

**Sensitive Ecosystems Inventory:
Central Okanagan, 2000-2001**

Volume 3: Wildlife Habitat Mapping

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Executive Summary

The Okanagan Valley contains the northern-most extent of Great Basin shrub-steppe habitats. It is often transected 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 BC and in Canada, due to their rarity and declines in population. In the Central Okanagan, the shrub-steppe and associated ecosystems are scarce, creating a natural bottleneck for species dependent on shrub-steppe habitats to the North Okanagan. Extensive land development is severing habitat connectivity and contributing to wildlife and habitat declines.

The Central Okanagan Regional District (CORD) recognizes the need to incorporate sensitive ecosystem and wildlife habitat conservation in land use planning. A Sensitive Ecosystem Inventory (SEI; Iverson and Cadrin 2003) was initiated by CORD, with the support of the Ministry of Water, Lands and Air Protection. Terrestrial Ecosystem Mapping (TEM; Iverson *et al.* 2003), on which SEI is based, was conducted in 2000 and 2001, including wildlife habitat assessments.

The wildlife habitat component of the SEI is contained within this report. This includes habitat summaries and species-habitat models for nine wildlife species considered at risk in BC. Habitat ratings from these models were applied to the TEM database, and portrayed as habitat suitability maps using GIS software.

The results of this habitat mapping indicate that very little habitat remains in the study area for those species dependant on wetlands and mature riparian ecosystems (e.g. Painted Turtle and Western Screech-owl). Although rocky habitats are relatively plentiful, wildlife species that rely on them (e.g. Bighorn Sheep, Gopher Snake, Northern Pacific Rattlesnake) often require adjacent grasslands, which are not abundant in the area. Deep-soiled grasslands are particularly scarce.

Wildlife suitability models can be used alone, or preferably in conjunction with Sensitive Ecosystem Mapping, to identify potential environmental values of areas for conservation purposes (i.e., natural parks) or to guide development proposals. Areas with High and Moderate habitat suitability should be used to identify where environmental assessments should be conducted if the lands are proposed for development. The identification of these areas helps achieve the Goals and Objectives of the Environmental Protection Discussion Paper (CORD 2001), by designating these habitats as Development Permit Areas. Environmental assessments for development proposals, including on-site inventory, should be conducted to verify and revise the predictive mapping. Revised environmental attributes in a georeferenced format can be returned to the planning staff at CORD 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 monitoring the efficacy of environmental planning and adaptive management.

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1.0 Introduction

This report presents information on wildlife habitat mapping in the valley of the Central Okanagan. It is the third volume in the Central Okanagan Sensitive Ecosystems Inventory reports.

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 (RIC 1999). 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 RIC standards for developing wildlife habitat ratings in British Columbia (RIC 1999):

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 over every occurring ecosystem unit (i.e. every site series / structural stage / site modifier combination).

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

Percent of Provincial Benchmark*	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	Low	L		
6 - 25 %	Low	4				
1 - 5 %	Very Low	5	Nil	N	Likely No Value	X
0%	Nil	6				

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

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. Both of these also influence the wildlife assemblage and use within an area. During Terrestrial Ecosystem Mapping (TEM), the specific ecological conditions (e.g. terrain, vegetation communities, and structural stage) for each polygon are assessed. TEM is used in a habitat model by assigning each ecosystem unit a wildlife habitat rating. These ratings are then joined with the TEM database and spatial data using GIS, and portrayed as a habitat suitability and/or capability map of the study area.

The field component of TEM is highly valuable, in that the terrain, vegetation and wildlife aspects can be assessed in the field, contributing to a greater accuracy of interpreted habitat use for wildlife. Field sampling is used to extrapolate the occurrence of certain habitat features, such as snags and coarse woody debris, to the types of habitats they commonly occur in.

Sensitive Ecosystems Inventory (SEI) focuses on rare or sensitive ecosystems and the prime or critical habitats for select wildlife species. Often, sensitive ecosystems contain important habitats for many wildlife species. SEI takes into account ecological rarity and sensitivity, and wildlife habitat suitability of TEM units.

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's and Nation's rare and endangered species. The area also has attracted considerable human settlement and the associated land developments. Previous land development 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 mapping can dramatically improve development 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.

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

1.4 Objectives

The objective of wildlife habitat mapping is to provide input to land-use planning in the Central Okanagan Regional District (CORD) 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 and significance of identified areas.

2.0 Methods

2.1 Project Wildlife Species

Ten wildlife species, all known to occur in the Kelowna area, were initially selected to demonstrate important wildlife habitats in the study area (Table 2). These species satisfy the following RIC (1999) criteria 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.

Except for Mule Deer, all of the selected species are considered at risk in the Province (CDC 2002). Some of these species have also been designated through Federal listings (COSEWIC 2002).

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

Common Name	Scientific Name	Prov. Status ¹	COSEWIC Status ²	Rating Scheme
Painted Turtle	<i>Chrysemys picta</i>	Blue	-	4-class
Northern Pacific Rattlesnake	<i>Crotalus oreganus</i>	Blue	pending	4-class
Gopher Snake	<i>Pituophis catenifer</i>	Blue	Threatened	4-class
Flammulated Owl	<i>Otus flammeolus</i>	Blue	Special Concern	4-class
Interior Western Screech-owl	<i>Otus kennicotti macfarlanei</i>	Red	Endangered	4-class
Lewis' Woodpecker	<i>Melanerpes lewis</i>	Blue	Special Concern	4-class
Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>	Blue	pending	4-class
Badger	<i>Taxidea taxus</i>	Red	Endangered	4-class
Mule Deer	<i>Odocoileus hemionus hemionus</i>	Yellow	-	6-class
California Bighorn Sheep	<i>Ovis canadensis californiana</i>	Blue	-	6-class

¹Provincial status:

Red List = indigenous species or subspecies (taxa) considered *Extirpated*², *Endangered*², or *Threatened*² in BC.

Blue List = indigenous taxa considered Vulnerable (special concern²) in BC.

Yellow List = indigenous species or subspecies not at risk in BC.

² COSEWIC (Committee on the Status of Wildlife in Canada) status:

Extirpated = no longer exist in the wild in Canada, but do occur elsewhere.

Endangered = facing imminent extirpation or extinction.

Threatened = likely to become endangered if limiting factors are not reversed.

Special Concern = of special concern because of characteristics that make them particularly sensitive to human activities or natural events.

2.2 Species-Habitat Models

Wildlife habitat was modeled for the Central Okanagan TEM according to the standards in the *BC Wildlife Habitat Ratings Standards - Version 2.0* (RIC 1999).

There are two basic components to a species-habitat model: the species account and the ratings table.

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 will be layered on the map, how the ratings will be 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 checked, guided development of the final ratings tables.

