

Management Plan for the Nuttall's Cottontail *nuttallii* subspecies (*Sylvilagus nuttallii* *nuttallii*) in Canada

Nuttall's Cottontail *nuttallii* subspecies



2015



Government
of Canada

Gouvernement
du Canada

Canada

Recommended citation:

Environment Canada. 2015. Management Plan for the Nuttall's Cottontail *nutallii* subspecies (*Sylvilagus nuttallii nuttallii*) in Canada. *Species at Risk Act* Management Plan Series. Environment Canada, Ottawa. 3 p. + Annex.

For copies of the management plan or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the [Species at Risk \(SAR\) Public Registry](http://www.registrelep-sararegistry.gc.ca)¹.

Cover illustration: David Nagorsen

Également disponible en français sous le titre
« Plan de gestion du lapin de Nuttall de la sous-espèce *nutallii* (*Sylvilagus nuttallii nuttallii*) au Canada »

© Her Majesty the Queen in Right of Canada, represented by the Minister of the Environment, 2015. All rights reserved.

ISBN 978-0-660-03442-3

Catalogue no. En3-5/60-2015E-PDF

Content (photos excluded) may be used without permission, with appropriate credit to the source.

¹ <http://www.registrelep-sararegistry.gc.ca>

MANAGEMENT PLAN FOR THE NUTTALL'S COTTONTAIL *NUTTALLII* SUBSPECIES (*Sylvilagus nuttallii nuttallii*) IN CANADA

2015

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

In the spirit of cooperation of the Accord, the Government of British Columbia has given permission to the Government of Canada to adopt the “Management Plan for the Nuttall’s Cottontail (*Sylvilagus nuttallii*) in British Columbia” (Part 2) under section 69 of the *Species at Risk Act*. Environment Canada has included an addition which completes the SARA requirements for this management plan.

The federal management plan for the Nuttall’s Cottontail *nuttallii* subspecies in Canada consists of two parts:

Part 1 - Federal Addition to the “Management Plan for the Nuttall’s Cottontail *nuttallii* subspecies (*Sylvilagus nuttallii*) in British Columbia”, prepared by Environment Canada.

Part 2 - “Management Plan for the Nuttall’s Cottontail (*Sylvilagus nuttallii*) in British Columbia”, prepared by the BC Nuttall’s Cottontail Working Group.

TABLE OF CONTENTS

Part 1 - Federal Addition to the "Management Plan for the Nuttall's Cottontail <i>nutallii</i> subspecies (<i>Sylvilagus nuttallii</i>) in British Columbia", prepared by Environment Canada.....	1
PREFACE	2
ADDITIONS AND MODIFICATIONS TO THE ADOPTED DOCUMENT	3
Species Status Information.....	3
Effects on the Environment and Other Species	3
REFERENCES.....	3
Part 2 - "Management Plan for the Nuttall's Cottontail (<i>Sylvilagus nuttallii</i>) in British Columbia", prepared by the BC Nuttall's Cottontail Working Group	

Part 1 - Federal Addition to the “Management Plan for the Nuttall’s
Cottontail *nuttallii* subspecies (*Sylvilagus nuttallii*) in
British Columbia”, prepared by Environment Canada

PREFACE

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)² agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of management plans for listed Special Concern species and are required to report on progress five years after the publication of the final document on the SAR Public Registry.

SARA section 65 requires the competent Minister, which is the federal Minister of the Environment in this case, to prepare a management plan for all listed special concern species. SARA section 69 allows the Minister to adopt all or part of an existing plan for the species if the Minister is of the opinion that an existing plan relating to a wildlife species includes adequate measures for the conservation of the species.

The attached provincial management plan (Part 2 of this document) for the species was provided as science advice to the jurisdictions responsible for managing the species in British Columbia. Environment Canada has prepared this federal addition to meet the requirements of SARA.

Success in the conservation 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 management plan and will not be achieved by Environment Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this plan for the benefit of the Nuttall's Cottontail *nuttallii* subspecies and Canadian society as a whole.

Implementation of this management plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

² <http://registrelep-sararegistry.gc.ca/default.asp?lang=En&n=6B319869-1%20>

ADDITIONS AND MODIFICATIONS TO THE ADOPTED DOCUMENT

The following sections have been included to address specific requirements of federal recovery documents that are not addressed in the “Management Plan for the Nuttall’s Cottontail (*Sylvilagus nuttallii*) in British Columbia”.

Species Status Information

This section augments the “Species Information” (section 3) provided in the B.C. Ministry of Environment management plan.

It is estimated that the percent of the global range of this species in Canada is 5% (COSEWIC 2006).

Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the [*Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*](#)³. 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.

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

Negative impacts to the environment and other species are not anticipated. Actions to manage and protect habitat for Nuttall’s Cottontail *nuttallii* subspecies (e.g., inventory, education, threat mitigation, habitat conservation) will promote the conservation of other species using those habitats, including other SARA-listed species (e.g., Behr’s Hairstreak [*Satyrium behrii*], Sage Thrasher [*Oreoscoptes montanus*], Desert Nightsnake [*Hypsiglena chlorophaea*], Western Rattlesnake [*Crotalus oreganus*], Great Basin Gopher Snake [*Pituophis catenifer deserticola*]).

REFERENCES

COSEWIC 2006. COSEWIC Assessment and Update Status Report on the Nuttall’s Cottontail *nuttallii* subspecies (*Sylvilagus nuttallii nuttallii*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 23 pages.

<http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_nuttalls_cottontail_e.pdf> [Accessed March 1, 2013].

³ <http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1>

Part 2 - “Management Plan for the Nuttall’s Cottontail (*Sylvilagus nuttallii*) in British Columbia”, prepared by the BC Nuttall’s Cottontail Working Group

Management Plan for the Nuttall's Cottontail (*Sylvilagus nuttallii*) in British Columbia



Prepared by the B.C. Ministry of Environment



April 2013

About the British Columbia Management Plan Series

This series presents the management plans that are prepared as advice to the Province of British Columbia. Management plans are prepared in accordance with the priorities and management actions assigned under the B.C. Conservation Framework. The Province prepares management plans for species' that may be at risk of becoming endangered or threatened due to sensitivity to human activities or natural events.

What is a management plan?

A management plan identifies a set of coordinated conservation activities and land use measures needed to ensure, at a minimum, that the target species does not become threatened or endangered. A management plan summarizes the best available science-based information on biology and threats to inform the development of a management framework. Management plans set goals and objectives, and recommend approaches appropriate for species or ecosystem conservation.

What's next?

Direction set in the management plan provides valuable information on threats and direction on conservation measures that may be used by individuals, communities, land users, conservationists, academics, and governments interested in species and ecosystem conservation.

For more information

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

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

**Management Plan for the Nuttall's Cottontail
(*Sylvilagus nuttalli*) in British Columbia**

Prepared by B.C. Ministry of Environment

April 2013

Recommended citation

B.C. Ministry of Environment. 2013. Management plan for the Nuttall's Cottontail (*Sylvilagus nuttallii*) in British Columbia. B.C. Ministry of Environment, Victoria, BC. 16 pp.

