Recovery Strategy for the scarlet ammannia (*Ammannia robusta*) in British Columbia and Ontario

Prepared by the Scarlet Ammannia Recovery Team

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>

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Al Woodliffe

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Disclaimer

The British Columbia Ministry of Environment and the Ontario Ministry of Natural Resources led the development of this recovery strategy for scarlet ammannia, under the *Accord for the Protection of Species at Risk in Canada.*

This recovery strategy has been prepared as advice to the responsible jurisdictions and the many different constituencies that may be involved in recovering the species. The recovery strategy does not necessarily represent the views of all individuals of the recovery team or the official positions of the organizations with which the individual recovery team members are associated.

The goals, objectives, and recovery approaches identified in the strategy are based on the best existing knowledge and are subject to modifications resulting from new findings and revised objectives. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

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.

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RESPONSIBLE JURISDICTIONS

The British Columbia Ministry of Environment and the Ontario Ministry of Natural Resources are responsible for producing a recovery strategy for scarlet ammannia 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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EXECUTIVE SUMMARY

Scarlet ammannia (*Ammannia robusta*) was designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Endangered in April 1999; the designation was confirmed in May 2001. Scarlet ammannia is listed as Endangered under Schedule 1 of the federal *Species at Risk Act.* This species is ranked as an S1 (critically imperiled) species in both British Columbia and Ontario. In British Columbia, it appears on the Ministry of Environment Red-list; in Ontario, it is listed as Endangered under Ontario's *Endangered Species Act, 2007*.

Scarlet ammannia ranges from south-central British Columbia south to Mexico (Hitchcock 1961; McClintock 1993; Douglas et al 1999). It also ranges eastward throughout central North America to Ohio and southwestern Ontario. From Ontario, it ranges south to the extreme southern United States and Mexico. The total number of populations in Canada has declined 40%, from 10 historic populations to 6 extant populations over the last 50 years.

In British Columbia, scarlet ammannia inhabits moist to wet, often alkaline, muddy shorelines of lagoons or ponds; sandy shorelines; or moist or dried alkaline flats. These sites are submerged early in the year, with plants emerging when lake levels drop in late July to early September. Ontario sites are on mudflats; sand beaches; wetland edges; dried-up pond bottoms; and moist, sandy depressions.

Threats to scarlet ammannia in BC include: habitat loss or degradation; changes in ecological dynamics or natural processes (flood regime); invasive species; cattle grazing, trampling and recreational vehicle activity are considered minor potential threats. Threats in Ontario include: changes in ecological dynamics or natural processes (flood regime and succession); invasive species and habitat loss or degradation.

No critical habitat can be identified for scarlet ammannia in Canada at this time, but it may be identified at a later date in a federal addendum by Environment Canada, or in a future action plan. It is expected that critical habitat will be proposed following the completion of outstanding work required to quantify specific habitat and area requirements for the species, further research on the biology of the species and monitoring of the populations to determine population trends. Consultation with affected landowners and organizations will also be necessary.

Recovery actions could potentially affect the following socioeconomic sectors: land development along foreshore areas; recreational users of provincial parks; agriculture (irrigation), and domestic animal grazing. The expected magnitude of these effects is unknown and will be further addressed in the recovery action plan.

The recovery goal for scarlet ammannia is to protect and maintain the four extant populations in Ontario and the two extant populations in BC, and to restore the species at historic sites if deemed necessary. Specific targets for population numbers are not possible at this time due to the species being an annual and also a lack of survey data for determining long-term population trends.

Recovery objectives for the species are as follows:

1. Ensure the persistence of the species at all known extant sites, with no loss or degradation of currently occupied habitat, for the next five years.
2. Assess the extent of the four main threats to the six populations (habitat loss or degradation, invasive species, flood regime, and succession) by 2012.
3. Confirm the distribution of scarlet ammannia in Ontario and British Columbia (historic and new locations), and update population and distribution objectives as needed by 2012.
4. Investigate the feasibility of restoring populations at extirpated sites or in suitable habitat near historical areas by 2012.

Approaches to achieve these recovery objectives include: habitat protection, public outreach, inventory and monitoring, habitat management, scientific research and habitat restoration.

In British Columbia, a multi-species action plan will be completed by 2012 for four sand spit species (and others), including scarlet ammannia, small-flowered lipocarpha (*Lipocarpha micrantha*), short-rayed alkali aster (*Symphyotrichum frondosum*), and toothcup (*Rotala ramosior*). An action plan for Ontario scarlet ammannia sites will be completed by 2013.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

BACKGROUND

Species Assessment Information from COSEWIC

Common Name (population): scarlet ammannia
Scientific Name: *Ammannia robusta*
Status: Endangered
Last Examination and Change: May 2001
Canadian Occurrence: British Columbia, Ontario
Reason for designation: Annual shoreline aquatic found at fewer than five remaining sites and occupying very small areas of habitat where it exhibits fluctuating population sizes and numbers due to dependence on low water levels and at continued risk from shoreline development, recreational activities and natural or artificial maintenance of high water levels.
Status history: Designated Endangered in April 1999. Status re-examined and confirmed in May 2001. Last assessment based on an existing status report.

