

**COSEWIC**  
**Assessment and Update Status Report**  
on the  
**Nuttall's Cottontail *nuttallii* subspecies**  
*Sylvilagus nuttallii nuttallii*  
in Canada



**SPECIAL CONCERN**  
**2006**

**COSEWIC**  
COMMITTEE ON THE STATUS OF  
ENDANGERED WILDLIFE IN  
CANADA



**COSEPAC**  
COMITÉ SUR LA SITUATION DES  
ESPÈCES EN PÉRIL  
AU CANADA

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Nuttall's Cottontail *nuttallii* subspecies — Photo by David Nagorsen.

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## COSEWIC Assessment Summary

### Assessment Summary – April 2006

**Common name**

Nuttall's Cottontail *nuttallii* subspecies

**Scientific name**

*Sylvilagus nuttallii nuttallii*

**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 hectares, 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.

**Occurrence**

British Columbia

**Status history**

Designated Special Concern in April 1994 and in April 2006. Last assessment based on an update status report.



## COSEWIC Executive Summary

### **Nuttall's Cottontail *nuttallii* subspecies** *Sylvilagus nuttallii nuttallii*

#### **Species information**

Nuttall's Cottontail is a small rabbit with a total length of 319 mm (263-363) and a body mass of 496 g (342-778). It has a pale brown dorsal pelage, a distinct pale brown nape on the back of the head, black-tipped ears, grey on the sides and rump, a white-grey tail, and white ventral pelage. Smaller size, the brown nape on the back of the head, and the greyish-rump distinguish Nuttall's Cottontail from the Snowshoe Hare.

#### **Distribution**

Nuttall's Cottontail is distributed across the Great Plains, Rocky Mountains and intermountain regions of the western United States ranging as far north as southern Canada (Saskatchewan, Alberta, British Columbia). The subspecies *S. n. nuttallii* ranges from California, Nevada, and Arizona north through Oregon, Washington, Utah and Idaho to British Columbia where it is confined to the southern Okanagan-Similkameen valleys. It was first recorded in British Columbia in 1939 and is known from about 40 distinct sites with an extent of occurrence of about 1,380 km<sup>2</sup>.

#### **Habitat**

Nuttall's Cottontail is associated with shrub-steppe habitats dominated by Antelope-Bush, Big Sagebrush, Rabbit-Brush, and Western Juniper. The most important habitat attributes are the presence of sagebrush with a cover of 30% or more and rocky outcrops. Since 1939, when *S. n. nuttallii* first appeared in Canada, shrub-steppe habitats have continued to decline because of urban and agricultural development. About 10% of the species' Canadian range is within protected areas. Federal lands within the known range include 11 Indian Reserve lands, a National Wildlife Area, National Research Council lands, and the Agricultural Research Station at Summerland.

#### **Biology**

*S. n. nuttallii* eats grasses (Wheatgrasses, Needle-and Thread, Cheatgrass), forbs and shrubs such as Big Sage and Common Juniper. The breeding season probably extends from March to July in Canada with females producing two or three litters per year. Breeding in young-of-the-year is rare; the generation time is about one year. Survival rates are higher for females than males. High mortality in juvenile cohorts is

related to precipitation and the quality of summer forage. Adult Nuttall's Cottontails are solitary and only interact during the breeding season.

### **Population sizes and trends**

In shrub-steppe habitats, population densities may reach 0.23 to 0.43 animals per ha in British Columbia. Average population densities fluctuate from year-to-year in response to variation in precipitation, but no information is available on long-term population trends. The total population of *S. n. nuttallii* in Canada is unknown but based on the available habitat is unlikely to exceed 3500 individuals.

### **Limiting factors and threats**

The only imminent threat is ongoing habitat loss from urban and agricultural development. Since 1939, when this subspecies was first recorded in Canada, shrub-steppe habitat has declined in the southern Okanagan-Similkameen valleys. With the human population projected to increase by 27% in this region by 2021 more habitat will be lost. The few other potential threats include livestock grazing and pesticides.

### **Special significance of the species**

*S. n. nuttallii* is largely unknown to the public and naturalists. It is not a game animal and has little commercial significance as an agricultural pest. With a very limited range confined to the southern Okanagan-Similkameen valleys, it is one of several mammalian taxa associated with the intermontane regions of western North America that reach their northern limits in this region of Canada.

### **Existing protection**

*S. n. nuttallii* was designated Special Concern by COSEWIC in 1994. British Columbia has designated this species as S3 (vulnerable). It is protected from killing or collecting under the provincial Wildlife Act, and is not hunted. Its habitat has no protection under the province's Forest and Range Practices Act. A network of protected areas encompass its distributional area including 10 provincial parks, 3 provincial ecological reserves, a national wildlife refuge, the South Okanagan Wildlife Management Area, and Nature Trust and The Land Conservancy lands. Largest protected areas include the various conservation lands in the White Lake-Vaseux Lake area and South Okanagan Grasslands Provincial Park.



## COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5<sup>th</sup> 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

## COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

## COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

## DEFINITIONS (2006)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and it is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

\* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

\*\* Formerly described as "Not In Any Category", or "No Designation Required."

\*\*\* Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.



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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

**Update  
COSEWIC Status Report**

on the

**Nuttall's Cottontail *nuttallii* subspecies  
*Sylvilagus nuttallii nuttallii***

**in Canada**

2006

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## SPECIES INFORMATION

### Name and classification

*Sylvilagus nuttallii* (Bachman 1837) belongs to the Order Lagomorpha, Family Leporidae. Nelson (1909) assigned *S. nuttallii* to the *Sylvilagus floridanus* species group. Results from a phylogenetic analysis of dental traits suggested that *S. nuttallii* and the Eastern Cottontail (*Sylvilagus floridanus*) were sister taxa forming an unresolved clade (Ruedas 1998). But, Halanych and Robinson (1997) using mitochondrial DNA (12S rRNA gene) demonstrated that *S. nuttallii* was most closely related to the Desert Cottontail (*Sylvilagus audubonii*) with a sequence divergence of only 2.1%. Sequence divergence with *S. floridanus* was 4.8%.

