# 2023 Ecological Analysis Update

## The University of British Columbia Okanagan


Prepared By:
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Prepared For:
Sustainability Office, Campus Planning


October 13, 2023

# THE UNIVERSITY OF BRITISH COLUMBIA OKANAGAN
# ECOLOGICAL ANALYSIS UPDATE

Prepared For:

Sustainability Office, Campus Planning
The University of British Columbia Okanagan

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# ACRONYMS

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|---|---|
| ESA | Environmentally Sensitive Areas |
| SEI | Sensitive Ecosystems Inventory |
| TEM | Terrestrial Ecosystems Mapping |
| UBCO | University of British Columbia Okanagan |

# EXECUTIVE SUMMARY

The University of British Columbia Okanagan (UBCO) Sustainability Office, Campus Planning requested a comprehensive ecological assessment of the UBCO campus lands (hereafter campus). The intention of the ecological assessment was to gather updated data on the ecosystems, plants, wildlife, and valuable wildlife trees of the campus since the previous analysis completed in 2014. The goal of the analysis is to define the current state of campus ecosystems and important habitat attributes for use in future development planning.

The ecological assessment consisted of multiple surveys and types of analysis, which included an ecosystem change analysis that determined the change in campus ecosystems from 2006 to 2021 using terrestrial ecosystem mapping (TEM) polygons and airphotos from 2006 and 2021. The majority of campus was classified as rural or urban, with a large amount of cultivated field in the west campus lands and some forests, mostly to the north of central campus. There are also valuable grasslands and wetlands near Robert Lake and the pond southeast of central campus. More land was acquired between 2006 and 2021, and some of the natural forest ecosystems were lost as the campus grew. In 2021, 23% of campus was classified as ecologically sensitive (wetlands, grasslands, or forests), and there was a slight increase in the total area of sensitive ecosystems since 2006 with the acquisition of new land. However, the total percentage of campus made up of ecologically sensitive areas decreased by 6.4% from 2006 to 2021 with development.

To determine the current state of valuable habitat attributes within forest ecosystems, trees on campus were assessed for their wildlife value, and a database and map of wildlife trees and important wildlife tree groups was created. There were 13 very high value and 26 high value wildlife trees for a total of 39 wildlife trees within UBCO campus lands. Most were standing dead trees, but some were live ponderosa pine (*Pinus ponderosa*) and there was one interior Douglas-fir (*Pseudotsuga menziesii*). Most of the very high value wildlife trees were snags located near the pond, which saw use by several bird species for nesting and roosting during the June wildlife survey. Large ponderosa pines by the Arts building showed extensive signs of great horned owl (*Bubo virginianus*) use in January, including whitewash and pellets. There were 15 tree groups identified around campus, excluding the larger forested ecosystems. There was one very high value tree group located near the pond which provided important habitat for wildlife, and two high value tree groups.

With the combination of pest management and wildfire risk mitigation on campus, few large snags have been left to provide habitat. We recommend the retention of remaining snags and woody debris for wildlife use wherever possible. However, we recognize that habitat preservation goals are often at-odds with wildfire mitigation strategies. Retention

of large trees can help mitigate wildfire risks over time. If the forested areas of campus can be retained and allowed to mature, large trees will increase the fire resistance of campus forests and provide valuable wildlife habitat over time.

Plants and wildlife were assessed among ecosystem types throughout campus. On June 8th, 2023, surveys of all ecosystem types and very high value wildlife trees were conducted. All plant and wildlife species were recorded. A list of potential wildlife species that may occur in ecosystems on campus was also assembled by searching the BC Conservation Data Centre database. Wildlife species observed by Ecoscape during past projects, and by other reliable sources were also included.

The campus contains a diverse plant and wildlife community. Bird species are especially abundant around the lakes and wetlands of campus, including Robert Lake and the pond. Many provincially blue-listed wildlife species, or species of special concern in BC, have been observed on campus, including the Great Basin spadefoot (*Spea intermontana*), Western yellow-bellied racer (*Coluber constrictor mormon*), and Northern rubber boa (*Charina bottae*). There have also been observations of several red-listed or threatened species on campus. These include the American badger (*Taxidea taxus*), American white pelican (*Pelecanus erythrorhynchos*), whimbrel (*Numenius phaeopus*), Hudsonian godwit (*Limosa haemastica*), California gull (*Larus californicus*), prairie falcon (*Falco mexicanus*), and Swainson's hawk (*Buteo swainsoni*). Retention of forest, wetland, and grassland ecosystems will benefit these species.

The 2023 ecological assessment included an update to the TEM that is consistent with the province's recently released biogeoclimatic mapping guide for the Southern Thompson-Okanagan. Our scope included ground-truthing and revision of terrestrial ecosystem polygons and mapping, and an update of the rating and mapping of environmentally sensitive areas (ESA). Only a few changes were made between the 2021 terrestrial ecosystem designations and the 2023 update, including three additional polygons, and some classification changes. When ESA ratings were applied, Robert Lake and the pond were rated as very high value and made up 2% of the total campus area. High value areas constituted 19.8% of campus and were mostly forests, 44.8% of campus was moderate value and was disturbed natural habitats and green spaces lacking hardscaping, and 33.3% of campus was rated as low value and included all developed area, buildings, and parking lots.

As campus continues to grow, remaining forested ecosystems may decrease in size and become fragmented from each other. Maintaining connectivity between forested ecosystems will be important for wildlife moving through campus and can be achieved by keeping lines and stands of trees intact between patches. Conserved ecosystems should be as large as possible to maximize the habitat they provide. Retaining wetland ecosystems will also provide important habitat, and these habitats are becoming

increasingly rare in the Okanagan and provide vital habitat for many species, especially migratory birds. Robert Lake and it's surrounding transitional grassland ecosystems may continue to expand as they naturally have since 2005. We recommend that the remaining forest ecosystems on campus be protected and maintained as campus grows. Many ecosystems would also benefit from remediation through invasive weed control, and potentially additional planting of native species. These wetland and forest ecosystems will not only provide important habitat to wildlife but will sequester and store carbon as they age and grow.

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# 1.0 INTRODUCTION

As the UBCO campus continues to grow, it is important to consider the impact of development on the natural ecosystems within the campus lands. Ecoscape Environmental Consultants Ltd. (Ecoscape) has been retained by the University of British Columbia Okanagan (UBCO) Campus Planning and Development to provide an Ecological Analysis Update, including ecosystem classifications, ecosystems change analysis, survey of wildlife and vegetation communities, and creation of a wildlife tree database.

The campus and it's surrounding lands have changed and grown significantly since 2005. More lots were acquired west of campus that expanded the campus lands boundary and increased the amount of forest and wetland ecosystems under campus management. Development of the main campus core with additional campus buildings, parking lots, and residences has increased the area of paved and impermeable surfaces. However, some areas have also been preserved and protected during campus expansion, which include some pond and wetland habitats. Forest ecosystems have been managed for wildfire risk and to reduce infestations of mountain pine beetle (*Dendroctonus ponderosae*).

Since 2005, these compounding changes and ecosystem pressures have changed the UBCO campus, but significant effort has been made to balance development with ecosystem preservation. This report explores ecosystem changes and the current ecological condition of campus and offers recommendations and guidance for future ecosystem and habitat management.

# 2.0 ECOSYSTEMS CHANGE ANALYSIS

The objective of the ecosystems change analysis was to quantify the loss and gain of sensitive ecosystems since the campus has been owned and managed by UBCO. The hope is that the exercise will allow for a greater understanding of the change that has occurred over the last 15 years, and that it will help guide future campus development and better inform retention of sensitive ecosystems.

## 2.1. Background

The University of British Columbia acquired the Okanagan campus in 2005 from Okanagan University College; it consisted of a contiguous parcel (96.04 ha) with academic, residential, and combined land uses (Figure 2-1). The land acquisition pre-dated the dedication of John Hindle Drive, Innovation Drive and Hollywood Road, which were integrated in 2008 at the time of the campus' rezoning to a comprehensive development (CD-20). The UBCO campus expanded further in 2010, 2015 and 2018 with the addition of the Tutt Lands, Lots A, B & C, and the IP1 parcel. In 2021, the western and northern

sections of the Tutt Lands were sold, resulting in a current campus area of 141.82 ha (Figure 2-1).

## 2.2. Methodology

To understand how the campus has changed over time, we used two sets of airphotos, one from 2006, less than one year after the campus was acquired, and one from 2021, which was fifteen years later. Publicly available terrestrial ecosystem mapping (TEM) data (Iverson et al. 2008) was overlaid with the 2006 airphoto to comprehensively map the ecosystems that were present in 2006. The ecosystem polygons were refined and, in some cases, redrawn or reclassified to reflect a finer spatial scale and to accurately represent the existing 2006 conditions (Figure 2-2). This process was repeated for 2021 (Figure 2-3). The ecosystem polygons in 2006 and 2021 were then compared to determine how the sensitive ecosystems had changed over the fifteen-year period (Figure 2-4).

## 2.3. Terrestrial Ecosystems

### 2.3.1 Biogeoclimatic Zones

The UBCO campus is in the Okanagan variant Very Dry Hot subzone of the Ponderosa Pine biogeoclimatic zone (PPxh1). This zone is the driest forested zone in BC and stretches throughout the Okanagan Valley from Vernon to the U.S. border between 400 to 800 m in elevation. Winters are mild and summers are hot. Many ecosystems in this zone would historically be maintained by low-severity wildfire. The PPxh1 is dominated by ponderosa pine, with interior Douglas-fir (*Pseudotsuga menziesii*) in wetter subzones. The understory is usually sparse and comprised of species such as, bluebunch wheatgrass (*Pseudoroegneria spicata*), saskatoon (*Amelanchier alnifolia*), common snowberry (*Symphoricarpos albus*), yarrow (*Achillea millefolium*), and arrow-leaf balsamroot (*Balsamorhiza sagittata*) (Hope et al. 1991).

### 2.3.2 Terrestrial Ecosystems

The majority of campus was classified as Rural (RW), Urban (UR), or other non sensitive, anthropogenic classifications (i.e., Gravel Pit or Exposed Soil) in both 2006 and 2021 (Figures 2-2 and 2-3). The campus in 2021 consisted of 72 polygons corresponding to 17 different ecosystems (Table 2-1). Natural ecosystems not impacted by campus development were dominated by Ponderosa pine – bluebunch wheatgrass – cheatgrass (PC) and Ponderosa pine – Bluebunch wheatgrass – Rough fescue ecosystems (PF). Several ecosystems on campus, including PF, GS02, and GS03, are considered provincially at risk, or red-listed by the British Columbia Conservation Data Center (CDC 2021), while several other ecosystems (PT, PC, PW, SP, CT) are classified as special concern or blue-listed (Table 1). The section below describes all ecosystems present in 2006 and 2021, with the 2021 ecosystem polygons described (Figure 2-3).