Description of the Species

Ammannia robusta (scarlet ammannia) is a glabrous (smooth, without hairs or glands), decumbent (lying on the ground with the end curved upward) to erect, simple or branched annual plant 15–100 cm tall (Figure 1; Graham 1985; McClintock 1993; Douglas *et al.* 1999). The opposite leaves are entire, oblong to oblong-lanceolate, 1.5–8 cm long and heart-shaped and clasping at the base. One to three, or sometimes four, unstalked, pale lavender flowers are 3–5 mm long and occur in the leaf axils. The fruits are unstalked, globular, and 4–6 mm long (Douglas *et al.* 1999). Seeds are small (ca. 0.5–0.8 mm long) and numerous (ca. 250–450) in each fruit, with each mature plant producing between 15 and 45 fruits (G.W. Douglas, unpublished data, 2004).

The ecological role of scarlet ammannia remains unstudied and there is no record of the plant being used for cultural resources (food, clothing, medicine, ceremonial, or symbolic purposes) or for ecotourism.

Populations and Distribution

Scarlet ammannia ranges from south-central British Columbia south to Mexico (Hitchcock and Cronquist 1961; McClintock 1993; Douglas *et al*. 1999). It also ranges eastward throughout central North America to Ohio and southwestern Ontario. From Ontario, it ranges south to the extreme southern United States and Mexico.

It is absent from the east coast of North America, except for New Jersey, where it is reported as an exotic species (Figure 2; NatureServe 2005). Scarlet ammannia also occurs in the Caribbean, and on the coast north of Rio de Janeiro in South America, where it is apparently an early, but persistent, introduction (Graham 1985). The British Columbia populations are about 200 km northwest of the nearest populations in Spokane County, Washington (WTU 2003). The nearest occurrences to the Ontario populations are in Michigan or Ohio, where the species is unranked (NatureServe 2005).

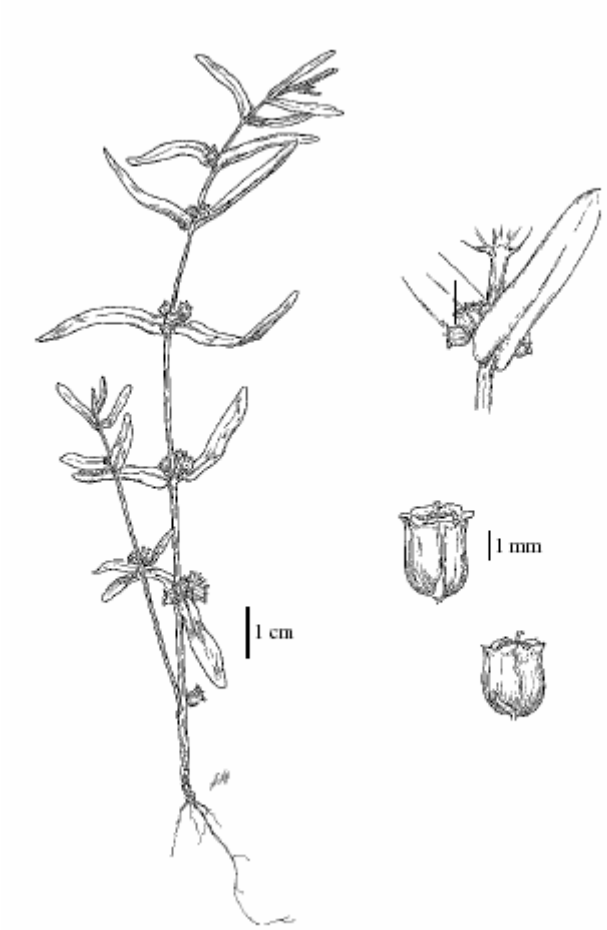

Figure 1. Illustration of scarlet ammannia (from Douglas *et al*. 1999, with permission).

In British Columbia, the species is restricted to the Osoyoos Lake area (Figure 3; Douglas and Oldham 1997; Douglas *et al.* 2002). In this area, populations have been recorded from Haynes Point just east of Osoyoos (extirpated), the Osoyoos Indian Reserve, and private land near Osoyoos (Figure 3). Populations in Ontario are restricted to Essex County, the most southwesterly county in the province (Figure 4) in three mainland locations and two locations on Pelee Island in Lake Erie.

Globally, scarlet ammannia is ranked G5, indicating that in most of its range the plant is "apparently common, demonstrably secure and essentially ineradicable under present conditions" (NatureServe 2004). In the United States, it is ranked S1 (critically imperiled) in Wisconsin, Idaho, Wyoming, and Washington and SNR (not ranked) in 27 other states. In Canada, the species has a national rank of N1 (Critically Imperiled). In British Columbia, the Conservation Data Centre has ranked scarlet ammannia as S1, and it appears on the British Columbia Ministry of Environment Red-list (Douglas *et al*. 2002). In Ontario, the Natural Heritage Information Centre (NHIC) has also ranked the species S1. Critically imperiled species are extremely rare (typically five or fewer occurrences or very few remaining individuals) and are especially vulnerable to extirpation or extinction.