2.3 Field Sampling

Field assessments occurred in conjunction with ecosystem mapping field sampling. Survey intensity level 4 (visitation of 15 - 25% of polygons) was used (RIC, 1998). Fieldwork took place over two sessions in 2000: 10 days in May and 10 days in June. Another field session occurred in July/August 2001 for the South Slopes area. Six wildlife biologists participated in the fieldwork (Calvin Tolkamp, Sal Rasheed, Ted Lea, Debbie Webb, Mike Sarell, and Allison Haney). Mike Ladd and Orville Dyer from the Ministry of Water, Land & Air Protection accompanied the field crews for several days in 2000. During field sampling, habitat values were recorded on the Wildlife Habitat Assessment (WHA) form (FS 882HRE 98/5). These forms were submitted to CORD and the Ministry of Sustainable Resource Management. Data was entered into the VENUS data capture software (Appendix I). 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 Code	Species	Life requisites and habitat-uses
R-CHPI	Painted Turtle	Security/Thermal habitat for Reproduction (egg-laying sites) General Living during Growing season (ponds)
R-CRVI	Northern Pacific Rattlesnake	Food for general Living during Summer Security/Thermal habitat for general Living, Growing season
R-PICA	Gopher Snake	Food for general Living during Growing season Security/Thermal habitat for Reproduction (egg-laying sites)
B-FLOW	Flammulated Owl	Food for Reproduction Security habitat for Reproduction Thermal habitat for Reproduction
B-WSOW	Western Screech-owl	Food for Reproduction Security/Thermal habitat for Reproduction
B-LEWO	Lewis' Woodpecker	Food for Reproduction Security/Thermal habitat for Reproduction
M-COTO	Townsend's Big-eared Bat	Security/Thermal habitat for general Living, Growing Season Food for general Living during Growing season
M-TATA	Badger	General Living during Growing season Security/Thermal habitat (maternity dens) for Reproduction
M-ODHE	Mule Deer	Food for general Living during Growing season Security habitat for general Living during Growing season Food for general Living during Winter Security habitat for general Living during Winter Thermal habitat for general Living during Winter
M-OVCA	California Bighorn Sheep	Food for general Living during Growing season Security habitat for general Living during Growing season Food for general Living during Winter Security habitat for general Living during Winter Security habitat for Reproduction (lambing cliffs)

2.4 Wildlife Habitat Mapping

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

We generated wildlife habitat maps by applying the ratings table values for each map theme (i.e. habitat use / life requisites for each species) onto the TEM spatial and non-spatial data. A Wildlife Habitat Mapping Tool (WHR103), developed by the Ministry of Sustainable Resource Management, was used to apply the ratings tables to the TEM map in ArcView GIS software.

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 units (i.e. ecodeciles) using one of the following three methods; based on which one best demonstrates the relative importance of that map theme:

- Highest-value method – 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. This method is used to highlight areas that have potential for high value habitat.
- Averaged method – 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.

We used buffers around specific habitat features to eliminate areas that would not be used because they are too far from another essential habitat. For example, Bighorn Sheep do not stray far from escape terrain, so only foraging habitats within 500m of escape terrain were identified as suitable. Western Screech-owl foraging habitat had to be within 150m of nesting habitat, and Painted Turtle nesting habitat had to be within 150m of ponds or wetlands.

3.0 Wildlife Results

3.1 Species Accounts

Complete species accounts, including citations, are in Appendix II. The Species accounts also include the final habitat maps for each species. Brief summaries of some important habitat requirements for each project species are included below.

Painted Turtles are water-obligates; they must feed, breed and hibernate in water. Painted Turtles leave ponds only to lay eggs, or to migrate to other ponds. The scarcity of ponds and small lakes in the study area limits the abundance of Painted Turtles. Turtles are most vulnerable when they are traveling on land, where predators or traffic may kill them. This species is known in the study area only from Gorman's Ponds and two additional ponds where we observed them during this study.

Northern Pacific Rattlesnakes and Great Basin Gopher Snakes are both Blue-listed, and require rock outcroppings for hibernating, and riparian areas or expanses of grasslands or open forests for foraging. Both species are heavily impacted by human activity. The rattlesnake is poorly documented in the study area, and is known only from the southern portions. The Gopher Snake is known from a slightly larger distribution, but records are scarce.

Flammulated Owls inhabit complex forests that are generally dominated by mature Douglas-fir trees. Cavities in large trees or snags are required for nesting. Although there has been little inventory in the study area, we expect Flammulated Owls to be present in reasonable numbers, given the abundance of suitable habitat.

Western Screech-owls are dependent on riparian forests, and most often nest in cavities in large cottonwood trees. They are known from the valley floor in the Kelowna area and have been observed near several of the main creeks and rivers (Hobbs 2002). The extent of riparian forests, usually confined to ravines and canyon bottoms, limits the potential extent of Western Screech-owls in the study area.

Lewis' Woodpeckers occur in grasslands and other open areas. Solitary conifers in very open areas, or cottonwoods on the edge of riparian forests are generally used for nesting and perching. Trees must be large-diameter and soft enough for birds to excavate nest cavities. In the study area, removal of large trees and snags and land-clearing have reduced the amount of suitable habitat. Ingress of young trees, due to fire suppression, can also decrease the habitat suitability for this species.

Townsend's Big-eared Bats are known to roost in caves and attics, but may use cavities in large trees as well. They likely forage in moist, insect-rich sites. Townsend's Big-eared Bats are well documented in the north and south Okanagan, and are likely to occur in the study area. These bats are very vulnerable to disturbances such as rock climbing, and will readily abandon roosts.

Badgers are residents of deep-soiled grasslands, although they will venture into a broad range of habitats. The central Okanagan historically had limited grasslands in the northeast part of the study area and most of those have been developed for residential and agricultural purposes.

California Bighorn Sheep inhabit rugged terrain and open grasslands. Only one population, up Shorts Creek, currently exists in the study area. A now extinct population occurred in Okanagan Mountain Park and likely extended north into the rugged terrain above Mission Creek. A lone ram

has been sighted at Mount Drought, which may indicate that there was a population there at one time. Forest ingress and urban expansion have reduced the already limited habitat for Bighorn Sheep, and rock climbers now use many of the lambing cliffs.

Mule Deer use a variety of habitats throughout the year. Winter habitats, considered the most critical, must supply food (mostly shrubs or Douglas-fir foliage), screening vegetation to hide from predators, and shelter from cold, wind and deep snow. Low-elevation mature or old forests (generally Douglas-fir dominated) with dense canopies, multi-storied structure, and shrubby understories provide the best winter habitats. Habitats on warm, south-facing aspects are important for deer in the winter and early spring.

3.2 *Field Sampling Results*

A total of 747 plots were visited and assessed during the Sensitive Ecosystem Inventory, of which 503 were visual plots. Only cursory investigation for evidence of wildlife use was conducted in many of the visual plots. We did not observe evidence of use during fieldwork for many of the project species. This is not surprising, because most of them are rare, elusive, and/or nocturnal, and fieldwork was intended as a habitat inventory rather than a wildlife survey.

Painted Turtle

We observed Painted Turtles in two ponds: at plot COG60 on the west side of the study area, and at plot COG159 on the east side. Two other sites had high-value living habitat: at plots COG54 and COV93. Adult and juvenile turtles were observed at plot COG159 (Figures 1 and 2) located in a 300 m long reservoir. There was exposed soil at the NE end of the reservoir (COV301), containing small depressions and shells of turtle eggs (Figures 3 and 4), indicating that it was used for nesting. The few ponds in the study area with water year-round should support Painted Turtles.



Figure 1: Juvenile Painted Turtle (plot COG159).



Figure 2: Painted Turtles basking on a log (plot COG159).



Figure 3: Painted Turtle nest with remnant shell (plot COV301).



Figure 4: Exposed soil used as nesting habitat by Painted Turtles (plot COV301). The nest is by the field notebook seen near the centre of photo.