Traditionally (Nelson 1909; Hall 1981) three subspecies are recognized: *S. n. grangeri* (Great Plains including Canada and Rocky Mountains), *S. n. nuttallii* (California to British Columbia), and *S. n. pinetis* (southern Rocky Mountains) (Fig. 1). No genetic studies have been done to assess their validity. Diersing (1978) analyzed geographic variation in pelage and skull morphology among 44 geographic samples from the entire range of *S. nuttallii* including Canada. His multivariate analysis revealed two discrete groups that differed in cranial and body size. He classified them as *S. n. nuttallii* and *S. n. pinetis*/*S. n. grangeri*. A sample of *S. n. nuttallii* from British Columbia was strongly divergent from a sample of *S. n. grangeri* from Saskatchewan and Alberta. Diersing (1978) concluded that *S. n. grangeri* and *S. n. pinetis* were morphologically similar and proposed they be synonymized with the name *S. n. pinetis* taking priority because of its earlier usage. However, because Diersing's (1978) thesis was not published, this nomenclatural change has no validity under the Code of International Zoological Nomenclature and the Prairie population in Canada should be treated as *S. n. grangeri*.

In the original COSEWIC report (Carter and Merckens 1994), the two subspecies of *S. nuttallii* were assigned different COSEWIC rankings. *S. n. nuttallii* qualifies as a designatable unit because it is a named subspecies and it occupies a different ecozone from the Prairie subspecies, *S. n. grangeri*.

Another English common name for the species is the Mountain Cottontail. Anderson (1946) applied the English common names Washington cottontail and sagebrush cottontail and the French common name lapin brun du Washington to the subspecies *S. n. nuttallii*.

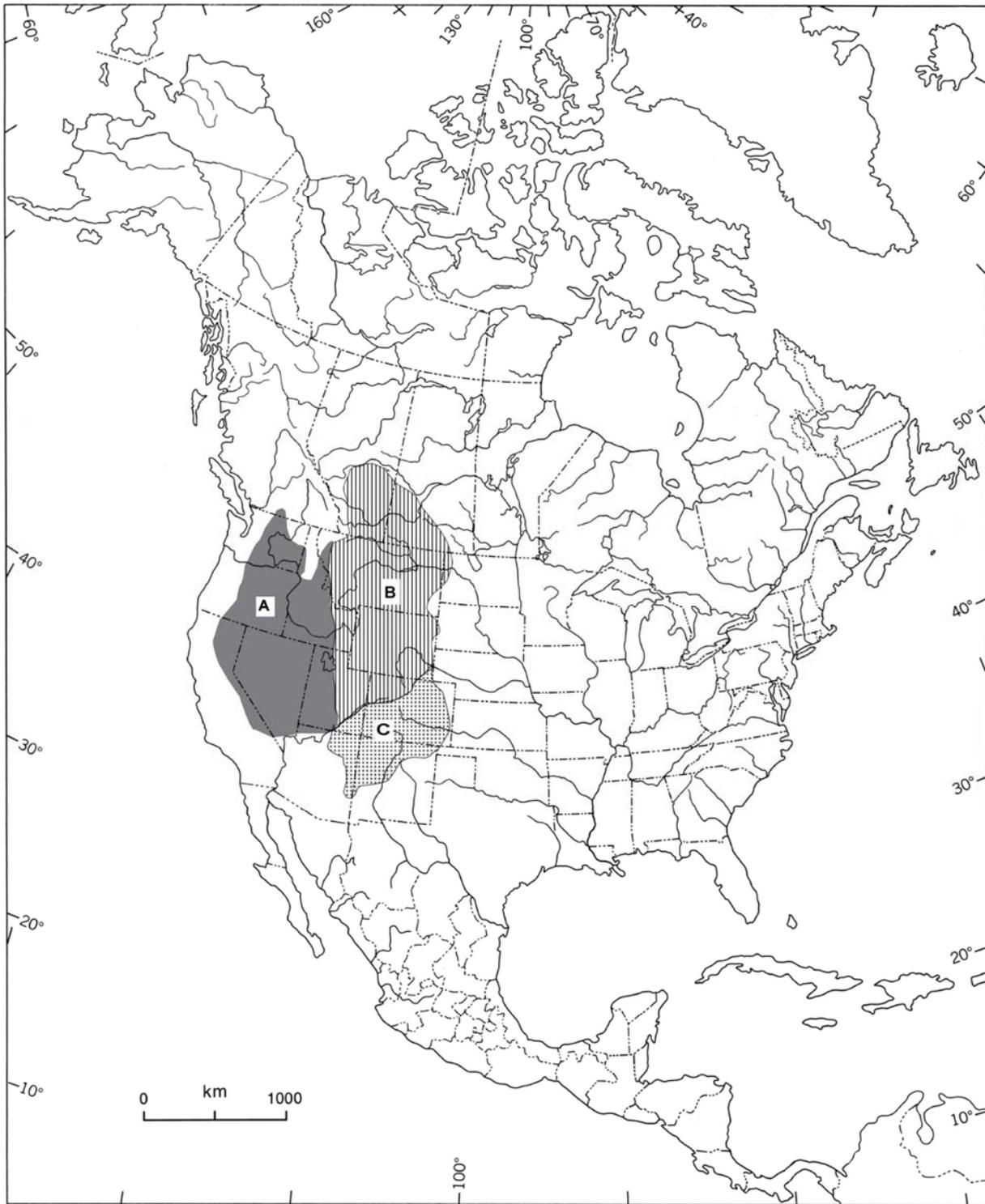


Figure 1. Global range of Nuttall's Cottontail (*Sylvilagus nuttallii*) and its three subspecies: A, *S. n. nuttallii*, B, *S. n. grangeri*, C, *S. n. pinetis*. Subspecies boundaries modified from Hall (1981) and Diersing (1978).