Cover illustration/photograph

The Nuttall's Cottontail cover photograph was provided by Jared Hobbs.

Additional copies

Additional copies can be downloaded from the B.C. Ministry of Environment Recovery Planning webpage at:

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

Publication information

Library and Archives Canada Cataloguing in Publication

Management plan for the Nuttall's cottontail (*Sylvilagus nuttallii*) in British Columbia [electronic resource] / prepared by the B.C. Ministry of Environment.

(British Columbia management plan series)

Electronic monograph in PDF format.

Includes bibliographical references.

ISBN 978-0-7726-6696-3

1. Nuttall's cottontail--British Columbia--Okanagan-Similkameen. 2. Mammal populations--British Columbia--Okanagan-Similkameen. 3. Wildlife management--British Columbia--Okanagan-Similkameen. I. British Columbia. Ministry of Environment II. Series: British Columbia management plan series

QL737 L32 M36 2013

333.95'932416097115

C2013-980051-4

Disclaimer

This management plan has been prepared by the B.C. Nuttall's Cottontail Working Group, as advice to the responsible jurisdictions and organizations that may be involved in managing the species.

This document identifies the management actions that are deemed necessary, based on the best available scientific and traditional information, to prevent Nuttall's Cottontail populations in British Columbia from becoming endangered or threatened. Management actions to achieve the goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations. These goals, objectives, and management approaches may be modified in the future to accommodate new objectives and findings.

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

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this management plan. The B.C. Ministry of Environment encourages all British Columbians to participate in the conservation of the Nuttall's Cottontail.

ACKNOWLEDGEMENTS

This management plan was drafted by Orville Dyer (Ministry of Forests, Lands and Natural Resource Operations). We thank Ellen Simmons, Richard Armstrong, and Jeanette Armstrong from the En'owkin Centre, who provided Traditional Knowledge. We appreciate review comments from Giselle Rehe (volunteer), Mike Sarell (Ophiuchus Consulting), and Purnima Govindarajulu (Ministry of Environment). Funding for peer review was provided by the Ministry of Environment. Thanks also go to Jared Hobbs (Ministry of Forests, Lands and Natural Resource Operations) for the cover photograph. This document follows the B.C. guide for recovery planning (B.C. Ministry of Environment 2010a).

EXECUTIVE SUMMARY

Nuttall's Cottontail (*Sylvilagus nuttallii nuttallii*) was designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1994 and 2006. It was listed as Special Concern in Canada on Schedule 1 of the *Species at Risk Act* (SARA) in 2007. The reasons for listing include the small area of available habitat (less than 8000 hectares) with continuing loss and increasing fragmentation, small population size (less than 3500 individuals), limited rescue potential from Washington State, and substantial uncertainty over the current area of occupancy. In British Columbia (B.C.) Nuttall's Cottontail is ranked S3 (Blue listed, considered to be special concern, by the Conservation Data Centre [CDC]). The B.C. Conservation Framework ranks Nuttall's Cottontail as Priority 2 under Goal 2 (Prevent species and ecosystems from becoming at risk) and Priority 3 under Goal 3 (Maintain the diversity of native species and ecosystems).

Nuttall's Cottontail is a small rabbit, approximately 32 cm in length and 500 g in weight. Fur colour is pale brown on the back, grey on the sides, and rump and white on the belly. The tail is grey above with white underneath and is often held so the white underside is showing. This identifying characteristic is reflected in the Syilx (Okanagan) language name for Nuttall's Cottontail, *npəpqʷupaʔs*, which means "little white patch on the bum." Its smaller size, grey rump, and pale brown on the back of the neck distinguish it from the Snowshoe Hare, which is about 44 cm in length and weighs over 1 kg as an adult.

The species ranges from B.C. south to California and east to Idaho and Utah. In Canada the *nuttallii* subspecies occurs only in B.C., where it is found in the south Okanagan Valley, from the United States border north to the Summerland area and Okanagan Mountain Park, mostly below 800m elevation. It also occurs in the lower Similkameen Valley as far north as Keremeos. Its habitat is mainly dense antelope-brush or sagebrush shrub-steppe and rock outcrops. Forage includes a variety of grasses, forbs, and shrubs. This species was first reported in B.C. in 1939 near Osoyoos and appears to have rapidly expanded to near its present range extent by 1956. The population size is not known but is estimated to be less than 3500 individuals. The overall population trend is not known but is thought to be declining due to habitat loss related to urban and agricultural development, which are the main threats to the species.

The management goal is to maintain a stable or increasing population of Nuttall's Cottontail, distributed throughout the species' current range in B.C. within the Okanagan and Similkameen drainages.

The objectives are:

1. to clarify the distribution of Nuttall's Cottontail throughout its range in B.C., especially areas of occupancy within protected areas and on Crown land.
2. to identify important habitats and connectivity corridors.
3. to protect¹ important habitats and connectivity corridors.

¹ Protection refers to minimizing or eliminating human caused threats and can be achieved through various mechanisms including voluntary stewardship agreements, conservation covenants, sale by willing vendors on private lands, land use designations, and protected areas.

Protecting sufficient habitat in large, connected patches is key to long-term conservation of Nuttall's Cottontail. Additional inventory is required to clearly identify the current distribution of the species, important habitats, current levels of habitat protection, important corridors, and additional conservation needs. Current habitat mapping overestimates actual habitat and the habitat model needs to be updated to effectively identify habitat protection targets and prevent inadvertent loss of existing habitat. Important sites and corridors need to be identified through inventory and monitoring before additional habitat protection can be recommended to achieve long-term conservation goals.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	iiii
EXECUTIVE SUMMARY	iv
1 COSEWIC* SPECIES ASSESSMENT INFORMATION	1
2 SPECIES STATUS INFORMATION	1
3 SPECIES INFORMATION	2
3.1 Species Description	2
3.2 Traditional Knowledge	2
3.3 Populations and Distribution	2
3.4 Needs of the Nuttall's Cottontail.....	5
3.4.1 Habitat and Biological Needs.....	5
3.4.2 Ecological Role	6
3.5 Limiting Factors	6
4 THREATS	6
4.1 Threat Classification	7
4.2 Description of the Threats.....	7
5 MANAGEMENT	8
5.1 Management Goal	8
5.2 Rationale for the Management Goal	9
5.3 Management Objectives	9
6 APPROACHES TO MEET OBJECTIVES.....	9
6.1 Actions Already Completed or Underway	9
6.2 Recommended Management Actions.....	11
6.3 Narrative to Support Management Actions Table	13
6.3.1 Habitat Protection and Private Land Stewardship	13
6.3.2 Monitor Trends	14
7 MEASURING PROGRESS.....	14
8 EFFECTS ON OTHER SPECIES	14
9 REFERENCES	15

LIST OF TABLES

Table 1. Threat classification table for the Nuttall's Cottontail in British Columbia.	7
Table 2. Recommended management actions and suggested implementation schedule for the Nuttall's Cottontail in British Columbia.....	11