#### *2.3.2.1. Forests*

Polygons 4, 8, 28, and 33 represent Ponderosa pine – bluebunch wheatgrass – cheatgrass ecosystems (PC). On campus, this ecosystem constitutes most of the forest west of Quail Trail. This forest type is common on steep, warm aspects with shallow, coarse soils. Forests are open and the understory is dominated by bluebunch wheatgrass with scattered forbs. Saskatoon is a common understory shrub (Iverson et al. 2004).

Polygons 5, 6, 13, 16, 18, 19, and 21 consist of the Ponderosa pine – Bluebunch wheatgrass – Rough fescue ecosystems (PF). The PF ecosystem is generally found on cooler aspects, or more neutral slopes and benches of warm aspects. This forest ecosystem is east of Quail Trail on campus and present in small patches south and southeast of H Lot. It can also be found near the Hollywood Road and University Way roundabout. The overstory of this ecosystem is mainly ponderosa pine and Douglas fir and is moderately closed. Historically, this ecosystem would be shaped and cleared by frequent low-severity surface fires. The understory is a mixture of bluebunch wheatgrass, rough fescue, and pinegrass (*Calamagrostis rubescens*) with scattered shrubs, forbs, and mosses. The PF ecosystem type is provincially red-listed and considered at risk.

Polygons 27 and 70 represent mostly Ponderosa pine – Red three-awn ecosystems (PT). This ecosystem type normally occurs on very shallow soils or ridges on steep, warm aspects. This ecosystem can be found in the forested area north of campus near the top of the hill and small ridge where soils are shallow and dry. These forests are very open with large, scattered trees and exposed bedrock. The understory consists of scattered shrubs and bunchgrasses, including bluebunch wheatgrass and rough fescue.

Polygons 2, 14, 17, 25, 71, and 72 were classified as Ponderosa pine – Bluebunch wheatgrass – Idaho fescue ecosystems (PW). On campus, most of these forests are to the north of main campus and can be found in residual patches between Commons Field and H Lot, and between Nonis Field, the Gym, and John Hindle Drive. This ecosystem can also be found near the pond and on the Upper Bench. This forest type is usually found on gentle slopes with shallow soils on both warm and cool aspects. These sites would historically be maintained by frequent low-severity surface fires. The understory is dominated by saskatoon, bluebunch wheatgrass, rough fescue, and arrowleaf balsamroot. This ecosystem type is limited in the Okanagan and is usually impacted by urban development.

Polygon 24 represents the Douglas fir / Ponderosa pine – Snowbrush – Pinegrass (SP) ecosystem. This forest ecosystem is found on slightly cool aspects on slopes with shallow or very shallow soils, sometimes with exposed bedrock, and can be found to the south/southwest of the Pond on campus. The understory is a mixture of pinegrass and bunchgrasses with some scattered shrubs, forbs, and mosses.

#### *2.3.2.2. Wetlands and Associated Transitional Grasslands*

Polygon 22, the Pond, was classified as Shallow Open Water (OW) with a component of Cattail Marsh (CT). Common cattail (*Typha latifolia*) occurs in depressions, or along the perimeter of lakes and ponds. Water levels vary with season but can be approximately 1-m deep in the spring. The soil is usually mucky and comprised of decomposed organic material (Ryan et al. 2022).

Both polygons 22 and 23, the Pond and the ephemeral pond on the east side of campus, have components of Shallow Open Water (OW). Open Water areas have open water typically less than 2 m deep with no more than 10% emergent vegetation. Polygon 22 has permanent open water, while polygon 23 is ephemeral.

Polygon 51 (Robert Lake) is classified as Alkaline Lake (AK). Alkaline lakes are shallow waterbodies that usually have a pH greater than 7 and are created from runoff that evaporates, resulting in high salinities (Ryan et al. 2022). These lakes and the habitats surrounding them are of high importance because they are uncommon and typically act as biodiversity hotspots.

The area surrounding Robert Lake can be generally classified as Alkaline/Saline Meadow. Polygon 48 represents Nuttall's alkaligrass – foxtail barley (GS02). These ecosystems occur in basins where high evaporation of runoff results in high salinity soil and are generally dominated by salt-tolerant grasses (Ryan et al. 2022).

Polygon 48 also represents another grassland type ecosystem, Baltic Rush - Field Sedge (Gs03). This ecosystem is found near alkaline basins with water tables that are high at least part of the year. Baltic Rush – Field Sedge ecosystems are also uncommon and are considered at risk in BC (Ryan et al. 2022).

Polygons 42 and 47 north of Robert Lake are classified as Reed Canarygrass (RC). These communities are common in marshes and old fields that have been seeded. Reed canarygrass is strongly rhizomatous and creates a dense sod and canopy that excludes other species (Ryan et al. 2022).

#### *2.3.2.3. Human Impacted Areas*

Polygons 1 and 45 make up the majority of the West Campus Lands and are classified as Cultivated Field (CF), with some Cultivated Orchard (CO) to the east of the fields (polygon 7).

Most of the campus core is categorized as Rural (RW) or Urban (UR). We distinguished between these two classifications by the approximate quantity of impermeable surface and vegetation in each polygon. Polygons with buildings, pavement, and other impermeable surfaces were designated as Urban (polygons 20, 40, 41, and 58), while polygons with some structures, but largely had modified, permeable understories (i.e.,

lawn, weedy vegetation) were Rural (polygons 3, 9, 10, 11, 12, 15, 29, 30, 34, 35, 36, 37, 38, 39, 43, 44, 46, 49, 52, 53, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, and 69).

Polygon 31 represents Gravel Pit (GP) toward the northeast end of campus. Polygon 51 near the same area was classified as Exposed Soil (ES).

**Table 2-1.** Ecosystem communities within the UBCO Campus in 2021.

| Biogeoclimatic Subzone | Ecosystem Code | Site Series | Site Series Name | Provincial Status |
|---|---|---|---|---|
| PPxh1 | PF | 05 | Ponderosa pine – Bluebunch wheatgrass – Rough fescue | Red |
| PPxh1 and IDFxh1 | Gs02 | | Nuttall's Alkaligrass – Foxtail Barley | Red |
| BG | Gs03 | | Baltic Rush – Field Sedge | Red |
| PPxh1 | PT | 02 | Ponderosa pine – Red three-awn | Blue |
| PPxh1 | PC | 04 | Ponderosa pine – Bluebunch wheatgrass – Cheatgrass | Blue |
| PPxh1 | PW | 01 | Pondersosa pine – Bluebunch wheatgrass – Idaho fescue | Blue |
| IDFxh | SP | 04 | Interior Douglas fir / Ponderosa Pine – Snowbrush - Pinegrass | Blue |
| PPxh1 and IDFxh1 | CT | | Common Cattail Marsh | Blue |
| - | AK | - | Alkaline Lake | - |
| - | RC | - | Reed Canarygrass | Exotic |
| - | RW | - | Rural | - |
| - | UR | - | Urban | - |
| - | GP | - | Gravel Pit | - |
| - | ES | - | Exposed Soil | - |
| - | OW | - | Shallow Open Water | - |
| - | CO | - | Cultivated Orchard | - |
| - | CF | - | Cultivated Field | - |

[1]**Provincial status:** *Red* = endangered or threatened. *Blue* = of special concern. *Yellow* = not at risk. *NA* = Not listed.
**Note:** Ecosystem status was determined using the BC Species and Ecosystems Explorer tool: https://a100.gov.bc.ca/pub/eswp/ on 2023-05-11.

## 2.4. Change Analysis

Between 2006 and 2021, the University acquired more land to the west of campus and further developed the original campus lands. In 2021, 23% of the campus was classified as ecologically sensitive (wetlands, grasslands, or forests), and there was a slight increase in the total area of sensitive ecosystems from 28.36 to 32.87 ha due to the land acquisition (Table 2). While total ecologically sensitive area increased only slightly, the total proportion of campus made up of ecologically sensitive areas decreased by 6.4% with the further expansion and development of the campus core. Of the ecologically sensitive areas that existed within the original 2005 campus boundary, before the acquisition of lands, 7.6 ha were lost to development by 2021. All ecologically sensitive areas replaced

by development were coniferous woodland ecosystems (Figure 4). Although some treed patches were maintained, these trees were not considered in-tact ecosystems, and thus were not considered retained ecosystems because their understory had been degraded or lost entirely. For example, the tree stand west of ICI was retained during development, and there are also retained tree patches at Knowledge Lane and the University House. While the trees still provide shade and important habitat for birds and other wildlife, they are not considered ecosystems for the purpose of this analysis.

The total area of wetland increased from 0.53 ha to 3.06 ha with the acquisition of Robert Lake and due to an ecosystem change in polygon 23, where water overflow created an ephemeral open water pond. There were no ecologically sensitive grassland ecosystems in 2006 but the acquired transitional grasslands surrounding Robert Lake totalled 2.24 ha and constituted 1.58% of the campus area.

From 2006 to 2021, the area of coniferous woodland stayed approximately the same (Table 2-2). However, the proportion of the campus comprised of forests decreased by 9.5% from 28.98% in 2006 to 19.44% in 2021, as more land was acquired and developed by the University. Part of the acquired lands west of the campus core are forested, but some of the acquired forest has since been developed (polygon 41). While the total forested area increased with the acquisition of lands, the total forested percentage decreased, with some of the forest lost to development by 2021.

As expected with the continued expansion and development of UBCO, total human modified ecosystems (i.e., Urban, Rural, Road Surface, Gravel Pit, and Exposed Soil) have increased from 67.68 ha to 80.53 ha. The percentage of developed lands decreased from 70.5% to 56.8% with the acquisition of new land, mostly made up of fields. Total fields increased from 0 to 28.43 ha and constituted 20% of campus in 2021. Some of the acquired fields were since developed into road surfaces with the construction of Upper Campus Way. This development did not replace ecologically sensitive area; however, permeable soil and vegetation were still replaced by hardscaped road surface.

**Table 2-2.** Sensitive ecosystem change analysis; total area and percentage of study area in 2006 and 2021. Change in percentage is relative to total campus area in 2021.

| Land Type | Ecosystem Type | 2006 Area (ha) | 2021 Area (ha) | 2006 % of Study Area | 2021 % of Study Area | Change in Area (ha) | Change in % |
|---|---|---|---|---|---|---|---|
| Ecologically Sensitive | Wetland | 0.53 | 3.06 | 0.55 | 2.16 | +2.53 | +1.61 |
| | Grassland | 0 | 2.24 | 0 | 1.58 | +2.24 | +1.58 |
| | Forest | 27.83 | 27.57 | 28.98 | 19.44 | -0.26 | -9.54 |
| **Total Ecologically Sensitive Area** | | **28.36** | **32.87** | **29.53** | **23.18** | **+4.51** | **-6.35** |
| Human Modified | Developed Land | 67.68 | 80.53 | 70.47 | 56.78 | +12.85 | -13.69 |
| | Fields | 0 | 28.43 | 0 | 20.04 | +28.43 | +20.04 |
| **Total** | | **96.04** | **141.82** | **100** | **100** | **+45.79** | |

## 2.5. Conclusions and Retention Recommendations

Land acquisition and campus development since 2006 have altered the areas of environmentally sensitive ecosystems. Forests, wetlands, and grasslands have increased slightly since 2006, while developed areas and fields have increased much more, making the total proportion of environmentally sensitive ecosystems lower in 2021 than in 2006. The percentage of natural ecosystems within campus lands decreased by 6.4% from 2006 to 2021. If development of ecologically sensitive areas continues at the same rate, 16.8% of the campus will be classified as ecologically sensitive in 15 years, and in 30 years, roughly 10% of the campus will be classified as ecologically sensitive.

