# Sensitive Ecosystems Inventory: Lake Country, 2005

## Volume 3: Wildlife Habitat Mapping

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THE REAL ESTATE FOUNDATION OF BRITISH COLUMBIA

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This project has adapted material from the reports for the Bella Vista – Goose Lake Range Sensitive Ecosystems Inventory[8] and Central Okanagan Sensitive Ecosystems Inventory[9].

We would like to thank the many landowners that gave us permission to access their lands for field sampling.

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[1] The mission of the Real Estate Foundation is to support sustainable real estate and land use practices for the benefit of British Columbians.
[2] Iverson & MacKenzie Biological Consulting Ltd.
[3] District of Lake Country
[4] Polar Geoscience
[5] Ophiuchus Consulting
[6] Artemis Wildlife Consultants
[7] Baseline Geomatics Inc.
[8] Iverson 2003
[9] Iverson and Cadrin 2003

# Abstract

The Okanagan Valley contains the northern-most extent of Great Basin shrub-steppe ecosystems. These are often bisected by species-rich riparian and wetland habitats, and flanked by open forests and rugged slopes. The ensemble of wildlife that depends on habitats in the valley is diverse, containing species from the boreal forests to the north and the deserts to the south. Many of the southern-associated species are considered at risk in British Columbia and in Canada, due to their rarity and declining populations in landscapes that are sought for human development. In the North Okanagan, grasslands and shrub-steppe ecosystems dominate the lower elevations, and form the northern extent of these ecosystems in the valley. Extensive land development is fragmenting and encroaching on important wildlife habitats, contributing to wildlife and habitat declines.

This report is **Volume 3** of a Sensitive Ecosystems Inventory (SEI) project, initiated by the District of Lake Country and Ministry of Environment. The report includes habitat summaries and species-habitat models for eleven wildlife species considered at risk in British Columbia. **Volume 1**[10] describes Sensitive Ecosystems, and offers practical advice on how to best avoid or minimize damage to them. **Volume 2**[11] provides details on the Terrestrial Ecosystem Mapping and terrain mapping.

The results of this habitat mapping indicate that abundant habitat exists for species that use open forest and grassland (e.g., Gopher Snake, Western Rattlesnake, Badger). Habitat for species preferring certain grassland conditions such as gently sloping, large contiguous areas (e.g., Grasshopper Sparrow) with low-profile vegetation (e.g., Long-billed Curlew) is scarcer. Limited wetland habitat is available for wildlife reliant on these habitats (e.g., Great Basin Spadefoot, Painted Turtle). Considering their natural rarity, a relatively large amount of healthy riparian habitat exists, including mature to old deciduous forest (e.g., Western Screech-owl habitat), and deciduous thickets with intact shrubby understory (e.g., Yellow-breasted Chat habitat). Overall, the mosaic of habitat types present in the study area leads to high habitat suitability for a wide range of wildlife species, and high biodiversity values.

Wildlife suitability models can be used to depict potential habitat values for individual species, or in conjunction with Sensitive Ecosystems Inventory to identify potential environmental values of areas for conservation purposes (i.e., natural parks), or to guide development proposals. Environmental assessments for development proposals, including on-site inventory, should be conducted to verify and revise the predictive suitability mapping. Revised environmental attributes, in a georeferenced format, can be returned to the planning staff at the District of Lake Country to revise in-house mapping. This would permit revisions to ecosystem and wildlife suitability mapping, updates of developed lands and areas retained as green space, and permit monitoring the efficacy of environmental planning and adaptive management.

Wildlife suitability models have also been incorporated into a Conservation Analysis that was developed to guide landscape-level planning.

[10] Iverson 2006
[11] Iverson and Uunila 2006

# Table of Contents

## List of Figures



## List of Tables

# 1 Introduction

This report presents information on wildlife habitat mapping in the District of Lake Country which lies east of Okanagan Lake, including land north of Ellison Lake and surrounding Wood Lake and the south end of Kalamalka Lake. It is the third volume in the Sensitive Ecosystems Inventory reports for Lake Country.

**Volume 1**[12] describes the study area, inventory methods and results, rare and fragile ecosystems of Lake Country, highlights their values and importance, and offers practical advice on how to best avoid or minimize damage to them. **Volume 2**[13] provides details on the Terrestrial Ecosystem Mapping and terrain mapping.

## 1.1 What is Wildlife Habitat Mapping?

Habitat mapping portrays the potential importance of the land and its features to specific wildlife species through a species-habitat model. The model is used to generate a habitat map by assigning ratings to different habitat types, based on the needs of the species for particular life requisites. The ratings indicate the value of a habitat compared to the best habitat in the province[14]. Suitability is the ability of the habitat in its current condition to support a species. Capability is the ability of the habitat to support a species under optimal natural conditions, irrespective of the current condition of the habitat.

The following key elements and concepts summarize the Provincial standards for developing wildlife habitat ratings in British Columbia[14]:

1. There are three rating schemes; each reflects a different level of information available about the habitat requirements of a species (Table 1).
2. Ratings reflect a percentage of the provincial benchmark habitat. The provincial benchmark habitat has the highest suitability value for a given species in the province, against which all other habitats for that species must be rated. The benchmark is an actual location.
3. All ratings are a value for a specified season and activity, or life requisite.
4. A habitat rating is provided for each species for every occurring ecosystem unit (i.e., every site series / structural stage / site modifier combination).

Table 1 below shows the different habitat rating schemes.

[12] Iverson 2006
[13] Iverson and Uunila 2006
[14] Resources Inventory Committee 1999 (now Resources Information Standards Committee)

**Table 1: Habitat rating schemes for different knowledge levels of habitat requirements.**

| Percent of Provincial Benchmark[15] | 6-class (Substantial Knowledge of Habitat Use) | | 4-class (Intermediate Knowledge of Habitat Use) | | 2-class (Limited Knowledge of Habitat Use) | |
|---|---|---|---|---|---|---|
| 76 - 100 % | High | 1 | High | H | Habitat Useable | U |
| 51 - 75 % | Moderately High | 2 | Moderate | M | | |
| 26 - 50 % | Moderate | 3 | | | | |
| 6 - 25 % | Low | 4 | Low | L | | |
| 1 - 5 % | Very Low | 5 | | | Likely No Value | X |
| 0% | Nil | 6 | Nil | N | | |

Habitat ratings are assigned to each ecosystem unit (e.g., habitat type) and then the values are projected onto the landscape where they are mapped. Habitat inventories assess the presence of available and potential habitat; they do not provide an indication of species presence or actual abundance. Much of the accuracy in predicting these habitat values is contingent on our understanding of how wildlife uses their habitats.

## 1.2 How does Wildlife Habitat Mapping interact with TEM and SEI?

Terrain and soil characteristics influence the vegetation of a site, within a given climate. Terrestrial Ecosystem Mapping (TEM) evaluates the specific ecological conditions (e.g. climate, terrain, vegetation community, and structural stage) for each polygon. All of these factors influence the wildlife assemblage and use within an area. TEM is used in a habitat model by assigning each ecosystem unit a wildlife habitat rating, indicating how useable (currently or potentially) the site is for a given wildlife species. These ratings are then applied to the TEM database and spatial data using GIS and portrayed as a habitat suitability or capability map of the study area.

In the field component of TEM, the terrain, vegetation, and wildlife aspects are assessed in the field and discussed with the other members of the field crew, contributing to a greater accuracy of interpreted habitat use for wildlife. Field sampling is used to extrapolate the occurrence of certain habitat features as well, such as snags and course woody debris, to the types of habitats they commonly occur in.

Sensitive Ecosystems Inventory (SEI) rates ecosystems based on their ecological rarity and sensitivity, but also considers critical habitat needs for select wildlife species. Often, sensitive ecosystems contain important habitats for many wildlife species.

## 1.3 How is Wildlife Habitat Mapping Used?

The Okanagan Valley is one of the most diverse wildlife areas in Canada, and contains many of the Province and Nation's rare and endangered species. The area also has attracted considerable human settlement and associated land developments. Previous land use planning was limited in its ability to assess, identify, and conserve important wildlife habitats. This often led to the permanent loss of critical wildlife habitats, increasing the need to conserve those that remain. SEI and wildlife habitat mapping can

[15] The best habitat in the province. For example, High suitability (1 or H) is 76-100% as good as the best habitat in the province.

dramatically improve land use planning to ensure that critical habitats are not developed, or that appropriate mitigation activities are undertaken.

The effectiveness of wildlife habitat mapping is contingent on the information being portrayed in a manner that is easily interpreted by planners, developers, regulatory agencies, and the public. This can be a challenge considering the diverse array of wildlife species potentially present, and the variety of habitat types used. The values of ecosystems as habitat for wildlife have been considered in the SEI mapping, although 'Not Sensitive' ecosystems may still provide important habitat. Wildlife values for select species were given further consideration in the 'Conservation Analysis' provided in Volume 1[16], which should be consulted for landscape-level planning. For land-use planning at a finer scale (e.g., neighbourhood plans), each species model should be inspected to direct detailed inventories to avoid or mitigate impacts to crucial habitats.

Wildlife habitat mapping can also be used as a tool in wildlife management and recovery, a guide for wildlife viewing, and as a gauge of the loss of critical wildlife habitats.

## 1.4 Objectives

The objective of the wildlife habitat mapping is to provide input to land-use planning in the study area by providing estimated habitat values for wildlife species of management concern. The habitat mapping enables planners and managers to examine some of the wildlife values in order to guide development. Potential impacts can be identified and mitigation plans developed. ***Wildlife habitat mapping does not replace the need for development proponents to field-verify the presence or absence of wildlife species and the significance of identified habitats.***

# 2 Methods and Limitations

## 2.1 Project Wildlife Species

A vast number of rare or endangered wildlife potentially occur in the study area (Appendix B). Eleven of these wildlife species, all known to occur in the North Okanagan, were selected to demonstrate important wildlife habitats in the study area (Table 2). These species satisfy the following criteria[17] used to select wildlife species for habitat mapping:

- the level of knowledge of the species' use of habitat is adequate;
- the habitat required by selected species is also habitat required by other wildlife species;
- TEM is able to capture most of the habitat features required by the species;
- the species' habitat is present in the project area; and
- the species, or evidence of the species, is likely to be observed in the project area.

All of the selected species are considered at risk in the Province[18], and some of these species have also been designated through Federal listing[19]. Species designated Threatened or Endangered are protected under the federal Species at Risk Act.