LIST OF FIGURES

Figure 1. Global range of Nuttall's Cottontail (<i>Sylvilagus nuttallii</i>) and its three subspecies: (A) <i>S. nuttallii nuttallii</i> ; (B) <i>S. nuttallii grangeri</i> ; (C) <i>S. nuttallii pinetis</i> from COSEWIC (2006).	3
Figure 2. B.C. range of Nuttall's Cottontail from COSEWIC (2006). Solid circles represent occurrence records based on known historical museum specimens and observations 1939–2002.....	4

1 COSEWIC* SPECIES ASSESSMENT INFORMATION

Date of Assessment: April 2006

Common Name (population):** Cottontail *nuttallii* subspecies, Nuttall's

Scientific Name:** *Sylvilagus nuttallii nuttallii*

COSEWIC Status: Special Concern

Reason for Designation: This rabbit was first recorded in Canada about 70 years ago and has since increased its range in the Okanagan, where it may have reached the maximum possible extent of its distribution. Remaining rabbit habitat in the Okanagan is less than 8000 ha, increasingly fragmented, and continues to be lost to urbanization and agriculture. The total population size, based on available habitat, is probably less than 3500 individuals. Rescue potential from Washington is minimal because of the declining availability of habitat. There are substantial uncertainties about the current area of occupancy, which may have declined over the last few decades as habitat has been lost.

Canadian Occurrence: B.C.

COSEWIC Status History: Designated Special Concern in April 1994 and in April 2006.

* Committee on the Status of Endangered Wildlife in Canada.

** Common and scientific names reported in this management plan follow the naming conventions of the B.C. Conservation Data Centre, which may be different from names reported by COSEWIC.

2 SPECIES STATUS INFORMATION

Nuttall's Cottontail, <i>nuttallii</i> subspecies ^a		
Legal Designation		
FRPA : ^b No	B.C. <i>Wildlife Act</i> : ^c Schedule A	SARA : Schedule 1 – Special Concern (2007)
OGAA : ^b No		
Conservation Status ^d		
B.C. Rank: S3 (2011)	B.C. List: Blue	Global Rank: G5T5 (1997)
Other Subnational Ranks (USA): ^e SNR		
B.C. Conservation Framework (CF) ^f		
Goal 1: Contribute to global efforts for species and ecosystem conservation.		Priority: ^g 4 (2009)
Goal 2: Prevent species and ecosystems from becoming at risk.		Priority: 2 (2009)
Goal 3: Maintain the diversity of native species and ecosystems		Priority: 3 (2009)

^a Data source: B.C. Conservation Data Centre (2013) unless otherwise noted.

^b No = Not listed in one of the categories of wildlife that require special management attention to address the impacts of forest and range activities on Crown land under the *Forest and Range Practices Act* (FRPA; Province of British Columbia 2002) and/or the *Oil and Gas Activities Act* (OGAA; Province of British Columbia 2008).

^c Schedule A = designated as wildlife under the B.C. *Wildlife Act*, which offers it protection from direct persecution and mortality (Province of British Columbia 1982).

^d S = subnational; N = national; G = global; T = refers to the subspecies level; B = breeding; X = presumed extirpated; H = possibly extirpated; 1 = critically imperiled; 2 = imperiled; 3 = special concern, vulnerable to extirpation or extinction; 4 = apparently secure; 5 = demonstrably widespread, abundant, and secure; NA = not applicable; NR = unranked; U = unrankable.

^e Data source: NatureServe (2012).

^f Data source: B.C. Ministry of Environment (2010b).

^g Six-level scale: Priority 1 (highest priority) through to Priority 6 (lowest priority).

3 SPECIES INFORMATION

3.1 Species Description

Nuttall's Cottontail (*Sylvilagus nuttallii*) is a small rabbit, approximately 32 cm in length and 500 g in weight as an adult. Fur colour is pale brown on the back, grey on the sides and rump, and white on the belly. The tail is grey above with white underneath and is often held so the white underside is showing (COSEWIC 2006). Its smaller size, grey rump, and pale brown on the back of the neck distinguish it from the Snowshoe Hare (*Lepus americanus*), which is 44 cm in length and weighs over 1 kg as an adult (Nagorsen 2005).

3.2 Traditional Knowledge

Nuttall's Cottontail is a recent addition to British Columbia (B.C.) fauna so does not have a long history of traditional use in the province. The Syilx (Okanagan) language name for Nuttall's Cottontail is *npəpqʷupaʔs*, pronounced “n pep co pass,” which means “little white patch on the bum.” It was not hunted specifically. However, if it was encountered or killed, the fine fur was used for ornamentation on baby's cradles or for moccasins due to its softness (R. and J. Armstrong, pers. comm., 2012).

3.3 Populations and Distribution

Nuttall's Cottontail, *nuttallii* subspecies, ranges from Idaho and Utah west to California and north to B.C. where it reaches its northern limit (Figure 1). In Canada, the *nuttallii* subspecies occurs only in B.C., where it is found in the south Okanagan Valley, from the United States border north to the Summerland area and Okanagan Mountain Park. It also occurs in the lower Similkameen Valley as far north as Keremeos and west to the mouth of the Ashnola River (Figure 2). Sightings occur up to 1200 m but most are below 800 m (Nagorsen 2005). The population is distributed across about 40 separate locations and three major land tenures (Crown, Indian Reserve, Private) (COSEWIC 2006). The range in B.C. is approximately 5% of the global range of the subspecies (COSEWIC 2006).

Nuttall's Cottontail was first reported in B.C. in 1939 near Osoyoos. Substantial collecting for museum specimens had occurred in the area before this time, suggesting a relatively recent range expansion by this species into the province. It appears to have rapidly expanded to near its present range extent by 1956, suggesting high dispersal capabilities. Additional range expansion of this subspecies is not expected due to less suitable habitat beyond the periphery of its current distribution.

The population size is not known but is estimated to be less than 3500 individuals based on available habitat (COSEWIC 2006). However, population size is highly variable both within and among years. Within a given year, the number of individuals peaks by August and then declines through fall and winter. Sullivan et al. (1989) reported annual variation in numbers of individuals at their Summerland study site ranging from 5 in early summer to 15 by August, 8 in late winter, and 4 by the following spring. Densities were reported to be from 0.23 to 0.43 animals per hectare. In B.C., annual estimates of Nuttall's Cottontail numbers at a Summerland, B.C., research site varied by about two-thirds over a 3-year period (Sullivan et al. 1989). In Oregon,

annual population estimates varied by 50% between two years (McKay and Verts 1978). The overall population trend is not known but is thought to be declining due to habitat loss (COSEWIC 2006). Less than 8000 ha of potential habitat remains (COSEWIC 2006).