Northern Pacific Rattlesnake

We found no evidence of Northern Pacific Rattlesnakes during fieldwork. High-value denning and basking habitats on south-facing rocky hillsides were seen at 15 of the 747 field plots. Figures 5 and 6 are examples of high value basking habitat. High-value foraging habitats include riparian areas, which support dense prey populations. We observed this kind of habitat at many plots. Rattlesnake populations seem to be more abundant in the south and north Okanagan, although this may reflect the lack of inventory work in the Central Okanagan.



Figure 5: Warm aspect slope providing high-value basking and possible denning habitat for Northern Pacific Rattlesnakes (plot COV172).



Figure 6: Warm aspect slope providing moderate-value basking habitat for Northern Pacific Rattlesnakes (plot COG79).

Gopher Snake

We found no evidence of Gopher Snakes during fieldwork. Gopher Snakes use habitats that are very similar to those used by Northern Pacific Rattlesnakes. High value foraging habitat occurs in deep-soiled grasslands, riparian areas, and around wetlands. These habitats support dense prey populations and have more moderate summer temperatures. We encountered the best habitats at lower elevations in the PPxh1 biogeoclimatic subzone. Gopher Snakes den in deep-soiled grasslands or warm rock outcroppings. Figures 5 and 6 show examples of denning and basking habitats on rock outcroppings we encountered during fieldwork.

Unlike Northern Pacific Rattlesnakes, Gopher Snakes lay eggs. Egg-laying habitat is frequently associated with warm-aspect grasslands with deep soils (Figures 7 and 8). We assessed eight plots (n=747) with high-value egg-laying habitat.



Figure 7: High-value egg-laying habitat for Gopher Snakes (plot COG23).



Figure 8: High-value egg-laying habitat for Gopher Snakes (plot COG91).

Flammulated Owl

We found no evidence of Flammulated Owls during fieldwork. Flammulated Owls prefer mature to old Ponderosa Pine/Douglas-fir forests that have cavities for nesting and thickets to provide cover from predators. We observed high-value nesting habitats at nine plots, including COG78 (Figure 9), an old forest. Only five of these plots also had thickets suitable for security cover.



Figure 9: High-value nesting habitat for Flammulated Owls (plot COG78).

Western Screech-owl *macfarlanei* subspecies

Low elevation riparian areas provide ideal habitats for Western Screech-owls, particularly mature to old stands of black cottonwood. We found no evidence of Western Screech-owl during fieldwork. However, we observed high-value nesting habitats in 11 plots, out of a total of 747. Figure 10 depicts high-value nesting habitat, and Figure 11 depicts moderate-value nesting habitat.



Figure 10: Large black cottonwoods provide potential high-value nesting habitat for Western Screech-owls (plot 9802070).



Figure 11: Decaying trembling aspen trees provide potential moderate-value nesting habitat for Western Screech-owls (plot 9802104).

Lewis' Woodpecker

We observed three adult Lewis' Woodpeckers foraging in grasslands just north of plot COG91, and using a lone, dead ponderosa pine tree for perching. We encountered high-value nesting habitat where there were scattered dead or dying ponderosa pine trees in the open forests or grasslands on the east side of the lake, such as plot COG47 (Figure 12). Riparian cottonwood stands are another important habitat for Lewis' Woodpecker (Figure 10).



Figure 12: Potential high-value nesting habitat for Lewis' Woodpecker (plot COG47).

Townsend's Big-eared Bat

Townsend's Big-eared Bats inhabit rock caverns and likely use cavities in large-diameter trees, especially cottonwood. No bats were observed during habitat field assessments. We observed high value roosting habitat at nine plots, including warm-aspect rock bluffs with crevices that may lead into chambers (Figure 13). We observed some large-diameter cottonwood trees that may have cavities suitable for roosting.

Figure 13: Cliff with potential high-value roosting habitat for Townsend' Big-eared Bats (near plot COG47).



We encountered high-value foraging habitat in three broad habitat types: riparian corridors, open water with riparian fringes (Figure 14), and open forests (Figure 12).

Figure 14: High-value foraging habitat for Townsend's Big-eared Bat (plot COG54).

Badger

We found badger burrows at two locations in the deep-soil grasslands on the east side of the study area. Figures 15 and 16 show the habitat and burrow found at plot COG91. Suitable badger habitat is relatively scarce on the west side of the study area as deep-soiled grasslands are lacking. We observed the most expansive suitable habitat north of Mission Creek. We assessed 11 plots with high-value security habitat that were suitable for maternal dens.



Figure 15: Badger burrow (plot COG91).



Figure 16: Badger habitat (plot COG91). The mound of soil near the centre is the badger burrow shown in Figure 15.

Mule Deer

We found evidence of Mule Deer at many plots. We recorded habitat values but did not develop a model. We found the most evidence of use at lower elevations, in the PPxh1 biogeoclimatic subzone, mostly in young forests (Figure 17). During winter, deer probably favour these forests when they occur on warm aspect.



Figure 17: Habitat in the PPxh1 with abundant evidence of Mule Deer use (plot 9802108).

We observed evidence of Mule Deer in the IDFxh1 biogeoclimatic subzone in shrubby, moist forests on the west side of the study area (Figure 18). These forests are probably mostly used in the summer. We also found mineral licks during fieldwork (Figure 19.)



Figure 19: Exposed soil used as a mineral lick by Mule Deer (Plot COV43).



Figure 18: Shrubby, moist plot with abundant evidence of Mule Deer use (Plot COV44).

California Bighorn Sheep

We found no evidence of California Bighorn Sheep during fieldwork. Bighorn Sheep are presently only known from the Shorts Creek area. We found high-value security habitat for the growing season at 15 plots (n=747), and potential lambing cliffs were observed at 6 plots. However, the patches of habitat were generally small and isolated, and unlikely to be used. Plot COV45 (Figure 20) was in the valley of Wennie Creek on the west side of Okanagan Lake. Similar habitat was found alongside other creeks on the west side of Okanagan Lake. We observed relatively isolated suitable habitats on the east side of the study area just north of Okanagan Mountain Park, and along Mission Creek and Black Mountain.



Figure 20: High-value security habitat for Bighorn Sheep (plot COV45).

3.3 Final Ratings Table

The final ratings table lists all of the mapped ecosystem units, including every combination of site series, seral association, site modifiers, and structural stage. Each ecosystem unit was assigned a rating for all the habitat uses/life requisites for each wildlife species. Critical habitat uses are shown as map themes (Table 4). The complete final ratings table is available in digital format (cok_ss_final_rat.csv). An example of the format of the ratings table for the 19 modeled themes, and a link to the ratings table, are provided in Appendix III.

Habitat-use models were prepared for nine wildlife species (Table 4). The model for Mule Deer was not portrayed for the following reasons:

- the species is not considered at risk; and
- deer use a very wide range of habitat types, many of which are not considered Sensitive Ecosystems (e.g. clearcuts), which would tend to mask the identification of habitats critical to rare wildlife species.