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[16] Iverson 2006
[17] Resources Inventory Committee 1999 (now Resources Inventory Standards Committee)
[18] Conservation Data Centre (CDC) 2005: http://srmwww.gov.bc.ca/cdc/

**Table 2: Wildlife species modelled in this project, their status, and rating scheme used.**

| Common Name | Scientific Name | Prov. Status[20] | COSEWIC Status[21] | Rating Scheme |
|---|---|---|---|---|
| Great Basin Spadefoot | *Spea intermontana* | Blue | Threatened | 4-class |
| Painted Turtle | *Chrysemis picta* | Blue | - | 4-class |
| Western Rattlesnake | *Crotalus oreganus* | Blue | Threatened | 4-class |
| Gopher Snake | *Pituophis catenifer* | Blue | Threatened | 4-class |
| Swainson's Hawk | *Buteo swainsoni* | Red | - | 4-class |
| Long-billed Curlew | *Numenius americanus* | Blue | Special Concern | 4-class |
| Western Screech-owl | *Megascops kennicottii macfarlanei* | Red | Endangered | 4-class |
| Yellow-breasted Chat | *Icteria virens* | Red | Endangered | 4-class |
| Grasshopper Sparrow | *Ammodramus savannarum* | Red | - | 4-class |
| Spotted Bat | *Euderma maculatum* | Blue | Special Concern | 4-class |
| Badger | *Taxidea taxus jeffersonii* | Red | Endangered | 4-class |

## 2.2 Species-Habitat Models

Wildlife habitat was modeled for the Lake Country TEM according to the standards in the *BC Wildlife Habitat Ratings Standards - Version 2.0*[22].

There are two basic components to a species-habitat model: the species account and the ratings table. The model is then applied to the ecosystem mapping to generate the spatial depiction of suitable habitat.

The species account summarizes the knowledge about a species and how it will be modeled. The account describes the distribution of the species in the province and in the project area, provides an overview of its ecology, and includes a detailed description of the critical life requisites and habitat uses of the species. The ratings section outlines the rating scheme (2, 4, or 6-class), the life requisites, and habitat uses that are modeled (map themes), and assumptions used to rate habitat characteristics. A section on map interpretation is also included, which describes how map themes were layered on the map, how the ratings were applied to the polygons, and provides information needed to correctly interpret each map.

Preliminary ratings tables, developed before field sampling, consist of an abbreviated table that provides habitat values for representative ecosystem units likely to occur in the project area. Our tables were modified to present assumptions used for rating ecosystems, which were incorporated into each species account. These assumptions, after being field-verified, guided development of the final ratings tables.

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[19] Committee on the Status of Wildlife in Canada (COSEWIC) 2005: http://www.cosewic.gc.ca/

[20] Red List: indigenous species or subspecies (taxa) considered *Extirpated*, *Endangered*, or *Threatened* in BC.
Blue List: indigenous taxa considered *Vulnerable* (Special Concern) in BC.

[21] Endangered = facing imminent extirpation in Canada or extinction.
Threatened = likely to become endangered in Canada if limiting factors are not reversed.
Special Concern = particularly sensitive to human activities or natural events.

[22] Resources Inventory Committee 1999 (now Resources Information Standards Committee)

## 2.3 Field Sampling

Field assessments occurred in conjunction with field sampling for ecosystem mapping. Survey intensity level 4 was used[23]. Fieldwork took place in June and July of 2005. During field sampling, habitat values were recorded on Wildlife Habitat Assessment (WHA) forms (FS 882HRE 98/5). An example of the form is presented in Appendix C. Data was entered into Venus 5.0 data capture software. Table 3 lists and briefly describes the life requisites and habitat-uses rated in the field.

**Table 3: Life requisites and habitat-uses rated during fieldwork**

| Species | Life Requisite and Habitat Use | Rating Code |
|---|---|---|
| Great Basin Spadefoot | Security/thermal habitat for reproducing (breeding ponds).<br>Security/thermal habitat and food for general living, all year (terrestrial sites). | RE<br>LIA |
| Painted Turtle | Security/thermal habitat for reproducing (egg-laying sites).<br>Security/thermal habitat and food for general living, all year (ponds). | RE<br>LIA |
| Western Rattlesnake | Security/thermal habitat for general living all year (basking/denning sites).<br>Food and security/thermal habitat for general living, summer. | LIA<br>LIS |
| Gopher Snake | Food and security/thermal habitat for general living, growing season.<br>Security/thermal habitat for reproducing (egg-laying sites). | LIG<br>RE |
| Swainson's Hawk | Security habitat for reproducing.<br>Food for general living, growing season. | RE<br>LIG |
| Long-billed Curlew | Security habitat for reproducing.<br>Food for general living, growing season. | RE<br>LIG |
| Western Screech-owl | Security/thermal habitat for reproducing. | RE |
| Yellow-breasted Chat | Security/thermal habitat and food for general living, growing season. | LIG |
| Grasshopper Sparrow | Security/thermal habitat and food for general living, growing season. | LIG |
| Spotted Bat | Security/thermal habitat for reproducing and roosting | RB |
| Badger | Security/thermal habitat and food for general living, all year. | LIA |

## 2.4 Wildlife Habitat Mapping

A final habitat ratings table was developed after field inspections were completed, and after a final list of ecosystem units was developed. Values were assigned using information from the species accounts, including assumptions, and from the wildlife report generated from field data in Venus 5.0.

We generated wildlife habitat maps by applying the ratings table values for each map theme (i.e., habitat use / life requisites for each species) to the TEM spatial and non-spatial data. An Ecosystem-based Resource Mapping (ERM) tool[24], developed by the former Ministry of Sustainable Resource Management, was used to apply the ratings tables to the TEM map in ArcView GIS software.

[23] Resources Inventory Committee 1998 (now Resources Inventory Standards Committee)
[24] http://srmwww.gov.bc.ca/wildlife/whr/sta.html

Multiple map themes were displayed on the habitat-use map for some species, using a hierarchy of critical habitat requirements and life requisites. As habitat uses may overlap, we ensured that the most critical habitat uses overlaid less critical habitat uses. Each map was assigned a set of colours that identify the theme and values mapped.

Ratings were assigned to polygons with multiple ecosystem components (i.e., deciles) using one of the following four methods; based on which one best demonstrates the relative importance of that map theme:

- Highest-value – the highest rating within each polygon is displayed, regardless of the area it represents. The highest-value method exaggerates the amount of high value habitat because the whole polygon may be coloured high even if only a small part of it is actually high value.
- Averaged – the average rating within each polygon is displayed. Some parts of a polygon may be coloured as having some value, even if those parts have little or no habitat value. Similarly, some parts of a polygon may be rated as having low value, although the habitat in those parts has high value.
- Largest area – the rating for the ecosystem unit that covers the largest area of a polygon is displayed.
- Dot density – ratings for all of the ecosystems units are displayed, based on the percent area of the polygon they occupy. The dominant ecosystem unit provides the background colour, while dots of different colours or shades show the relative amount of other units occurring in the polygon.

## 2.5 Mapping Limitations

Limitations to Terrestrial Ecosystem Mapping are described in detail in Volume 1[25], including:

- Scale of the aerial photographs (1:15,000). It is recommended that digital data not be enlarged beyond the scale of the photos as this may result in unacceptable distortion and faulty registration with other data sets.
- Date of the aerial photographs (1994) and field sampling (2005). On-going land uses may have changed some polygons after the date that the aerial photographs were taken or the field sampling was conducted.
- Ability to see disturbances such as cover of invasive plants on aerial photographs. Information from field sampling was applied to adjacent areas.
- Complex landscape, resulting in many complex polygons. Small ecosystems are often captured as a small component of a larger polygon that may contain up to three ecosystems.

For wildlife modelling purposes, additional limitations include:

- High variability of some ecosystem units (e.g., slope, soil depth, and, in a few units, vegetation composition). A given ecosystem unit may be described as having 'moderate to steep slopes', and some wildlife will use moderate slopes but are less likely to use steep slopes. Soil depth can also be highly variable; a shallow-soiled unit may have large pockets of deep soil suitable for burrowing.
- Condition of the habitat (e.g., understory fragmentation, forest ingrowth, invasive plants) is not accounted for in TEM, except for seral association in grasslands. This information is available in SEI as a condition value, and, while not incorporated into wildlife models, it was included in the Conservation Analysis[26], where the sensitivity/rarity of the ecosystem, the condition of the ecosystem, and the wildlife values were all considered.

[25] Iverson 2006
[26] Volume 1: Iverson 2006

# 3 Results

## 3.1 Species Accounts

Complete species accounts, including citations, are available as described in Appendix A. Each species account also includes the final habitat suitability map for the species. Brief summaries of some important habitat requirements for the project species are included in the Wildlife Habitat Maps section below.

## 3.2 Field Sampling

A total of 282 plots were visited and assessed during Terrestrial Ecosystem Mapping and Sensitive Ecosystem Inventory, with 9 full plots, 66 ground inspections, and 207 visual inspections completed in the field (Figure 1). Only cursory investigations, if any, for evidence of wildlife use was conducted in some of the visual plots.

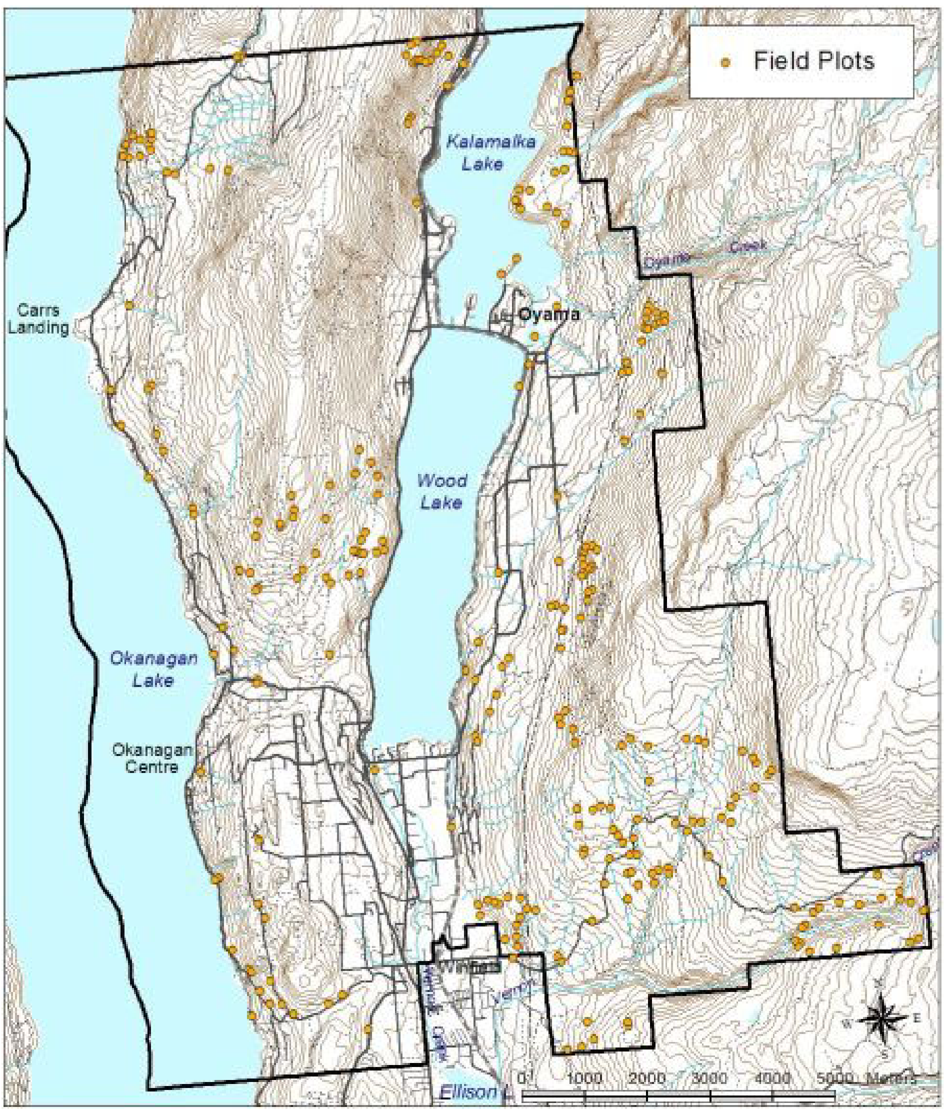


**Figure 1:** Location of plots assessed during ecosystem mapping fieldwork.

For many of the project wildlife species, we did not observe evidence of use during fieldwork. This is not surprising, as most of them are rare, elusive, or nocturnal, and fieldwork was intended as a habitat inventory rather than a wildlife survey.