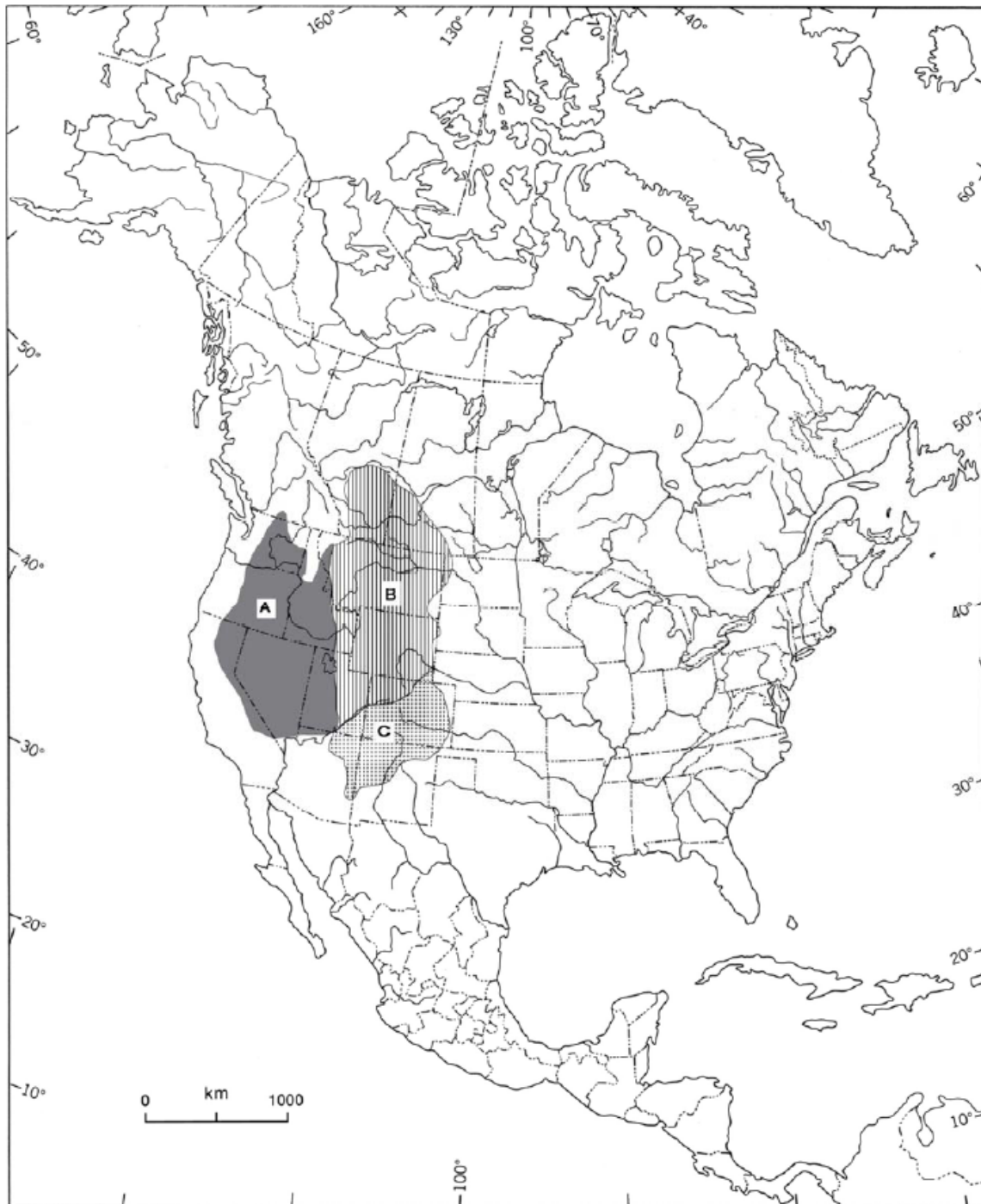


Figure 1. Global range of Nuttall's Cottontail (*Sylvilagus nuttallii*) and its three subspecies: (A) *S. nuttallii nuttallii*; (B) *S. nuttallii grangeri*; (C) *S. nuttallii pinetis* from COSEWIC (2006).

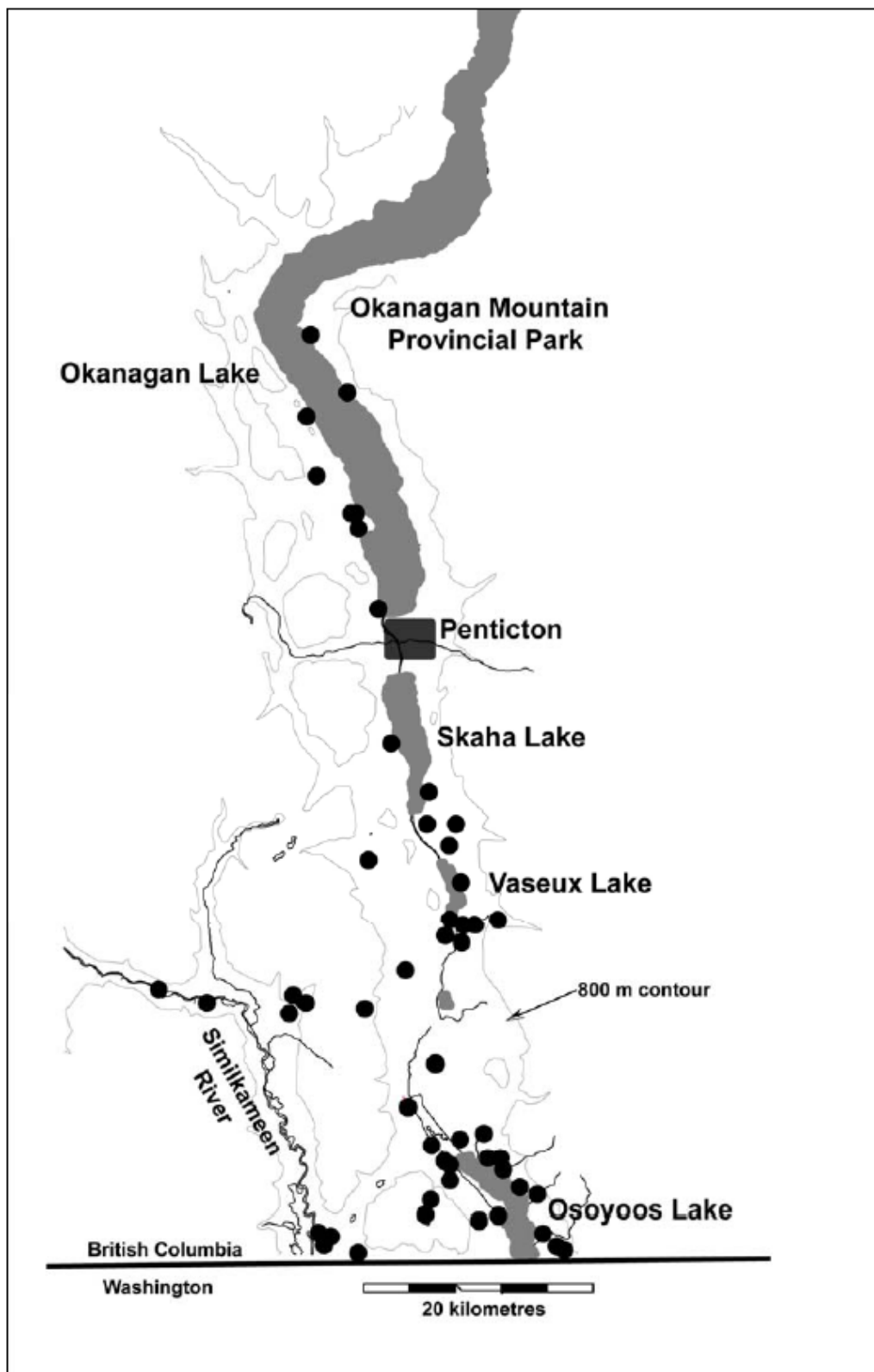


Figure 2. B.C. range of Nuttall's Cottontail from COSEWIC (2006). Solid circles represent occurrence records based on known historical museum specimens and observations 1939–2002.