Table 4: Life requisites and habitat-uses rated for final map themes

Species Code	Species	Life requisites and habitat-uses	Rating Code
R-CHPI	Painted Turtle	Security/Thermal habitat for Reproduction General Living All year	STRE LIA
R-CRVI	Northern Pacific Rattlesnake	Security/Thermal habitat for general Living All year Food for general Living during Summer	STLIA LIS
R-PICA	Gopher Snake	Security/Thermal habitat for general Living All year Security/Thermal habitat for Reproduction Food for general Living during Summer	STLIA STRE LIS
B-FLOW	Flammulated Owl	Security/Thermal habitat for Reproduction	STRE
B-WSOW	Western Screech-owl	Security/Thermal habitat for Reproduction Food for Reproduction	STRE FDRE
B-LEWO	Lewis' Woodpecker	Security/Thermal habitat for Reproduction	STRE
M-COTO	Townsend's Big-eared Bat	Security/Thermal habitat for Living, Growing Season Food for general Living during Growing season	STLIG FDLIG
M-TATA	Badger	General Living All year	LIA
M-OVCA	California Bighorn Sheep	Security habitat for Reproduction (lambing cliffs) Security habitat for general Living during Winter Food for general Living during Winter Security habitat for general Living, Growing season Food for general Living during Growing season	SHRE SHLIW FDLIW SHLIG FDLIG

3.4 Wildlife Habitat Mapping

Small-scale maps, portraying the layered map themes for each species, are presented in Figures 21 through 29. A larger-scale, combined map, showing moderate and high ratings for only the most critical habitat uses for all species, is illustrated in Figure 30. The map themes portrayed in Figure 30 are listed in Table 5. Appendix II (Species Accounts) provides descriptions of how the map themes are rated and presented, as well as larger-scale maps for each species.

Interpretations of the model are provided for each habitat suitability map. We discuss the distribution of habitat, and the accuracy of the model based on past sightings and wildlife observations during fieldwork.

Painted Turtle

The suitability map for Painted Turtle indicates that there is very little habitat available in the study area. Most of these habitats are ponds near Westbank and ponds north and south of Mission Creek. Some of these ponds may not be able to support turtles because they are too small, too shallow, or lack suitable nesting habitat nearby. There are also suitable habitats indicated along Mission and Lambly creeks. However, it is unlikely that these areas are used, as deep pools with high water temperatures are usually not found in the steep sections of these creeks. These conditions may occur along the lower reaches of Shorts Creek. Verification of turtle use is required at most sites.

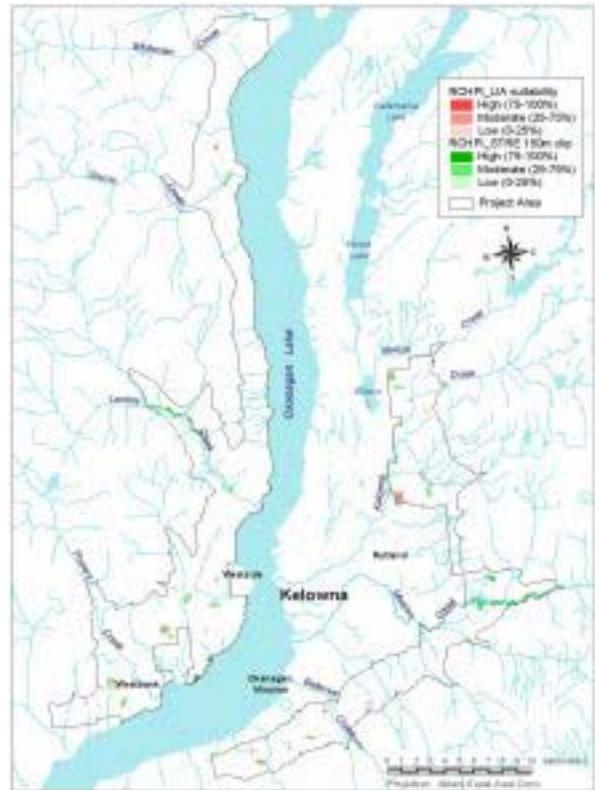


Figure 21: Suitability for Painted Turtle.

Northern Pacific Rattlesnake

There is a considerable amount of habitat predicted for Northern Pacific Rattlesnakes. This represents far more habitat than is suspected of currently being used (e.g., it is believed there are no rattlesnakes north of Bear Creek). One of the reasons for this overestimate is that rattlesnake distribution is dependent on the availability of hibernacula for overwintering. Hibernacula have very specific characteristics that cannot be predicted through TEM, and may not be present in much of the modeled habitat. Furthermore, past persecution and road mortalities may have eliminated some populations, so they may not occur in some areas with suitable habitats. Foraging areas likely provide a good representation of what would be used if hibernacula are present. Concentrations of rattlesnakes are best known in the Westbank area.

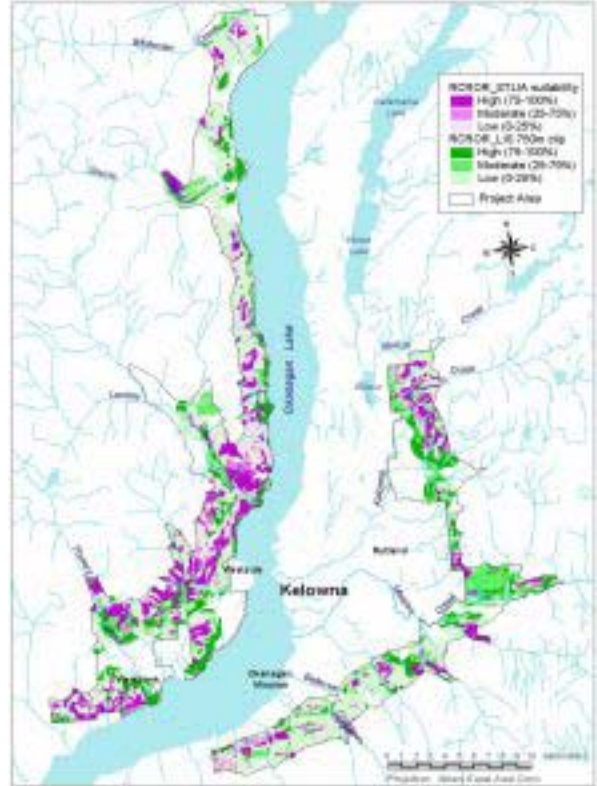


Figure 22: Suitability for Northern Pacific Rattlesnake.

Gopher Snake

Suitable basking and denning habitats for Gopher Snakes are similar to those for rattlesnakes, as the same ratings were used. However, Gopher Snakes require sandy slopes to lay eggs, and there are some differences in foraging habitat. The extent of Gopher Snake distribution appears to be accurate, as they are known throughout the area. However, populations have probably suffered from land use activities, road mortalities, and persecution. The highest concentrations of habitats are in the Westbank and north Rutland areas.

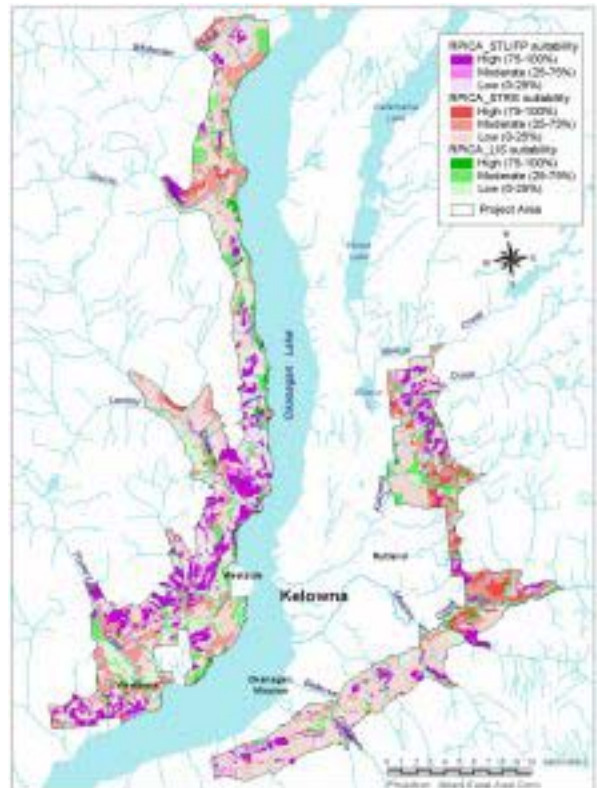


Figure 23: Suitability for Gopher Snake.