Few, if any, wildlife inventories appear to have been conducted in this area. Previous observation records for the project species were amalgamated from all known sources[27], and are summarized in Table 4. Records obtained during fieldwork for this study are included in Table 4 as well. Details of these observations are provided by species in Section 3.4.

**Table 4: Observations of project wildlife species or evidence of their use in the study area.**

| Species | Previous Observations in Study Area | Observations During SEI |
|---|---|---|
| Great Basin Spadefoot | None | Two breeding locations, southeast portion |
| Painted Turtle | None | None |
| Gopher Snake | None | Two roadkills |
| Western Rattlesnake | One location, near Winfield | One location, east Kalamalka |
| Swainson's Hawk | None | One location, north boundary |
| Western Screech-owl | One location, near Winfield | None |
| Long-billed Curlew | None | None |
| Grasshopper Sparrow | None | None |
| Yellow-breasted Chat | None | None |
| Spotted Bat | None | None |
| Badger | None | One location, near Winfield |

Other red- or blue-listed species recorded from the study area include Racer and White-throated Swift.

## 3.3 Final Ratings Table

The final ratings table lists all of the mapped ecosystem units, including every combination of site series, site modifier, structural stage, stand modifier and seral association. See the expanded legend in Volume 3[28] for a description of all ecosystem units. Each ecosystem unit was assigned a rating for each of the 16 habitat uses for the eleven wildlife species. An example of the format of the ratings table is provided in Appendix D.

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[27] CDC 2005, Ministry of Environment 2005

[28] Iverson and Uunila 2006.

## 3.4 Wildlife Habitat Maps

By applying the habitat ratings to the TEM database and spatial data, seventeen map themes were created (Table 5) including a duplication of one map theme (Gopher Snake denning uses the ratings from Western Rattlesnake denning).

**Table 5: Map themes of habitat uses and life requisites modelled.**

| Species | Species Code | Map Themes | Rating Code |
|---|---|---|---|
| Great Basin Spadefoot | A-SPIN | Breeding<br>General Living (foraging and burrowing) | RE<br>LIA |
| Western Rattlesnake | R-CROR | Basking/denning<br>Foraging | LIA<br>LIS |
| Gopher Snake | R-PICA | Basking/denning[29]<br>Foraging<br>Reproducing (egg-laying) | LIW<br>LIG<br>RE |
| Swainson's Hawk | B-SWHA | Nesting<br>Foraging | RE<br>LIG |
| Long-billed Curlew | B-LBCU | Nesting<br>Foraging | RE<br>LIG |
| Western Screech-owl | B-WSOW | Nesting | RE |
| Yellow-breasted Chat | B-YBCH | General Living (nesting and foraging) | LIG |
| Brewer's Sparrow | B-BRSP | Nesting<br>Foraging | RE<br>LIG |
| Grasshopper Sparrow | B-GRSP | General Living (nesting and foraging) | LIG |
| Badger | M-TATA | General Living (denning and foraging) | LIA |

The Species Accounts (see Appendix A) provide descriptions of how the map themes were rated and presented, as well as full-page maps for each species. Smaller versions of each map are presented in the following sections with an interpretation of each model. We discuss the distribution of habitats and the accuracy of the model based on past sightings and wildlife observations during fieldwork.

[29] Rattlesnake general living, all year (R-CROR_LIA) ratings are used for this map theme.

## Great Basin Spadefoot

The Great Basin Spadefoot requires wetlands for courting, egg-laying, and development of eggs and larvae. The development of young spadefoots from egg to tadpole to adult is relatively quick, so temporary water bodies that dry up in summer are commonly used. Ephemeral wetlands may actually be preferred due to the absence of fish or other aquatic predators.

Other than during spring breeding, adult spadefoots spend the rest of the year in nearby terrestrial habitats. These habitats must have deep, friable soils for burying themselves to avoid desiccation during dry weather and over-wintering.

No previous observation records exist for the study area, but tadpole spadefoots were detected during fieldwork at two locations in the south-eastern portion of the study area. High suitability breeding ponds (Figure 2) appear to occur sparsely throughout the study area.

**Figure 2:** Small wetlands provide excellent breeding habitat for Great Basin Spadefoot.

The suitability model generated two map themes: aquatic breeding habitats and terrestrial living habitats (Figure 3). Breeding habitats overlay living habitats. Both themes were displayed using the highest-value method.

Suitable breeding sites predicted by the model occur throughout the study area. However, spadefoots do not generally breed in large lakes, due to the presence of fish. Breeding has been depicted as suitable within 150 m of shoreline on the main lakes, although it is unlikely that it would occur. High value breeding ponds appear scarce in the area.

Terrestrial habitats near breeding ponds are more valuable to spadefoots, but very small, temporary 'wetlands' may not have been identified in the TEM.

Spadefoots are well adapted to desert conditions, with a hardened 'spade' on their hind foot for burrowing into soils, and skin secretion that prevents dehydration while buried.

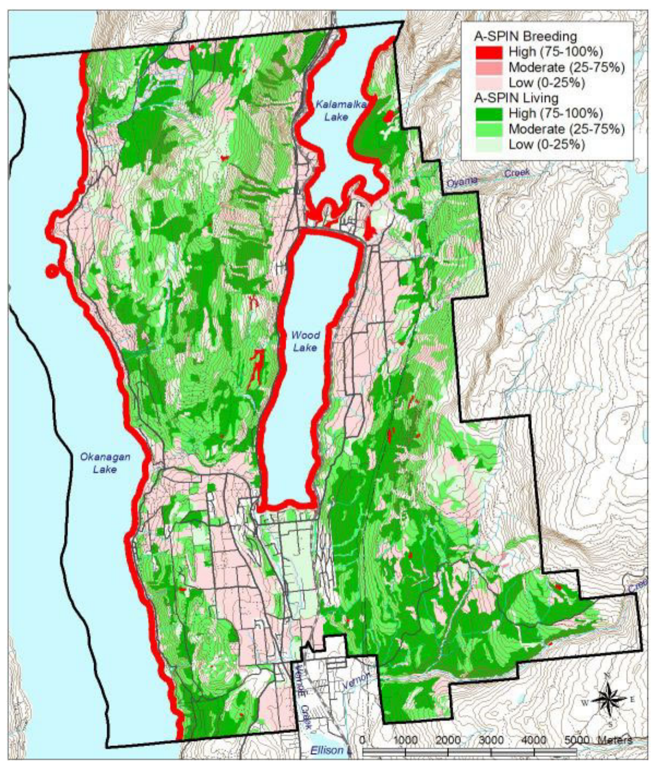


**Figure 3:** Distribution of suitable breeding and terrestrial habitats for Great Basin Spadefoot.

## Painted Turtle

Turtles require wetlands throughout the year for foraging and over-wintering. Females leave the ponds to lay eggs in nearby terrestrial habitats with coarse, well-drained soils and sparse vegetation.

Turtles only leave their ponds when females lay eggs during the summer, and the occasional dispersal, particularly if their pond dries up during a dry spell.

Painted Turtles have not been recorded from the Lake Country study area, although they likely occur in the main lakes (Kalamalka and Wood Lake). Smaller, suitable ponds are scarce in the study area but high suitability ponds (Figure 4) occur sporadically throughout the study area.

**Figure 4:** Ponds provide living habitat for Painted Turtle.

The suitability model generates two map themes: aquatic living habitats and terrestrial nesting habitats (Figure 5). Both themes are displayed using the highest-value method. Only nesting habitats within 150 m of suitable ponds are portrayed. Living is depicted as suitable only within 150 m of shoreline of large lakes.

The model predicts abundant suitable living habitat, but the majority of shoreline along the main lakes appears unsuitable for nesting. Mortality from roads along the lakeshores is potentially very high as well.

Turtles spend the winter in the mud at the bottom of ponds. During this period of inactivity, turtles respire by absorbing oxygen from water they take into their pharynx and cloaca (i.e., both ends of the digestive tract).

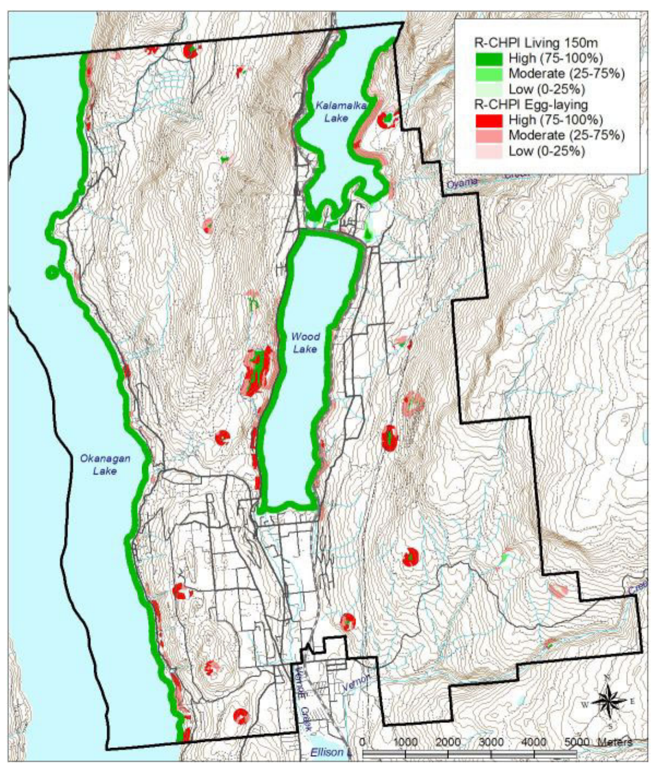


**Figure 5:** Distribution of suitable living and nesting habitats for Painted Turtle.

## Western Rattlesnake

Western Rattlesnakes require sparsely vegetated ecosystems such as rock outcroppings for hibernating. Riparian areas, broadleaf woodlands, grasslands, or open forests are used for foraging. High-value denning and basking habitats on south-facing rocky hillsides (Figure 6) were observed at 13 of the field plots.