3.4 Needs of the Nuttall's Cottontail

3.4.1 Habitat and Biological Needs

Nuttall's Cottontail habitat occurs mainly in the Bunchgrass biogeoclimatic zone and open Ponderosa Pine zone (Carter et al. 1993) but may occur in the Interior Douglas-fir zone (B.C. Conservation Data Centre 2013). Antelope-brush (*Purshia tridentata*) and sagebrush (mainly *Artemisia tridentata*) shrub-steppe and rocky outcrops are the main habitats occupied by this species (COSEWIC 2006). Sagebrush and rocky outcrops are the most important habitat attributes for the species in the United States and likely holds true in Canada (COSEWIC 2006). Sullivan et al. (1989) reported that higher density sagebrush (> 30%) was preferred. Nuttall's Cottontail seldom uses cultivated fields or orchards (Sullivan et al. 1989), hayfields, meadows, ponderosa pine, or Douglas-fir forests (Carter et al. 1993). They may forage in orchards and cultivated fields occasionally, if they are adjacent to preferred habitats with good cover. They also have been observed on several occasions using riparian thickets adjacent to shrub-steppe habitat (M. Sarell, pers. comm., 2012). Orchard management practices no longer favour production of tall grass so agricultural habitat is likely less attractive to the species. A few Nuttall's Cottontails occupy industrial sites and urban edges as long as cover (e.g., metal rail cars for storage) and forage are available (O. Dyer, pers. comm., 2012). Most habitat use is below 800 m (Nagorsen 2005). Nuttall's Cottontails do not excavate burrows but may use burrows created by other species. A scrape (shallow depression with vegetation scratched away to expose bare soil) often is used for resting (COSEWIC 2006).

Nuttall's Cottontails are mostly solitary, except during the breeding season (COSEWIC 2006). Home range size is not available for the *nutallii* subspecies but is available for similar Eastern Cottontail (*Sylvilagus floridanus*) in Pennsylvania. Althoff and Storm (1989) found that female Eastern Cottontail home ranges varied from 2.1 to 2.8 ha depending on the season and males varied from 3.1 to 7.8 ha. The greatest variation in home range for males was during the breeding season.

Nuttall's Cottontail eats grasses, forbs, and shrubs. Grasses include bluebunch wheatgrass (*Pseudoroegneria spicata*), needle-and-thread grass (*Hesperostipa* sp.), and cheatgrass (*Bromus* sp.) (Nagorsen 2005). Browse (woody stems) from shrubs such as sagebrush becomes more important in winter (Nagorsen 2005) when snow may cover lower growing food sources. Nuttall's Cottontails re-ingest their fecal pellets to increase digestion of cellulose (Nagorsen 2005).

Breeding occurs from March to July, with females having up to 3 litters per year. This results in a peak in numbers by August. The population declines through fall and winter due to mortalities. Litter size in B.C. is unknown but may be similar to Oregon where litters averaged 4.6 young per female (McKay and Verts 1979). Females are capable of breeding in their first year but seldom do. Nuttall's Cottontail may live up to 4 years of age. Most mortality occurs in the first year (COSEWIC 2006).

3.4.2 Ecological Role

Nuttall's Cottontail is a recent, natural, addition to B.C. fauna so does not have a long history of interaction with other species in the province. It is a potential food source for Coyote (*Canis latrans*), Great Horned Owl (*Bubo virginiana*), Red-tailed Hawk (*Buteo jamaicensis*), Golden Eagle (*Aquila chrysaetos*), and American Badger (*Taxidea taxus*) (COSEWIC 2006). Gopher Snake (*Pituophis catenifer*) and Western Rattlesnake (*Crotalus oreganus*) were reported by Diller and Johnson (1988) as important predators on juvenile Nuttall's Cottontails in Idaho. These reptiles likely are important predators in B.C. as well. A Western Rattlesnake was observed eating a Nuttall's Cottontail near Keremeos (M. Sarell, pers. comm., 2012).

3.5 Limiting Factors

Nuttall's Cottontail reaches the northern limit of its global distribution in B.C. and population size may be limited by cold temperatures. Winter mortality is high and in Oregon was correlated with low temperatures (McKay and Verts 1978). In B.C. its distribution likely is limited by its dependence on shrub-steppe communities (COSEWIC 2006). Drought is also a limiting factor especially for juveniles. Water availability was suggested as a critical factor for juvenile survival (Verts et al. 1984). Sullivan et al. (1989) suggested that dry summers, where succulent forage was less available, may have caused a two-thirds decline in Nuttall's Cottontail numbers at their Summerland study site.

4 THREATS

Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational) (Salafsky et al. 2008). For purposes of threat assessment, only present and future threats are considered.² Threats presented here do not include biological features of the species or population such as inbreeding depression, small population size, and genetic isolation; or likelihood of regeneration or recolonization for ecosystems, which are considered limiting factors.³

For the most part, threats are related to human activities, but they can be natural. The impact of human activity may be direct (e.g., destruction of habitat) or indirect (e.g., invasive species introduction). Effects of natural phenomena (e.g., fire, hurricane, flooding) may be especially important when the species or ecosystem is concentrated in one location or has few occurrences, which may be a result of human activity (Master et al. 2009). As such, natural phenomena are included in the definition of a threat, though should be applied cautiously. These stochastic events should only be considered a threat if a species or habitat is damaged from other threats and has lost its resilience, and is thus vulnerable to the disturbance (Salafsky et al. 2008) so that

² Past threats may be recorded but are not used in the calculation of Threat Impact. Effects of past threats (if not continuing) are taken into consideration when determining long-term and/or short-term trend factors (Master et al. 2009).

³ It is important to distinguish between limiting factors and threats. Limiting factors are generally not human induced and include characteristics that make the species or ecosystem less likely to respond to recovery/conservation efforts.

this type of event would have a disproportionately large effect on the population/ecosystem compared to the effect they would have had historically.

4.1 Threat Classification

The threat classification below is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system and is consistent with methods used by the B.C. Conservation Data Centre and the B.C. Conservation Framework. For a detailed description of the threat classification system, see the [CMP website](#) (CMP 2010).