Flammulated Owl

Most of the suitable habitats were depicted along the upper edge of the study area and along slopes above creeks. The best concentrations of habitats occur in the northwest part of the study area and above Mission Creek. A few isolated areas with high suitability include areas above Powers, McDougall, Vernon, and Kelowna Creeks.

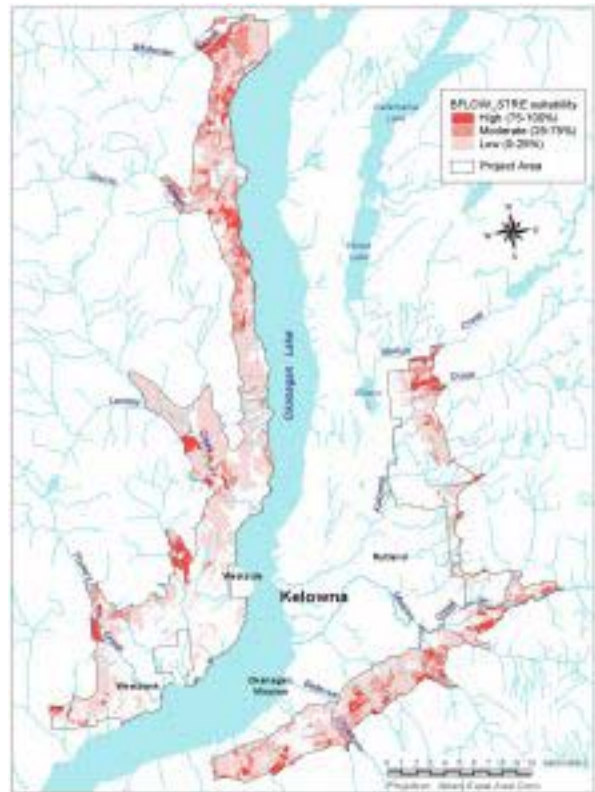


Figure 24: Suitability for Flammulated Owl.

Western Screech-owl

The Western Screech-owl (*macfarlanei* subspecies) is either very rare or poorly inventoried; known locations are mostly in the south Okanagan. There are only two records in the study area (Hobbs 2002). Both records are in areas modeled as suitable habitats: one is rated high and the other low. Most of the high-suitability habitat occurs along creeks. The steep, rugged topography along many creeks limits the availability of these riparian habitats. Land uses on gentler slopes that have converted much of the riparian habitat, except for the fringes along creeks, has further reduced habitat availability. The model is considered to be reasonably accurate.

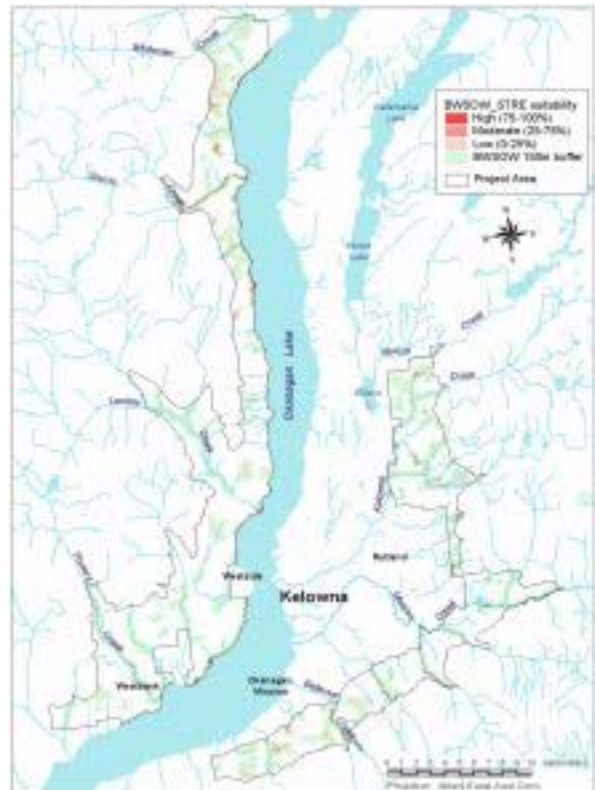


Figure 25: Suitability for Western Screech-owl.

Lewis' Woodpecker

Lewis' Woodpeckers are difficult to model, as they often use lone trees within grasslands and other open habitats that are not captured by TEM. Open coniferous stands and mature riparian stands are also suitable habitats. We have reasonable confidence that habitats modeled as suitable may have Lewis' Woodpeckers, but inventories should be conducted wherever there is the possibility of cavities in lone trees or along the fringe of mature riparian stands. These woodpeckers also often use older power poles in grasslands.

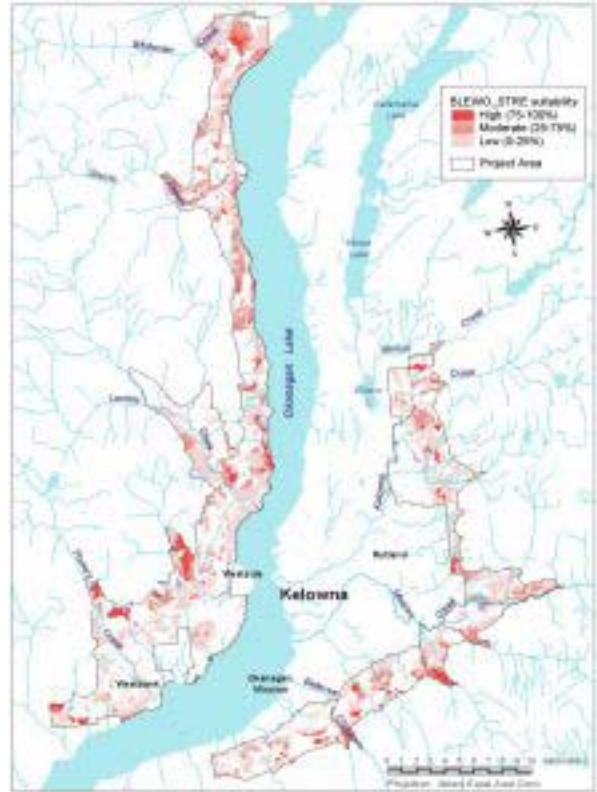


Figure 26: Suitability for Lewis' Woodpecker.

Townsend's Big-eared Bat

Townsend's Big-eared Bats are known to forage in a variety of habitats but are only known to roost, both in winter and summer, in cavernous rock features (e.g., mines and caves) and in the attics of abandoned buildings. There is some evidence that large cavities in trees may also be used. These are most likely to be found in large, decadent cottonwood trees. Inventories are difficult and time-consuming, so it should be assumed that they are present in suitable habitats unless demonstrated otherwise.