Most of the campus core was classified as Urban or Rural in 2021. The sensitive ecosystems are lakes, ponds, wetlands and transitional grasslands, and coniferous woodland make up the other important ecosystems. The remaining contiguous forest ecosystems are to the north of the campus core, with a small patch in the south near John Hindle Drive. All forests are in early seral stages and are classified as young or pole sapling. The sensitive ecosystems of wetlands and grasslands have increased from 2006 to 2021 due to the acquisition of lands, but still constitute a small proportion of the campus area. If managed with conservation in mind, these habitats may continue to expand as Robert Lake expands.

### 2.5.1 Connectivity and Intact Ecosystems

The remaining forest ecosystems are in early seral stages and have been managed for wildfire and bark and mountain pine beetle mitigation since 2005 (Haupt 2022, pers. comm.). As development continues, forested areas may decrease further. Maintaining total habitat area is important but maintaining connectivity between ecosystems will also

be increasingly vital and difficult as campus develops. Remaining habitats will likely become smaller and more fragmented.

Maintaining small patches of trees as stopovers for birds and other wildlife between forest patches may be beneficial. The creation of a habitat connectivity corridor from the north campus forests to Robert Lake and the nearby off-campus forested areas may also benefit wildlife and allow some species more protected access to the Robert Lake and the associated sensitive habitats.

### 2.5.2 Important Habitats

Small wetlands and associated red-listed ecosystems of Nuttall's Alkaligrass – Foxtail Barley and Baltic Rush - Field Sedge remain in the southwest corner of the West Campus Lands. Robert Lake, designated as Alkaline Lake, was acquired, and has grown since 2006, contributing to an increase in wetland areas. A small stormwater retention pond and cattail marsh toward the southeast account for the remaining Very High and High value areas.

The red-listed forested ecosystem of Ponderosa pine – Bluebunch wheatgrass – Rough fescue (PF) constitutes several polygons north of the campus core area. These forests are young, but may still provide valuable habitat, especially if they are given time to mature.

### 2.5.3 Retention Objectives

Robert Lake and the nearby wetland-associated grassland ecosystems should be retained and protected as important habitat. UBCO may also consider managing the surrounding cultivated field to allow the grassland ecosystems to expand as Robert Lake expands, increasing overall wetlands and grasslands. Additionally, the retention of forested ecosystems, particularly the red-listed Ponderosa pine – Bluebunch wheatgrass – Rough fescue (PF) ecosystems to the north of campus, would be beneficial to wildlife.

Specific options for planning retention objectives are included in Appendix A. To avoid habitat loss and fragmentation, we suggest a no net-loss retention approach. We suggest developing the campus core more densely and avoiding the expansion of development into the forest ecosystems or grassland ecosystems where possible. Maintaining connective patches of trees and natural ecosystems throughout campus will create stopover refuges for wildlife and help increase habitat connectivity. A large section of Gravel Pit, Exposed Soil, and disturbed Rural area exists in the northeast corner of campus. We recommend focusing development on areas that are already disturbed, rather than expanding into natural forests, grasslands, or wetlands.

Natural ecosystems, including wetlands, forests, grasslands, and even agricultural fields, sequester and store carbon dioxide when they are healthy and functional (CCA 2022). All these ecosystems actively sequester carbon with living vegetation, and store carbon in healthy soils (CCA 2022, Lal 2005). Healthy matrices of forests and wetlands specifically

are potent natural carbon sinks (Lafleur et al. 2018). Preserving these habitats on campus will not only benefit wildlife but will advance the goals of carbon sequestration and storage for the UBCO campus.

The remediation and construction of carbon sequestering and storing ecosystems may also help meet carbon sequestration goals. The carbon storage capacity of some ecosystems and agricultural lands can be limited by their soil nutrients and quality. Through paludification, wetlands and peatlands accumulate and store carbon from vegetation in nutrient rich soils that continue to build through slow decomposition and accumulation (Lafleur et al. 2018). However, wetlands are declining globally due to human disturbance (Were et al. 2019).

Carbon sequestration by wetlands can be enhanced by manipulating and restoring their carbon sequestration capacity (Chen et al. 2017, Were et al. 2019). For example, wetland restoration in Illinois resulted in 25-46% more carbon storage in restored wetlands than degraded wetlands in just three years (Chen et al. 2017). Restoring and enhancing wetlands can be done with many approaches, including enhancing soil through microbes and biochar, increasing soil health and plant growth with fertilizer, and using humic acid to increase the residence time of stored carbon (Were et al. 2019).

Carbon sequestration and storage through wetlands can also be directly increased by increasing the spatial extent of a wetland (Were et al. 2019). Robert Lake, the transitional grassland, and nearby cultivated field with underlying clay soils offer a unique and excellent opportunity to expand or create new wetlands. The lake has grown naturally since 2006 and it may continue to grow as surrounding areas develop. Facilitating the growth of this wetland into the surrounding field and remediating the soil and vegetation of the wetland could be a promising and effective natural carbon sequestration tool for the UBCO campus.

## 3.0 2023 ECOLOGICAL UPDATE

The ecosystem change analysis was completed with imagery through 2021 during the winter of 2022, and field surveys to determine the current ecological condition of campus were conducted in January and June of 2023. These surveys included wildlife tree surveys, ground-truthing of ecosystem polygons and their designations, and plant and wildlife surveys. The following section details the results of these surveys, including updated 2023 ecosystem mapping.

### 3.1. Wildlife Trees

The objective of the wildlife tree inventory was to create a database of important wildlife trees and groups of trees that provide wildlife habitat on campus to inform tree management and future development of the UBCO Campus. This section summarizes the

results of the wildlife tree inventory and provides considerations for future development of the campus.

### 3.1.1 Background

Standing dead trees, or snags, provide valuable nesting and roosting locations for many avian species, and potential overwintering and roosting habitat for some bat and small mammal species (Environment Canada 2015, Ganey and Votja 2004, Russell et al. 2006, Scott 1978). Large diameter mature trees with sufficient branch cover or large brooms can also provide important roosting and nesting habitat for birds. These important trees are often referred to as wildlife trees. Ponderosa pine snags act as valuable wildlife trees for many cavity-nesting species (Ganey and Vojta 2004, Scott 1978). Ponderosa pine forests have lower snag densities than other forest types but have equal densities of cavities and cavity-supporting snags as other forest types (Ganey and Vojta 2004). This means that while ponderosa pine snag densities are low, each snag supports higher densities of cavities than many other tree species.

The retention of large snags is often at odds with wildfire mitigation and large dead trees may also harbor insect pests. The removal of wildlife trees results in long-term adverse effects for important species like woodpeckers, swallows, wrens, nuthatches, and owls (Environment Canada 2013, Scott et al. 1977). To help UBCO identify and manage the individual wildlife trees on campus, Ecoscape conducted a wildlife tree survey and created a wildlife tree and tree group database that can be used with GIS to better inform future development.

### 3.1.2 Methods

Prior to surveying trees on campus, Ecoscape reviewed the campus tree database created by Bartlett Tree Experts on ArborScope. We filtered trees in this database by species and maturity level. Specifically, the coordinates of all species identified as mature or semi-mature, except for ponderosa pine, were loaded onto an ArcGIS Online field map for data collection in the field. Considering the number of ponderosa pines on campus, only pines larger than 50 cm diameter at breast height (DBH) were included in the field map to survey. Smaller ponderosa pines provide less habitat potential for wildlife. We chose to filter out smaller Ponderosa Pines because previous work in the area and the database from Bartlett Trees indicated that a range greater than 50 cm DBH captured the largest trees in the area, and therefore those with the highest wildlife tree potential.

#### *3.1.2.1. Wildlife Tree Criteria*

Project biologists Leanne McDonald, R.P. Bio, R.P. Ag, and Angie Kelly, M.Sc., B.I.T. conducted a wildlife tree survey of the campus on January 3rd, 2023. High-value and very high value wildlife trees were identified using professional judgement and criteria from the BC Ministry of Environment (Table 3-1). High-value wildlife trees were trees that had

at least two characteristics from Table 1 or were over 50 cm DBH. Very high-value trees had multiple criteria from Table 1 and signs of wildlife use. The locations of all wildlife trees were mapped, and DBH, species, decay class, value, estimated height, and the status of criteria from Table 1 were recorded for each tree. Wildlife trees were designated relative to the low number of remaining snags and young structural stage of remaining forest on campus. Wildlife trees were determined generously, and some trees that would not have been considered wildlife trees in older, more intact forests were designated as wildlife trees on the UBCO campus.

The locations of tree groups that may be beneficial to wildlife were also mapped. We rated tree groups from low to very high, dependent on stand age and habitat condition, signs of wildlife use, cover provided, presence of wildlife trees, and location on Campus in relation to other groups of trees or forested areas. We recorded value, dominant and secondary species, understory species, estimated mean DBH, and location and total size as a polygon.

**Table 3-1. High value wildlife tree criteria (BC MOE, 2019).**

| Wildlife Tree Value | Criteria |
|---|---|
| A high value tree has at least two of the characteristics listed in the adjacent column and, where possible, is within the upper 10–15% of the diameter range distribution for the site<br><br>NOTE: If a tree has an active nest, then automatically default to high value, regardless of tree size. | • Internal decay (heartrot or natural/excavated cavities present)<br>• A sound, firm stem shell<br>• Crevices present (loose bark or cracks suitable for bats)<br>• Large brooms present<br>• Active or recent wildlife use (feeding, nesting, denning)<br>• Tree structure suitable for wildlife use (suitable for large nest,<br>hunting perch sites, bear den, etc.)<br>• Largest trees for site (height and/or diameter) and veteran trees<br>• Locally important wildlife tree species<br>• Favourably located for use by wildlife |

### 3.1.3 Wildlife Trees

There were 13 very high value and 26 high value wildlife trees for a total of 39 wildlife trees in the campus study area (Table 3-2). All very high and high value wildlife trees were either ponderosa pine or snags, except for one high value Douglas fir (tree ID 10). There were 18 snags and 21 live trees recorded as either very high or high value wildlife trees (Figure 3-1). Live ponderosa pine wildlife trees had a higher mean DBH than snags, likely due to the history of removal of large snags from the campus area. Photos of all wildlife trees by tree ID and tree groups can be found in Appendix A.