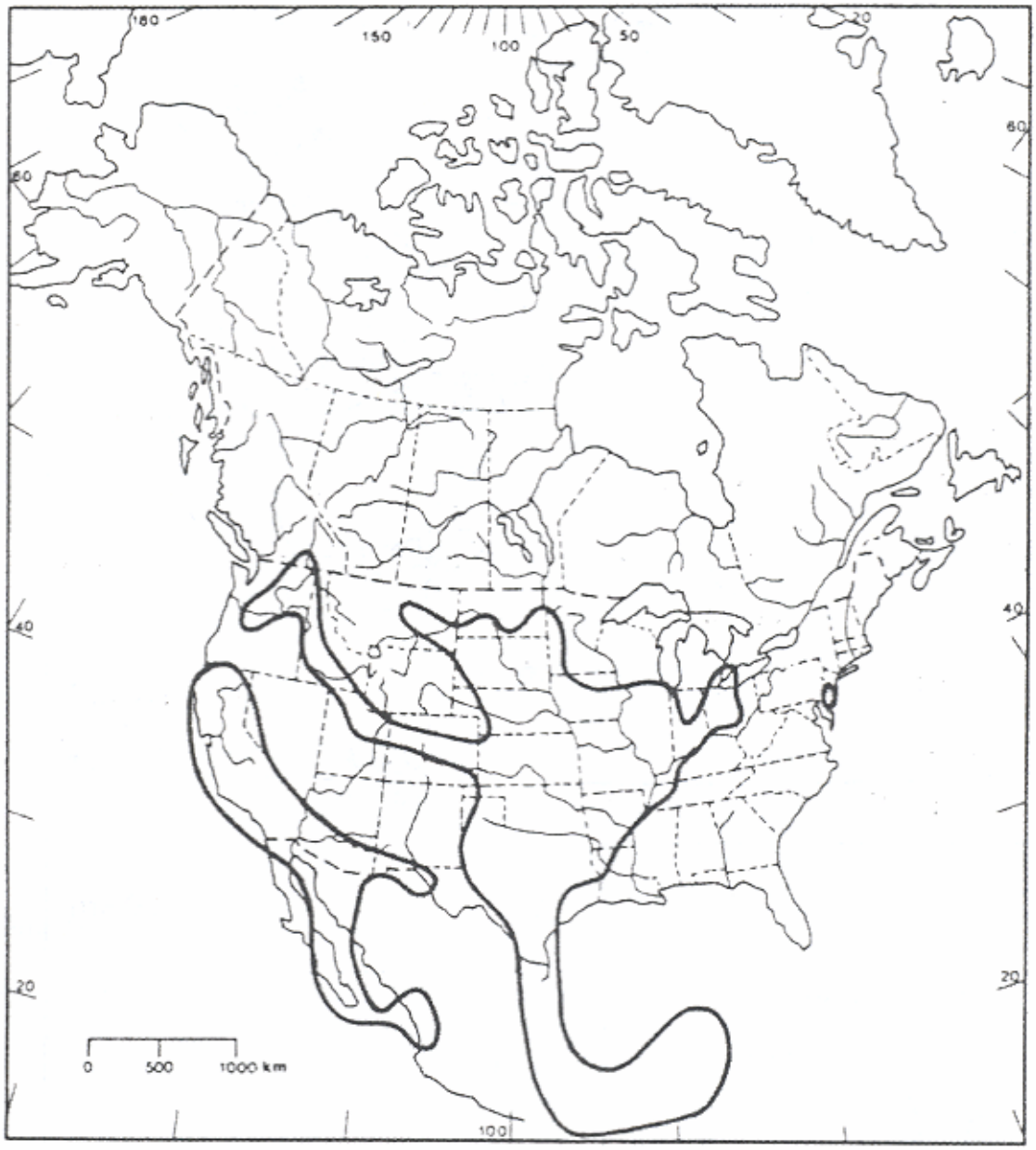

Figure 2. Range of scarlet ammannia in North America (Pryer and Keddy 1987).

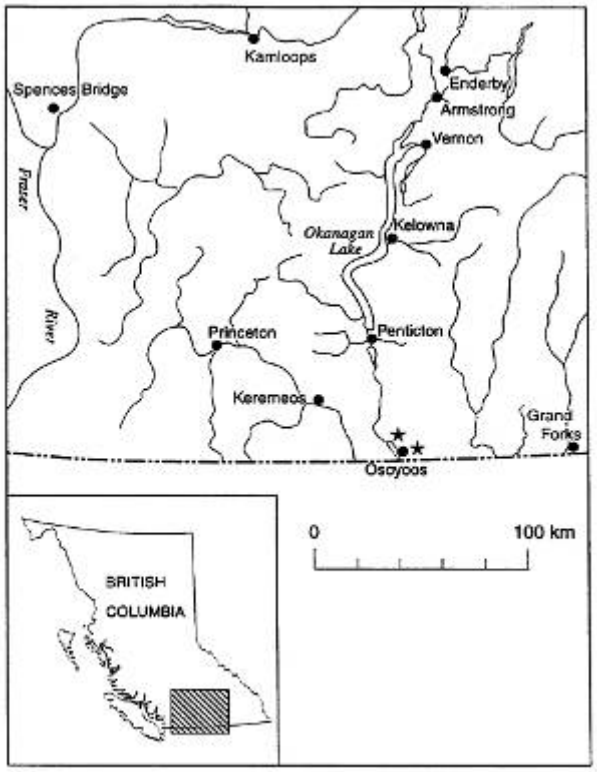

Figure 3. British Columbia distribution and extant occurrences of scarlet ammannia (stars).