**Figure 6:** Denning and basking habitat for rattlesnakes.

High-value foraging habitats include riparian areas and broadleaf woodlands, which support dense prey populations and have more moderate summer temperatures (Figure 7).

**Figure 7:** Foraging habitat for rattlesnakes in the heat of summer.

Suitability was modeled for two map themes for rattlesnakes; both were displayed by the highest-value method (Figure 8). The denning theme (top map layer) consists of security/thermal habitats potentially used all year, including denning during winter, basking in spring and fall, and throughout the summer for gravid females. Foraging includes habitats that likely provide security and thermal shelter as well as food.

The map depicts suitable habitat throughout the study area, particularly the northern portion.

Rattlesnakes are the only dangerously venomous snake species in BC, but will rarely bite unless threatened.

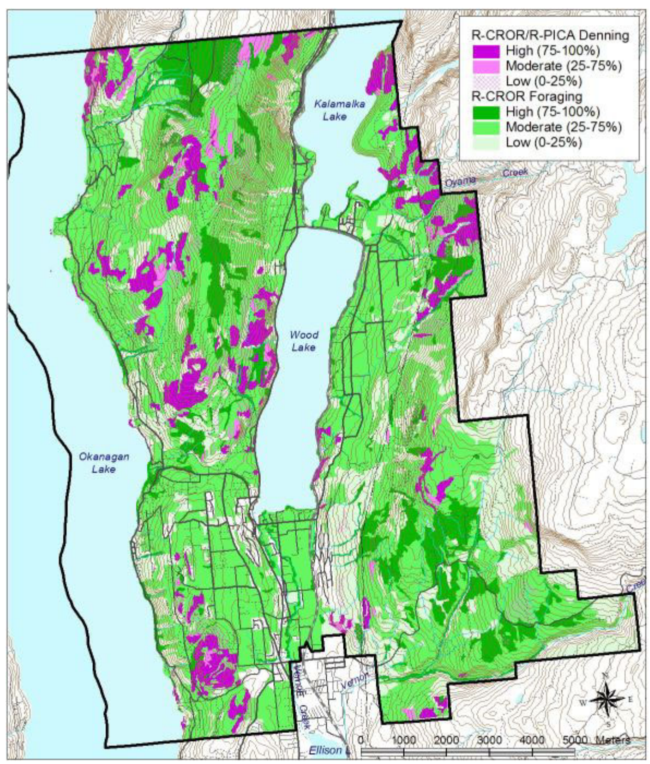


**Figure 8:** Distribution of suitable denning and foraging habitats for Western Rattlesnake.

## Gopher Snake

Gopher Snakes den in either deep-soiled grasslands or sparsely vegetated ecosystems (rocky habitats). Deep-soiled den sites were not modeled for this project, as they are very difficult to predict. Because of the similarities in rocky den sites to rattlesnake suitability, ratings were not assigned separately for Gopher Snake.

High value foraging habitat occurs in deep-soiled grasslands, broadleaf woodlands and riparian areas.

Unlike Western Rattlesnakes, Gopher Snakes lay eggs. Egg-laying habitat is frequently associated with warm-aspect grasslands with deep soils (Figure 9). We assessed seven plots of the 282 with high-value egg-laying habitat.

The only known records of Gopher Snakes from the study area are from fieldwork for this project: a road-kill near Winfield and another near Oyama.

**Figure 9:** Warm aspect slopes with sparse tree cover and deep soils are important for egg laying and foraging for Gopher Snakes.

The Gopher Snake habitat-suitability model generated three map themes. Denning is the top map layer and overlays egg-laying, which overlays general living (Figure 10). Denning was derived from the rattlesnake denning theme, and predicts only rocky den sites. This model does not attempt to predict earthen burrows that may also be used by Gopher Snakes for over-wintering. Deep-soiled, warm aspect sites were used to predict egg-laying habitat, which may also capture some den sites. The living theme depicts areas potentially rich in prey that also provide security and thermal cover.

Suitable habitat is predicted to occur throughout the study area, although the best habitat is in the grasslands southeast of Wood Lake.

Although they resemble the rattlesnake, Gopher Snakes are constrictors, and non-venomous.

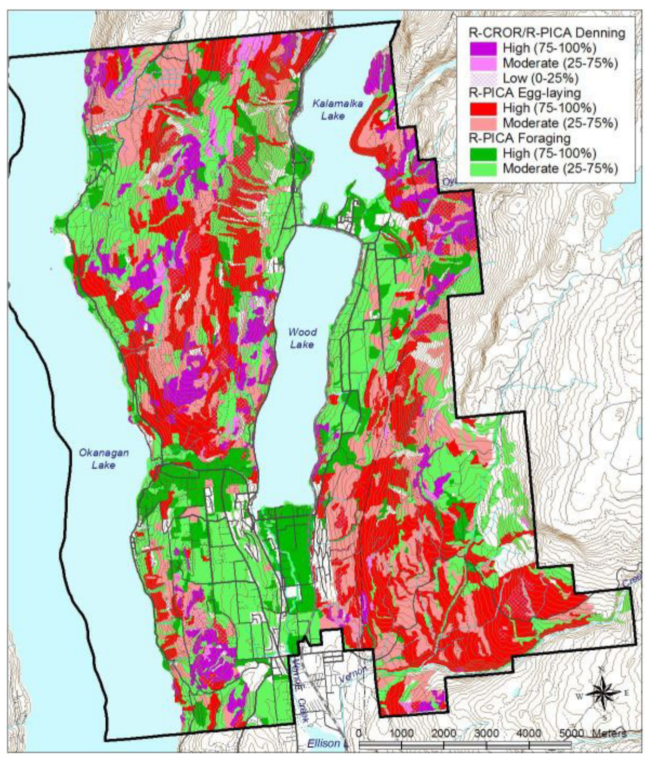


**Figure 10:** Distribution of suitable denning, egg-laying, and living habitats for Gopher Snake.

## Swainson's Hawk

These hawks require expansive, open areas for foraging, and scattered large trees in or adjacent to grasslands for nesting (Figure 11).

Swainson's Hawks were not previously known from the study area, but were observed foraging and nesting near the northern edge during fieldwork.

Eight of 282 plots were assessed as having high value nesting habitat, and 18 as high-suitability for foraging, indicating that abundant habitat exists.

**Figure 11:** Expansive grasslands for foraging and sporadic trees for nesting are critical for Swainson's Hawks.

Both the nesting (top layer) and foraging theme generated by the model were displayed using the highest-value method (Figure 12).

Most of the nesting habitat depicted occurs in the northern portion of the study area. However, very small stands of trees and isolated trees near grasslands are valuable for nesting as well.

Hawks are highly motile, hunting over a large area, and require a relatively large amount of suitable foraging habitat to support a nesting pair. Most of the best foraging areas were in the southeast portion of the study area.

The colouration of Swainson's Hawks, as well as the more common Red-tailed Hawk, is highly variable. They can be distinguished by their longer, narrower, and more pointed wings.

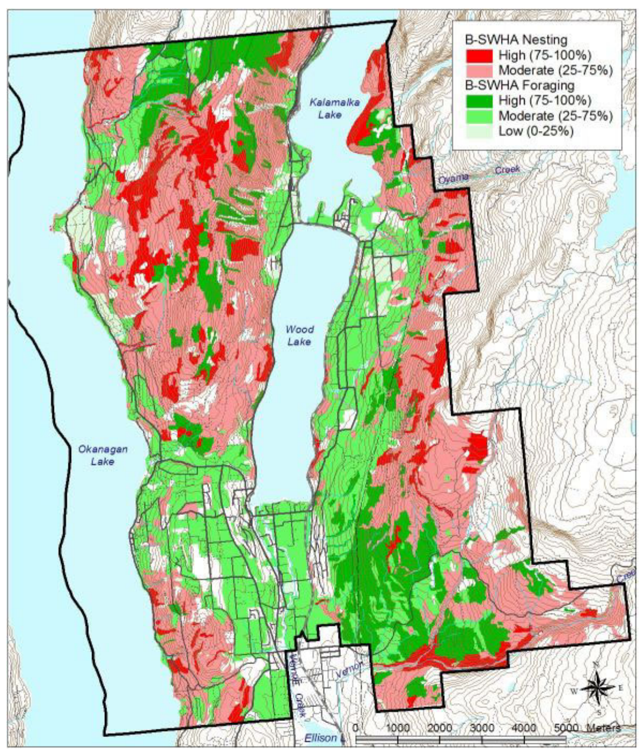


**Figure 12:** Distribution of suitable nesting and foraging habitats for Swainson's Hawk.

## Long-Billed Curlew

Curlews require fairly large areas of level to gently sloping grassland with short vegetation and no trees for nesting. Families of curlews will often move to lush cultivated fields once the young have fledged. Foraging occurs in hayfields, pastures, meadows, and grasslands.

No sign of Long-billed Curlews was detected during fieldwork, and they have not been previously recorded from the study area.

High suitability nesting habitat (Figure 13) was encountered at only three plots during fieldwork. Expanses of gently sloping grasslands are typically the first areas to succumb to development pressures.

**Figure 13:** Long-billed Curlews only nest on flat or gently sloping grasslands.

The suitability model for curlews generates two map themes: nesting and foraging (Figure 14). Curlews generally avoid nesting near treed areas, so only polygons that contain 20% or less forested ecosystems are displayed.

High suitability habitat is predicted to occur in fairly restricted areas in the southeast and northern portion of the study area. Despite the availability of grasslands in the study area, optimum nesting conditions are scarce due to slope or proximity to trees.

Curlews are very tolerant of cattle grazing, except that they are vulnerable to trampling of the eggs and young.