## Morphological description

A small rabbit, *S. n. nuttallii* has a pale brown dorsal pelage, grey on the sides and rump, and a white ventral pelage (Fig. 2). A distinct pale brown nape is present on the back of the head and neck. The ears are tipped with black; the tail is white on the dorsal surface and grey underneath. The skull has a distinct interparietal bone and supraoccipital processes that touch the braincase. Body measurements (range in parentheses) for Canadian *S. n. nuttallii* are total length 319 mm (263-363) n=9, tail vertebrae 33 mm (24-44) n=9, hind foot 85 mm (75-90) n=9, ear 57 mm (54-58) n=4, and body mass 495 g (342-778) n=4 (Nagorsen 2002).



Figure 2. Nuttall's Cottontail (*Sylvilagus nuttallii*). Photo by Dave Nagorsen.

The only other hare or rabbit in the southern interior grasslands of British Columbia is the Snowshoe Hare (*Lepus americanus*). The White-tailed Jackrabbit (*Lepus townsendii*) appears to be extirpated. Although *L. americanus* has a white pelage in winter, animals in brown summer pelage could be confused with *S. n. nuttallii*. *L. americanus* lacks the brown nape on the back of the head and the greyish-rump; it is also much larger (hind foot greater than 116 millimetres, ear greater than 63 millimetres) (Nagorsen 2002).

## Genetic description

Nothing is known about the population structure of this rabbit in Canada. There are no geographic barriers that would be expected to limit gene flow among *S. n. nuttallii* in the Okanagan Basin.

## DISTRIBUTION

### Global range

Nuttall's Cottontail is distributed across the Great Plains, Rocky Mountains and intermountain regions of the western United States ranging as far north as southern Canada (Saskatchewan, Alberta, British Columbia). *S. n. nuttallii* ranges from California, Nevada, and Arizona north through Oregon, Washington, Utah and Idaho to British Columbia (Fig. 1).

### Canadian range

In Canada, *S. n. nuttallii* is confined to the Okanagan Basin of British Columbia where it ranges as far north as Keremeos in the Similkameen valley, and Summerland and the south end of Okanagan Mountain Provincial Park in the Okanagan Valley (Fig. 3). Most occurrences are below 700 m elevation. It is known from about 40 distinct locations. The extent of occurrence based on historical and recent occurrences is about 1,380 km<sup>2</sup>. This represents about 5% of the global range of the subspecies. The area of occupancy is unknown.

This rabbit was first documented in British Columbia in 1939 when two specimens were taken on Anarchist Mountain near Osoyoos (Cowan and Hatter 1940). In the 65 years since its first appearance, *S. nuttallii* rapidly spread throughout the low elevation shrub-steppe grasslands of the southern Okanagan and Similkameen valleys. By 1951, for example, Guiguet (1952) described it as common throughout the benches on the eastern side of Osoyoos Lake and by 1956 (Cowan and Guiguet 1956) it had nearly reached the present limits of its range. With little suitable habitat available in the northern Similkameen and Okanagan valleys, it now occupies most of its potential range in the province. The arrival and spread of *S. nuttallii* in British Columbia occurred while the White-tailed Jackrabbit (*Lepus townsendii*) was disappearing from this region (Nagorsen 2005).

It is conceivable that *S. n. nuttallii* occurred in British Columbia before 1939 but was not detected because of rarity. Nevertheless, given that the southern Okanagan Valley was the focus of various naturalists and museum collectors in the early 1900s, it seems unlikely that Nuttall's Cottontail would have gone undetected and its appearance in 1939 probably represents a natural range expansion from Washington. The earliest museum collections of mammals from the southern Okanagan-Similkameen valleys were made in 1903 and 1904 by W. Spreadborough and E.M. Anderson in 1913 (Anderson 1914). Neither collector took specimens nor reported observations of this rabbit. In 1928 and 1929, H.M. Laing surveyed mammals in this region making large collections and recording observations in detailed field notes. He found no evidence of *S. nuttallii* (Laing, 1928; 1929). Carter and Merkens (1994) implied that Nuttall's Cottontail was present in British Columbia in prehistoric time, but was extirpated in response to environmental changes. With no information on the mammalian fauna of the southern Okanagan valley before 1900, it is difficult to evaluate this hypothesis. Aboriginal Traditional Knowledge (ATK) or mammalian faunal remains recovered in archaeological sites from the Okanagan Basin could be explored to address this issue.