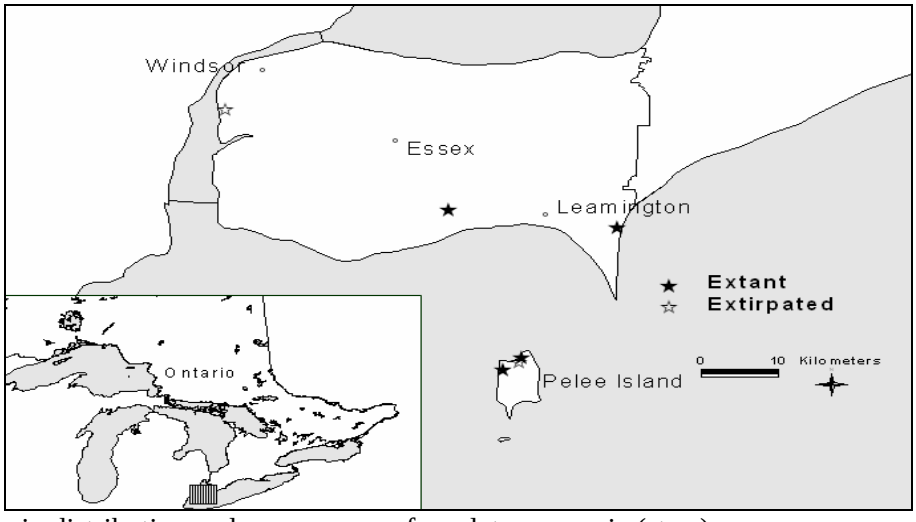

Figure 4. Ontario distribution and occurrences of scarlet ammannia (stars).

Less than 1 percent of the species' global distribution is currently located in Canada. Over the past 10 years in British Columbia, the population numbers and amount of available seasonal habitat have fluctuated widely; this is possibly due to annual changes in water levels, which contribute to the moisture levels required for germination and subsequent growth.

Rescue effect, from more southerly populations, may occur but it would be rare due to the distance (200 km). The total number of populations in Canada has declined 40%, from 10 historic populations to 6 extant populations over the last 50 years.

As this species is an annual plant, and therefore subject to fluctuating numbers, data are insufficient to determine population trends at any of the sites. Two extant populations are confirmed, as well as two extirpated populations of scarlet ammannia in British Columbia (Table 1). The total number of plants varies considerably from zero plants in most years to 150,000 plants in the most optimum year.

Four of six recorded Ontario populations are currently believed to be extant, including one recently (2003) discovered population on Pelee Island (Table 2). Repeat surveys have been completed for several Ontario sites, but no quantitative trend data are available. Observations are recorded below (Table 2).

Table 1. Observation data for British Columbia scarlet ammannia populations (extant and extirpated locations).

Extant locations	Date	Plant numbers	Area	Observer(s)
Osoyoos Lake Mica Spit Subpopulation #1 (Osoyoos Indian Reserve)	1994, July 27	0		Douglas & Illingworth
	1995, August 15	100	50 m²	Douglas
	1997, July 15	0		Douglas
	1999, August 20	0		Douglas
	2001, August 29	0		Douglas & Paige
	2002, August 11	0		Douglas
	2003, August 5	0		Douglas
	2004, August 30	0		Douglas & Fenneman
Osoyoos Lake Mica Spit Subpopulation #2 (Osoyoos Indian Reserve)	1994, July 27	0		Douglas & Illingworth
	1995, August 15	ca. 150,000	0.7 ha	Douglas
	1997, July 15	0		Douglas
	1999, August 20	0		Douglas
	2001, August 29	0		Douglas & Paige
	2002, August 11	ca. 75,000	0.7 ha	Douglas
	2003, August 5	0		Douglas
	2004, August 30	ca. 15,000	0.2 ha	Douglas & Fenneman
	2005, August 18	ca. 300	0.4 ha	Bjork & McIntosh
Private site, Osoyoos	2004	300–400	3 m^2	Douglas & Fenneman

Extirpated locations	Date	Plant numbers	Area	Observer

Osoyoos Lake Motel Population (private motel east of Osoyoos)	1953, August 6	Not recorded	Not recorded	Calder [1]
Osoyoos Lake Haynes Point Populations (provincial park)	1953, August 6	Not recorded	Not recorded	Calder[2]

Table 2. Observation data for scarlet ammannia populations in Ontario.

Location	Last observation	Rank[3]	Ownership	Comments
Gibwood Nature Preserve, Pelee Island	2003 (G. Buck)	A	Nature Conservancy of Canada	125 plants appeared in a wetland created in 2003, likely from a dormant seed bank; also present in low numbers in other areas of disturbed soil nearby.
Lighthouse Point Provincial Nature Reserve, Pelee Island	2001, September 21 (M. Oldham and K. Brodribb)	B	Ontario Parks, Ministry of Natural Resources	Several hundred scattered plants on sandbars and mudflats. Searched for in 2003–2006 (all high water years) and none observed (A. Woodliffe).
Hillman Marsh Conservation Area	2001, September 20 (M. Oldham and K. Brodribb)	B	Essex Region Conservation Authority	Several dozen scattered plants seen in 1985; not observed in 1997; single plant observed in 2001.
Kingsville	2001, September 21 (M. Oldham and K. Brodribb)	B	Private	Single plant seen in 1986; about 50 plants in 1997; 21 plants counted (but could have been an equal number missed).
LaSalle	1992, August 6 (M. Oldham and T. Reznicek)	Extirpated	Private	Formerly very rare and local in sandy track (< 20 plants seen). Searched for in 1997 (M. Oldham); area now a subdivision.
Pelee Island	1987, August 14 (M. Oldham)	Presumed extirpated	Private	In 1987, several hundred plants within 10–20 m^2. Searched for in 1997 with no trace of ammannia. Area is now overgrown with willow and dogwood; presumed extirpated as habitat appears unsuitable.

[1] Royal British Columbia Museum (1991)
[2] Royal British Columbia Museum (1991)
[3] A - Excellent predicted viability; B - Good predicted viability.