Threats may be observed, inferred, or projected to occur in the near term. Threats are characterized here in terms of scope, severity, and timing. Threat “impact” is calculated from scope and severity. For information on how the values are assigned, see [Master et al.](#) (2009) and table footnotes for details. Threats for the Nuttall’s Cottontail were assessed for the entire province (Table 1).

Table 1. Threat classification table for the Nuttall’s Cottontail in British Columbia.

Threat #	Threat description	Impact ^a	Scope ^b	Severity ^c	Timing ^d
1	Residential & commercial development	Low	Small	Extreme	High
1.1	Housing & urban areas	Low	Small	Extreme	High
2	Agriculture & aquaculture	Low	Small	Extreme	High
2.1	Annual & perennial non-timber crops	Low	Small	Extreme	High
4	Transportation & service corridors	Low	Small	Extreme	High
4.1	Roads & railroads	Low	Small	Extreme	High
11	Climate change & severe weather	Unknown	Pervasive	Unknown	Moderate
11.2	Droughts	Unknown	Pervasive	Unknown	Moderate

^a **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

^b **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species’ population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

^c **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or 3-generation timeframe. Usually measured as the degree of reduction of the species’ population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

^d **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

4.2 Description of the Threats

The overall province-wide Threat Impact for this species is Low.⁴ This overall threat considers the cumulative impacts of multiple threats. The most significant threats are from residential and agricultural development (Table 1). Details are discussed below under the Threat Level 1 headings.

IUCN #1 Residential and commercial development (low impact)

Historic habitat loss to urban development increased approximately 10-fold from 1939 to 2001, from 368 to 3567 ha (COSEWIC 2006). Antelope-brush and sagebrush communities in the Okanagan Valley have declined by 33% to 70%, depending on the community (Lea 2008). Habitat loss is ongoing with an expected human population increase of 27% between 2004 and 2021 (COSEWIC 2006). Much of the population increase is expected to occur at low elevations within Nuttall's Cottontail habitats below 800 m. Development on sagebrush, antelope-brush, and rocky outcrop habitats below 800 m will reduce habitat availability for Nuttall's Cottontail. Habitat loss due to urban development removes food supply and cover, essentially eliminating the species within the footprint. Development may also increase habitat fragmentation and reduce patch size below minimal usable levels.

IUCN #2 Agriculture and aquaculture (low impact)

About 19,000 ha of habitat within Nuttall's Cottontail range were lost to agricultural development by 2001. Habitat loss due to agriculture is continuing. Between 1999 and 2004 vineyards increased by 517 ha (COSEWIC 2006). As habitat loss due to agriculture removes food supply and cover, agricultural sites are seldom used by Nuttall's Cottontails (Sullivan et al. 1989). This loss may also reduce patch size below minimal levels and increase habitat fragmentation.

IUCN #4 Transportation and service corridors (low impact)

Nuttall's Cottontails are killed by vehicles on roads. No quantified data are available but anecdotal reports suggest the scope of road mortality is likely > 1% of the population over 10 years (O. Dyer, pers. comm., 2012; M. Sarell, pers. comm., 2012). As Nuttall's Cottontail populations may vary by as much as two-thirds from spring to fall (Sullivan et al. 1989), road mortality may have a large impact, especially locally, if it occurs when the population is at a low point.

IUCN #11 Climate change and severe weather (unknown impact)

Future climate change impacts are unclear. Climate models predict an increase in the amount of grassland beyond the current limits of the Bunchgrass zone (Wilson and Hebda 2008), which may increase potential habitat including sagebrush and antelope-brush communities. However, climate models also predict an increase in temperature, from 2.5 to 4.8°C by 2080, and decreased precipitation in the summer (Austin et al. 2008). The combination of reduced summer precipitation and increased evaporation may impact juvenile survival since Nuttall's Cottontail is

⁴ The overall threat impact was calculated following Master et al. (2009) using the number of Level 1 Threats assigned to this species where Timing = High or Moderate. This includes 0 Very High, 0 High, 0 Medium, 3 Low, and 1 Unknown (Table 2). The overall threat considers the cumulative impacts of multiple threats.

negatively affected by drought and limited availability of water (Verts et al. 1984; Sullivan et al. 1989).

5 MANAGEMENT

5.1 Management Goal

The management goal is to maintain a stable or increasing population of Nuttall's Cottontail, distributed throughout the species current range in B.C. within the Okanagan and Similkameen drainages.

5.2 Rationale for the Management Goal

The management goal for Nuttall's Cottontail supports Goal 2 (prevent species and ecosystems from becoming at risk) and Goal 3 (maintain the diversity of native species and ecosystems) of the B.C. Conservation Framework.

There is no accurate population estimate for Nuttall's Cottontail in B.C. and the species is known to fluctuate by up to two-thirds in numbers both within and among years. Therefore, identifying a reasonably accurate and useful population estimate or target is not likely feasible. However, if habitat protection is provided at strategic sites, sites are linked with reasonable habitat corridors and threats are reduced, it is thought that the present number of localities and mature individuals are likely sufficient to maintain viability in B.C. and prevent this species from becoming more at risk (e.g., Threatened). Inventory of occupied sites and identification of connectivity corridors are knowledge gaps that still need to be addressed.

5.3 Management Objectives

1. To clarify the distribution of Nuttall's Cottontail throughout its range in B.C., especially areas of occupancy within protected areas and on Crown land.
2. To identify important habitats and connectivity corridors.
3. To protect⁵ important habitats and connectivity corridors.

⁵ Protection can be achieved through various mechanisms including voluntary stewardship agreements, conservation covenants, sale by willing vendors on private lands, land use designations, and protected areas.

6 APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Underway

The following actions have been categorized by the action groups of the B.C. Conservation Framework (B.C. Ministry of Environment 2010b). Status of the action group for this species is given in parentheses.

Compile Status Report (complete)

- COSEWIC report updated (COSEWIC 2006).

Send to COSEWIC (complete)

- Nuttall's Cottontail designated Special Concern in 1994 (Carter and Merckens 1994) and status confirmed in 2006 (COSEWIC 2006).

Planning (complete)

- B.C. Management Plan completed (this document, 2013).

Habitat Protection and Private Land Stewardship (in progress)

- Occupied sites are afforded protection within 13 provincial conservation tenures: 10 through the legal provisions of the *Parks Act* and the *Ecological Reserve Act* (e.g., Okanagan Mountain Provincial Park, Haynes Lease Ecological Reserve, South Okanagan Wildlife Management Area, South Okanagan Grasslands Protected Area); the Vaseux-Bighorn National Wildlife Area; and several private conservation lands owned by The Nature Trust, The Land Conservancy (COSEWIC 2006), and the Nature Conservancy of Canada.

Monitor Trends (ongoing)

- Monitoring of the area of occupancy is ongoing on an opportunistic basis.
- Formal inventory was done by Sullivan in 1984, 1985, and 1986 (Sullivan et al. 1989), Carter et al. (1993), Marks and Young (2009), Herdman (2009), and Dyer (in prep.). Incidental locations have also been provided by a variety of biologists and naturalists.