Six snags (tree IDs 5, and 19-23) around the edge of the pond in the southeast corner of campus were recorded as very high value wildlife trees (Figure 3-1). These snags were very high value because of their location, the high number of cavities or strong potential

for future cavities, and their visible use by pygmy nuthatches (*Sitta pygmaea*). The decay class of these six wildlife trees ranged between five and seven. All very high value wildlife trees were surveyed for wildlife use on June 8, 2023. The results of those surveys can be found in section 3.3.2.1 Birds and Wildlife Trees.

The largest ponderosa pines recorded were near Research Road behind the Arts building. Tree IDs 3, 14, and 15 on the south end of the row of five large ponderosa pine had extensive signs of roosting by great horned owls (*Bubo virginianus*), including owl pellets below the trees. The DBHs of these three trees were 79 cm (tree 3), 57.5 cm (tree 14), and 96 cm (tree 15), making tree 15 the largest tree on campus. These trees were rated as very high value because of their clear and continued use by owls and their large size. Trees 4 and 16 were also part of this row of ponderosa pine and were rated as high value for their large size and proximity to the trees clearly used by great horned owls.

There were several snags throughout the patch of forest on the northern end of campus that we recorded as high value wildlife trees. These snags were small and did not have many cavities but may provide forage benefits for nuthatches, woodpeckers, and other cavity nesting species if left standing. One snag near the northern boundary of the campus was recorded as very high value. This snag, (tree 29) was short but had a DBH of 74 cm, five cavities, and some crevices created by decaying bark. There were also several sets of small mammal tracks showing repeated travel between this wildlife tree and nearby live trees.

**Table 3-2. Wildlife trees identified in January 2023 by species and mean diameter at breast height.**

| Value | Tree Type | Total Number | Mean DBH (cm) |
|---|---|---|---|
| Very High | Ponderosa Pine (*Pinus ponderosa)* | 5 | 61.7 |
| | Snag | 8 | 32.6 |
| High | Ponderosa Pine (*Pinus ponderosa)* | 15 | 58.0 |
| | Douglas Fir (*Pseudotsuga menziesii*) | 1 | 52.0 |
| | Snag | 10 | 20.7 |

### 3.1.4 Important Tree Groups

One very high value, two high value, nine medium value, and three low value tree groups on campus were mapped (Figure 2-1). The very high value tree group provided important habitat around the pond in the southeast corner of campus and contained very high value wildlife trees. This habitat was relatively intact, and the group contained the most wildlife trees of all tree groups. The pond provides high value habitat for wildlife and maintaining

the forest cover around this habitat is important to facilitating wildlife use and providing an important refuge for wildlife.

High value tree groups had relatively large mean DBH, were mature or semi-mature in age, and had signs of use by birds or deer. Tree groups were also rated as high value because they provided important stopover habitat and connectivity to other ecosystems and tree groups that may support wildlife on campus, and thus help reduced habitat fragmentation. One high value tree group along the southern border of campus bordering John Hindle Drive also contained two very high value wildlife trees.

Medium value tree groups showed some signs of use by wildlife but were younger and contained smaller trees than high value groups. Most medium value tree groups were located on the east and north side, with one group to the south of the of the campus study area near the very high value pond tree group. These medium value groups may contribute to the connectivity between the forested areas and other higher value tree groups (Figure 2-1).

The three low value tree groups were located within the main campus and were isolated from other habitats. The trees in those groups were spares and relatively young. The two low value tree groups nearest to the Arts Building were mapped because they contained blue spruce (*Picea pungens*). The spruce trees were young to semi-mature but may provide well-sheltered nesting habitats for songbirds. The third low value tree group near the sports field was mapped because it contained some relatively large ponderosa pines and may serve as a stopover habitat for birds and other wildlife traveling through campus to other higher value tree groups.

### 3.1.5 Conclusions and Recommendations

The campus study area has few remaining wildlife trees, and wildlife trees were designated generously with consideration of the relative state of age of the forest and treed habitats on campus. Since 2006, the campus has been managed for mountain pine beetle infestations, which has resulted in the removal of 2,471 trees (Haupt 2021). Annual beetle infestations have decreased since 2006, and no new beetle infested trees were found in 2022 (Haupt pers. comm. 2022). Ladder fuels like low branches, and coarse woody debris, or downed logs on the forest floor, have also been routinely removed to mitigate wildfire hazard. There were significant signs of thinning and the removal of low branches throughout the remaining campus forests. Trees and snags were also removed if they were potentially dangerous to the public to leave standing. These combined tree management activities have left few snags and wildlife trees.

Mature dry ponderosa pine forests unaffected by forest management or logging would naturally contain fewer snags in comparison to other forest types when maintained by fire and natural disturbances (Harris 1999). However, forests that burn and are subject to other natural disturbances have biological legacies like standing snags and fallen coarse

woody debris that contribute to the habitat structure as the forest regenerates (Lindenmayer and Noss 2006). While many of these natural biological legacies have been removed from the campus forests, some remain, and more can be retained if the forested areas are not developed and are allowed to mature.

Natural, unmanaged forests progress through seral stages as they recover and regenerate following disturbances such as wildfire and traditional Indigenous burning, windstorms, and pests. Interior Douglas fir and ponderosa pine forests in interior BC are historically fire maintained systems, burning frequently at low to moderate severities (Baron et al. 2021, Brooks et al. 2021). These forests would naturally contain a diversity of tree ages and sizes in a mosaic of seral stages. However, like many forests of the Pacific Northwest, the forests near UBCO have been heavily impacted by fire suppression, harvest, and development, changing their natural fire-regime and seral stages. The forests remaining on the campus are currently in young seral stages, but their structure will change as they mature, and they will naturally become more fire resistant. Finding a balance between promoting healthy habitat and maintaining wildfire safety as forests mature is challenging.

Old growth and mature ponderosa pine stands are not only naturally more resistant to severe wildfire, but they also store significantly more carbon than smaller, younger ponderosa pines (Law et al. 2003). Carbon sequestration by ponderosa pine stands increases rapidly as stands age, and plateaus around 150-200 years of age, but does not decrease in old growth stands (Law et al. 2003). Managing ecosystems to develop and keep mature, healthy forests increases overall carbon storage capacity. Healthy forests with balanced soils store carbon not only in trees and other vegetation, but also in the soil (Lal 2005).

Excluding fire from ponderosa pine stands increases the total stored carbon, but also increases the volatility and risk of high-severity wildfire. Wildfire mitigation treatments like thinning decrease the total carbon storage of a stand but increase the sustainability of that carbon storage over a longer period by reducing the risk of high-severity wildfire (Hurteau et al. 2011).

Large individual trees store significantly more carbon than small trees, and carbon storage increases dramatically with increased DBH (Mildrexler et al. 2020). In a study of forests in the Pacific Northwest, large diameter trees accounted for 3% of the trees in study plots but stored 42% of the total carbon of the study plots (Mildrexler et al. 2020). Retaining large individual trees and developing and protecting healthy forest habitats are highly effective ways to sequester and store carbon.

#### *3.1.5.1. Tree Retention Recommendations*

Flammulated owls (*Psiloscops flammeolus*, provincially blue-listed) and Lewis's woodpeckers (*Melanerpes lewis*, blue-listed and federally threatened) require a snag

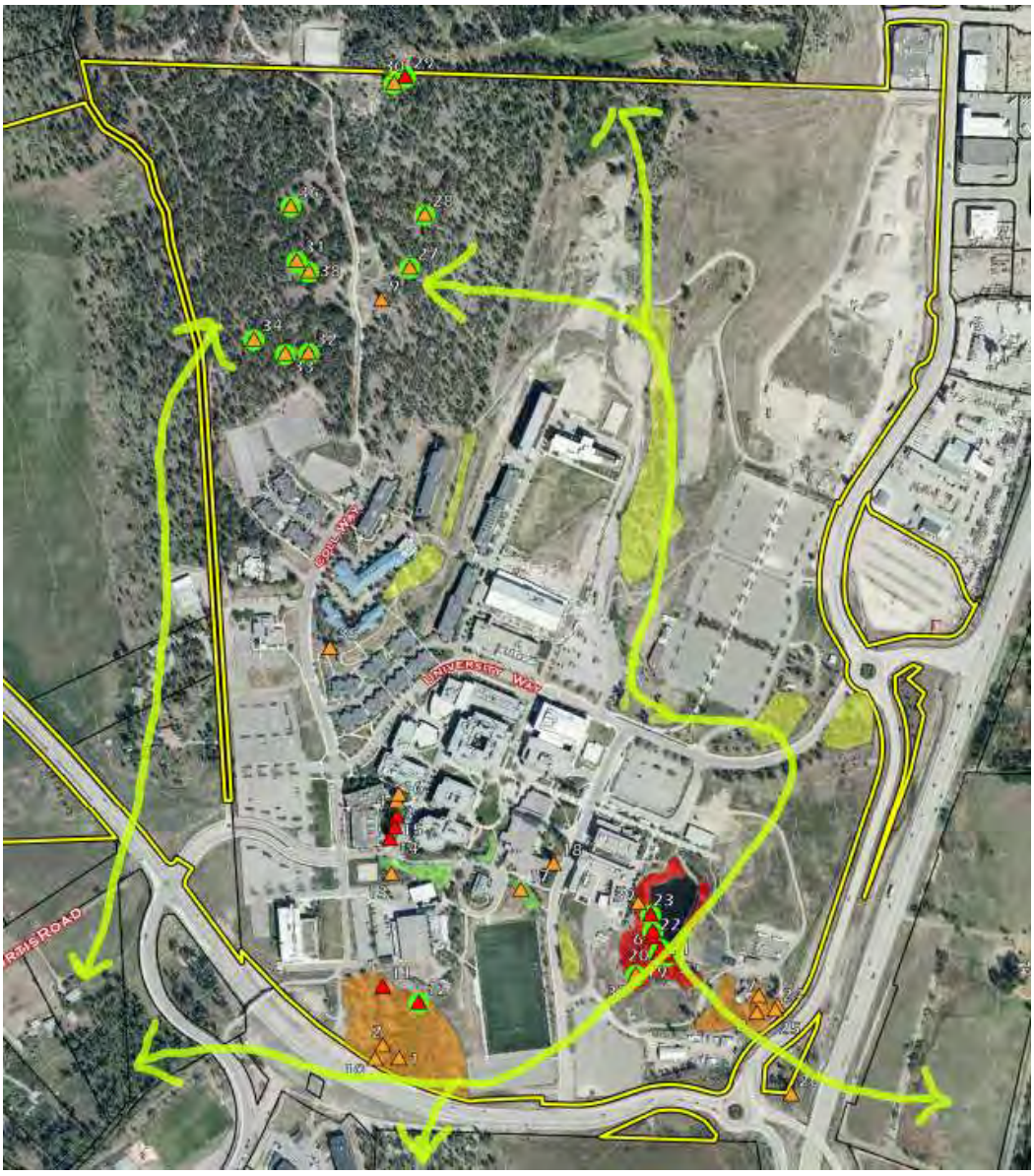
density of approximately 0.25 – 1.2 snags per ha (Stringer et al. 2013). Snags for flammulated owl use should be at least 45 cm DBH, and at least 53 cm DBH for Lewis's woodpeckers (Stringer et al. 2013). Ponderosa pine snags stay standing for approximately 10 to 20 years following wildfire (Russell et al. 2006). Older, larger DBH ponderosa pine snags also stay standing longer than smaller, younger ponderosa pines (Russell et al. 2006, Smith 1999). Thus, we recommend retaining large trees and snags wherever possible to facilitate use by at-risk species. When retention is not possible, wildlife trees should be modified rather than removed whenever feasible following the BC Ministry of Environment Best Management Practices for wildlife trees found here:

- https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/hazardtree_26may_09.pdf

The wildlife trees around the pond to the southeast of campus are excellent examples of wildlife trees. It is strongly recommended that these trees be retained and the very high valued tree group around the pond continue to be protected to provide refuge for wildlife in a highly altered landscape. We also recommend retaining any future snags in the treed patch, regardless of size, to allow them to become wildlife trees and contribute to the habitat structure of the forest.