Needs of the scarlet ammannia

Biological needs

Scarlet ammannia is an annual plant. In British Columbia, it is known that plants germinate in late July to early September. Germination takes place on a warm (maximum temperatures in late summer usually range from 30 to 45°C), muddy substrate that has been recently exposed due to evaporation of the pond or lagoon. The plant then grows to maturity with fruiting in September to early October. Senescence occurs with the onset of frost in mid to late October. The seed bank is then submerged over winter. Recovery is possible only if this annual cycle occurs within the life span of the submerged seeds (G.W. Douglas, pers. comm., 2004). At this time, no information is available on maximum seed bank age of scarlet ammannia. Germination requirements for Ontario plants are not known, though they are likely similar to those in B.C.

Baskin *et al.* (2002) have studied germination on the related species *Ammannia coccinea* (red ammannia) and *Rotala ramosior* (toothcup; also known as toothcup-meadow foam in B.C.). Scarlet ammannia was overlooked in the North American flora for many years because of its close morphological similarity to *A. coccinea* (Graham 1979, 1985), a species not known from Canada. Although these species have life cycles and taxonomy similar to scarlet ammannia (Graham 1979, 1985; Baskin *et al.* 2002), this does not necessarily mean inferences can be made regarding germination for scarlet ammannia from these studies. However, due to the lack of specific data for scarlet ammannia, these studies are outlined as guidelines for further research.

Baskin *et al*. (2002) found, during greenhouse experiments, that seeds of red ammannia germinated significantly better when seeds were flooded than when they were not flooded for various periods during the dormant stage. The optimum germination temperature of this species was 15°C nights and 30°C days. They also concurred that the ability of the seeds, under flooded field temperatures, to come out of dormancy during fall to winter indicated that the seeds were not dormant when the mudflats were exposed in summer.

Since toothcup is mainly self-pollinated (Mattrick 2001), it is likely that scarlet ammannia is also self-pollinated. Mattrick (2001) also stated that toothcup was insect-pollinated. Since scarlet ammannia flowers, and all other flowers in the habitat, are small and inconspicuous and likely unattractive to most insect pollinators, self-pollination is probably advantageous for consistent seed production.

The small size (ca. 0.5–0.8 mm long; G.W. Douglas, unpublished data, 2004) and lightness of the seed suggest that they are easily transported by wind, gravity, and water (Mattrick 2001). Seeds could also be potentially carried by waterfowl on feet or in feathers.

Habitat needs

Scarlet ammannia depends on water-level fluctuations for the creation and maintenance of suitable habitat. In British Columbia, scarlet ammannia inhabits moist to wet, often alkaline, muddy shorelines of lagoons or ponds, or sandy shorelines. These sites are submerged early in the year, with plants emerging when lake levels go down in late July to early September. Scarlet

ammannia usually occurs in dense stands, although scattered individuals may occur over wide areas some years. At the lagoon on the east side of Osoyoos Lake, *Eleocharis parvula* (small spike-rush) is a constant companion along with various small herbaceous species, including *Gnaphalium* spp. (cudweed). Both at the Osoyoos Lake Mica Spit site and at the privately owned site near Osoyoos, many other rare species occur with scarlet ammannia. These include *Chamaesyce serpyllifolia* ssp. *serpyllifolia* (thyme-leaved spurge), *Cyperus squarrosus* (awned cyperus), *Eleocharis rostellata* (beaked spike-rush), and *Rotala ramosior* (toothcup).

Ontario sites are on mudflats, sand beaches, wetland edges, dried-up pond bottoms, and moist sandy depressions created by dirt bikes. Examples of associated plant species at the Ontario sites include *Eleocharis acicularis* (needle spike-rush), *Xanthium strumarium* (common cocklebur), *Cyperus esculentus* (yellow nut-grass), *Alisma plantago-aquatica* (American water plantain), *Bidens* spp. (beggarticks), *Juncus torreyi* (Torrey's rush), *Epilobium coloratum* (purpleleaf willow-herb), and *Lysimachia nummularia* (creeping loosestrife).

Threats

Threat categories are arranged in order of descending priority.

British Columbia

Habitat loss or degradation: Shoreline development presents the most significant known threat to scarlet ammannia and its habitat in British Columbia. Cottage and housing development affect existing and potential scarlet ammannia habitat via the creation of docks, boat ramps, boathouses, and sheds along the shoreline. Significant development beside or near the lagoon at Osoyoos Lake (Mica Spit sub-population) may irreversibly alter lagoon hydrology, and affect scarlet ammannia populations. The removal of native substrate and subsequent replacement with coarse sand has contributed to population extirpation at the Haynes Point Provincial Park site (Douglas and Oldham 1997).

Changes in ecological dynamics or natural processes – flood regime: Scarlet ammannia requires a fluctuating water regime; however, due to water levels being artificially controlled at all of the extant sites in B.C., the natural flood/drought cycles are no longer in effect. For example, if water levels were maintained at a higher level, the seed bank would not be exposed and scarlet ammannia would not germinate. Conversely, if water levels were maintained at a lower level, the plant would not flower, or seeds would not be able to germinate (T. McIntosh, pers. comm., 2006).

In the case of the Mica Spit site on Osoyoos Lake, water levels are maintained under the International Joint Commission agreement between Canada and the United States. The Mica Spit site for scarlet ammannia occurs on and around a lagoon, the water level of which is directly related to lake levels.

Invasive species: Invasive non-native plants (e.g., Russian olive, willows) potentially threaten scarlet ammannia by reducing available habitat and competing for resources (T. McIntosh, pers. comm., 2006). Efforts to control invasive plants through mechanical or chemical means may

inadvertently harm extant and currently unknown populations or individuals of scarlet ammannia.

Other potential threats include cattle grazing, trampling, and recreational activities such as all-terrain vehicle use.