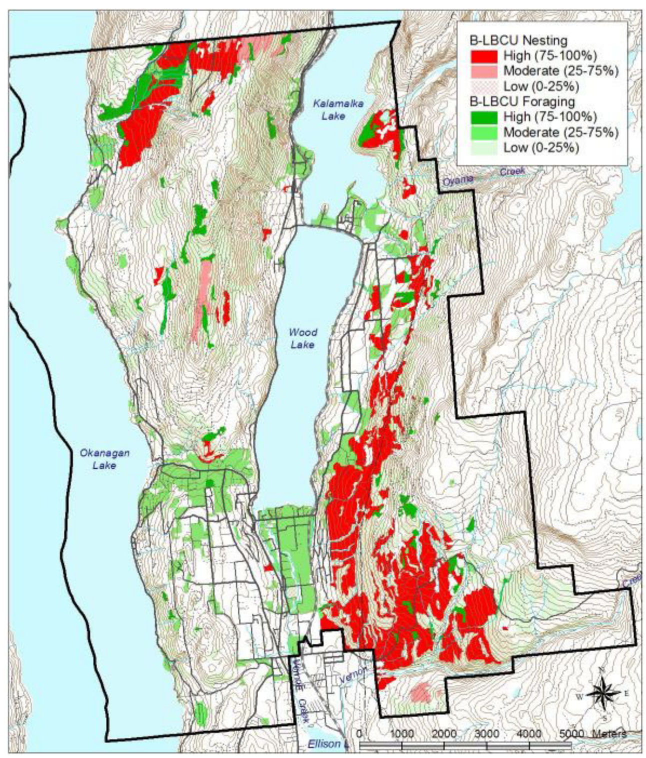


**Figure 14:** Distribution of suitable nesting and rearing habitats for Long-billed Curlew.

## Western Screech-owl

Western Screech-owls are dependant on mature to old riparian forest and most often nest in cavities in large cottonwood trees. Nesting is known from the Okanagan valley floor as far north as Coldstream Creek, and also in the middle Shuswap (J. Hobbs, H. Davis pers. comms.).

We found no evidence of Western Screech-owls during fieldwork, but one previous record exists for the study area near Winfield.

Potential high-value nesting habitat was observed at three plots, all dominated by large cottonwood (Figure 15). A number of aspen or birch stands were assessed as moderate suitability (seven plots).

**Figure 15:** Mature cottonwood stands provide optimum nesting habitat.

The suitability model for Western Screech-owl generates only one map theme, nesting habitat, which is displayed using the highest-value method (Figure 16). Some foraging may occur in adjacent areas.

A relatively large amount of low suitable habitat is predicted to occur throughout the study areas. However, high suitability habitat consisting of mature cottonwood stands is scarce and generally restricted to remnant habitats along creeks in the southern portion of the study area.

The call of the Western Screech-owl is easily identified, described as a 'bouncing ping-pong ball'.

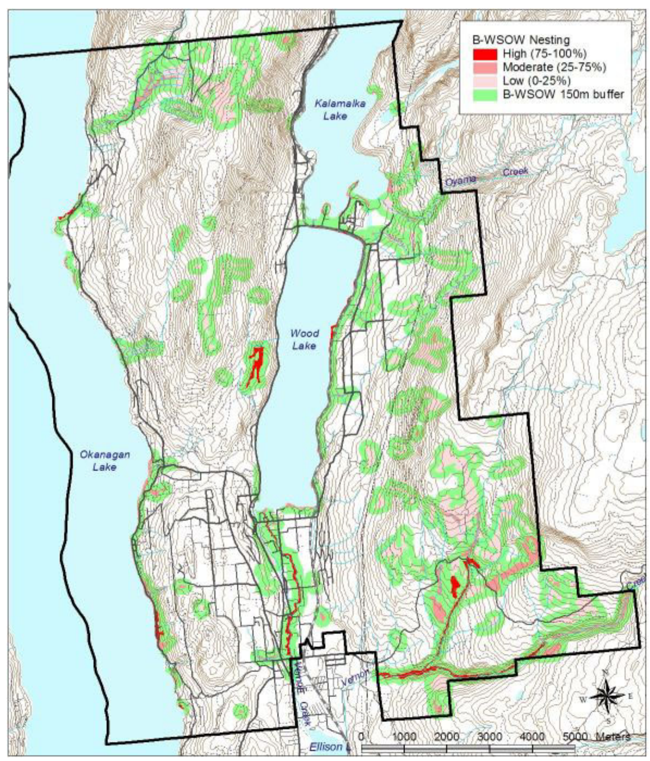


**Figure 16:** Distribution of suitable nesting habitat for Western Screech-owl.

## Yellow-breasted Chat

These songbirds are dependant on riparian areas with a shrubby understory, preferably with dense wild rose and snowberry.

Yellow-breasted Chats were not observed during fieldwork, and no previous records are known from the study area. However, the lowlands south of Wood Lake would have been prime habitat at one time.

High suitability habitat for Yellow-breasted Chats (Figure 17) was recorded at only one plot. Some other sites would be of high value except that the amount of cattle use has resulted in degradation of the shrubby understory vegetation.

**Figure 17:** Dense stands of rose and other deciduous shrubs provide potential nesting habitat.

All chat activity is generally confined to a nesting territory. Therefore, there is only one map theme (living), which includes nesting and foraging (Figure 18). This theme is displayed using the highest-value method.

Chat habitat often occurs as small strips or pockets, and likely occupies only a portion of some of the polygons identified. These are usually located in gullies or around wetlands.

Chats earned their name because of their noisy and highly diverse range of calls, including a typical 'chat-chat-chat-chat'. They are one of the very few songbirds that are vocal at night.

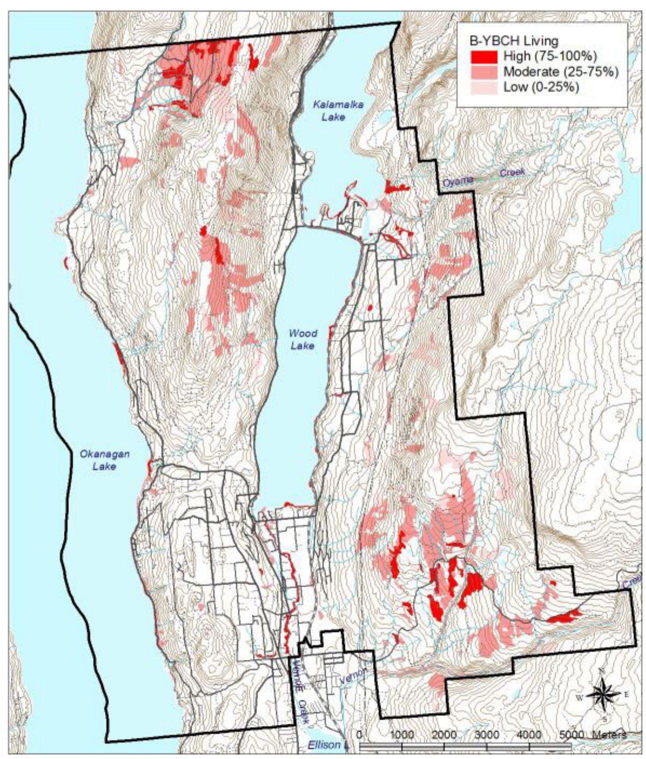


**Figure 18:** Distribution of suitable living (including nesting) habitat for Yellow-breasted Chat.

## Grasshopper Sparrow

Grasshopper Sparrows generally occur in grasslands with little or no sagebrush or trees, which are flat or on gentle warm aspects.

Grasshopper Sparrows have not been recorded from the study area.

High suitability living habitat (Figure 19) was encountered at ten of the plots assessed.

**Figure 19:** Open grasslands are important nesting habitats for Grasshopper Sparrows.

Nesting and foraging by Grasshopper Sparrows generally occurs in the same type of habitat. Therefore, the model generated only one map theme: living (Figure 20). The theme is displayed using the dot-density method, as this bird prefers fairly large areas of suitable habitat. This allows the visualization of contiguity and where unsuitable habitats occur in otherwise suitable polygons.

Large areas of high-rated living habitats are concentrated in the southeast portion of the study area, and west of Kalamalka Lake. High and moderate rated living habitats should be the target of inventories.

Grasshopper Sparrows nest on the ground, usually at the base of bunchgrasses, and use the overhanging vegetation to build a dome with a side entrance. They received their name from a portion of their call that resembles the buzz of a grasshopper.

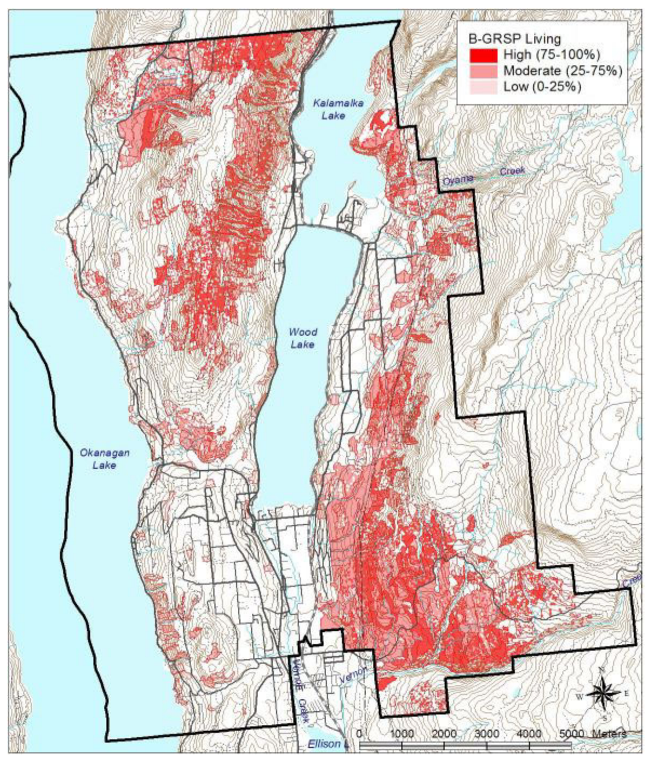


**Figure 20:** Distribution of suitable living habitat for Grasshopper Sparrow.

## Spotted Bat

Spotted Bats roost in crevices in large, sheer cliffs, which are also used by maternal colonies where females give birth to young.

No roosts are known from the study area.

Only marginal habitat was encountered in the study area (Figure 21).

**Figure 21:** Crevices in large, sheer cliffs provide protection from predators.

The Spotted Bat suitability model generates just the one theme: breeding, which also includes non-maternity roosting (Figure 22).

The model predicts no high-suitable habitat, and very little moderate suitability, as verified by fieldwork. Because of the scarcity of suitable roosting habitat, the cliffs that do exist may be extremely important for this species.

Spotted Bats are the only bat species in BC whose echolocation calls are audible to the human ear, which sound like a series of high-pitched ticks.

