 2010. If overlooked populations are found, critical habitat should be defined on a site-by-site basis.

Monitoring: The Clo-oose Bay site should be monitored annually (August or early September) to to determine species presence.

Any of the above actions could become incorporated into an upcoming action plan for the species.

1.4 Actions already completed or underway

The Institute for Applied Ecology (Corvallis, Oregon) has been conducting a series of studies into the biology of Pink Sand-verbena in coastal Oregon for several years. Work has been completed on several aspects of the plant's conservation biology including the genetic diversity of natural populations, dormancy mechanisms, propagation techniques, and re-introductions (Braun 1991; Karoly 2001; Kaye 1995, 1996, 1998, 1999a, 1999b, 2000, 2001, 2002, 2003a, 2003b, 2004; Kaye et al. 1999; McGlaughlin 1999; McGlaughlin et al. 2002).

Seeds were collected from plants at Clo-oose Bay in 2001 and set aside for germplasm conservation and as a source for experimental study. Some seeds are in the possession of Jim Hamilton, a resident of Clo-oose. Others, collected by George Douglas, are stored at the Pacific Forestry Centre in Victoria, BC. Seeds collected at Clo-oose Bay were used locally to test propagation techniques—all plants died without flowering: In one study, seeds were germinated in sand-filled 20-gallon drums but the plants failed to flower. In a second experiment, plants were seeded into a shallow trench but the test was aborted when hikers collected the wooden markers for kindling and trampled the test site (Jim Hamilton, pers. comm. 2005). A small number of seeds were sent to researchers in Oregon and grown in 2 gallon pots filled with coarse sand as part of a common garden experiment with local Oregon plants; these grew well and flowered (Tom Kaye, pers. comm. 2006).

The Clo-oose Bay site has been monitored annually since 1999.

1.5 Knowledge gaps

It is unclear whether there is a buried seedbank at Clo-oose Bay.

There is inadequate information on how the small quantity of seeds collected at Clo-oose Bay can be used to restore or augment the local population. There needs to be more information

on number of seeds required to propagate new plants for reintroduction. Furthermore, there is little applied experience in the development of *in-situ* 'increase gardens' where seed reserves can be 'bulked up'.

Re-introduction techniques developed by the Institute for Applied Ecology in Oregon have not been tested on the west coast of Vancouver Island.

The demographic and phenological characteristics of Canadian Pink Sand-verbena populations, and underlying factors, have not been described. For instance the relative contributions of seedbank inputs (on site seed production, transportation to site from other populations) and outputs (transport away, and viability decline over time in the wild) are not known.

It is not clear whether populations persist at Pachena and Ahousat, or whether there are populations elsewhere on Vancouver Island. Past survey efforts have not been sufficient, considering that populations of this taxon are often small and may remain dormant in the seedbank for several years. If buried seedbanks are present at one or both of these sites then they should be recovered using local germplasm rather than seed from elsewhere.

Further research is required to elucidate effects of log debris and invasive beachgrass on Pink Sand-verbena and its habitat.

2 RECOVERY

2.1 Recovery Feasibility

There are significant knowledge gaps pertaining to this species. However, recovery decisions should consider the conservation of biodiversity and the principle that a lack of full scientific certainty is not reason to postpone cost-effective measures to prevent the reduction or loss of a species that faces threats of serious or irreversible damage (as per SARA S. 38). To act in accord with the assumption that this species has been negatively impacted by human activities and that mitigation is now necessary for its continued presence in Canada may save the species. To assume and act otherwise risks the potentially preventable loss of a component of Canadian biodiversity.

In determining feasibility the following four criteria have been considered:

- Are individuals capable of reproduction currently available to improve the population growth rate or population abundance? The population at Clo-oose Bay may still be extant as banked seeds. Even if this is not the case, seeds collected at the site in 2001 are available. As a last resort, there are healthy populations in the United States and seeds from those populations are likely viable in Canada. Once suitable seed is obtained, the plants can be raised in a controlled environment and successfully transplanted into the wild where they can reproduce and establish a population (Kaye

2003b).