Ontario

Changes in ecological dynamics or natural processes – flood regime and succession: Lake Erie shoreline populations are subject to a general and widespread trend of decreasing water levels in the Great Lakes. The creation of dykes and dams also threatens Ontario populations, although there may be an opportunity to manage the existing dyke at Hillman Marsh to imitate natural fluctuations. Succession by native species, mainly willows and poplars, is probably a threat in at least three of four extant sites (Douglas and Oldham 1997).

Invasive species: Exotic species such as the introduced (genetic) form of *Phragmites australis* (common reed) and *Lysimachia radicans* (creeping loosestrife) threaten to shade out scarlet ammannia populations at some sites.

Habitat loss or degradation: One Ontario population has been extirpated due to housing development (Douglas and Oldham 1997).

Actions Already Completed or Underway

Invasive species removal
At Osoyoos Lake, efforts have been made to reduce threats at the Mica Spit site through fencing and removal of invasive plant species. Removal of invasive species by the Osoyoos Indian Band was funded by the Habitat Stewardship Program from 2004 to 2007.

Protection from motorized vehicles
A fence erected by the Osoyoos Indian Band across the base of the Osoyoos Lake Mica Spit site should eliminate habitat and population destruction by motorized vehicles. The condition of the fence will require monitoring from time to time since it has been breached on several occasions and subsequently repaired.

Water levels
There have been discussions with the International Joint Commission (IJC) for Osoyoos Water Levels and the recovery team regarding potential research projects to determine the water-level requirements of the species during all life phases.

Monitoring
Some sites have occasionally been monitored in Ontario. In both provinces, local botanists continue to monitor known sites and surveys for new populations.

Knowledge Gaps

To accurately identify recovery objectives and activities, the following areas should be investigated:

- additional inventory for other populations of scarlet ammannia, or potential recovery habitat;
- habitat surveys and monitoring at potential sites;
- determination of population trends (through development of standardized monitoring protocols);
- research on germination requirements and seed bank viability and longevity, and habitat attributes such as lake levels, alkalinity, and soil texture; and
- research on species biology, including demography, genetics and pollination mechanisms, and impacts of invasive species.

RECOVERY

Recovery Feasibility

Maintaining scarlet ammannia in Canada is considered by the recovery team to be biologically and technically feasible (Table 3).

If the habitat and suitable conditions can be maintained, scarlet ammannia is expected to remain at known sites. The level of effort required to recover this population is moderate and includes habitat preservation, stewardship, restoration and management, as well as population introduction, monitoring, and inventory.

Also, additional populations may be discovered if thorough surveys are conducted at potential habitat and historical sites. Within Ontario, there is the potential for further discoveries of the species on or near Lake Erie (e.g., Canard River, Big Creek Marsh, Wheatley Provincial Park, Rondeau Provincial Park), although these sites have all been searched in the past. There is also the potential for discovery of scarlet ammannia along the Detroit River, or in artificial ponds in the Windsor area. A recently discovered population appeared within a shallow wetland created on Pelee Island, demonstrating that re-establishment from the seed bank may be possible where suitable habitat and germination conditions exist (G. Buck, pers. comm., 2007).

Table 3. Biological and technical recovery feasibility. Criteria from Environment Canada *et al*. (April 2005).

Criteria	Scarlet ammannia
1. Are individuals capable of reproduction currently available to improve the population growth rate or population abundance?	YES – there are six extant populations in Canada, with approximately 150,000 individuals present in an optimal year.
2. Is sufficient suitable habitat available to support the species or could it be made available through habitat management and/or restoration?	YES – the habitat at the currently occupied sites is suitable, and habitat at some of the previously occupied sites could be restored. Additional suitable habitat may also be available.
3. Can significant threats to the species or its habitat be avoided or mitigated through recovery actions?	YES – recovery actions such as stewardship and cooperation with landowners and land managers can prevent major threats.
4. Do the necessary recovery techniques exist and are they known to be effective?	YES – standard propagation techniques exist for raising new stock for translocation; also, general restoration methods/techniques are known.

Recovery Goal

The recovery goal for scarlet ammannia is to protect[4] and maintain the four extant populations in Ontario and the two extant populations in BC, and to restore the species at historic sites if deemed necessary.

Population and Distribution Objectives

Specific targets for population numbers are not possible due to the species being an annual and survey data are not available for determining long-term population trends.

Recovery Objectives

1. Ensure the persistence of the species at all known extant sites, with no loss or degradation of currently occupied habitat, for the next five years.
2. Assess the extent of the four main threats to the six populations (habitat loss or degradation, invasive species, flood regime, and succession) by 2012.
3. Confirm the distribution of scarlet ammannia in Ontario and British Columbia (historic and new locations), and update population and distribution objectives as needed by 2012.
4. Investigate the feasibility of restoring populations at extirpated sites or in suitable habitat near historical areas by 2012.

Specific steps to be taken to meet the recovery objectives are listed in Table 4.

[4] Protection can be achieved through various mechanisms including: voluntary stewardship agreements; conservation covenants; sale by willing vendors on private lands; land use designations on Crown lands; and legal and other protection on federal, provincial, and local government lands.

Approaches Recommended to Meet Recovery Objectives

The general approaches that will be taken to address identified threats are:

- habitat protection
- outreach and stewardship
- inventory and monitoring
- habitat management
- habitat restoration/rehabilitation
- scientific research

Recovery planning table

Table 4. Strategies to effect recovery.