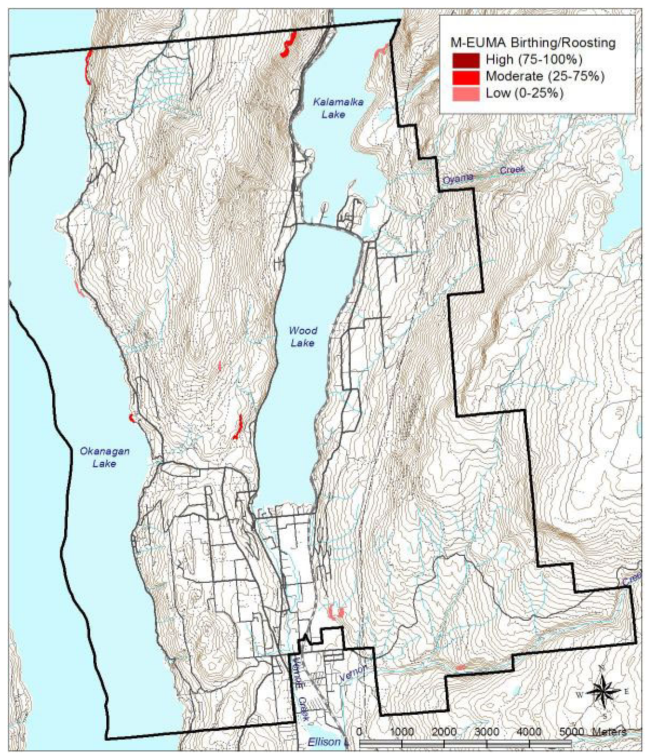


**Figure 22:** Distribution of suitable breeding habitat for Spotted Bat.

## Badger

Badgers are usually residents of deep-soiled grasslands (Figure 23) although they will venture into a broad range of habitats. The north Okanagan has an abundance of deep-soiled grasslands that probably historically supported stable Badger populations.

We found old Badger burrows at one location east of Winfield.

Many plots were assessed as high-value habitat during fieldwork, including suitability for maternity dens.

**Figure 23:** Expansive, deep-soiled grasslands without road traffic are essential for Badger populations.

One map theme, living, is generated by the model, which includes foraging and denning (Figure 24). The dot density method is used to display habitat values, as this gives an indication of the proportion of the polygon suitable for use.

Suitable burrowing habitat may occur as small pockets within a polygon. The abundance of rodent prey could not be directly included in the habitat suitability model, but pocket gopher burrows often occurred in small pockets of deep soil throughout the rolling topography of much of the study area. However, badgers commonly forage for more colonial prey (i.e., marmots and ground squirrels), displaying patchy use of habitats.

Badger populations have likely declined from habitat loss, persecution and traffic mortality. Fragmentation of habitats has also likely contributed to their decline.

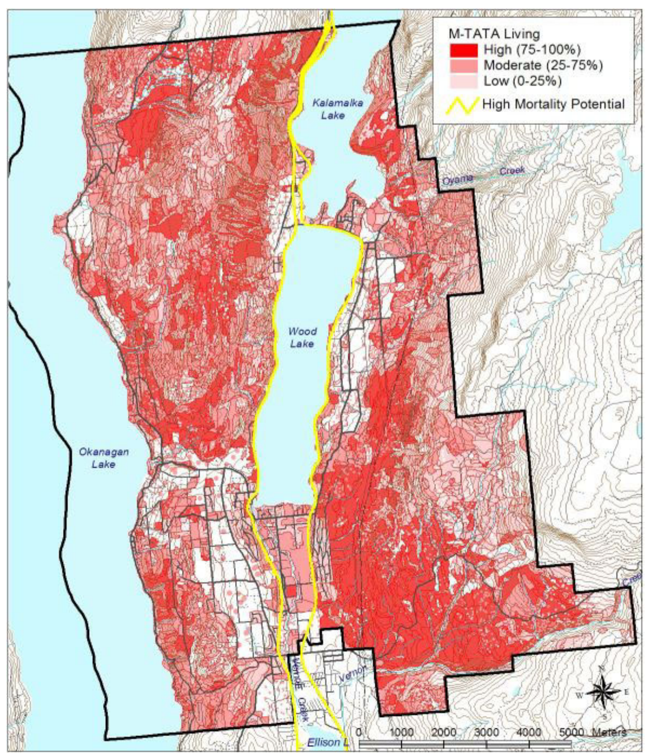


**Figure 24:** Distribution of suitable living habitat for Badger.

## 3.5 Composite Critical Habitat Map

Ten life requisites were chosen to represent the most limiting habitat requirements of the project wildlife species (Table 6). This does not imply that the species or life requisites omitted are not as important. Rather, their needs may be met if habitats for the remainder of the map themes are conserved.

**Table 6: Map themes used in composite critical habitat map.**

| Species | Species Code | Map Theme | Rating Code |
|---|---|---|---|
| Great Basin Spadefoot | A-SPIN | Breeding | RE |
| Western Rattlesnake | R-CROR | Basking / denning | LIA |
| Gopher Snake | R-PICA | Egg-laying | RE |
| Swainson's Hawk | B-SWHA | Nesting | RE |
| Long-billed Curlew | B-LBCU | Nesting | RE |
| Western Screech-owl | B-WSOW | Nesting | RE |
| Yellow-breasted Chat | B-YBCH | General Living (nesting and foraging) | LIG |
| Grasshopper Sparrow | B-GRSP | General Living (nesting and foraging) | LIG |
| Spotted Bat | M-EUMA | Breeding/Roosting | RB |
| Badger | M-TATA | General Living (denning and foraging) | LIA |

A composite critical habitat map of high- and moderate-value habitats for the ten critical map themes was generated and is presented in Figure 25. This map is displayed using the highest-value method. While this method is excellent for highlighting polygons containing important areas, it often tends to exaggerate the amount of valuable area, as entire polygons are shown by the highest value they contain.

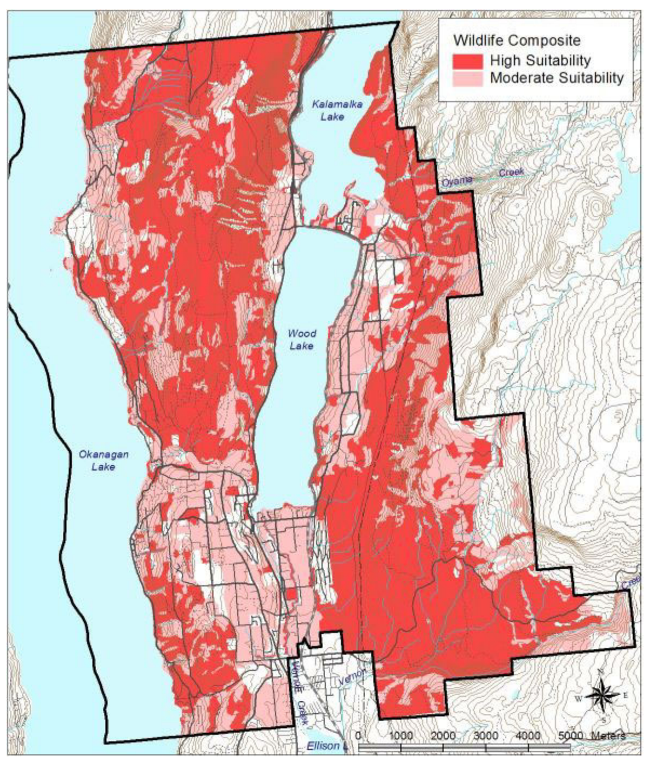


**Figure 25:** High and Moderate ratings for ten critical life requisites, displayed using highest value method.

The composite wildlife map portrays abundant high-suitability habitat, indicating that the majority of polygons in the study area contains valuable habitat for at least one of the project species. The map should be used to view important habitats on a landscape level. For areas of interest, refer to individual wildlife habitat models and investigate them in the field to assess values.

## 3.6 Habitat Values of Sensitive Ecosystems

Sensitive Ecosystem Inventory categories[30] are shown in Figure 26 by largest area, which portrays the dominant component of each polygon. Almost all polygons dominated by *sensitive ecosystems* have high suitability for at least one of the project wildlife species (see Figure 25). *Other important ecosystems*, particularly disturbed grasslands, often have high value for many of the project wildlife species as well. It should be noted that because the SEI categories are displayed using largest area, many of the polygons likely contain higher SEI values than shown.

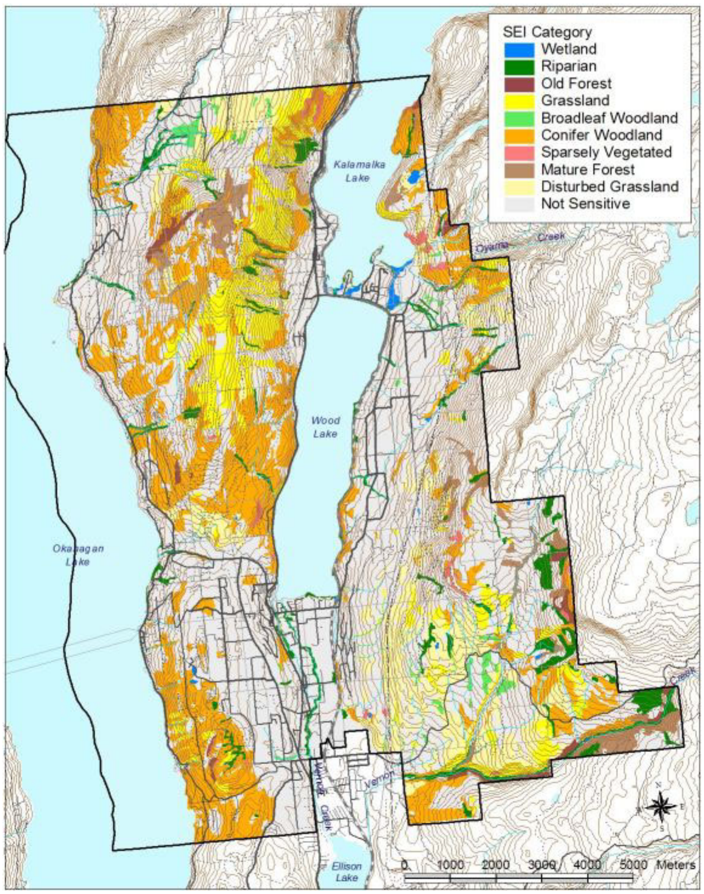


**Figure 26:** Sensitive ecosystem mapping, displayed using largest area method.

Many polygons without sensitive or other important ecosystems may still provide important wildlife habitat for species at risk, including rural and agricultural areas, and very weedy grasslands with little or no native vegetation.

30 Iverson 2006

The Conservation Analysis described in Volume 1[31] takes into account not only the rarity and fragility of ecosystems (sensitive ecosystems), but also the condition of the ecosystems and wildlife values (Figure 27). The Conservation Zones resulting from the Conservation Analysis appear to protect the bulk of critical habitat for all project species, including important wildlife corridors.