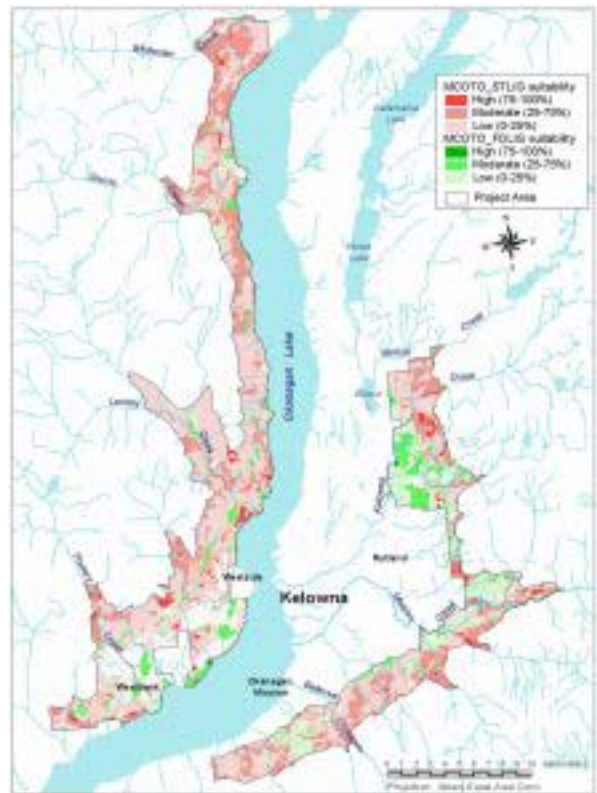


Figure 27: Suitability for Townsend's Big-eared Bat.

Badger

Badgers most commonly use deep-soiled, open areas for foraging and denning. Deep-soils in open ecosystems identified suitable badger habitat. The model depicts very little badger habitat. The best habitats are along Mission Creek, near Black Mountain, southeast of Ellison, the Bald Range above Lambly Creek, and up Shorts Creek. There is also some suitable habitat identified north of Okanagan Mountain Park but this area is isolated from other suitable habitats. Most suitable habitats have been converted to agricultural and residential use, or have been lost to forest encroachment. The abundance of rodent prey could not be included in the habitat suitability model.

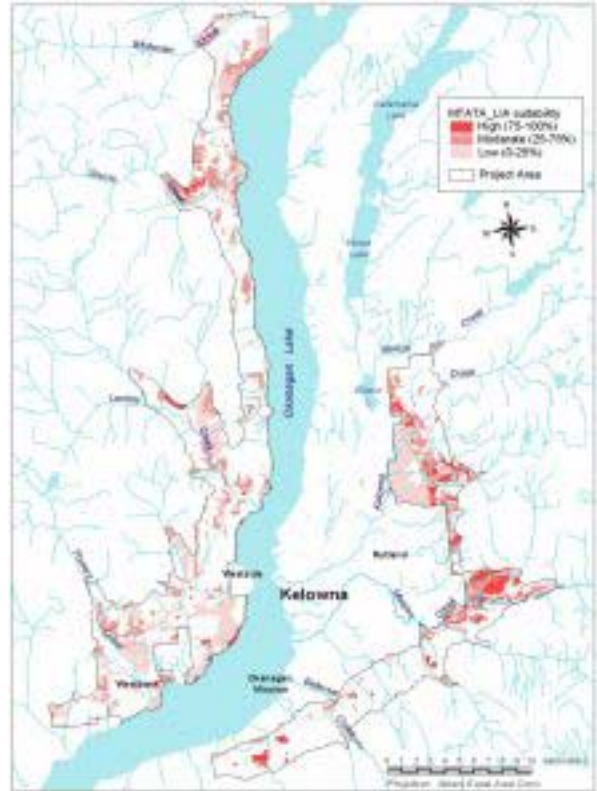


Figure 28: Suitability for Badger.

California Bighorn Sheep

The historical distribution of California Bighorn Sheep has been drastically reduced. Over-hunting, habitat loss, and forest encroachment and ingress are largely responsible for this decline. The only sheep in the study area are a diminishing herd at Shorts Creek. Historically, herds were known from Drought Mt. and Mt. Law in Peachland, Carrot Mt, Mt. Swite, McDougall Rim, Mt. Boucherie, and Okanagan Mountain Provincial Park. These areas all have current suitable habitats, although they may not be adequate to support reintroductions. There also are suitable habitats in the Kelowna and Mission creek areas, however, there are no records of Bighorn Sheep from these areas.

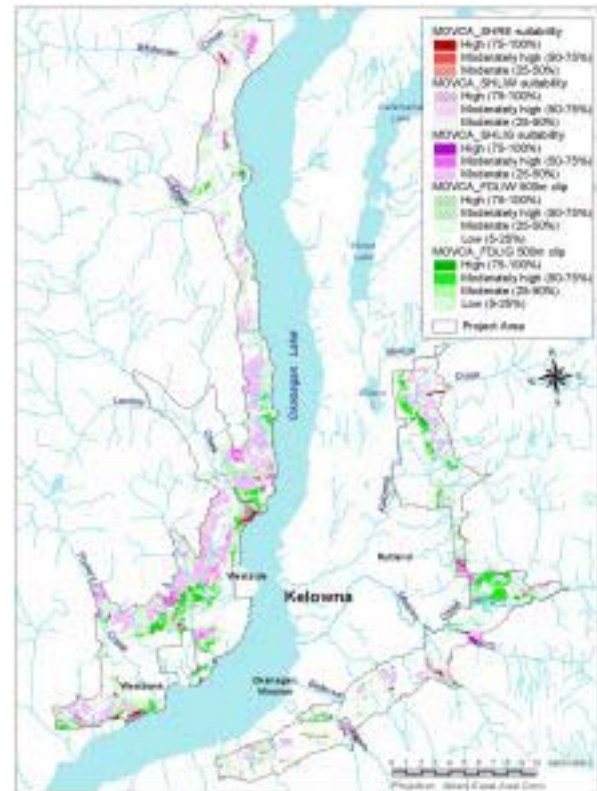


Figure 29: Suitability for California Bighorn Sheep.

Composite Critical Habitats

A composite critical habitat map, of high- and moderate-value habitats for the 12 most critical life requisites of the nine species (Table 5), was generated (Figure 30). The map should be used to view important habitats on a landscape level. Areas of interest should be investigated to assess values, with the individual wildlife habitat models referred to.