We recommend the retention of remaining snags and other biological legacies (i.e., coarse woody debris) for wildlife use wherever possible, particularly in the northern forested area and the high value tree group on the southern border of campus. However, we recognize that habitat preservation goals are often at-odds with wildfire mitigation strategies, especially in urban and rural settings. Retention of large trees can help mitigate wildfire risks over time. Large, fire tolerant trees, such as ponderosa pine, and mature forest stands that have evolved to survive low-severity fire reduce the risk of high-severity crown fires (Hessburg et al. 2022). If the forested areas of campus can be retained and allowed to mature, large trees will become more fire resistant.

Preservation of the forested area from the north border of campus through the Upper Bench area would protect the largest and most intact forest habitat on campus. The eastern edge of the forested area on the Upper Bench provides connectivity to the string of medium value tree groups along the edge of the campus core. These tree groups may act as steppingstones of habitat connectivity around the campus core from north to south and connect wildlife to the very high value tree group near the pond (Inset 1 and Figure 1). Fragmenting this corridor with roads and development may reduce wildlife movement around and through campus.




**Inset 3-1. Potential connectivity of habitats and potential wildlife movement around the UBCO Campus with imagery from 2021.**

### *3.1.5.2. Habitat Enhancement Recommendations*

Even with snag and tree retention plans in place, the development of snags and wildlife trees will take time. To facilitate wildlife use of forests and replicate habitat features of snags in the interim, nest boxes could be installed. Nest boxes and artificial cavities can create useful habitat features for threatened cavity nesting species like Lewis's woodpeckers, Western screech owls (*Megascops kennicottii*, blue-listed and federally threatened), and flammulated owls (Environment Canada 2013, Stringer et al. 2013). All these species depend on snags large enough to support cavities for nesting (Environment and Climate Change Canada 2017, Environment Canada 2013, Western Screech-Owl *macfarlanei* subspecies Recovery Team 2008). However, use of nest boxes by these

species will depend on the size, maturity, and quality of surrounding forest and foraging areas. For example, Lewis's woodpeckers require fruit-bearing shrubs, such as saskatoon (*Amelanchier alnifolia*) and choke cherry (*Prunus virginiana*), nearby nest sites as a food resource (Environment Canada 2017). Nest boxes should be used in conjunction with habitat protection and remediation plans and are not a long-term solution to replace healthy, intact forest ecosystems.

Some species of bats depend on crevices or tree cavities for roosting. Bats are currently declining in BC and North America due to habitat loss and White Nose Syndrome (Ministry of Environment 2016). Bat species such as the little brown myotis (*Myotis lucifugus*), a provincially blue-listed and federally endangered species, uses bat boxes and other anthropogenic structures as roosts, and the population has suffered due to loss of habitat and natural roost sites (Environment Canada 2015). Installation of bat boxes may also help facilitate habitat use by bats. Bat boxes may be useful in areas near wetlands, for example on large trees in the high value tree group on the southern border of the Campus study area closest to Robert Lake. The best management practices for BC bats can be found here:

- http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=12460

Plans for constructing bat boxes and nest boxes for Lewis's woodpeckers and screech owls can be found in Appendix B. Nest boxes may need repairs and bat boxes may require refreshing of dark paint every few years to help maintain the temperature inside the box. However, minimizing human disturbance to bat boxes helps prevent the transmission of White Nose Syndrome to resident bats, so bat boxes should not be tampered with unless necessary (Environment Canada 2015). Like nest boxes, bat boxes can only provide useful bat roosts if the surrounding habitat is of sufficient quality for bat foraging. Thus, bat boxes should be installed in protected and remediated habitats that will not be lost to development. Organising volunteer students, faculty, or alumni may be an effective way to maintain nest and bat boxes.

## 3.2. 2023 Terrestrial Ecosystem Mapping

In 2022, the Province of BC released a significant update to their biogeoclimatic mapping of zones, subzones, and variants, as well as a revision of all site series within the Southern Thompson-Okanagan (Ryan et al. 2022). Although similar to the previously published field guide (Lloyd et al. 1990), the classifications differ in that:

- Nomenclature and coding of biogeoclimatic subzones and variants have changed for some units;
- There are new provincial standards for the coding of site units; and
- Non-forested ecosystems are described for wetland, flood, grassland, rock and avalanche classes.

To be consistent with the new mapping update, Ecoscape used a crosswalk table to transition from the old nomenclature to the new mapping standard. In addition, the TEM designations and polygon boundaries were ground-truthed on campus in June 2023. Overall, the polygons boundaries and TEM designations remained mostly unchanged between 2021 and 2023, however there are new ecosystem codes and changes to the site series names for the natural ecosystems. In one case, two of the forested ecosystems (PF and PW), were condensed into a single ecosystem (101) under the new mapping standard. Table 3-3 provides a summary of the new ecosystem codes and new site series names, while Figure 3-2 provides the updated mapping.

The seventy-two numbered ecosystem polygons identified and described in 2021 as part of the Ecosystem Change Analysis (see Section 2.3.2) (Figure 2-3) largely remained the same. The updates to ecosystems in 2023 are depicted as new polygon numbers (73-75) (Figure 3-2). The changes in ecosystems included a splitting of polygon 4, a forested ecosystem in the northern part of campus, into two different forested polygons (4 and 73). Polygon 73 occurs in a transition zone and encapsulates aspects of two different ecosystems (104 and 101), and therefore it was decided to create a new polygon to better reflect this transition.

A new polygon (#74) was created at the north end of the pond to better capture the narrow flood fringe community, Water birch – Red osier dogwood - Rose (Ff01), that surrounds that section of the pond. This ecosystem typically occurs around the margins of ponds or along small streams and is dominated by broadleaf shrubs such as roses, water birch and snowberry. Polygon 24 which occurs along the western and southern boundary of the pond was split into two polygons (24 and 75) to better reflect the two different forested ecosystems that surround the pond. Polygon 75 is comprised of mostly 101 with only a small component of 110, while polygon 24 is entirely comprised of 110 (see Table 3-3).

The other change between 2021 and 2023 was the reclassification of polygons 42 and 47. These transitional communities occur at the north end Robert Lake and straddle John Hindle Drive. These polygons were changed from Reed Canarygrass to components of Cattail Marsh (Wm05) and Field Sedge (Ga03). These more recent features have likely been influenced by the presence of John Hindle Drive through additional convenance of water to these areas.

**Table 3-3.** Ecosystem communities within the UBCO Campus in 2023 using the new Provincial mapping standard (Ryan et al. 2022).

| Biogeoclimatic Subzone | Old Ecosystem Code | New Ecosystem Code | New Site Series Name | Provincial Status |
|---|---|---|---|---|
| PPxh1 | PF & PW | 101 | Ponderosa pine / Interior Douglas fir – Bluebunch wheatgrass – Rough fescue | Red |
| PPxh1 | Gs02 | Ga02 | Nuttall's Alkaligrass – Foxtail Barley | Red |
| PPxh1 | Gs03 | Ga03 | Field Sedge | Red |
| PPxh1 | DM | Ff01 | Water birch – Red osier dogwood – Rose | Red |
| PPxh1 | PT | 102 | Ponderosa pine / Interior Douglas fir – – Bluebunch wheatgrass – Selaginella | Blue |
| PPxh1 | PC | 104 | Ponderosa pine – Bluebunch wheatgrass – Balsamroot | Blue |
| PPxh1 | SP | 110 | Interior Douglas fir / Ponderosa Pine – Pinegrass | Blue |
| PPxh1 | CT | Wm05 | Common Cattail Marsh | Blue |
| - | AK | AK | Alkaline Lake | - |
| - | RW | RW | Rural | - |
| - | UR | UR | Urban | - |
| - | GP | GP | Gravel Pit | - |
| - | ES | ES | Exposed Soil | - |
| - | OW | OW | Shallow Open Water | - |
| - | CO | CO | Cultivated Orchard | - |
| - | CF | CF | Cultivated Field | - |

[1]**Provincial status:** *Red* = endangered or threatened. *Blue* = of special concern. *Yellow* = not at risk. *NA* = Not listed.
**Note:** Ecosystem status was determined using the BC Species and Ecosystems Explorer tool**:** https://a100.gov.bc.ca/pub/eswp/ on 2023-05-11.

### 3.2.1 2023 Environmentally Sensitive Areas

Environmentally Sensitive Areas were classified based on the ecosystem characteristics and wildlife habitat suitability of each delineated terrestrial ecosystem polygon on campus in 2023. We used professional judgement, previous experience, and various environmental criteria to rank each polygon. We considered BC Conservation Data Center (CDC) status (i.e., Red or Blue listing), rare and endangered species occurrence potential, landscape condition (i.e. presence of invasive species, connectivity, and fragmentation), successional status, regional rarity, and relative biodiversity. Based on these criteria, each

ecosystem polygon was assigned a value rating reflective of the overall habitat condition. Value ratings were assigned using the environmental sensitivity analysis classes below:

- Very high (ESA 1): These areas represent extremely high ecological value and typically contain rare or critical habitat areas for sensitive or at-risk species, undisturbed or pristine ecosystems and habitats, and biodiversity hotspots (e.g., wetlands, old growth forest). They substantially contribute to the regional habitat function and connectivity and are the highest priority for conservation.
- High (ESA 2): These areas contribute to the regional biodiversity and connectivity of the surrounding landscape but lack critical habitats for at risk species (e.g., riparian areas, mature forest). Development should generally avoid these areas to conserve the important features or to allow potential progression to the Very High category (e.g., mature forest becoming old growth). Encroachment into these areas should be compensated for by restoration in other areas to work towards achieving a no net loss of High value habitats.
- Moderate (ESA 3): Ecosystems of moderate significance represent disturbed habitats or fragmented features with the potential to return to High value through natural succession (e.g., young or fragmented forest, degraded habitats). Moderate areas contribute to the diversity of the landscape; however, their condition and adjacency may limit significant function. These areas will benefit from restoration and enhancement activities which will facilitate succession to higher value habitats.
- Low (ESA 4): These areas contribute little to no value regarding habitat diversity and have limited potential for supporting significant wildlife (e.g., heavily impacted or disturbed sites). Development is typically focused on these areas based on their limited contribution to regional biodiversity and limited capacity to return to high value through natural succession. These areas may be restored through intensive remediation and management practices.