6.2 Recommended Management Actions

Table 2. Recommended management actions and suggested implementation schedule for the Nuttall's Cottontail in British Columbia.

Objective	Recommended management action	Performance measure ^a	Threat ^b or concern addressed	Priority ^c
1	Develop an inventory strategy to clarify distribution. Priorities should focus on clarification of distribution in protected areas and Crown land to clarify current levels of protection and suitable habitats that provide connectivity between protected areas.	Inventory strategy developed by 2013.	Knowledge gap	Essential
1	Implement the inventory strategy.	Inventory strategy implemented between 2014 and 2015. Levels of existing protection determined by 2015.	Knowledge gap	Essential
1	Update the existing draft habitat map, adding new information on occupied sites to identify suitable habitats and establish a baseline to assess future trends.	Habitat map updated by 2015.	Knowledge gap	Essential
2	Identify minimum patch size required to maintain viable populations to inform habitat protection priorities.	Minimum patch size determined.	Knowledge gap	Beneficial
2	Develop a climate envelope map using existing data to identify occupied sites with high resilience to climate change and connections to potential future habitat.	Climate envelope map developed.	Knowledge gap; 11.2	Beneficial
2	Identify important sites for conservation, with connectivity corridors (to provide connectivity between protected ^d areas), to inform a strategic approach to habitat protection.	Important sites for conservation, with connectivity corridors identified by 2015. Initial priorities set for habitat protection by 2016	Knowledge gap; 1.1, 2.1, 4.1	Essential

Objective	Recommended management action	Performance measure ^a	Threat ^b or concern addressed	Priority ^c
3	Coordinate Nuttall's Cottontail habitat protection and management actions with partners in the South Okanagan-Similkameen Conservation Program (SOSCP) and with recovery actions for other shrub-steppe and rock outcrop species.	Coordination for habitat protection is in place and ongoing.	1.1, 2.1, 4.1	Beneficial
3	Protect a network of relatively large, connected, occupied sites using existing protection tools such as parks and protected areas, private conservancies, best practices, <i>Land Act</i> tenures, private land stewardship agreements, covenants, etc.	Protection of new sites initiated by 2015. Targets of number of sites/area to be protected set by 2018.	1.1, 2.1	Essential
3	Increase awareness of Nuttall's Cottontail and best management practices (BMPs) among land managers with occupied habitat.	BMP for Nuttall's Cottontail developed. Land managers are informed about needs of this species.	1.1, 2.1	Beneficial
3	Integrate consideration of the species' needs into land use planning and other planning documents.	Species needs considered in planning.	1.1, 2.1, 4.1	Beneficial
3	Identify sites where road mortality is high and implement mitigation options, if possible.	Sites of high road mortality identified and mitigation measures in place.	4.1	Beneficial
1	Develop a Nuttall's Cottontail monitoring strategy at strategic sites throughout the species' known range in B.C. to assess occupancy trends on a 5-year basis.	Monitoring strategy developed.	Knowledge gap	Beneficial
1	Implement a Nuttall's Cottontail monitoring strategy.	Monitoring strategy implemented.	Knowledge gap	Beneficial

^a Actions that are considered beneficial do not have a timeline associated with the performance measure as they can start at any time that is feasible.

^b Threat numbers according to the IUCN-CMP classification (see Table 1 for details).

^c Essential (urgent and important, needs to start immediately); Necessary (important but not urgent, action can start in 2–5 years); or Beneficial (action is beneficial and could start at any time that was feasible).

^d Protection can be achieved through various mechanisms including voluntary stewardship agreements, conservation covenants, sale by willing vendors on private lands, land use designations, and protected areas.

6.3 Narrative to Support Management Actions Table

6.3.1 Habitat Protection and Private Land Stewardship

Many other species at risk occur within the range of Nuttall's Cottontail and use similar habitats including sagebrush and antelope-brush shrub-steppe and rock outcrops. Some examples include Behr's Hairstreak (*Satyrium behrii*), Western Rattlesnake, Gopher Snake, *deserticola* subspecies, Desert Nightsnake (*Hypsiglena chlorophaea*), and Sage Thrasher (*Oreoscoptes montanus*). Planning should also take a shrub-steppe ecosystem approach; protecting this ecosystem will incidentally protect habitat for this species and provide connectivity. It is important to work together with other recovery and management teams through the SOSCP partnership to maximize the effectiveness of landscape level conservation and minimize costs.

Minimum viable populations and minimum patch sizes for conservation of Nuttall's Cottontail are not known. The species has a high reproductive capacity and appears to have high dispersal capabilities, including through areas of less preferred habitat. This knowledge gap should be addressed.

Inventory is limited for this species. One of the reasons for designating the species as Special Concern was due to substantial uncertainties about the current area of occupancy. Additional inventory is required to clearly identify the current distribution of the species, important habitats, and existing levels of conservation, important corridors and additional conservation needs. The species easily can be detected by the presence of pellets in suitable habitats and reported by volunteers with minimal training. This is a high priority to effectively direct habitat protection. Focusing inventory on existing conservation lands and Crown land, as an initial priority, will help to clarify whether substantial habitat is already protected and determine the most cost-effective options for corridor protection.

Habitat loss is the most imminent threat for Nuttall's Cottontail. Important sites for conservation need to be identified and protected with corridors for movement and recolonization, if necessary. Some habitat is already protected but, due to limited inventory, it is not clear how much is protected and where additional efforts are needed. Substantial, potential habitat is mapped on Crown land and private conservancies using a draft habitat model. However, this habitat mapping overestimates actual habitat and requires updating to effectively identify habitat protection targets. Important sites and corridors need to be identified before additional habitat protection is recommended. Protecting enough habitat in large, connected patches is key to long-term conservation and will need to continue after the term of this plan. Integration of best practices into land use planning is beneficial but is not as important as direct protection of habitat. It will also be beneficial to inform managers of occupied sites of Nuttall's Cottontail requirements to avoid accidental impacts such as removal of sagebrush density, infill of gullies, or removal of rock outcrops.

Climate impacts are unclear. Temperature and precipitation models are available that may help to clarify potential impacts and adaptation strategies by identifying sites that are likely to be more resilient to climate change. Temperature is not likely to be a direct issue, since the species survives in hotter climates to the south, but may impact moisture availability through

evaporation. Precipitation models should be a primary focus for a climate envelope model. Maintaining habitat patches that are large enough to support long-term viability is important for conservation.

6.3.2 Monitor Trends

Occurrence records need to be updated and maintained to identify long-term monitoring priorities and ensure habitat protection remains effective. When habitats are protected from destruction within conservation tenures, monitoring likely can be done effectively on an opportunistic basis by informed land managers, once every 5 years to update a management plan or once every 10 years before COSEWIC assessments. Monitoring on important, unprotected sites may need to be done more often.

7 MEASURING PROGRESS

The success of the management of Nuttall's Cottontail will be determined primarily through monitoring its distribution. If monitoring indicates that the distribution is stable or increasing, then the population and distribution goal for Nuttall's Cottontail will have been met.