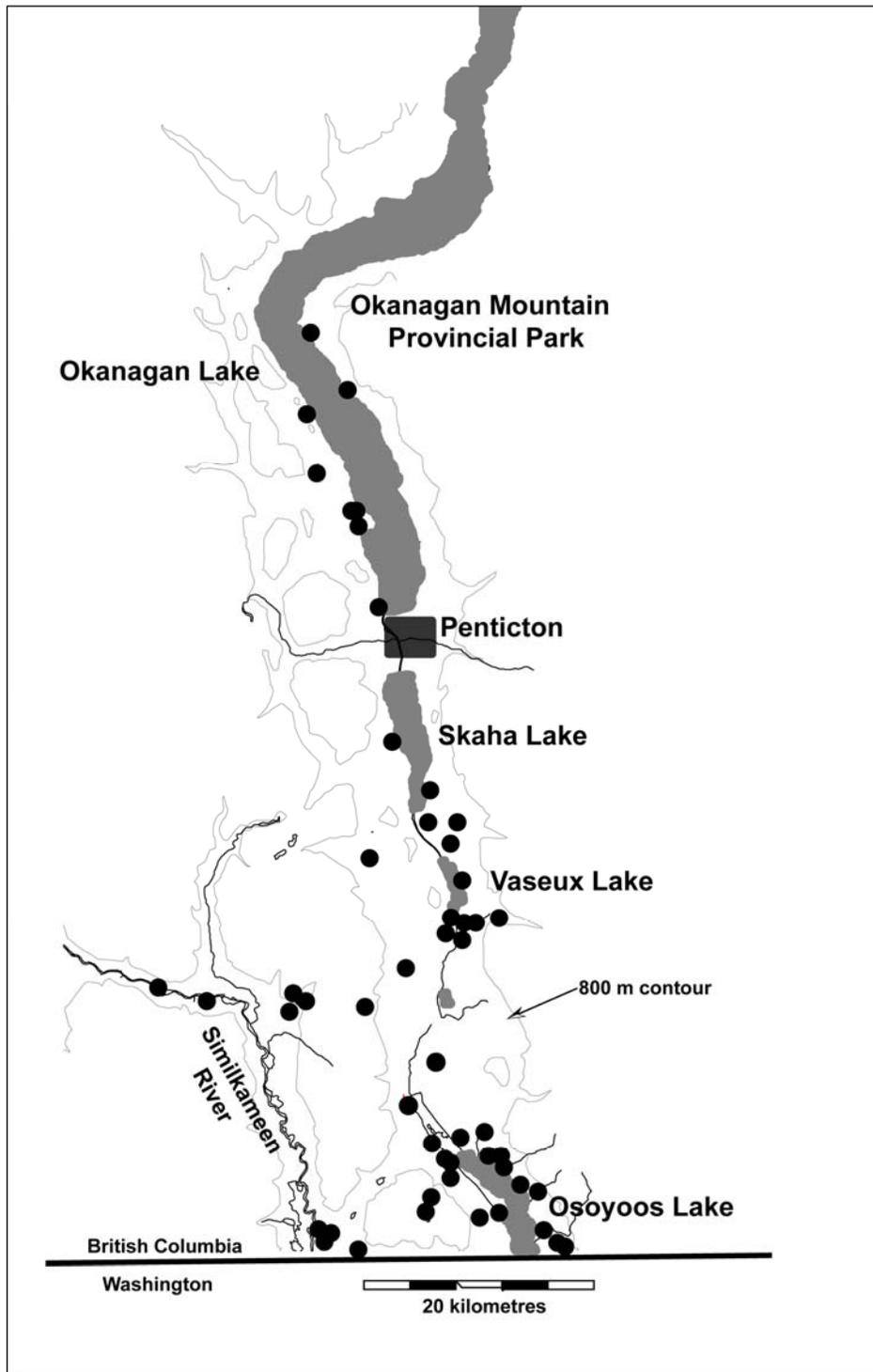


Figure 3. Canadian range of Nuttall's Cottontail, Nuttall's subspecies (*Sylvilagus nuttallii nuttallii*). Solid circles represent occurrence records based on known historical museum specimens and observations 1939-2002.

There are also few data on the history of Nuttall's Cottontail in Okanogan County of Washington, the county adjacent to the Canadian population. In his range map, Dalquest (1941) showed this rabbit distributed throughout most of the Columbia Plateau in eastern Washington and ranging north to the Canadian border in the Okanogan Valley. However, there is no information on its distribution in Okanogan County before the 1940s.

## HABITAT

### Habitat requirements

In the western United States, *S. n. nuttallii* occupies shrub-steppe habitats with Antelope-Bush (*Purshia tridentata*), Big Sagebrush (*Artemisia tridentata*), Rabbit-Brush (*Chrysothamnus nauseosus*), and Western Juniper (*Juniperus occidentalis*). The most important habitat attributes are the presence of sagebrush and rocky outcrops (Orr 1940; MacCracken and Hansen 1982; Verts and Carraway 1998). In Canada this subspecies occupies similar habitats. Using faecal pellet densities as an index of habitat use, Sullivan *et al.* (1989) found that this rabbit mostly used sagebrush habitats with 30% or more vegetative cover (Table 1). Ponderosa Pine (*Pinus ponderosa*) parkland with sagebrush is also used. Faecal pellets were sparse or absent on cultivated lands. Live-trap captures on a 25.6 ha grid showed a similar pattern (Sullivan *et al.* 1989) with most captures of Nuttall's Cottontail in traps located in natural steppe habitat in the study area. Few captures were made in traps set in the parts of the study area with cultivated orchard and old-field habitat (Sullivan 1985; 1986). Carter *et al.* (1993) reported similar habitat use based on spotlight surveys and estimates of faecal pellets in various habitats. They found that several habitat types not assessed by Sullivan *et al.* (1989) such as meadow/hayfield, riparian, and Douglas fir/Ponderosa Pine were rarely used by *S. nuttallii*. Nuttall's Cottontail does not excavate burrows; abandoned burrows of other mammals and rocky outcrops are essential as refuges from predators.

Sullivan *et al.* (1989) and Carter *et al.* (1993) demonstrated that *S. n. nuttallii* is rare in cultivated lands such as orchards and old fields. Nevertheless, the level of use of agricultural lands by this species is not clear. Irrigated areas may provide herbaceous forage for this rabbit. At the Federal Agricultural Research Station at Summerland, this species feeds on ornamental plants (Carter *et al.* 1993). Its use of vineyard habitats has not been studied.