Polygons 22 and 51 were the highest ranked ecosystems of ESA 1, or very high value, and were 2.0% of the campus area and a total of 2.9 ha (Table 3-4, Figure 3-3). These polygons represented valuable wetland habitats of Robert Lake (polygon 51) and the pond near the engineering building (polygon 22). Polygons near these wetlands were ranked as high (ESA 2) and represented the alkaline grassland ecosystems near Robert Lake and riparian forests near the pond. The other high value polygons were forested areas. Most of these ecosystems were to the north of campus, with one small stand of trees represented as polygon 25 to the south of campus, and another small stand of trees (Polygons 24, 71, 74, & 75) around the pond at the southeast end of campus. All high value areas combined were 28.09 hectares and made up 19.8% of the campus study area.

The remaining campus area was either moderate value (44.9%) or low value (33.3%). Moderate ESA rated areas were sites that have been altered by human activity, but still represent green vegetated areas with some remaining habitat value, such as cultivated fields, isolated trees, and undeveloped fields. Polygon 12, for example, was originally listed as a low value area in 2021 but has been changed to moderate with re-evaluation in 2023 because it consists of green vegetated space that is used by some wildlife, rather than paved or open exposed soil. All hardscaped areas, such as buildings and parking lots, and areas of heavy disturbance, including gravel pits and exposed soil, were rated as low value.

**Table 3-4.** Environmental sensitivity analysis polygon rankings and total area and percentage of study area for the UBCO Campus in 2023.

| ESA Value | Area (ha) | Percentage of Study Area (%) |
|---|---|---|
| Very High (ESA 1) | 2.90 | 2.0 |
| High (ESA 2) | 28.09 | 19.8 |
| Moderate (ESA 3) | 63.57 | 44.9 |
| Low (ESA 4) | 47.27 | 33.3 |
| **Total** | **141.83** | **100** |

## 3.3. Plant and Wildlife Surveys

Spring surveys of the campus's plants and wildlife and monitoring of the wildlife trees identified in the fall was conducted on June 8th, 2023, by Leanne McDonald, R.P. Bio and Angie Kelly, M.Sc., B.I.T.

Wildlife trees identified as very high value were surveyed for wildlife use on June 8th, 2023. The weather was clear and sunny. Monitoring of trees 5, 21, 22, and 23 at the pond began at 6:47 am and ended at 7:02 am, and it was 11° C. Monitoring of trees 6, 24, and 25 began at 7:25 and ended at 7:40, and it was 16° C. Trees 11 and 12, the wildlife trees in the patch of trees near the southwestern boundary along John Hindle Drive were monitored from 8:25 to 8:40 am, and it was 20° C. Tree 29 along the north boundary of campus was monitored from 9:47 to 10:02 am and it was 23° C.

### 3.3.1 Plants

Plants were identified and recorded by location and broad ecosystem type, rather than specific TEM ecosystem designation (Table 3-5). Exotic species were present in all ecosystem types surveyed, and were most prevalent in areas of disturbance, such as near parking lots and pathways, and throughout the Upper Bench. Several provincially and regionally noxious species were observed. These noxious species were most common

along the Upper Bench and near the gravel pit areas but were also present in other ecosystems, including the pond and Robert Lake. We recommend control measures for invasive and noxious weeds throughout campus, especially near wetlands. This will continue to be important as more land is developed, invasive species are adept at rapidly colonizing disturbed soils. The invasive species found near lot H and the exposed soils to the north of it are a good example of this. More information and recommendations on invasive weed management can be found in Appendix C.

#### *3.3.1.1. Culturally Significant Plants*

Potential culturally significant plants that were observed on campus are listed in Table 3-5 in bold. References citing their traditional uses are also given. However, Ecoscape cannot state for certain if these plants are culturally significant, and we recommend that the Planning Department engage with First Nations to determine the cultural significance of all plants listed.

**Table 3-5.** Plant species observed within campus lands on June 8, 2023. Species identified as culturally important are listed in bold.

| Ecosystem Type and Location | Family | Scientific Name | Common Name | BC List[1] or Status |
|---|---|---|---|---|
| **Forests** (North forests, and near Gym and Pond) | ***Asteraceae*** | ***Achillea millefolium*** | **Yarrow[2]** | **Yellow** |
| | *Poaceae* | *Agropyron cristatum* | Crested Wheatgrass | Exotic |
| | ***Rosaceae*** | ***Amelanchier alnifolia*** | **Saskatoon[2, 3]** | **Yellow** |
| | ***Asteraceae*** | ***Antennaria spp.*** | **Pussytoes[2]** | **Yellow** |
| | *Asteraceae* | *Antennaria umbrinella* | Umber Pussytoes | Yellow |
| | *Apocynaceae* | *Apocynum androsaemifolium* | Spreading Dogbane | Yellow |
| | *Asteraceae* | *Baladamorhiza sagittat* | Arrowleaf Balsamroot | Yellow |
| | ***Berberidaceae*** | ***Berberis aquifolium*** | **Tall Oregon-Grape[4]** | **Yellow** |
| | *Poaceae* | *Calamagrostis rubescens* | Pinegrass | Yellow |
| | *Rhamnaceae* | *Ceanothus sanguineus* | Redstem Ceanothus | Yellow |
| | *Asteraceae* | *Chondrilla juncea* | Skeleton-weed | Exotic |
| | *Asteraceae* | *Chrysothamnus viscidiflorus* | Green Rabbit-brush | Yellow |
| | *Santalaceae* | *Comandra umbellata* | Bastard Toadflax | Yellow |
| | *Poaceae* | *Dactylis glomerata* | Orchard Grass | Exotic |
| | *Acanthaceae* | *Erigeron divergens* | Diffuse Daisy | Yellow |
| | *Asteraceae* | *Erigeron speciosus* | Showy Daisy | Yellow |
| | ***Rosaceae*** | ***Fragaria chiloensis*** | **Strawberry[2, 3]** | **Yellow** |
| | *Asteraceae* | *Grindelia squarrosa var. quasiperennis* | Curly-cup Gumweed | Unknown |
| | *Saxifragaceae* | *Heuchera cylindrica* | Round-leaved Allum Root | Yellow |
| | *Asteraceae* | *Hieracium scouleri* | Scouler's Hawkweed | Yellow |
| | *Cupressaceae* | *Juniperus communis* | Common Juniper | Yellow |
| | *Fabaceae* | *Lathyrus odoratus* | Sweet Pea | Exotic |
| | *Brassicaceae* | *Lepidium perfoliatum* | Clasping-leaved Peppergrass | Exotic |
| | *Linaceae* | *Linum spp.* | Flax | Exotic |
| | *Boraginaceae* | *Lithospermum ruderale* | Lemonweed | Yellow |
| | *Poaceae* | *Lolium hybridum* | Intermediate Rye Grass | Exotic |
| | *Apiaceae* | *Lomatium macrocarpum* | Large-fruited desert-parsley | Yellow |
| | ***Fabaceae*** | ***Medicago sativa*** | **Alfalfa[2, 3]** | **Exotic** |
| | *Fabaceae* | *Melilotus albus* | White Sweet Clover | Exotic |
| | *Hydrangeaceae* | *Philadelphus lewisii* | Mock-orange | Yellow |
| | *Pinaceae* | *Pinus ponderosa* | Ponderosa Pine | Yellow |
| | *Plantaginaceae* | *Plantago patagonica* | Wooly Plantain | Yellow |
| | ***Rosaceae*** | ***Prunus virginiana*** | **Choke Cherry[2, 3, 4]** | **Yellow** |
| | *Poaceae* | *Pseudotoegnerisa spicata* | Bluebunch Wheatgrass | Yellow |

**Table 3-5.** Plant species observed within campus lands on June 8, 2023. Species identified as culturally important are listed in bold.

| Ecosystem Type and Location | Family | Scientific Name | Common Name | BC List[1] or Status |
|---|---|---|---|---|
| | ***Pinaceae*** | ***Pseudotsuga menziesii*** | **Interior Douglas Fir[2, 3]** | **Yellow** |
| | ***Rosaceae*** | ***Rosa acicularis ssp. sayi*** | **Prickly Rose[2]** | **Yellow** |
| | *Asteraceae* | *Sonchus oleraceus* | Common Sow Thistle | Provincially noxious |
| | *Caprifoliaceae* | *Symphoricarpos albus* | Common Snowberry | Yellow |
| | ***Asteraceae*** | ***Taraxacum spp.*** | **Dandelion[2]** | **Exotic** |
| | *Liliaceae* | *Toxicoscordion venenosum var. venenosum* | Meadow Death Camas | Yellow |
| | *Ulmaceae* | *Ulmus pumila* | Siberian Elm | Exotic |
| | *Dryopteridaceae* | *Woodsia alpina* | Alpine Cliff Fern | Yellow |
| **Wetlands and Riparian Forest** (Pond) | ***Aceraceae*** | ***Acer glabrum var. douglasii*** | **Douglas Maple[2]** | **Yellow** |
| | *Apocynaceae* | *Apocynum androsaemifolium* | Spreading Dogbane | Yellow |
| | *Asteraceae* | *Arctium minus* | Common Burdock | Regionally noxious |
| | *Fabaceae* | *Astragalus miser* | Timber Milk-vetch | Yellow |
| | *Betulaceae* | *Betula occidentalis* | Water Birch | Yellow |
| | *Brassicaceae* | *Brassica spp.* | Mustard | Exotic |
| | *Poaceae* | *Bromus tectorum* | Cheatgrass | Provincially noxious |
| | *Asteracea* | *Centaurea diffusa* | Diffuse Knapweed | Provincially noxious |
| | *Asteraceae* | *Cirsium arvense var. horridum* | Canada Thistle | Provincially noxious |
| | ***Cornaceae*** | ***Cornus sericea*** | **Red Osier Dogwood[2, 3, 4]** | **Yellow** |
| | ***Rosaceae*** | ***Crataegus douglasii*** | **Black Hawthorn[2, 3]** | **Yellow** |
| | *Onagraceae* | *Epilobium latifolium* | Broad-leaved Willowherb | Yellow |
| | *Poaceae* | *Fescue spp.* | | |
| | *Asteraceae* | *Gaillardia aristata* | Brown-eyed Susan | Yellow |
| | *Asteraceae* | *Heterotheca villosa* | Hairy Golden-aster | Yellow |
| | *Lemnaceae* | *Lemna spp.* | Duckweed | Yellow |
| | *Brassicaceae* | *Lepidium draba* | Heart-podded Hoarycress | Regionally noxious |
| | *Asteraceae* | *Matricaria discoidea* | Pineapple Weed | Provincially noxious |
| | *Vitaceae* | *Parthenocissus quinquefolia* | Virginia Creeper | Exotic |
| | ***Salicaceae*** | ***Populus trichocarpa*** | **Black Cottonwood[2, 3]** | **Yellow** |