Performance measures are listed for each objective as they relate to specific actions in Table 2.

8 EFFECTS ON OTHER SPECIES

Nuttall's Cottontail occupies areas and habitats where other listed species at risk are known to occur including the Behr's Hairstreak, Sage Thrasher, Desert Nightsnake, Western Rattlesnake, and Gopher Snake. Any habitat protection or habitat threat mitigation for the Nuttall's Cottontail likely benefit other listed species that occur in the same ecosystems. Maintaining Nuttall's Cottontails also provides a sustainable food source for Western Rattlesnakes and Gopher Snakes. Both snakes are listed by the SARA as Threatened. Snake predation on juvenile Nuttall's Cottontails in Oregon was high but impacts were compensated by the rabbit's high reproductive output (Diller and Johnson 1988).

9 REFERENCES

- Althoff, D.P. and G.L. Storm. 1989. Daytime spatial characteristics of cottontail rabbits in central Pennsylvania. *J. Mammal.* 70:820–824.
- Austin, M.A., D.A. Buffett, D.J. Nicolson, G.G.E. Scudder, and V. Stevens, eds. 2008. Taking nature's pulse: the status of biodiversity in British Columbia. Biodiversity BC, Victoria, BC. 268 pp.
<http://www.biodiversitybc.org/assets/pressReleases/BBC_StatusReport_Web_final.pdf> [Accessed May 14, 2012]
- B.C. Conservation Data Centre. 2013. BC Species and Ecosystems Explorer. B.C. Min. Environ., Victoria, BC. <<http://a100.gov.bc.ca/pub/eswp/>> [Accessed March 25, 2013]
- B.C. Ministry of Environment. 2010a. British Columbia guide to recovery planning for species and ecosystems. B.C. Min. Environ., Victoria, BC. 32 pp.
<<http://www.env.gov.bc.ca/wld/recoveryplans/revry1.htm>> [Accessed May 14, 2012]
- B.C. Ministry of Environment. 2010b. Conservation framework. B.C. Min. Environ., Victoria, BC. <<http://www.env.gov.bc.ca/conservationframework/index.html>> [Accessed May 14, 2012]
- Carter, D., A. Harestad, and F.L. Bunnell. 1993. Status of Nuttall's Cottontail in British Columbia. B.C. Environment Wildlife Working Rep. No. WR-56:1–26.
- Carter, D. and M. Merckens. 1994. Update COSEWIC status report on the Nuttall's cottontail *Sylvilagus nuttallii nuttallii* (British Columbia population) and *Sylvilagus nuttallii pinetis* (Prairie population) in Canada. Committee on the Status of Endangered Wildlife in Canada. 38 pp.
- Conservation Measures Partnership (CMP). 2010. Threats taxonomy.
<<http://www.conservationmeasures.org/initiatives/threats-actions-taxonomies/threats-taxonomy>> [Accessed December 17, 2012]
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2006. COSEWIC assessment and update status report on the Nuttall's Cottontail *nuttallii* subspecies (*Sylvilagus nuttallii nuttallii*) in Canada. Ottawa, ON. vi + 23 pp.
<http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_nuttalls_cottontail_e.pdf> [Accessed May 14, 2012]
- Diller, L.V. and D.R. Johnson. 1988. Food habits, consumption rates, and predation rates of Western rattlesnakes and gopher snakes in southwestern Idaho. *Herpetologica* 44:228–233.
- Dyer, O. in prep. Nuttall's Cottontail (*Sylvilagus nuttallii*) pellet surveys in the southern Okanagan Valley, British Columbia, 2011–2012. B.C. Min. Environ., Penticton, BC.
- Herdman, E. 2009. Nuttall's Cottontail surveys in the South Okanagan data only. Univ. B.C. Okanagan Campus, Kelowna, BC.
- Lea, T. 2008. Historical (pre-settlement) ecosystems of the Okanagan Valley and Lower Similkameen Valley of British Columbia – pre-European contact to the present. *Davidsonia* 19(1):3–36.
- Marks, D. and V. Young. 2009. Nuttall's Cottontail (*Sylvilagus nuttallii*) pellet surveys in the southern Okanagan Valley, British Columbia, 2009. B.C. Min. Environ., Penticton, BC.

- McKay, D.O. and B.J. Verts. 1978. Estimates of some attributes of a population of Nuttall's cottontail. *J. Wildl. Manage.* 42:159–168.
- Master, L., D. Faber-Langendoen, R. Bittman, G.A. Hammerson, B. Heidel, J. Nichols, L. Ramsay, and A. Tomaino. 2009. NatureServe conservation status assessments: factors for assessing extinction risk. NatureServe, Arlington, VA.
<http://www.natureserve.org/publications/ConsStatusAssess_StatusFactors.pdf> [Accessed December 17, 2012]
- Nagorsen, D.W. 2005. Rodents and lagomorphs of British Columbia. Royal BC Museum, Victoria, BC.
- NatureServe. 2012. NatureServe explorer: an online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, VA. <<http://www.natureserve.org/explorer>> [Accessed May 14, 2012]
- Province of British Columbia. 1982. Wildlife Act [RSBC 1996] c. 488. Queen's Printer, Victoria, BC. <http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96488_01> [Accessed May 14, 2012]
- Province of British Columbia. 2002. Forest and Range Practices Act [RSBC 2002] c. 69. Queen's Printer, Victoria, BC.
<http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_02069_01> [Accessed May 14, 2012]
- Province of British Columbia. 2008. Oil and Gas Activities Act [SBC 2008] c. 36. Queen's Printer, Victoria, BC.
<http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_08036_01> [Accessed May 14, 2012]
- Salafsky, N., D. Salzer, A.J. Stattersfield, C. Hilton-Taylor, R. Neugarten, S.H.M. Butchart, B. Collen, N. Cox, L.L. Master, S. O'Connor, and D. Wilkie. 2008. A standard lexicon for biodiversity conservation: unified classifications of threats and actions. *Conserv. Biol.* 22:897–911.
- Sullivan, T.P., B. Jones, and D.S. Sullivan. 1989. Population ecology and conservation of the mountain cottontail, *Sylvilagus nuttallii nuttallii*, in southern British Columbia. *Can. Field Nat.* 103:335–340. <<http://www.biodiversitylibrary.org/item/106991#page/356/mode/1up>> [Accessed May 14, 2012]
- Verts, B.J., S.D. Gehman, and K.J. Hundertmark. 1984. *Sylvilagus nuttallii*: a semi-arboreal lagomorph. *J. Mammal.* 65:131–135.
- Wilson, S.J. and R.J. Hebda. 2008. Mitigating and adapting to climate change through the Conservation of Nature. The Land Trust Alliance of British Columbia. Salt Spring Island, BC.

Personal Communications

- Orville Dyer. 2012. Ministry of Forests, Lands and Natural Resource Operations, Penticton, BC.
Richard and Jeanette Armstrong. 2012. En'owkin Centre, Penticton, BC.
- Mike Sarell. 2012. Ophiuchus Consulting, Oliver, BC.