**Table 1. Faecal pellet densities (mean number/1.8 m<sup>2</sup>) for Nuttall's Cottontail (*Sylvilagus nuttallii*) in natural and cultivated habitats in the southern Okanagan-Similkameen valleys. Based on surveys done in 1984 and 1985; modified from Sullivan *et al.* (1989).**

Study Area/Habitat	1984				1985			
	Mean Cover Class <sup>1</sup>	Pellet Density	±SE	No. Plots	Mean Cover Class <sup>1</sup>	Pellet Density	±SE	No. Plots
<b>Grid System</b>								
Mixed sagebrush-Ponderosa Pine parkland	-	118.5	18.9	103	-	41.1	7.5	94
Orchard/old field	-	2.8	1.8	56	-	3.5	2.1	56
<b>Summerland</b>								
Big sagebrush	1.7	38.7	16.1	20	1.7	36.3	11.8	20
Mixed sagebrush <sup>2</sup>	1.8	0.7	0.6	20	1.8	0.6	0.4	20
Grassland-sage	1.7	17.3	7.7	20	1.7	30.6	12.0	18
Mixed sagebrush <sup>2</sup>	1.5	242.0	106.7	20	1.5	122.1	52.5	20
Small sagebrush	1.1	117.4	70.0	20	1.1	45.9	24.7	20
<b>Keremeos-Nighthawk</b>								
Big sagebrush	1.6	14.7	7.1	20	1.6	12.9	5.7	20
Small sagebrush-rock outcrop	1.5	43.3	15.3	20	1.5	17.8	8.0	20
Grassland	0.2	0.0	0.0	20	0.2	0.0	0.0	20
Small sagebrush	1.3	3.5	1.8	20	1.3	0.3	0.3	20
Ponderosa Pine	0.8	0.1	0.1	20	0.8	0.1	0.1	20
<b>Nighthawk-Osoyoos</b>								
Grassland	0.1	0.0	0.0	20	0.1	0.0	0.0	20

<sup>1</sup>based on a 5 class classification: 0=0%, 1=1-20%, 2=21-40%, 3=41-60%, 4=61-80%, 5=81-100%

<sup>2</sup>Mixed sagebrush was measured in 2 different sites

## Habitat trends

The southern Okanagan-Similkameen valleys were first used for livestock grazing in the late 1880s. Agricultural development associated with orchards, irrigated hay fields, and vineyards that began in the early 1900s and more recent urban growth have resulted in significant declines in grassland and shrub-steppe habitat (Cannings *et al.* 1987; Ministry of Environment, Lands and Parks 1998). According to Redpath (1990) more than 90% of the land in the southern Okanagan-Similkameen has been altered from its 'normal' state. Because the most intense agricultural activity and urban development are in the valley bottoms, potential Nuttall's Cottontail habitat has been lost. Lea (unpublished data) estimated declines of 57% for Antelope-Bush habitats, 47% for Big Sage Needle Grass habitats, and 29% for Big Sage-Bunchgrass habitats from the 1800s to 2001. From 1939, when *S. n. nuttallii* was first recorded, these shrub-steppe habitats have continued to decline (Table 2). No quantitative data exist, but with the recent proliferation of vineyards, and continued urban growth more shrub-steppe habitat has been lost since 2001.

**Table 2. Historical changes in area (hectares) of some Nuttall's Cottontail (*Sylvilagus nuttallii*) habitats in the south Similkameen-Okanagan valleys of British Columbia from 1939-2001. Based on unpublished data from Ted Lea, British Columbia Ministry of Water, Land and Air Protection. Note that *S. nuttallii* was first recorded in British Columbia in 1939. Lea's analysis does not include habitat types such as sagebrush rock outcrops that are used by Nuttall's Cottontail.**

Habitat Type	Year				
	1939 <sup>1</sup>	1995 <sup>2</sup>	2001 <sup>2</sup>	Lost	% Lost
Antelope-Bush	7046	4279	4093	2952	41.9
Big Sage-Needle Grass	3439	2364	2364	1075	31.3
Big Sage-Bunchgrass	2128	2005	2005	123	5.8

<sup>1</sup>based on 1938 air photos

<sup>2</sup>based on recent air photos and biophysical mapping with ground surveys.

## Habitat protection/ownership

The precise amount of habitat legally protected is unknown. Protected areas within the known range (i.e., extent of occurrence) include 10 provincial parks, 3 provincial ecological reserves, and a national wildlife refuge (see Existing Protection or Other Status Designations section). Other conservation lands include the South Okanagan Wildlife Management Area, Nature Trust, and The Land Conservancy lands. These protected areas represent about 10% of the extent of occurrence of Nuttall's Cottontail. The amount of shrub-steppe habitat in these protected areas is unknown. A GIS analysis with a habitat suitability model is needed to estimate the amount of Nuttall's Cottontail habitat actually contained in these areas. Federal lands within the known range include 11 Indian Reserve lands (40,850 ha), the Vaseux-Bighorn National

Wildlife Area (792 ha), National Research Council lands (2,152 ha), and the Agricultural Research Station, Summerland (320 ha). Land tenure for the known range of *S. nuttallii* is given in Table 3. The proportion of these land types actually occupied by Nuttall's Cottontail is unknown.

**Table 3. Land tenure for land within the known range (extent of occurrence) of Nuttall's Cottontail (*Sylvilagus nuttallii*) in British Columbia.**

Tenure	Area (km <sup>2</sup> )
Crown Land-Federal and Provincial	619.1
Indian Reserve Lands	357.2
Private Land	408.5
Total	1384.8

## BIOLOGY

Because of possible life history differences in subspecies, biological information presented here is mostly limited to studies done on *S. n. nuttallii*. Only two studies have been done on the Canadian population. They assessed general distribution, habitat, and population ecology (Sullivan *et al.* 1989; Carter *et al.* 1993). Data on reproduction and food habits are based on research done in Oregon and Idaho. Remarkably, there are no data available for movements by this species.

### Life cycle and reproduction

*S. n. nuttallii* is herbivorous. Studies in Oregon and Idaho (Johnson and Hansen 1979; MacCracken and Hansen 1982) have shown that it feeds mostly on grasses such as Wheatgrasses (*Agropyron* sp.), Needle-and Thread (*Stipa* sp.), and Cheatgrass (*Bromus tectorum*). Forbs and shrubs such Big Sage and Common Juniper are also consumed.