**Table 3-5.** Plant species observed within campus lands on June 8, 2023. Species identified as culturally important are listed in bold.

| Ecosystem Type and Location | Family | Scientific Name | Common Name | BC List[1] or Status |
|---|---|---|---|---|
| | *Rosaceae* | *Potentilla recta* | Sulphur Cinquefoil | Regionally noxious |
| | *Salicaceae* | *Salix bebbiana* | Bebb's Willow | Yellow |
| | ***Saliaceae*** | ***Salix lasiandra var. lasiandra*** | **Pacific Willow[2]** | **Yellow** |
| | *Solanaceae* | *Solanum dulcamara* | Bittersweet Nightshade | Provincially noxious |
| | *Rosaceae* | *Spirea lucida* | Birch-leaved Spirea | Yellow |
| | *Asteraceae* | *Tragopogan dubius* | Yellow Salsify | Exotic |
| | ***Typhaceae*** | ***Typha latifolia*** | **Common Cattail[2, 3]** | **Yellow** |
| | *Scrophulariaceae* | *Verbascum spp.* | Mullein | Exotic |
| **Wetlands and Grasslands** (Robert Lake) | *Cyperaceae* | *Bolboschoenus maritime ssp. paladosus* | Maritime Bullrush | Yellow |
| | *Ranunculaceae* | *Ceratocephala testiculata* | Hornseed Buttercup | Exotic |
| | *Poaceae* | *Elymus repens* | Quackgrass | Regionally noxious |
| | *Poaceae* | *Hordeim jubatum* | Foxtail Barley | Yellow |
| | *Asteraceae* | *Logfia arvensis* | Field Filago | Exotic |
| | *Poaceae* | *Puccinellia nuttalliana* | Nuttall's Alkaligrass | Yellow |
| **Disturbed and Cleared Areas** (Upper Bench, H Lot, Exposed Soils) | *Simaroubaceae* | *Ailanthus altissima* | Tree of Heaven | Exotic |
| | *Brassicaceae* | *Berteroa incana* | Hoary Alyssum | Regionally noxious |
| | *Poaceae* | *Bromus japonicus* | Japanese Brome | Exotic |
| | *Brassicaceae* | *Capsella bursa-partoris* | Shepherd's purse | Exotic |
| | *Convolvulaceae* | *Convolvulus arvensis* | Field Bindweed | Exotic |
| | *Boraginaceae* | *Echium vulgare* | Viper's Bugloss | Exotic |
| | *Elaeagnaceae* | *Elaeagnus angustifolia* | Russian Olive | Exotic |
| | *Geraniaceae* | *Erodium cicutarium* | Common Stork's Bill | Exotic |
| | *Asteraceae* | *Onopordum acanthium ssp. acanthium* | Scotch Thistle | Regionally noxious |
| | *Poaceae* | *Phleum pratense* | Timothy | Exotic |
| | *Poaceae* | *Poa bulbosa ssp. vivipara* | Bulbous Bluegrass | Exotic |
| | *Polygonaceae* | *Rumex crispus* | Curled Dock | Exotic |

[1] **Yellow**: Not considered at risk. **Blue**: Of special concern. **Red**: Endangered or threatened.

[2] Turner, Nancy J., R. Bouchard, and D.I.D. Kennedy. 1980. Ethnobotany of the Okanagan-Colville Indians of British Columbia and Washington, Victoria. British Columbia Provincial Museum.

[3]Palmer, G. 1975. Shuswap Indian Ethnobotany, Syesis 8:29-51.

[4]Teit, James A. 1928. The Salishan Tribes of the Western Plateaus, SI-BAE Annual Report #45.

### 3.3.2 Wildlife

The UBCO campus contains many ecosystem types, including wetlands and dry ponderosa pine forests, that provide potential habitat for a wide array of wildlife including birds, mammals, and amphibians.

#### *3.3.2.1. Birds and Wildlife Trees*

Table 3-6 provides a summary of the birds observed on June 8, 2023 including their provincial and federal status and their use of wildlife trees. Tree 29 showed signs of possible small mammal use, with leaves and moss that were possible bedding materials in one of the cavities. This tree also had several sets of tracks leading to and away from it in the snow when it was visited in January. The tracks were not clear enough to be identified but may have been red squirrel tracks.

Trees 5, 22, 24, and 25 near the pond were used by birds. Tree 22 had many cavities that were used by house sparrows (*Passer domesticus*) and European starlings (*Sturnus vulgaris*), both exotic species, for nesting. Pygmy nuthatches (*Sitta pygmaea*) were observed using cavities in tree 5, and a red-winged blackbird was likely nesting in tree 25. The redheads (*Aythya americana*) observed at the Pond were a breeding pair and had six ducklings.

The trees that showed extensive signs of great horned owl roosting in January, trees 3, 14, and 15, showed little sign of owl use in June. This may be because the campus resident great horned owls have increased their territory range or changed roosting spots with the seasons. Several great horned owl feathers were found on the ground in the trees just north of lot R, as well as wing marks in the sand beneath the trees. These were likely from fledgling owls hopping along the ground as they learn to fly.

**Table 3-6.** Birds observed on campus on June 8, 2023, with their provincial and federal status and wildlife tree ID, if relevant.

| Ecosystem Type and Location | Scientific Name | English Name | BC List or Status | SARA Status | Wildlife Tree ID |
|---|---|---|---|---|---|
| **Forests** (North forests, and near Gym and Pond) | *Contopus sordidulus* | Western Wood-Pewee | Yellow | | |
| | *Corvus corax* | Common Raven | Yellow | Secure | |
| | *Haliaeetus leucocephalus* | Bald Eagle | Yellow | | |
| | *Passerculus sandwichensis* | Savannah Sparrow | Yellow | | |
| | *Piranga ludoviciana* | Western Tanager | Yellow | | |
| | *Poecile atricapillus* | Black-capped Chickadee | Yellow | | |
| | *Pooecetes gramineus* | Vesper Sparrow | Yellow | | |
| | *Setophaga coronate* | Yellow-rumped Warbler | Yellow | | |
| | *Troglodytes aedon* | House Wren | Yellow | | |

**Table 3-6.** Birds observed on campus on June 8, 2023, with their provincial and federal status and wildlife tree ID, if relevant.

| Ecosystem Type and Location | Scientific Name | English Name | BC List or Status | SARA Status | Wildlife Tree ID |
|---|---|---|---|---|---|
| **Wetlands and Riparian Forest** (Pond) | *Agelaius phoeniceus* | Red-winged Blackbird | Yellow | | 25 |
| | *Anas platyrhynchos* | Mallard | Yellow | | |
| | *Aythya americana* | Redhead | Yellow | | |
| | *Bombycilla cedorum* | Cedar Waxwing | Yellow | | |
| | *Charadrius vociferus* | Killdeer | Blue | | |
| | *Colaptes auratus* | Northern Flicker | Yellow | | |
| | *Icterus bullockii* | Bullock's Oriel | Yellow | | |
| | *Mareca strepera* | Gadwall | Yellow | | |
| | *Melospiza melodia* | Song Sparrow | Yellow | | |
| | *Passer domesticus* | House Sparrow | Exotic | | 22 |
| | *Pica hudsonia* | Black-billed Magpie | Yellow | | |
| | *Sitta pygmaea* | Pygmy Nuthatch | Yellow | | 5 |
| | *Spinus tristis* | American Goldfinch | Yellow | | |
| | *Sturnus vulgaris* | European Starling | Exotic | | 22 |
| | *Tachycineta bicolor* | Tree Swallow | Yellow | | 24 |
| | *Tachycineta thalassina* | Violet-green Swallow | Yellow | | |
| | *Turdus migratorius* | American Robin | Yellow | | |
| | *Tyrannus tyrannus* | Eastern Kingbird | Yellow | | |
| | *Zenaida macroura* | Mourning Dove | Yellow | | |
| **Wetlands and Grasslands** (Robert Lake) | *Himantopus mexicanus* | Black-necked Stilt | Not Reviewed | | |
| | *Spatula cyanoptera* | Cinnamon Teal | Yellow | | |
| | *Spatula discors* | Blue-winged Teal | Yellow | | |
| | *Podiceps nigricollis* | Eared Grebe | Blue | | |
| | *Troglodytes aedon* | House Wren | Yellow | | |
| | *Xanthocephalus xanthocephalus* | Yellow-headed Black Bird | Yellow | Secure | |
| **Disturbed and Cleared Areas** (Upper Bench, H Lot, near Ephemeral Pond) | *Stelgidopteryx serripennis* | Northern Rough-winged Swallow | Yellow | | |

[1] **Yellow**: Not considered at risk. **Blue**: Of special concern. **Red**: Endangered or threatened.

[2] **Not at Risk**: A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances. **Special Concern**: A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats. **Endangered**: A wildlife species facing imminent extirpation or extinction. **Threatened**: A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

#### *3.3.2.2. UBCO Wildlife*

A list of UBCO species was compiled from several sources and can be found in Appendix B. We included all wildlife observed during our January 3 and June 8 field visits, and added all species recorded by UBCO professors Ian Walker, Robert Lalonde, and E. Blythe Nilson from their observations and their searches of eBird (Walker et al. 2019). We then searched the BC Conservation Data Center for all species at risk that use ecosystem types present in the UBCO campus lands and have the reasonable potential to be present on campus.

### 3.3.3 Wildlife Species at Risk

Many species at risk have been observed on the UBCO campus, either during field visits for this assessment or during other projects (Table 3-7). These species include the American badger, the Great Basin spadefoot, Western yellow-bellied racer, and Northern rubber boa.

A search of the BC Conservation Data Center (CDC) identified several more species at risk occurrences within the campus boundary, including the American avocet (*Recurvirostra americana),* which relies on marshes, ponds, and alkaline lakes, and have been observed nesting at Robert Lake (AOU 1983, BC CDC 2022). The Great Basin spadefoot, a provincially blue-listed and federally threatened species, has been observed at Robert Lake, breeds in a storm ditch associated with parking lot H and an adult was encountered beneath woody debris upslope of parking lot H during the ecological assessment in 2014. The Great Basin spadefoot also requires dry conifer forest near wetlands for terrestrial habitat. Another provincially blue-listed species, the painted turtle (*Chrysemys picta*) also utilizes Robert Lake (BC CDC 2022) and the Pond. The painted turtle population has been declining due to habitat loss and road mortality (COSEWIC 2016b). The protection and expansion of Robert Lake and its nearby wetlands would benefit all three species.