Table 5: Map themes used in composite map (Figure 30)

Species Code	Species	Map Themes used in Figure 30
R-CHPI	Painted Turtle	Living, All year (<i>LIA</i>) Reproduction within 150m of LIA (<i>STRE 150m clip</i>)
R-CRVI	Northern Pacific Rattlesnake	Security/Thermal habitat for Living All year (<i>STLIA</i>)
R-PICA	Gopher Snake	Security/Thermal habitat for Reproduction (<i>STRE</i>)
B-FLOW	Flammulated Owl	Security/Thermal habitat for Reproduction (<i>STRE</i>)
B-WSOW	Western Screech-owl	Security/Thermal habitat for Reproduction (<i>STRE</i>)
B-LEWO	Lewis' Woodpecker	Security/Thermal habitat for Reproduction (<i>STRE</i>)
M-COTO	Townsend's Big-eared Bat	Security/Thermal habitat for Living, Growing Season (<i>STLIG</i>)
M-TATA	Badger	Living, All year (<i>LIA</i>)
M-OVCA	California Bighorn Sheep	Security Habitat for Reproduction - lambing cliffs (<i>SHRE</i>) Security Habitat for Living, Winter (<i>SHLIW</i>) Food for Living, Winter within 500m of SHLIW (<i>FDLIW 500m clip</i>)

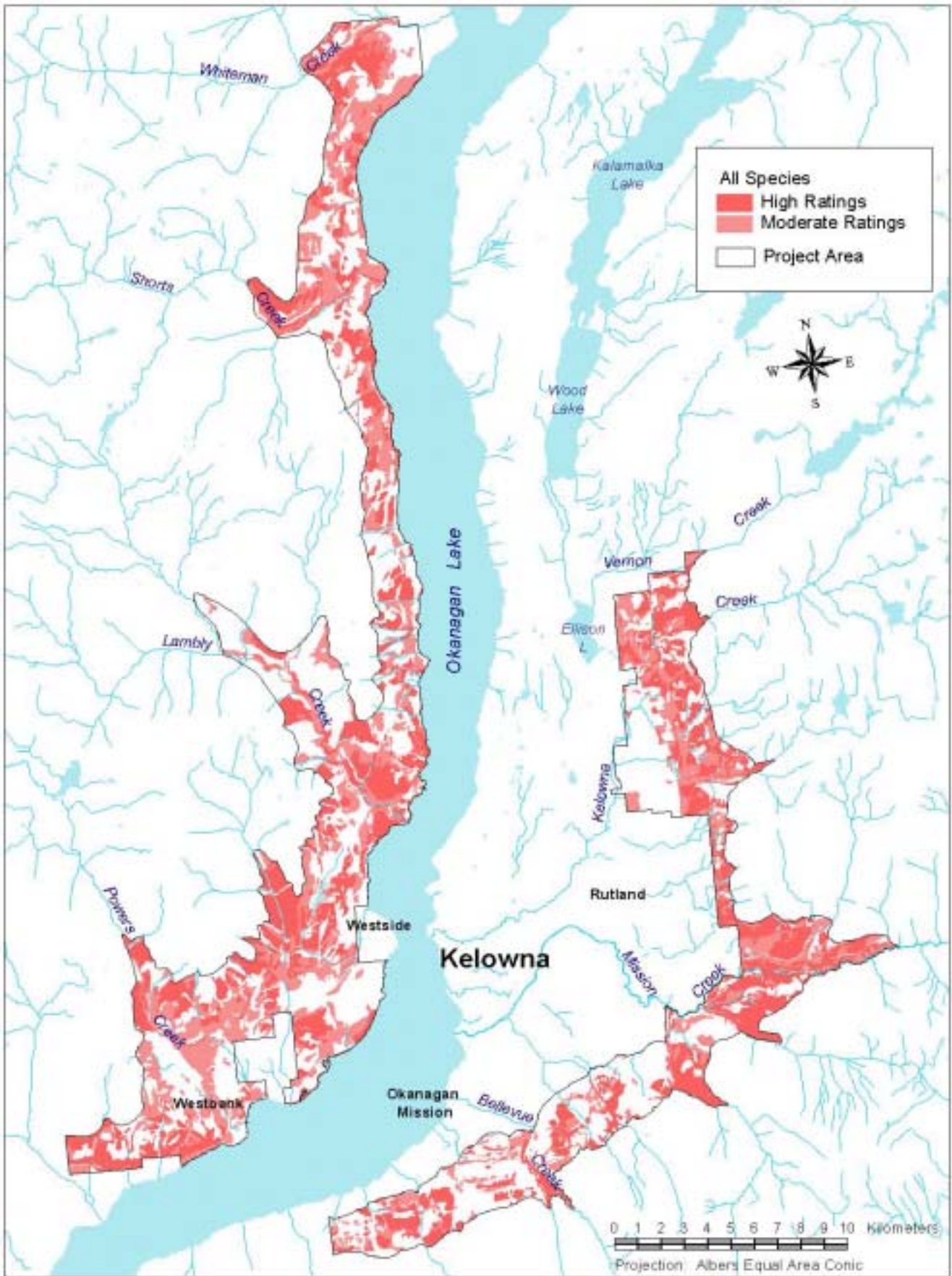


Figure 30: High and Moderate ratings for critical life requisites of all species (see Table 5).

Wildlife Recommendations

Local government, 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 management strategies, such as recovery habitats for species at risk and ecosystem management practices, including prescribed burns. As a planning tool, critical habitats (Figure 20) can be combined with Sensitive Ecosystem mapping to identify potentially critical areas that should not be considered for development prior to conducting an environmental assessment. 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 coverages within the area of interest, as a minimum standard. A useful template of Terms of Reference can be found in the Habitat Atlas for Species at Risk (BC Environment 1998, pg 108). The Sensitive Ecosystem Inventory report contains additional environmental impact assessment guidelines (Iverson and Cadrin 2003).

People conducting environmental assessments using this information should have a good understanding of each species' habitat requirements and associated threats, as well as the management recommendations provided, when evaluating development impacts and establishing environmentally sensitive areas (ESA). Many of the species require connectivity throughout their range and this should be given consideration when assessing the lands of interest in context with the surrounding area. Areas with multiple high habitat values should be covenanted or otherwise designated for conservation.

The following are brief management guidelines for each wildlife species. These have been extracted from the Management Recommendations section in the Species Accounts.

Painted Turtle

Management should include protection or enhancement of shrubs around the wetland as a buffer from disturbances. Specific locations of nesting sites should be identified, and corridors must be maintained between ponds and nesting sites. Developments that pose a hazard or obstruction to Painted Turtles, including roads, retaining walls, and steep-sided trenches, should not occur between aquatic habitat and nearby suitable nesting habitats. Management should also consider the connectivity between aquatic habitats, to maintain gene flow between turtle populations. Artificial nesting habitat can be created, particularly as part of a mitigation program.

Northern Pacific Rattlesnake and Gopher Snake

Management of Low, Moderate and High potential denning (Security/Thermal) 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 see 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 mortalities.

Lewis' Woodpecker

Developers should confirm that suitable habitat actually exists or can be recovered, as there is some uncertainty about whether the predicted habitats are actually used. Management of Lewis' Woodpecker habitat requires the retention of wildlife trees. Recruits for new wildlife trees should be maintained or planted, while maintaining the openness required by this species; this may include removal of trees encroaching into grasslands or open forests. Developers should try to link these areas with other portions of the property that will not be developed to provide suitable buffers. Inadequate buffers around developed lands, including recreational trails, may require the removal of wildlife trees due to safety reasons.

Flammulated Owl

Ensure critical habitat features are maintained in suitable habitats, including wildlife trees and sufficient recruits. Habitats should be linked with other natural areas to provide adequate buffers. Light recreation is appropriate providing wildlife trees can be maintained.

Western Screech-owl

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.

Townsend's Big-eared Bat

Management of these areas should focus on ensuring there are no disturbances to roosting habitats. Sites can be investigated to determine whether roosts are actually present, but inventories should be conducted at least once over the four seasons. Alternatively, roosts could be assumed to be present where field checking confirms the presence of suitable habitat. A "no disturbance" buffer should be placed around roosting habitats and, if necessary, the roost should be protected. Foraging habitat should be incorporated into the buffers around roosting habitat and riparian leave areas.