In Oregon, the breeding season extends from January to late July (Powers and Verts 1971). Pregnant females were found from February to July. Breeding among females appeared to be synchronous, with females breeding immediately postpartum. Consequently, the summer population contains several well-defined cohorts of young from different litters. In Oregon, females produced three to four litters, and a few produced five (Powers and Verts 1971). Mean litter size was 4.6 based on embryo counts with litters smaller early and late in breeding season. Females rarely reach sexual maturity in the summer of their birth and breeding in young-of-the-year *S. n. nuttallii* is rare. The generation time is about one year (McKay and Verts 1978). Reproductive data for the Canadian population are scanty. The breeding season probably extends from March to July. Cowan and Guiguet (1956) reported litter sizes of only two with females producing two or three litters per year, but they did not give the source of their data.

*S. nuttallii* are solitary—adults only interact during the breeding season (Orr 1940; Verts and Gehman 1991). Sullivan *et al.* (1989) found that sex ratios (proportion of males) varied from year-to-year with estimates of 0.57, 0.44, and 0.16 for 1984-86 on his study grids in the Okanagan Valley. Survival rates were higher for females than males. In Oregon, mortality in juvenile cohorts was high (40-80%) and was related to precipitation and the quality of summer forage (McKay and Verts 1978; Hundertmark 1982). Increased mortality in autumn and early winter was associated with low temperatures. Individuals may live up to four years (Verts and Carraway 1998).

## **Predation**

Predation has not been studied in the Canadian population. Potential predators in the southern Okanagan-Similkameen valleys include: Great Horned Owl (*Bubo virginiana*), Red-tailed Hawk (*Buteo jamaicensis*), Golden Eagle (*Aquila chrysaetos*), Badger (*Taxidea taxus*), Bobcat (*Lynx rufus*), and Coyote (*Canis latrans*).

## **Physiology**

Physiological requirements and adaptations of this species have not been studied. To assist with digesting cellulose, *S. nuttallii* re-ingests its faeces, an adaptation of most hares and rabbits. No research has been done on this species' water requirements in arid environments, but Verts *et al.* (1984) suggested that water availability was a critical factor for survival of young.

## **Dispersal/migration**

There are no estimates of home range size for *S. nuttallii* and no data on dispersal or long distance movements. The general pattern for most cottontail species is that males have larger home ranges than females and home range size increases during the breeding season.

## **Interspecific interactions**

Two species of Leporidae were sympatric with *S. nuttallii* in British Columbia: *L. townsendii* and *L. americanus*. *L. townsendii* occupied similar shrub steppe habitats as *S. nuttallii* and had a similar diet, but appears to be extirpated from British Columbia (Nagorsen 2005). It is possible that declining populations of this large hare in the 1940s and 1950s contributed to the successful range expansion of *S. nuttallii* into British Columbia. *L. americanus* is found throughout British Columbia and is broadly sympatric with *S. nuttallii*. However, *L. americanus* is associated with forested habitats above the elevational range of *S. nuttallii*. Competition between these two species is unlikely because of habitat segregation.

## **Adaptability**

Verts and Carraway (1998) noted several adaptations for coping with arid environments: tree climbing, crepuscular or nocturnal activity, and a solitary life-style. One of the more striking adaptations of *S. nuttallii* is its arboreal activity up to 3 m above ground. Verts *et al.* (1984) concluded that this rabbit climbed juniper shrubs during summer droughts to obtain water droplets that condensed on the boughs and to consume the succulent foliage.

## **POPULATION SIZES AND TRENDS**

### **Search effort**

Most of the occurrence records for this species are either historical museum specimens or incidental observations from naturalists and biologists. Only two surveys have been done on this subspecies in Canada. Sullivan *et al.* (1989) sampled animals through spring and summer in 1984, 1985, and 1986 on a 25.6 ha live-trap grid at the Federal Agriculture Research Station at Summerland. According to Sullivan (1985), 19.7 ha of the grid was natural steppe habitat; 5.9 ha were cultivated orchards, old field or vineyards. Using recapture data, they estimated population density and survival rates. Because few animals were captured in the cultivated habitats, the density estimates apply to natural undisturbed habitat. No estimates exist for Canadian populations in cultivated habitats or in natural steppe habitats disturbed from intense livestock grazing.

In 1990, Carter *et al.* (1993) surveyed most of the known range in the southern Okanagan and Similkameen valleys using spotlight surveys along transects. Surveys were done on foot and from a vehicle. Not all habitat types were sampled and sampling effort was unequal for the habitats sampled. Because their report simply lists locations where *S. n. nuttallii* was observed and does not identify sites where the species was not detected, it provides no data on sampling effort, relative abundance, or presence-absence.

### **Abundance**

Sullivan *et al.* (1989) estimated the population in their Summerland study grid at 0.23 to 0.43 animals per ha. Their data are generally consistent with estimates for a population in Oregon, although that population reached a peak of 2.5 animals per ha in a year of high abundance (McKay and Verts 1978). The total number of individuals and the number of mature animals in Canada is unknown.

### **Fluctuations and trends**

There is no evidence that *S. nuttallii* has regular cyclic fluctuations in population density. However, McKay and Verts (1978) demonstrated marked population

fluctuations over a three-year period in Oregon. For example, late winter-spring densities differed by 50% in two consecutive years. McKay and Verts (1978) concluded that reproduction and survival of the young were linked to precipitation during the breeding season. Population densities in autumn and early winter were negatively associated with low temperatures. Sullivan *et al.* (1989), who monitored populations from May 1984-August 1986 in British Columbia, found that the average densities in 1985 and 1986 had declined to about one-third of the densities recorded in 1984. They attributed this decline to variation in summer precipitation and winter temperatures. No data are available on population trends of *S. n. nuttallii* in British Columbia.