Priority	Obj. no.	Broad approach/ strategy	Threat addressed	Specific steps	Outcomes or deliverables (identify measurable targets)
High	1, 2	Habitat protection – water levels	Changes in ecological dynamics or natural processes	• Work in cooperation with the U.S., International Joint Commission, and private landowners to manage water levels • Develop management options for Essex Region Conservation Authority, Ontario Parks, and Nature Conservancy sites	• Lower/raise water levels at appropriate times at all sites where this option is feasible
High	1, 2	Public outreach – stewardship with land owners and land managers	Habitat loss and degradation; mortality due to cattle grazing, trampling, recreational activities	• Encourage landowners and land managers to steward and manage lands for persistence of the species. • Continue to support the Osoyoos Indian Band with site stewardship activities	• Populations maintained • Reduced mortality due to development and recreation • Increased understanding and stewardship of species at risk and their habitats among landowners • Stimulated community support for recovery • Increased stewardship and habitat quality on Band Lands at extant sites
High	3, 4	Inventory and monitoring	ALL	• Obtain permission to inventory and monitor populations from landowners and land managers • Develop and implement standardized habitat survey and monitoring protocol • Monitor extant sites and survey historical and potentially suitable sites • Report monitoring results annually and assess trends in populations, area of occupancy and habitat condition • Submit all data to provincial Conservation Data Centre and the Natural Heritage Information Centre (NHIC) • Complete exploratory surveys at potential sites in a low-water year	• Regular, standardized monitoring of sites range-wide • Summary of monitoring results by site and assessment of trends in populations, area of occupancy and habitat conditions • Ability to assess status of populations and effectiveness of recovery actions
High	1, 2	Habitat management	Habitat loss and degradation	• Control trampling by humans and vehicle impacts, including boats (e.g. fencing)	• Reduced mortality and quality of habitat maintained
High	1, 2	Habitat	Invasive	• Monitor populations to assess	• Maintenance of current

Priority	Obj. no.	Broad approach/ strategy	Threat addressed	Specific steps	Outcomes or deliverables (identify measurable targets)
		management	species (inter-specific competition); changes in ecological dynamics or natural processes-succession	the effects of invasive species • Manage invading vegetation to protect the species occurrences as appropriate	suitable habitat for the species
Medium	1	Habitat protection – legal/policy protection	Habitat loss and degradation	• Encourage municipal and provincial planning agencies to implement protection including zoning and policies	• Legal and policy protection for populations on Crown and private land • Reduced mortality and loss of habitats/populations due to development and associated recreational activities • Populations maintained on public land
Medium	2, 3, 4	Scientific research	ALL	• Determine pollination mechanism, seed viability, dispersal mechanisms, and success • Research specific habitat requirements and other ecological factors • Conduct research on site-specific water level needs of scarlet ammannia • Assess potential for determining population viability • Determine feasibility of restoration • Determine whether seed supply is limiting	• Increased understanding of scarlet ammannia ecology to manage the life history stages to ensure recovery
Low	4	Habitat restoration	Habitat loss and degradation	• Identify sites suitable for restoration and establishment of populations if appropriate • Implement restoration activities	• Conditions favourable for scarlet ammannia • Restored populations established (as feasible and as necessary)

Performance Measures

Criteria for evaluation of the progress towards the goals and objectives of this strategy include:

1. Population monitoring indicates that the numbers of plants at the sites are stable or increasing, by 2012 (Objective 1);
2. Impact of the four main threats to the populations has been investigated as well as a reduction of threats by 2012 (Objective 2);
3. Agreements with appropriate resource managers are developed to mitigate the impacts of fluctuating water levels and support scarlet ammannia and other rare plant populations from this threat by 2012 (Objective 2).
4. Surveys of suitable habitat for new populations has been conducted and documented by 2012 (Objective 3);
5. Historic sites are investigated as potential habitat for re-introduction and restoration, where appropriate, in the Okanagan Valley, BC, and in Ontario by 2012 (Objective 4).

Critical Habitat

Identification of the species' critical habitat

No critical habitat can be identified for scarlet ammannia in Canada at this time, but it may be identified at a later date in a federal addition by Environment Canada, or in a future action plan. It is expected that critical habitat will be proposed following the completion of outstanding work required to quantify specific habitat and area requirements for the species, further research on the biology of the species and monitoring of the populations to determine population trends. Consultation with affected landowners and organizations will also be necessary.

Scarlet ammannia requires newly exposed shores or nearby depressions following a water drawdown. In British Columbia, scarlet ammannia is found only on moist, sandy-muddy depressions near shorelines or muddy, alkaline flats that are submerged early in the year and become exposed in late July and August. In Ontario, the habitat requirement is very similar, although it has not been observed on strongly alkaline soils, suggesting that scarlet ammannia may not require alkalinity.

The schedule of studies included in the section below outlines the additional research and analysis required to address the biological and technical limitations that prevent identification of critical habitat in this recovery strategy.

Recommended schedule of studies to identify critical habitat

The following three studies will be done in both British Columbia and Ontario, and will allow for the identification of critical habitat for extant populations:

1. Identify habitat attributes at extant sites (e.g., moisture regime, length of inundation and exposure, soil and water chemical properties, plant cover, water clarity) by 2012.

2. Using established survey and mapping techniques (applied during phenologically appropriate periods), delineate the boundaries of all occupied habitats by 2012.

3. For each occupied habitat, delineate the boundaries and condition of the associated shoreline with respect to fluctuations in water levels (temporal and spatial) and any large-scale hydrological changes by 2012.

The following three studies will be done in British Columbia only, and will facilitate the identification of additional critical habitat:

1. Identify, map, and describe all suitable sites in the Southern Okanagan Valley that are currently unoccupied by species at risk. Rate these habitats for their potential to support scarlet ammannia, as well as other species at risk by 2012.