- Is sufficient suitable habitat available to support the species or could it be made available through habitat management or restoration? Habitats at the Clo-oose Bay and Pachena Bay sites are relatively intact and there are a number of other beaches between Port Renfrew and Estevan Point which appear to possess suitable habitat. The habitat at some other beaches, where invasive grasses have become established, may still be restored through recovery actions (Pickart 1997).
- Can significant threats to the species or its habitat be avoided or mitigated through recovery actions? There are no unavoidable threats to the species or its habitat that preclude recovery.
- Do the necessary recovery techniques exist and are they demonstrated to be effective? Recovery techniques have been tested in Oregon (Kaye 2003a,b) and can probably be successfully adapted to sites in Canada.

Based on the above as per the criteria from the *Policy on the Feasibility of Recovery* (Environment Canada *et al*. 2005), recovery is considered feasible.

2.2 Recovery goals, objectives and corresponding approaches

2.2.1 Recovery goals

The long-term recovery goal over the next twenty years is presented as component goals in Table 3. These goals will reduce the likelihood that this taxon will become extirpated in Canada by securing yearly seed input to multiple seedbanks where individuals may survive between periodic germination events. These goals are unlikely to lead to downlisting because there is no historical evidence that the Canadian population has ever exceeded the lower COSEWIC assessment threshold for population size (250 mature individuals). However, the recovery goal will ensure the long-term stability of this population at presumed historic low numbers.

Table 3. Recovery goals for Pink Sand-verbena over the next 20 years (2006–2025 inclusive).

COSEWIC Criteria	Term	Goal Number	Recovery Goals
B1, B1a	Long-term (Twenty years)	1	Conserve Pink Sand-verbena throughout its historical range of occurrence in Canada: an extant Clo-ose Bay population and at least two more populations (re)introduced by 2015 near/within the historic range.
B1a	Short-term (five years)	2	Extant population at Clo-oose Bay.
D1	Long-term (Twenty years)	3	Protect all existing populations and manage each to ensure it doesn't fall below a minimum viable population size.
D1	Short-term (five years)	4	The Clo-oose Bay population is at least a minimum viable population size.

2.2.2 Recovery objectives (including population and distribution objectives)

Recovery objectives for Pink Sand-verbena over the next five years are presented in Table 4.

Table 4. Recovery objectives: 2006–2010, inclusive.

Objective	Goal Addressed	Threats	COSEWIC Assessment Criteria
1. Grow plants from a genetically appropriate seed source and introduce to the wild at Clo-oose Bay.	2, 4	Demographic collapse	B1a D1
2. Mitigate threats to habitat and survival at Clo-oose Bay by removing beach logs derived from harvesting operations on the west coast.	2, 4	Increased log debris	B1a D1
3. Increase public awareness of the existence and conservation value of Pink Sand-verbena, associated species at risk, and sand dune habitats.	1, 2, 3, 4	Recreation	B1 B1a D1
4. Secure permanent protection (legal or through stewardship) for sites of historic occurrences.	1, 3	Demographic collapse	B1 B1a D1
5. Engage the cooperation of all implicated landholders in habitat protection.	1, 2, 3, 4	Demographic collapse	B1 B1a D1
6. Identify and rank 5–10 potential recovery (translocation) sites.	1, 3	Demographic collapse	B1 B1a D1
7. Restore habitat to functioning condition at or near proposed sites for restored/new populations	1, 3	Increased log debris Demographic collapse Invasive species	B1 B1a D1

2.2.3 Rationale for Goals and Objectives

There are large knowledge gaps pertaining to this species and there is not enough information to accurately characterize its population dynamics; specifically, it is not known what it takes to make a population viable over the long term (Matt Fairbarns pers. comm. 2005). As such the safest assumption is that the population was stable prior to human interference and that humans have reduced seed input (local production and/or long distance transport) into the seedbank—it appears less likely that humans would have significantly affected seed output (viability decrease and transport off site). If this assumption is correct, then immediate action

may save the species in Canada. If incorrect, the environmental costs of increasing seed input to a locally unsuitable environment appears negligible. The alternative assumption is that the population was declining naturally (for reasons other than human interference) and that nothing should be done to help the species; to act in accord with this assumption risks allowing human actions to cause the potentially preventable loss of a component of Canada's biodiversity. The former assumption appears to carry less associated risk.