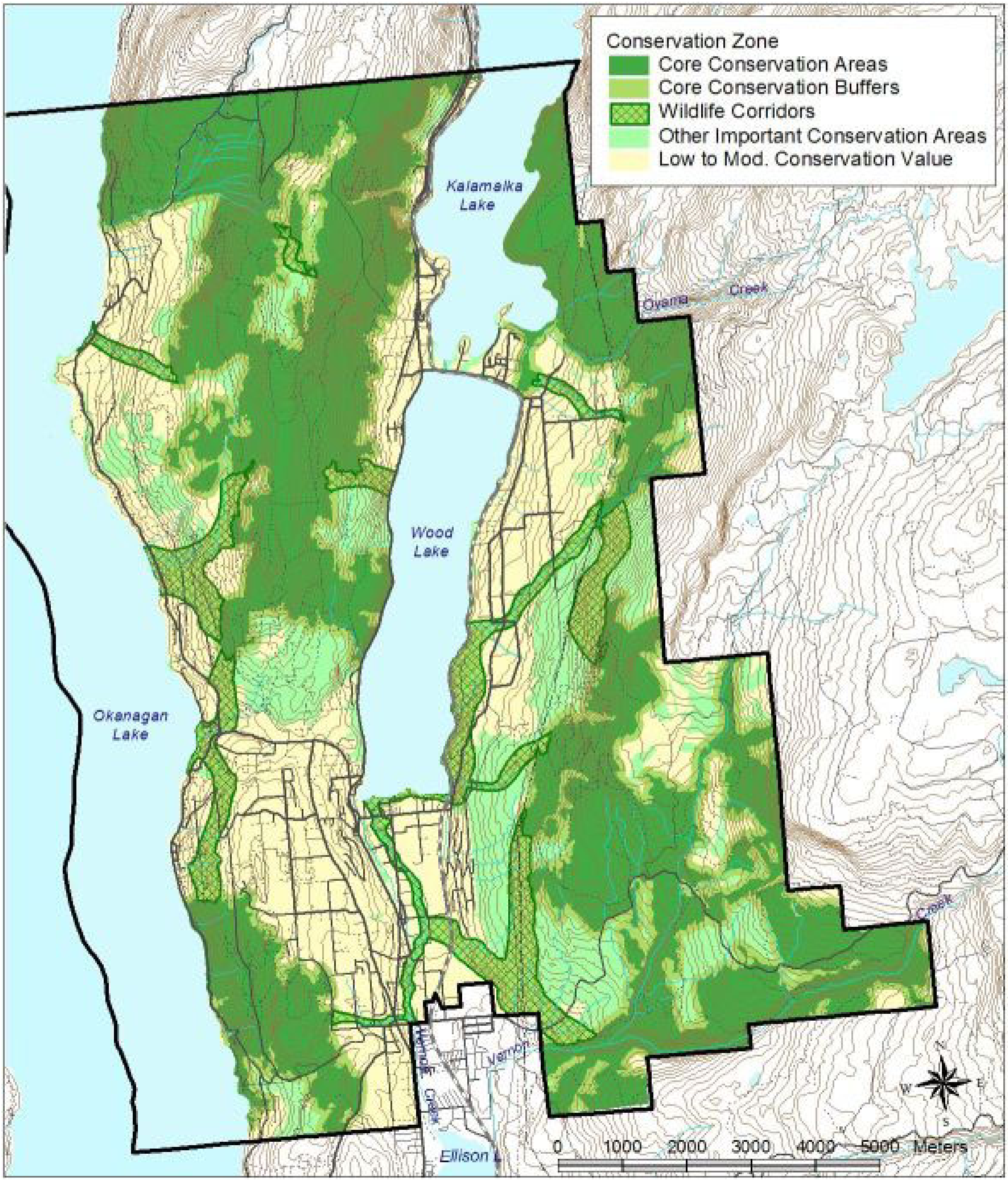


**Figure 27:** Conservation Zones resulting from the SEI Conservation Analysis.

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31 Iverson 2006

# 4 Recommendations

Local government, BC Parks, landowners, consultants, and other interested groups can use the wildlife habitat mapping in a number of ways. As a management tool, the wildlife suitability maps can be used to direct broad wildlife management strategies, such as recovery of habitats for species at risk and ecosystem management practices, including prescribed burns. As a landscape-level planning tool, the Conservation Zones (Figure 27) resulting from the Conservation Analysis can be used to direct development towards less sensitive areas. The composite critical habitats map (Figure 25) should be used to identify potentially critical areas that should be considered for conservation unless an environmental impact assessment recommends adjustments to these boundaries. A development permit bylaw could restrict development on these areas until they are assessed. Assessments should address the relevancy of each of the wildlife suitability models within the area of interest, as a minimum standard. The Regional District of Central Okanagan's 'Terms of Reference: Professional Reports for Planning Services' should be used as a minimum standard for conducting environmental assessments[32]. Volume 1[33] of the Sensitive Ecosystem Inventory contains additional environmental impact assessment guidelines.

Due to the wildlife significance of the area, environmental impact assessments should not only concentrate on ground-truthing the results of these suitability models, but should also inventory for other species at risk and their critical habitats. Volume 1[33] provides lists of species at risk that may be associated with each sensitive or other important ecosystem.

Anyone conducting environmental impact assessments using this information should have a good understanding of each species' habitat requirements and associated threats when evaluating development impacts and establishing environmentally sensitive areas (ESA). Best Management Practices are being developed for many species at risk, and these should be consulted in addition to the management recommendations outlined here.

Many wildlife species require connectivity throughout their range, and this should be given consideration when assessing the lands of interest in context with the surrounding area. Priority areas should be secured for conservation.

The following are brief management guidelines for each of the project wildlife species.

## 4.1 Great Basin Spadefoot

Inventories are required to determine which ponds are used for breeding. This data can be used to adjust the suitability for terrestrial habitats. Generally, buffers around breeding sites should be at least 350 m[34] to protect both breeding and adjacent terrestrial habitats and to avoid road and other mortality. However, this could vary depending on the suitability of upland habitat. Spadefoots may travel several hundred metres from ponds, and up to 1.5 km, so buffers should be extended to encompass the highest-suitability surrounding habitat, attempting to capture at least 5 ha of terrestrial area[35].

Corridors must be maintained between ponds and foraging sites. Developments that pose a hazard or obstruction to spadefoots, including roads, retaining walls, and steep-sided trenches, should not occur

[32] Regional District of Central Okanagan 2005
[33] Iverson 2006
[34] Semlitsch and Bodie 2003
[35] Sarell 2004

between aquatic breeding habitats and nearby suitable terrestrial habitats. Management should also consider the connectivity between aquatic habitats, to maintain gene flow between spadefoot populations. Artificial breeding habitats can be created as part of mitigation programs.

## 4.2 Western Rattlesnake and Gopher Snake

Management of Low, Moderate and High potential denning habitats should include a no-development zone, unless an inventory has demonstrated that the depicted habitat(s) are not used. Recreational corridors should avoid these areas to minimize human-snake conflicts, including mortality from mountain bikes and vehicles. Summer foraging areas should be carefully assessed to determine whether any development is appropriate, and if so, what mitigation measures are required. Although corridors to allow snake movement from winter security/thermal habitats to summer foraging habitats have not been mapped, they should be interpreted and applied to project planning. Roads should not intersect any of these areas unless appropriate mitigation measures are employed to avoid traffic mortalities. Paved roads are a particularly large threat to snakes due to their habit of basking on the warm surface for thermoregulation. Snake exclusion fencing may be required to reduce encounters and mortality in developed areas.

## 4.3 Long-Billed Curlew

Conduct inventories in grassland habitats during the breeding season to determine whether Long-billed Curlews are present. Curlews require an expanse of level to gently sloping grasslands. Any development in these areas, including roadways and recreational corridors, will significantly impact these birds. Livestock should not access these areas during the breeding season to protect nests from trampling. Domestic cats should not be permitted in these areas as they may prey upon adults and nestlings.

## 4.4 Swainson's Hawk

Inventories during the breeding season should be conducted to locate existing nest trees. Conserve wide grassland networks between nest trees and other suitable nesting habitats. Do not locate transportation or recreational corridors within 100 m of nest trees.

## 4.5 Western Screech-owl

Spring inventories are required to determine whether nesting occurs in riparian forests in the study area. Maintain deciduous and mixed stands, including wildlife trees, to provide nesting and foraging habitats. Incorporate surrounding natural habitats, particularly meadows, as a buffer to these areas. Nest boxes can help to mitigate small losses of nesting habitat.

## 4.6 Grasshopper Sparrow

Breeding season inventories are required to determine the extent to which they occur in grassland habitats, including weedy sites. They are semi-colonial but often shift their breeding territories between years. Therefore, additional suitable grassland habitats should be retained to accommodate breeding in subsequent years. A buffer to reduce disturbances is also recommended. Livestock should not access these areas during the breeding season to protect nests from trampling. Domestic cats should not be permitted in these areas as they may prey upon adults and nestlings.

## 4.7 Yellow-breasted Chat

Inventories during the breeding season are required to determine where they occur in the study area. Maintain deciduous stands and restore shrubby understory, particularly wild rose. Livestock should have limited access to these areas as they reduce the shrubby component of these ecosystems. Buffers should be incorporated to reduce disturbances to these areas. Domestic cats should not be permitted in these areas, as they may prey upon adults and nestlings.

## 4.8 Spotted Bat

Spotted Bats roost in large cliffs and may hibernate in these features as well. Generally there are few impacts to cliffs from human activities. Development and blasting should not be permitted within 200 m of a roost cliff. New developments should have shielded streetlights. Recreational rock climbing should not be permitted on roost cliffs.

## 4.9 Badger

Inventories should be conducted to locate burrows, particularly maternal burrows, although differentiating between maternal and other types of burrows is difficult. The most critical habitat sites for Badgers are their maternal dens and adjacent foraging areas. Burrows usually occur in deep soils on gentle to moderate sloping grasslands, often adjacent to significant populations of ground squirrels, marmots or pocket gophers. Management should ensure there is no disturbance to occupied or maternal burrow sites and that no activities significantly affect prey species or create barriers between suitable areas. Corridors or connectivity should be maintained with other natural areas to allow for their high degree of motility and dispersion. Road placement should avoid intersecting suitable badger habitat, as road mortality is the major cause of death for this species (Weir et al. 2005). Landowners may wish to conduct inventories to specifically identify important badger habitats.