2. Identify, map, and rate for restoration potential any significant shorelines in the Southern Okanagan Valley where the habitat attributes indicate that suitable habitat may exist but the structure and/or function has been lost or compromised as a result of alien plant invasion, urbanization, or water-level changes by 2012.

3. Through experimental trials, test the suitability of high-ranking sites for plant translocations/reintroductions by 2012.

A comprehensive survey of suitable habitat in southwestern Ontario may reveal additional populations of scarlet ammannia. The extent of occurrence of populations and associated vegetation communities may be mapped in years where the populations are evident, to contribute to critical habitat identification.

Existing and Recommended Approaches to Habitat Protection

None of the habitat associated with extant populations (Indian Reserve lands and private land) in British Columbia is formally protected. There is a need to work with landowners and managers to maintain this species. The Osoyoos Indian Band is continuing with stewardship activities, including fencing, outreach, and removal of invasive shrubs.

Scarlet ammannia is listed on the Species at Risk in Ontario (SARO) list regulation as Endangered and receives species protection under the province's *Endangered Species Act*. The habitat of this species receives protection through the provisions of the Provincial Policy Statement (PPS), issued under Section 3 of the *Planning Act*. The Act requires that planning decisions be consistent with the PPS which states that "development and site alteration are not permitted in significant habitat of endangered and threatened species." Of the four extant sites in Ontario, one is publicly owned and three are on private land. One site is a Provincial Nature Reserve managed by Ontario Parks; the second is within a Conservation Area managed by the Essex Region Conservation Authority; the third lies within a private nature reserve managed by the Nature Conservancy of Canada; and the fourth is in a private site. Ensuring the persistence of populations at these locations will depend on implementing appropriate management strategies for all of these sites.

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 recognizes 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

It is possible that additional populations of this species may occur on private lands. As with other species at risk found on private property, stewardship efforts will be the key to their conservation and recovery. To successfully protect many species at risk in British Columbia and Ontario, 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; conservation covenants on property titles; ecogifting part or all of their property to protect certain ecosystems or species at risk; or selling their property for conservation. For example, both government and non-governmental organizations have successfully conserved lands in British Columbia.

Effects on Other Species

Scarlet ammannia recovery efforts will generally benefit other rare plant species. In British Columbia, scarlet ammannia occurs on the Osoyoos Lake Mica Spit with small-flowered lipocarpha (*Lipocarpha micrantha*) and toothcup, two species at risk that have similar, but not identical, habitat requirements and face similar threats. It is possible that scarlet ammannia and toothcup could also occur in the same habitat at the Osoyoos private land site. In total, 18 British Columbia Red- or Blue-listed[5] rare species occur on the Osoyoos Lake Mica Spit and 11 occur at the private Osoyoos site. These include red-rooted cyperus (*Cyperus erythrorhizos*; S1), hairy water-clover (*Marsilea vestita*; S1), *Eleocharis geniculata* (assessment anticipated by COSEWIC in 2009), and bushy cinquefoil (*Potentilla paradoxa*; S1) (G.W. Douglas, pers. comm., 2004). Awned cyperus (*Cyperus squarrosus*; S2 - imperiled) always occurs with small-flowered lipocarpha and is Red-listed by the B.C. Conservation Data Centre. Because the entire Okanagan-Similkameen area contains a large number of endangered and threatened species, several of which are found in riparian/wetland areas, recovery efforts will focus on an ecosystem- or landscape-level plan.

[5] B.C. Conservation Data Centre ranks S1 and S2 species as Red-listed and S3 species as Blue-listed.

In Ontario, the management of water levels at Hillman Marsh and other sites has the potential to have an impact on a number of other species. The risk of impact (which may be positive or negative) will not be known until site-specific management plans are made. However, potential effects on other species at risk and natural features and functions should be considered in all recovery actions undertaken. Some other species at risk that occur in the same areas as scarlet ammannia include Blue Racer (*Coluber constrictor foxii*), Lake Erie Watersnake (*Nerodia sipedon insularum*), Eastern Foxsnake (*Elaphe gloydi*), Spiny Softshell Turtle (*Apalone spinifera*), Spotted Turtle (*Clemmys guttata*), Fowler's Toad (*Bufo fowleri*), King Rail (*Rallus elegans*), Prothonotary Warbler (*Protonotaria citrea*), and blue ash (*Fraxinus quadrangulata*).

Socioeconomic Considerations

Recovery actions could potentially affect the following socio-economic sectors: land development along foreshore areas, recreational users, agriculture (irrigation), and domestic animal grazing. The expected magnitude of these effects is unknown and will be further addressed in the recovery action plan. The extent of area presently covered by the species is approximately one hectare.

Recommended Approach for Recovery Implementation

A multi-species recovery approach is recommended for scarlet ammannia, small-flowered lipocarpha, toothcup, short-rayed alkali aster, and other provincially listed species in British Columbia. These species all share similar threats and have similar property ownership in the southern Okanagan valley. Any activities for recovery will be done in conjunction with the Southern Okanagan-Similkameen Conservation Program.

Although all three of these species occur in Ontario, scarlet ammannia does not share sites or property ownership with the others. A species-specific approach is the most appropriate for the recovery of the species in that province.

Statement on Action Plans

In British Columbia, a multi-species action plan will be completed by 2012 for four sand spit species (and others), including scarlet ammannia, small-flowered lipocarpha, short-rayed alkali aster, and toothcup.

An Action Plan for Ontario sites will also be completed by 2013.

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