Following the safest assumption outlined above, Pink Sand-verbena should be the target of recovery actions to increase seed input. A further assumption that a seedbank exists is another least risky assumption to avoid the possibility of introducing foreign genetics into a locally adapted population. In accord with this assumption, only the most genetically appropriate seed source should be used for restoration—use local seeds first and if local seeds are insufficient use the next most genetically similar seed source.

Individuals in the seed bank must be considered when estimating population numbers for viability. It is possible that this species forms viable populations with most individuals in a seedbank that is replenished through periodic reproduction (Matt Fairbarns pers. comm. 2005). In this case (depending on the values of variables relating to seed input and output from the seedbank), a relatively small number of mature plants may represent a viable population when the seedbank is considered.

This recovery strategy proposes immediate action along with demographic studies to identify factors influencing the rate of recruitment, survivorship of plants and plant modules (e.g., flowers/flowering shoots/fruits), and seedbank inputs and outputs (by long-term sequestration, germination or mortality). This information should enable the development of more precise recovery goals in later stages of recovery.

2.2.4 Broad strategy to be taken to address threats

Broad strategies for the recovery of Pink Sand-verbena are presented in Table 5.

Table 5. Broad approaches to effect recovery

Priority	Obj. no.	Broad approach	Threat addressed	Specific steps	Outcomes or deliverables
Urgent	1	Gene conservation	Demographic collapse	Improve storage conditions for seed collected from Clo-oose Bay. Establish an increase program to build up supplies of stored seed. Formalize issues around the legal collection and storage of seed.	A source of locally adapted seed.
Urgent	1	Population augmentation	Demographic collapse	Within an experimental framework, test techniques for augmentation of the Clo-oose Bay population using transplants derived from locally adapted seed. Establish a regular transplant program at Clo-oose Bay. Establish demographic studies at Clo-oose Bay.	Restoration of population at Clo-oose Bay. Identification of population constraints.
Urgent	3	Public extension and education	Recreation	Establish an on-site interpretation program at Clo-oose Bay to deter unintentional impacts by hikers. Temporary fencing during the hiking season should be considered in areas subject to recreation.	Improved conditions for survivorship.
			Site securement	Develop outreach programs for landowner contact at potential translocation sites.	An outreach package for landowners.
High	1,8	Monitoring	All	Monitor the Clo-oose Bay population and critical habitat annually. Encourage public to report sightings (done through interpretation programs).	Identification of threats and determination of population trends.

Table 5. Broad approaches to effect recovery

Priority	Obj. no.	Broad approach	Threat addressed	Specific steps	Outcomes or deliverables
High	6, 8	Survey	Demographic collapse	Assess suitability of beach habitats between Estevan Point and Port Renfrew (including historic locations). Survey suitable beaches on an annual basis for five years (2006–2011). Encourage public to report sightings (done through interpretation programs).	Identification of sites for (re)establishing populations and documentation of limitations at each. Location of overlooked populations.
High	2, 7	Habitat stewardship	Increased log debris	Remove anthropogenic logs (i.e., logging debris) from the Clo-oose Bay site.	Improved habitat conditions at Clo-oose Bay.
High	2, 7	Habitat stewardship	Increased log debris	Remove anthropogenic logs (i.e., logging debris) as appropriate at potential translocation sites.	Improved habitat conditions and reduced trampling impacts at potential translocation sites.
			Recreation	When translocation is undertaken, establish an on-site interpretation program at translocation sites to deter unintentional impacts by recreational users.	
			Invasive Species	Control invasive grasses as appropriate at potential translocation sites.	
				Monitoring to enable adaptive management should be included in the monitoring approach	

Table 5. Broad approaches to effect recovery

Priority	Obj. no.	Broad approach	Threat addressed	Specific steps	Outcomes or deliverables
High	4, 5	Habitat securement	Demographic collapse	Identify probable locations of extirpated populations at Pachena Bay and Ahousat and assess suitability for restoration. If habitat appears suitable, contact landowners and discuss issues related to restoration of extirpated populations. If appropriate, secure historic locations with protection tools. If historic locations are unsuitable, secure alternative sites for establishing populations.	Secure sites for translocation programs.