Badger

The most critical habitat sites for Badgers are their maternity dens. These dens usually occur on gentle to moderate sloping grasslands, often adjacent to significant populations of ground squirrels or pocket gophers. Soils are typically deep and either lacustrine or glaciofluvial. Management should ensure there is no disturbance to den sites, and that no activities significantly affect prey species or create barriers between foraging areas and denning 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. Owners may wish to conduct inventories to specifically identify important badger habitats.

California Bighorn Sheep

California Bighorn Sheep require rugged hillsides for lambing and escape terrain, and adjacent grasslands for foraging. Management of habitats should include a no disturbance area on rugged slopes, and maintenance of grasslands within a 500m buffer. Some activities may be suitable within foraging habitats, but no activities should occur within the rugged escape terrain,

particularly in or near lambing areas. Sheep are traditional in their habitat use; local sheep biologists and recovery strategies should be consulted to determine whether sheep are a significant concern in specific areas.

Although historic sheep populations in the Central Okanagan have declined and/or disappeared, critical habitats should be maintained for the possibility of transplants or re-colonization. Forest ingress into open habitats is likely a large factor in the decline of Bighorn Sheep in the Okanagan. The Garnet fire improved sheep habitat in the Penticton area by killing many trees and creating greater connectivity between Skaha/Vaseux herds and the eastside of the Central Okanagan. Preservation and restoration of critical habitat and corridors may allow Bighorn Sheep to re-occupy the Central Okanagan. Forests that currently inhibit the movement of sheep would need to be thinned and burned to make these habitats suitable again.

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5.0 Appendices

Appendix I: Wildlife Habitat Assessment Forms

BRITISH COLUMBIA

WILDLIFE HABITAT ASSESSMENT

Proj. id.	Date	H-habit. feature	type	page of																			
Plot no.		Surveyor																					
Species	Habit. use / Size		Plot type				Plot-in-context																
	5-letter code	Sp. LR	Sen.	FD	SH	TH	Cont.	Habitat feature	Cont.	Distance (km)	F/C LR	Imp.	Habitat feature	Cont.	Distance (km)	F/C LR	Imp.	FD	SH	TH	Suit.	Cont.	
Comments / Notes																							

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BRITISH COLUMBIA

WILDLIFE HABITAT ASSESSMENT

Project id.	Inside plot										Outside plot and inside ecosystem unit								
Species	Sex	Life Stage	Activity	Des.	No.	Cont.	Sex	Life Stage	Activity	Des.	No.	Sex	Life Stage	Activity	Des.	No.	Cont.		
Comments / Notes																			
Abbreviated Tree Attributes for Wildlife								Simple Coarse Woody Debris											
B.A.F.	Area		Min DBH					Decay class	Sampled							m of 30 m transect			
	No. of trees	No. dead	No. live																
	Avg. DBH (cm)		Avg. length (m)					Decay class											
	Avg. lch load class		Comments					Decay class											
						Comments													
Management																			
Species (Sp. group)		Use	Sen.	F/C LR(s)	Cap.	Mgmt. Tech.	M. Feat. / Ind.	Comments / Notes											
Comments / Notes																			

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Completed data forms submitted to the Regional District of Central Okanagan.

Appendix II: Species Accounts

[Painted Turtle](#)

[Northern Pacific Rattlesnake](#)

[Gopher Snake](#)

[Lewis' Woodpecker](#)

[Flammulated Owl](#)

[Western Screech-owl](#)

[Townsend's Big-eared Bat](#)

[Badger](#)

[California Bighorn Sheep](#)

Appendix III: Ratings Table

Ratings Table: [COK wl ratings Oph2003 final.xls](#)

Example of Ratings Table format:

ECO_SEC	BGC_ZONE	BGC_SUBZON	BGC_VRT	BGC_PHASE	SITE_S	SITEMC_S	SITE_MA	SITE_MB	STRCT_S	STRCT_M	STAND_A	SERAL	RCROR_LIS	RCROR_STLIA	RPICA_LIS	RPICA_STRE	RCHPI_LIA	RCHPI_STRE	BFLOW_STRE	BLEWO_STRE	BWSOW_STRE	MTATA_LIA	MCOTO_STLIG	MCOTO_FDLIG	MOVCA_FDLIG	MOVCA_SHLIG	MOVCA_FDLIW	MOVCA_SHLIW	MOVCA_SHRE	
NOB	IDF	xh	1		0	AM			3				M	N	M	N	N	N	N	N	N	N	N	M	6	6	6	6	6	
NOB	IDF	xh	1		0	AM			4		B		M	N	M	N	N	N	N	N	N	N	N	M	6	6	6	6	6	
NOB	IDF	xh	1		0	AM			5		B		M	N	M	N	N	N	L	N	N	N	L	M	6	6	6	6	6	
NOB	IDF	xh	1		0	AM			6		B		M	N	M	N	N	N	M	N	L	N	M	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AM			7				M	N	M	N	N	N	M	N	M	N	M	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AM	g		3				M	N	M	N	N	N	N	N	N	N	N	M	6	6	6	6	6	
NOB	IDF	xh	1		0	AM	g		4				M	N	M	N	N	N	N	N	N	N	N	M	6	6	6	6	6	
NOB	IDF	xh	1		0	AM	g		5				M	N	M	N	N	N	L	N	N	N	L	M	6	6	6	6	6	
NOB	IDF	xh	1		0	AM	g		6		M		M	N	M	N	N	N	M	N	L	N	M	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AM	g		7				M	N	M	N	N	N	M	N	M	N	M	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AM	k		3		B		L	N	L	N	N	N	N	N	N	N	N	M	6	6	6	6	6	
NOB	IDF	xh	1		0	AM	k		4				L	N	L	N	N	N	N	N	N	N	N	M	6	6	6	6	6	
NOB	IDF	xh	1		0	AM	k		5		B		L	N	L	N	N	N	L	N	N	N	L	M	6	6	6	6	6	
NOB	IDF	xh	1		0	AM	k		6				L	N	L	N	N	N	M	N	L	N	L	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AM	k		7				L	N	L	N	N	N	M	N	M	N	M	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO			3				H	N	H	N	N	N	N	N	N	N	N	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO			4				H	N	H	N	N	N	N	N	N	N	N	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO			5		B		H	N	H	N	N	N	N	N	N	N	L	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO			6				H	N	H	N	N	N	L	N	L	N	M	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO			7				H	N	H	N	N	N	L	N	M	N	M	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO	a		3				H	N	H	N	N	N	N	N	N	N	N	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO	a		4				H	N	H	N	N	N	N	N	N	N	N	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO	a		5		B		H	N	H	N	N	N	N	N	N	N	L	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO	a		6		B		H	N	H	N	N	N	L	N	L	N	M	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO	a		7				H	N	H	N	N	N	L	N	M	N	M	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO	g		3				H	N	H	N	N	N	L	N	N	N	N	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO	g		4				H	N	H	N	N	N	L	N	N	N	N	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO	g		5		B		H	N	H	N	N	N	L	N	N	N	L	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO	g		6		B		H	N	H	N	N	N	L	L	N	L	M	H	6	6	6	6	6	
NOB	IDF	xh	1		0	AO	g		7				H	N	H	N	N	N	L	L	N	M	N	M	H	6	6	6	6	6