### **Rescue effect**

*S. n. nuttallii* inhabits Okanogan County in Washington adjacent to the Canadian border. Washington has designated this species as S5 (secure) and it is hunted as a small game animal. The state's 2002 game harvest summary lists 168 cottontails shot in Okanogan County. Nuttall's Cottontail is the only species of cottontail rabbit found in Okanogan County (Johnson and Cassidy 1997). The general habitat model in Johnson and Cassidy (1997) shows potential habitat for this species widespread in the Okanogan and Similkameen valleys adjacent to the Canadian border. There are no physiographic barriers that would impede dispersal from Washington and suitable habitat for immigrants would be available particularly in the South Okanogan Grasslands Provincial Park adjacent to the international border.

## **LIMITING FACTORS AND THREATS**

*S. n. nuttallii* is at the northern limits of its range in Canada where it inhabits a restricted area in the Okanogan Basin. Biological factors that determine its limited range are not clear, but its distributional area in Canada coincides with the limits of low elevation shrub steppe habitats. Following its appearance in 1939, *S. n. nuttallii* reached its current range within 15-20 years. Although, shrub-steppe grassland habitat exists in the Nicola, Thompson, and Fraser River valleys, these valleys are separated from the Similkameen and Okanogan valleys by extensive tracts of forest. Limited suitable habitat is probably the main constraint on the distribution of *S. n. nuttallii* in Canada.

This subspecies is not at risk in the United States. In Canada its distribution is in an area undergoing rapid development and habitat change. The only imminent threat is ongoing habitat loss from urban and agricultural development. From 1939 to 2001, urban areas in the southern Okanogan-Similkameen region increased from 368 ha to 3,567 ha, and cultivated areas increased from 11,482 ha to 19,057 ha with a corresponding loss of shrub-steppe habitat (Table 2). Most habitat loss occurred before 1995, but more *S. n. nuttallii* habitat is expected to be lost. The total human population for the Okanogan-Similkameen Regional District was estimated to be 81,967 in 2004 (BC Stats 2005). It is projected to reach 112,000 (27% increase) in this region by 2021 with a projected loss of 4,000 ha of grassland, 4,000 ha of riparian habitat, and 250 ha of dry forest (Ministry of Environment, Lands and Parks 1998).

The growth of the wine industry with the recent expansion of vineyards has also impacted habitat. Vineyards in British Columbia now total about 2,210 ha with most in the Okanagan Valley. Since 1999, 517 ha of land has been converted to vineyards; another 242 ha of new vineyards is projected for 2005-2006. The amount of Nuttall's Cottontail habitat that was on these lands converted to vineyards is unknown. Habitat has been lost in the southern Okanagan valley. For example, some of the bench lands with extensive shrub-steppe habitat on the east side of Osoyoos Lake in the Osoyoos Indian Reserve, an area known to support Nuttall's Cottontail since the early 1950s (Guiguet 1952), have been converted to vineyards. Additional habitat on the Osoyoos Indian Reserve lands could be lost with future development.

Potential threats are few. Carter *et al.* (1993) speculated that livestock grazing reduces population densities presumably because of the loss of forage. Nonetheless, no research has been done on the impacts of grazing on *S. n. nuttallii* populations in British Columbia. Although poison baits were used 25-30 years ago to control *S. n. nuttallii* feeding on young fruit trees, it is no longer considered a pest and this practice has been abandoned (Sullivan 1983). Pesticides applied in fruit orchards potentially could have an impact, but this rabbit is uncommon in cultivated agricultural lands.

### **SPECIAL SIGNIFICANCE OF THE SPECIES**

Small, cryptic, and crepuscular, Nuttall's Cottontail is largely unknown to the public and naturalists. Curiously, a recent habitat wildlife atlas for the south Okanagan (Ministry of Environment, Lands and Parks 1998) does not mention this species. Nuttall's Cottontail is not hunted in British Columbia and probably has little commercial significance as an agricultural pest. The subspecies *S. n. nuttallii* has a very limited range in Canada confined to the southern Okanagan-Similkameen valleys. It is one of several mammalian taxa associated with the intermontane regions of western North America that reach their northern limits in this region of Canada.

### **EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS**

This species is not listed by the IUCN. The global heritage status rank for *S. nuttallii* is G5 (secure); national ranks are N5 (secure) for the United States and N5 for Canada. The subspecies *S. n. nuttallii* is ranked T5 (secure) globally; national ranks are N5 (secure) for the United States and NNR (not ranked) for Canada. British Columbia ranked this subspecies S3 (vulnerable). Washington State's ranking of S5 (secure) would apply to the subspecies *S. n. nuttallii*. Nuttall's Cottontail was assessed by COSEWIC in 1994 (Carter and Merckens 1994). The Prairie population (*S. n. pinetis*/*S. n. grangeri*) was designated Not at Risk; the British Columbian population (*S. n. nuttallii*) was designated Special Concern.

In British Columbia, *S. n. nuttallii* is protected from killing or collecting under the provincial Wildlife Act. There is no hunting season for this rabbit. Because it is not listed

as an Identified Wildlife Species, its habitat has no protection under the province's Forest and Range Practices Act.

The Canadian range of *S. n. nuttallii* overlaps a network of protected areas (Table 4). Because this rabbit is confined to a small area at the southern end of Okanagan Mountain Provincial Park, this large protected area is mostly extralimital. However, the White Lakes Grasslands and adjacent federal and provincial protected areas at Vaseux Lake encompass a large tract of connected, protected low elevation habitat for Nuttall's Cottontail. In addition, these protected areas are linked to various conservation lands purchased by the Nature Trust and The Land Conservancy. Another significant protected area is the South Okanagan Grasslands Provincial Park. It includes the Richter Pass, Chopaka, and Mt. Kobau areas and is contiguous with shrub-steppe habitat in Washington. The Vaseux-White Lakes and South Okanagan Grasslands protected areas, however, are separated by large tracts of private land. Some of these protected areas such as the South Okanagan Grasslands Provincial Park allow livestock grazing.