2.2.5 Effects on other species

There are no other native plants within the foreshore environment occupied by the Clo-oose Bay population and this small area does not appear to play an important role for any vertebrate species, so the approaches proposed in Table 5 will have no significant direct impacts on existing populations of native plants or vertebrates.

Removal of anthropogenic logs will likely restore natural processes of beach geomorphology and shoreline succession. Specifically, removal of anthropogenic logs may impede or reverse the unnatural stabilization of shoreline systems. A number of species of open sandy areas which are on the BC Conservation Data Centre's blue-list occur near populations of Pink Sand-verbena. At Clo-oose Bay, populations of American Glehnia (*Glehnia littoralis* ssp. *leiocarpa*), Black knotweed (*Polygonum paronychia*), and Beach Morning-glory (*Convolvulus soldanella*) occur on backshore ridges and dunes. Yellow Sand-verbena (*Abronia latifolia*) is another blue-listed plant which was once abundant in the backshore at Clo-oose Bay, it has not been seen since about 1995 (Jim Hamilton pers. comm. 2005). The backshore sand dune where American Glehnia, Black knotweed, and Beach Morning-glory are most abundant (and where Yellow Sand-verbena was last observed) has become stabilized due to the development of a forest strand on logging debris along the lower backshore, which now shields the dune from ocean winds. Further dune stabilization could be stopped or reversed by removal of logging debris and the forest strand. This would benefit the blue-listed species noted above and may even lead to the recovery of Yellow Sand-verbena if it is still present in the soil seedbank.

Yellow Sand-verbena also occurs at Pachena Bay, although the population is quite small and may have declined as a result of recreational activities. Recovery actions aimed at restoring the extirpated population of Pink Sand-verbena at Pachena Bay may benefit the dwindling population of Yellow Sand-verbena.

The public extension and education approach may increase public appreciation of sand dune ecosystems along the west coast of Vancouver Island as well as of some of the rare species that occur there.

2.2.6 Evaluation

The overall approaches to recovery set out in this strategy will be evaluated through routine monitoring of the status of Pink Sand-verbena and its habitat. Target levels have been established for plants in terms of occupied range and persistence (Table 3). These targets will be used to assess progress. The Recovery Strategy will be reviewed in five years to evaluate the progress on stated objectives and to identify additional approaches and changes that may be required. The following are additional performance measures that can be used to evaluate the progress of recovery:

- Formalization of critical habitat designations through a Recovery Action Plan,
- Number of protective measures established for critical habitat,
- Number of knowledge gaps successfully addressed,

- Successful prioritization of sites for securement,
- Number of high priority sites protected by acquisition or conservation covenants,
- Designation of the species under the provincial *Wildlife Amendment Act* as a Species at Risk,
- Number of Pink Sand-verbena education and outreach materials developed and distributed,
- Number of sites with appropriate management plans implemented,
- Creation of an *ex situ* seed storage programme,
- Creation of a guide for re-introductions and translocations of Pink Sand-verbena,
- Number of protocols and Best Management Practices developed and distributed,
- Number of secured sites improved through invasive species control and other restoration activities.
- Establishment of a seed increase programme.

2.2.7 Recommended approach for recovery

The recovery team should strive for cross-membership with the team managing recovery of this taxon in the United States and with team(s) that will be set up to manage the recovery of other rare species of sandy coastlines on Vancouver Island (e.g., the Sand-verbena Moth *Copablepharon fuscum* and Contorted-pod Evening-primrose *Camissonia contorta*). Despite the obvious benefits of cross-membership with recovery team(s) for other rare species of sandy coastlines, a single species approach is best suited to the recovery of Pink Sand-verbena. This will simplify development and implementation of recovery plans but will not cause conflicts between recovery actions because Pink Sand-verbena does not co-occur with the other two species named above.

A proposed Recovery Action Plan for Pink Sand-verbena will be posted on the Public Registry by July 2008.

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