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# Appendices

## Appendix A: Data Access

Spatial and non-spatial data for the Sensitive Ecosystems Inventory and Terrestrial Ecosystem Mapping (TEM), including wildlife mapping, are available for download at the former Ministry of Sustainable Resource Management's Terrestrial Ecosystem Mapping Data Warehouse at: http://srmwww.gov.bc.ca/ecology/tem/dataware.html

The following are available:

- Project metadata
- SEI report (Volume 1)[36]
- Arc/Info *.E00 Export Files includes two spatial coverages: ECI field sampling points and a ECP TEM polygon coverage
- TEM Polygon Attributes
- TEM Map Legend Files
- TEM report with expanded legend (Volume 2)[37]
- Wildlife Species Accounts
- Wildlife Ratings Tables
- Wildlife Report (Volume 3)

[36] Iverson 2006
[37] Iverson and Uunila 2006

## Appendix B: Known and potential rare wildlife species in the study area.

| Common Name | Scientific Name | Occurrence in Study Area | Prov. Status | COSEWIC Status |
|---|---|---|---|---|
| **Amphibians** | | | | |
| Tiger Salamander | *Ambystoma tigrinum* | unknown | Red | Endangered |
| Great Basin Spadefoot | *Spea intermontana* | southeast, likely throughout | Blue | Threatened |
| Western Toad | *Bufo boreus* | unknown but likely | - | Special Concern |
| **Reptiles** | | | | |
| Painted Turtle | *Chrysemis picta* | unknown but likely | Blue | - |
| Western Skink | *Eumeces skiltonianus* | unknown but possible | Blue | Special Concern |
| Western Rattlesnake | *Crotalus oreganus* | two locations, likely throughout | Blue | Threatened |
| Gopher Snake | *Pituophis catenifer* | two locations, likely throughout | Blue | Threatened |
| Racer | *Coluber contrictor* | northern portion, likely throughout | Blue | Special Concern |
| Rubber Boa | *Charina bottae* | unknown but likely | - | Special Concern |
| **Birds** | | | | |
| Great Blue Heron | *Ardea herodias* ssp. *herodias* | unknown but possible | Blue | - |
| California Gull | *Larus californicus* | unknown but possible | Blue | - |
| American Avocet | *Recurvirostre americana* | unknown and unlikely | Red | - |
| Long-billed Curlew | *Numenius americanus* | unknown but possible | Blue | Special Concern |
| Upland Sandpiper | *Bartramia longicauda* | unknown but possible | Red | - |
| Swainson's Hawk | *Buteo swainsoni* | northern edge, possibly throughout | Red | - |
| Ferruginous Hawk | *Buteo regalis* | unknown but possible | Red | Special Concern |
| Western Screech-owl | *Megascops kennicotti* ssp. *macfarlanei* | one location | Red | Endangered |
| Flammulated Owl | *Otus flammeolus* | unknown but likely | Blue | Special Concern |
| Short-eared Owl | *Asio flammeus* | unknown but possible | Blue | Special Concern |
| White-throated Swift | *Aeronautes saxatalis* | forage throughout, poor breeding | Blue | - |
| Lewis' Woodpecker | *Melanerpes lewis* | unknown but likely | Blue | Special Concern |
| Yellow-breasted Chat | *Icteria virens* | unknown but possible | Red | Endangered |
| Brewer's Sparrow | *Spizella breweri breweri* | unknown and unlikely | Red | - |
| Grasshopper Sparrow | *Ammodramus savannarum* | unknown but possible | Red | - |
| Lark Sparrow | *Chondestes grammacus* | unknown but possible | Red | - |
| **Mammals** | | | | |
| Merriam's Shrew | *Sorex merriami* | unknown but possible | Red | - |
| Preble's Shrew | *Sorex prebeii* | unknown but possible | Red | - |
| Townsend's Big-eared Bat | *Corynorhinus townsendii* | unknown but likely | Blue | - |
| Spotted Bat | *Euderma maculatum* | unknown but possible | Blue | Special Concern |
| Pallid Bat | *Antrozous pallidus* | unknown but possible | Red | Threatened |
| Fringed Myotis | *Myotis thysanodes* | unknown but likely | Blue | Special Concern |
| Western Small-footed Myotis | *Myostis ciliolabrum* | unknown but likely | Blue | - |
| Western Harvet Mouse | *Reinthrodontomys megalotis* | unknown but possible | Blue | Special Concern |
| Great Basin Pocket Mouse | *Perognathus parvus* | unknown but possible | Blue | - |
| Nuttall's Cottontail | *Sylvilagus nuttallii* ssp. *nuttallii* | unknown and unlikely | Blue | Special Concern |
| Badger | *Taxidea taxus* | one location, likely rare throughout | Red | Endangered |

## Appendix C: Wildlife Habitat Assessment Forms

BRITISH COLUMBIA

WILDLIFE HABITAT ASSESSMENT

| Proj. id. | | Date y m d | N-hab. feature | type | | page of |
|---|---|---|---|---|---|---|
| Plot no. | Surveyor | | | dst. | | |

| Species | Hab use / Ssn | | Plot type | | | | Plot-in-context | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5-letter code | Sp. L.R. | Ssn. | FD | SH | TH | Com. | Habitat feature | Conf. | Distance (km) | F/C L.R. | Imp. | Habitat feature | Conf. | Distance (km) | F/C L.R. | Imp. | FD | SH | TH | Suit. | Com. |

Comments / Notes

FS 882 (5) HRE 98/5

BRITISH COLUMBIA

WILDLIFE HABITAT ASSESSMENT

| Project id. | | Plot no. |
|---|---|---|

| Evidence of Use | Inside plot | | | | | | Outside plot and inside ecosystem unit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Sex | Life Stage | Activity | Des. | No. | Com. | Sex | Life Stage | Activity | Des. | No. | Sex | Life Stage | Activity | Des. | No. | Com. |

Comments / Notes

**Abbreviated Tree Attributes for Wildlife**

| B.A.F. | Area | Min DBH |
|---|---|---|
| No. of trees | No. dead | No. live |
| Avg. DBH (cm) | Avg. length (m) | |
| Avg. lich load class | Comments | |

**Simple Coarse Woody Debris** Sampled m of 30 m transect

| Piece # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Decay class | | | | | | | | | | | |
| Diam. class | | | | | | | | | | | |
| Piece # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Decay class | | | | | | | | | | | |
| Diam. class | | | | | | | | | | | |
| Comments | | | | | | | | | | | |

**Management**

| Species (Sp. group) | Use | Ssn. | F/C LR(s) | Cap. | Mgmt. Tech. | M. Feat / Int | Comments / Notes |
|---|---|---|---|---|---|---|---|

FS 882 (5) HRE 98/5

Completed data forms submitted to the Ministry of Environment.

## Appendix D: Ratings Table

Ratings Table filename: lkc_wl-ratings_15Feb06.csv (See Appendix A for access)

Example of Ratings Table format:

| ECO_SEC | BGC_ZONE | BGC_SUBZON | BGC_VRT | SITEMC_S | SITE_MA | SITE_MB | STRCT_S | STRCT_M | STAND_A | SERAL | A-SPIN_RE | A-SPIN_LIA | RCHPI_LIA | RCHPI_RE | R-CROR_LIS | R-CROR_LIA | R-PICA_LIG | R-PICA_RE | B-SWHA_RE | B-SWHA_LIG | B-LBCU_RE | B-LBCU_LIG | B-WSOW_RE | B-YBCH_LIG | B-GRSP_LIG | M-EUMA_RB | M-TATA_LIA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NOB | IDF | xh | 1 | AS | | | 3 | | | | L | L | N | N | H | N | M | N | N | N | N | N | N | M | N | N | N |
| NOB | IDF | xh | 1 | AS | | | 4 | | B | | L | L | N | N | H | N | M | N | N | N | N | N | N | H | N | N | N |
| NOB | IDF | xh | 1 | AS | | | 5 | | B | | L | L | N | N | H | N | M | N | N | N | N | N | L | H | N | N | N |
| NOB | IDF | xh | 1 | AS | | | 6 | | B | | L | L | N | N | H | N | M | N | N | N | N | N | M | H | N | N | N |
| NOB | IDF | xh | 1 | AS | | | 7 | | B | | L | L | N | N | H | N | M | N | N | N | N | N | M | H | N | N | N |
| NOB | IDF | xh | 1 | AS | g | | 3 | | | | L | L | N | N | H | N | M | N | N | N | N | N | N | M | N | N | N |
| NOB | IDF | xh | 1 | AS | g | | 4 | | B | | L | L | N | N | H | N | M | N | N | N | N | N | N | H | N | N | N |
| NOB | IDF | xh | 1 | AS | g | | 5 | | B | | L | L | N | N | H | N | M | N | N | N | N | N | L | H | N | N | N |
| NOB | IDF | xh | 1 | AS | g | | 6 | | B | | L | L | N | N | H | N | M | N | N | N | N | N | M | H | N | N | N |
| NOB | IDF | xh | 1 | AS | g | | 7 | | B | | L | L | N | N | H | N | M | N | N | N | N | N | M | H | N | N | N |
| NOB | IDF | xh | 1 | AS | g | k | 5 | | B | | N | N | N | N | M | N | L | N | N | N | N | N | L | H | N | N | N |
| NOB | IDF | xh | 1 | AS | g | w | 3 | | | | N | L | N | N | H | N | M | N | N | N | N | N | N | M | N | N | N |
| NOB | IDF | xh | 1 | AS | g | w | 4 | | B | | N | L | N | N | H | N | M | N | N | N | N | N | N | H | N | N | N |
| NOB | IDF | xh | 1 | AS | g | w | 5 | | B | | N | L | N | N | H | N | M | N | N | N | N | N | L | H | N | N | N |
| NOB | IDF | xh | 1 | AS | g | w | 6 | | B | | N | L | N | N | H | N | M | N | N | N | N | N | M | H | N | N | N |
| NOB | IDF | xh | 1 | AS | g | w | 7 | | B | | N | L | N | N | H | N | M | N | N | N | N | N | M | H | N | N | N |
| NOB | IDF | xh | 1 | AS | k | | 3 | | | | N | N | N | N | M | N | L | N | N | N | N | N | N | M | N | N | N |
| NOB | IDF | xh | 1 | AS | k | | 4 | | B | | N | N | N | N | M | N | L | N | N | N | N | N | N | H | N | N | N |
| NOB | IDF | xh | 1 | AS | k | | 5 | | B | | N | N | N | N | M | N | L | N | N | N | N | N | L | H | N | N | N |
| NOB | IDF | xh | 1 | AS | k | | 6 | | B | | N | N | N | N | M | N | L | N | N | N | N | N | M | H | N | N | N |
| NOB | IDF | xh | 1 | AS | k | | 7 | | B | | N | N | N | N | M | N | L | N | N | N | N | N | M | H | N | N | N |
| NOB | IDF | xh | 1 | AS | n | | 4 | | B | | N | L | N | N | H | N | M | N | N | N | N | N | N | H | N | N | N |
| NOB | IDF | xh | 1 | AS | w | | 3 | | | | N | L | N | N | H | N | H | N | N | N | N | N | N | M | N | N | N |
| NOB | IDF | xh | 1 | AS | w | | 4 | | B | | N | L | N | N | H | N | H | N | N | N | N | N | N | H | N | N | N |
| NOB | IDF | xh | 1 | AS | w | | 5 | | B | | N | L | N | N | H | N | H | N | N | N | N | N | L | H | N | N | N |
| NOB | IDF | xh | 1 | AS | w | | 6 | | B | | N | L | N | N | H | N | H | N | N | N | N | N | M | H | N | N | N |