**Table 4. Protected areas within the known range of Nuttall's Cottontail (*Sylvilagus nuttallii*) in British Columbia.**

Protected Area	Area (ha)	Comments
<b>Provincial Parks</b>		
Anarchist Protected Area	467	
Christie Memorial	3	
Haynes Point	38	
Inkaneep	21	
Keremeos Columns	57	
Okanagan Mountain	11,038	restricted to south end of park
South Okanagan Grasslands	9,364	
Vaseux Lake	2	
Vaseux Protected Area	2,015	
White Lake Grasslands	3,741	
<b>Provincial Ecological Reserves</b>		
Hayne's Lease	101	
Field's Lease	4.2	
Trout Creek	75	northern edge of range
<b>Federal</b>		
Vaseux-Bighorn National Wildlife Area	792	

## TECHNICAL SUMMARY

### ***Sylvilagus nuttallii nuttallii***

Nuttall's Cottontail- *nuttallii* subspecies

Lapin de Nuttall de la sous-espèce *nuttallii*

Range of Occurrence in Canada: British Columbia

<b>Extent and Area Information</b>	
<ul style="list-style-type: none"> <li>Extent of occurrence (EO)(km<sup>2</sup>) <b>map in report based on all known recent and historical occurrences</b></li> </ul>	1,380 km <sup>2</sup>
<ul style="list-style-type: none"> <li>Specify trend in EO</li> </ul>	Unknown
<ul style="list-style-type: none"> <li>Are there extreme fluctuations in EO?</li> </ul>	No
<ul style="list-style-type: none"> <li>Area of occupancy (AO) (km<sup>2</sup>) <b>Unknown</b></li> </ul>	Unknown
<ul style="list-style-type: none"> <li>Specify trend in AO</li> </ul>	-
<ul style="list-style-type: none"> <li>Are there extreme fluctuations in AO?</li> </ul>	-
<ul style="list-style-type: none"> <li>Number of known or inferred current locations</li> </ul>	40
<ul style="list-style-type: none"> <li>Specify trend in #</li> </ul>	Probably declining
<ul style="list-style-type: none"> <li>Are there extreme fluctuations in number of locations?</li> </ul>	No
<ul style="list-style-type: none"> <li>Specify trend in area, extent or quality of habitat</li> </ul>	Habitat declining
<b>Population Information</b>	
<ul style="list-style-type: none"> <li>Generation time (average age of parents in the population)</li> </ul>	1 year
<ul style="list-style-type: none"> <li>Number of mature individuals</li> </ul>	Less than 3500 based on available habitat
<ul style="list-style-type: none"> <li>Total population trend:</li> </ul>	Unknown
<ul style="list-style-type: none"> <li>% decline over the last/next 10 years or 3 generations.</li> </ul>	-
<ul style="list-style-type: none"> <li>Are there extreme fluctuations in number of mature individuals?</li> </ul>	Unknown
<ul style="list-style-type: none"> <li>Is the total population severely fragmented?</li> </ul>	Unknown
<ul style="list-style-type: none"> <li>Specify trend in number of populations</li> </ul>	-
<ul style="list-style-type: none"> <li>Are there extreme fluctuations in number of populations?</li> </ul>	-
<ul style="list-style-type: none"> <li>List populations with number of mature individuals in each:</li> </ul>	
<b>Threats (actual or imminent threats to populations or habitats)</b>	
Habitat loss from urbanization and agriculture (orchards and vineyards)	
<b>Rescue Effect (immigration from an outside source)</b>	
<ul style="list-style-type: none"> <li>Status of outside population(s)? <b>USA: Washington S5 (Secure)</b></li> </ul>	
<ul style="list-style-type: none"> <li>Is immigration known or possible?</li> </ul>	Yes
<ul style="list-style-type: none"> <li>Would immigrants be adapted to survive in Canada?</li> </ul>	Yes
<ul style="list-style-type: none"> <li>Is there sufficient habitat for immigrants in Canada?</li> </ul>	Yes
<ul style="list-style-type: none"> <li>Is rescue from outside populations likely?</li> </ul>	Unknown
<b>Quantitative Analysis</b>	
<b>Current Status</b>	
COSEWIC: Special Concern, April 1994 Special Concern, 2006	

### Status and Reasons for Designation

<b>Status:</b> Special Concern	<b>Alpha-numeric code:</b> n/a
<p><b>Reasons for Designation:</b></p> <p>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 hectares, 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.</p>	
<p><b>Applicability of Criteria</b></p>	
<p><b>Criterion A:</b> A recent immigrant to the Okanagan, no recent evidence of population decline, but habitat availability is declining.</p> <p><b>Criterion B:</b> Exact extent of distribution is unknown. There is no clear evidence of decline but there are no recent surveys.</p> <p><b>Criterion C:</b> Population size is unknown.</p> <p><b>Criterion D:</b> Population size is unknown but likely more than 1000.</p> <p><b>Criterion E:</b> Not available.</p>	

## **ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED**

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reports, and many publications for a general audience; he is an associate editor for the Canadian Field-Naturalist. Dave is involved with a number of conservation initiatives including the Vancouver Island Marmot Recovery Team; the Pacific Water Shrew Recovery Team, the Townsend's Mole Recovery team, the Terrestrial Mammals Specialist Group for COSEWIC; and the Rodent Specialist Group, Species Survival Commission of the IUCN.

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Royal British Columbia Museum, Victoria

Cowan Vertebrate Museum, University of British Columbia, Vancouver