The federally threatened Western screech owl has been observed in the forested areas north of campus (Figure 4). The Western screech owl relies on matrices of forested areas and riparian areas, and nest in tree cavities (COSEWIC 2012b). The preservation and maintenance of the forested ecosystems on campus, specifically those with mature trees and large snags, may benefit the Western screech owl.

The campus also occurs within the potential habitat of the American badger, and a female American badger and two kits used a den site on campus between lot J and Alumni Avenue in June 2016. American badgers are provincially red-listed and federally endangered and are declining due to habitat loss and road mortality. American badgers require open grassy habitats and dry conifer forests, and frequently use grasslands and open agricultural fields (COSEWIC 2012a). The open cultivated field and grasslands of campus are potential habitat for badgers, especially given their proximity to dry conifer forest patches, but access to this habitat is fragmented by roads and development. The

protection of grasslands, nearby forests, and remediation of grassland habitats near the cultivated field in the west campus lands may help improve badger habitat.

The Western yellow-bellied racer is associated with dry, open grassland habitats, and they are currently listed as a species of Special Concern (COSEWIC 2015). Western yellow-bellied racers use hibernacula that are often located near cliffs, rock outcrops, or talus adjacent to grassland and open forests that provide foraging habitat. Warm aspects with sun exposure and rock crevices are common places for hibernacula and should be protected when possible. The safeguarding of confirmed hibernacula sites and surrounding non-disturbance buffers is critical to ensure the viability of these species.

The Northern rubber boa use a mosaic of habitats, and prefer forest clearings, meadows, and grasslands near riparian areas and water. They require vegetation cover and often hide under rotting logs and coarse woody debris or in rock crevices. In 2018, a Northern rubber boa was observed on campus near the Upper Cascade student residences and was moved to the pine forest in the northwest region of campus.

While not observed on campus, the Lewis's woodpecker is a blue-listed and threatened species that relies on mature pine forests. They need standing dead trees, or snags, with cavities for nesting. Lewis's woodpeckers also require fruit-bearing shrubs, such as saskatoons and chokecherry, nearby nest sites as a food resource (Environment Canada 2017). Saskatoons are common on campus and were observed in most ecosystems, including the forested areas and riparian areas near the pond.

**Table 3-7.** Species at risk CDC occurrences on campus lands or within 1 km of campus and their habitat requirements (CDC 2023).

| Common Name | Scientific Name | BC List[1] | SARA Schedule 1[2] | Occurrence ID | Distance | Critical Habitat |
|---|---|---|---|---|---|---|
| American Avocet | *Recurvirostra americana* | Blue | Not at Risk | 10290 | Within project area | Marshes, ponds, alkaline lakes, and wetlands for breeding and nesting (CDC 1996). |
| American Badger, *jeffersonii* subspecies | *Taxidea taxus jeffersonii* | Red | Endangered | 10214; Previous UBCO observations | Record overlays campus, observations within campus lands | Non-forested grassland and shrubland ecosystems, however their range is between 16 to 64 $km^2$ and can therefore migrate through a range of habitats (COSEWIC 2012a) |
| Great Basin Spadefoot | *Spea intermontana* | Blue | Threatened | 107254; Previous UBCO observations | Within campus lands | Lakes, open water, ponds, and wetlands for breeding, with nearby grasslands and conifer forest (COSEWIC 2019). |

**Table 3-7.** Species at risk CDC occurrences on campus lands or within 1 km of campus and their habitat requirements (CDC 2023).

| Common Name | Scientific Name | BC List[1] | SARA Schedule 1[2] | Occurrence ID | Distance | Critical Habitat |
|---|---|---|---|---|---|---|
| Northern Rubber Boa | *Charina bottae* | Yellow | Special Concern | Previous UBCO observations | Within campus lands | Open dry forests, meadows, and grasslands near wetlands and riparian areas. Require woody debris cover (COSEWIC 2016c). |
| Painted Turtle | *Chrysemys picta* | Blue | Special Concern | 103050 | Within campus lands | Lakes, open water, ponds, and wetlands (COSEWIC 2016b). |
| Western Bumble Bee | *Bombus occidentalis* | Blue | Threatened | 15901 | Outside campus lands at Carney Pond | Diverse habitats, including mixed woodlands, farmlands, urban areas, montane meadows, and grasslands. Nests underground or in hollows in decaying wood (COSEWIC 2014). |
| Western Screech Owl | *Megascops kennicottii* | Blue | Threatened | 360967 | Within project area | Matrix of dry Ponderosa pine or Douglas fir forests and mixed woodland riparian habitats, tree cavities for nesting (COSEWIC 2012b). |
| Western Yellow-Bellied Racer | *Coluber constrictor mormon* | Blue | Special Concern | Previous UBCO observations | Within campus lands | Dry, open grasslands with nearby structures for hibernacula (COSEWIC 2015). |

[1] **Yellow**: Not considered at risk. **Blue**: Of special concern. **Red**: Endangered or threatened.

[2] **Not at Risk**: A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances. **Special Concern**: A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats. **Endangered**: A wildlife species facing imminent extirpation or extinction. **Threatened**: A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

We also searched the BC CDC database for critical habitat occurrences within 1 km of campus (Table 3-8). These occurrences are the suitable habitats of provincially or federally listed species and cover more area than singular species occurrences. Critical habitat occurrences for the American badger, Great Basin gopher snake, and Great Basin spadefoot all overlap UBCO campus lands.

**Table 3-8.** CDC critical habitat occurrences within 1 km of campus (CDC 2023).

| Common Name | Scientific Name | BC List[1] | SARA Schedule 1[2] | Critical Habitat ID | Critical Habitat Status | Distance | Critical Habitat |
|---|---|---|---|---|---|---|---|
| American Badger, *jeffersonii* subspecies | *Taxidea taxus jeffersonii* | Red | Endangered | 137100, 135064, 135075, 136918, 135073, 136919, 135081, 136922, 135082, 135083, 136924, 136928, 135100 | Proposed core and safe movement corridors | Record overlays campus | Non-forested grassland and shrubland ecosystems, however their range is between 16 to 64 km$^2$ and can therefore migrate through a range of habitats (COSEWIC 2012a). |
| Great Basin Gopher Snake, deserticola subspecies | Pituophis catenifer deserticola | Blue | Threatened | 90723 | Final | Record overlays campus | Rock outcrops, talus slopes, shrub-steppe, grassland, riparian, and open Ponderosa pine and Douglas fir forests (Environment and Climate Change Canada 2019). |
| Great Basin Spadefoot | *Spea intermontana* | Blue | Threatened | 84420, 84322, 84421 | Final | Record overlays campus | Grasslands and open woodlands with small pools preferably temporary ponds for breeding and terrestrial habitats for foraging, hibernation, and aestivation. Requires loose, deep, and friable soils for burrowing (COSEWIC 2007). |

[1] **Yellow**: Not considered at risk. **Blue**: Of special concern. **Red**: Endangered or threatened.

[2] **Not at Risk**: A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances. **SC = Special Concern**: A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats. **E = Endangered**: A wildlife species facing imminent extirpation or extinction. **T = Threatened**: A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

#### *3.3.3.1. Ecological Communities at Risk*

In addition to CDC searches for species at risk, we also searched for ecological communities at risk within 1 km of campus (Table 3-9). The blue-listed common cattail marsh occurs at the campus pond, and on the east side of Highway 97 across from campus. Nuttall's Alkaligrass - Foxtail Barley wetland associated grassland ecosystem is located at the north end of Robert Lake within campus lands.

**Table 3-9**. CDC listed at-risk ecological community occurrences within 1 km of the UBCO campus (CDC 2023).

| Common Name | Scientific Name | BC List[1] | Occurrence ID | Distance |
|---|---|---|---|---|
| Common Cattail Marsh | *Typha latifolia* Marsh | Blue | 103683, 103684 | Within campus lands and ~50m from campus boundary east of Hwy 97 |
| Nuttall's Alkaligrass – Foxtail Barley | *Puccinellia nuttalliana* | Blue | 14052 | Robert Lake overlapping campus lands |

[1] **Yellow**: Not considered at risk. **Blue**: Of special concern. **Red**: Endangered or threatened. **Various**: May be one of multiple potential listings, depending upon more detailed taxonomic classification.

#### *3.3.3.2. Other Wildlife Observations*

Several species that are not bird species and not at risk were observed on campus on June 8th. These species included yellow-bellied marmots (*Marmota flaviventris*), Columbian ground squirrel (*Urocitellus columbianus*), yellow-pine chipmunk (*Neotamias amoenus*), and the grove snail (*Cepaea nemoralis*). The grove snail is an exotic species in BC.

### 3.3.4 Conclusions and Recommendations

The UBCO campus contains several types of forest and two important wetland habitats. It also overlaps critical habitat occurrences and observations of many red and blue listed wildlife species. Conservation and remediation of natural ecosystems on campus will help support a range of plant and animal species and may increase campus biodiversity by attracting more species as habitats age.

Invasive and noxious weeds occur throughout campus lands but are concentrated in areas where soils have been disturbed. We recommend control measures for invasive weeds, as discussed in Appendix C.

Robert Lake and it's surrounding grasslands provide valuable habitat for many bird species. As noted in section 2.0 Ecosystem Change Analysis, Robert Lake has naturally expanded since 2005. Allowing the continued expansion of Robert Lake will increase the area of the important wetland and its associated grassland habitats.

## 4.0 WILDFIRE RISK

A previous wildfire hazard assessment for the UBCO campus rated the hazard likelihood of campus as very high (Wildfire Focus Area Sample Sheet UBCO Multi-Hazards 2022). This is primarily due to the regional location of campus, and potential effects to campus operations from wildfires within the Okanagan. As stated in the hazard assessment,

campus has wildfire mitigation and control measures in place, and the risk of a fire occurring on campus or spreading to campus from a nearby property is very low.

However, operations on campus could be affected if ember showers from nearby fires damage campus services, such as electrical infrastructure or campus buildings. Campus could also be less directly affected, and campus services may be disrupted if off-site services were damaged by fire, such as off-site water supply through the City of Kelowna or Fortis electrical services.

The hazard risk assessment stated that the campus wildfire mitigation plan and wildfire fuel management are effective, but further wildfire resilience and planning should be considered. UBCO should maintain and enhance its existing wildfire mitigation while also considering the needs of wildlife, especially those species that are rare and/or endangered. UBCO's Wildland Fire Management Plan should be reviewed and updated. Wildlife requirements that should be considered are summarized in Section 3.1.5. There are also provincial Climate Resiliency Standards that include recommendations to reduce wildfire risk to infrastructure and buildings. These standards should also be considered as part of the wildfire management planning.

## 5.0 CONCLUSIONS

Balancing the need for growth and development and the desire for retention and conservation of natural ecosystems is a complex challenge. The UBCO campus contains a diverse mix of habitat types and wildlife, despite its relatively small area. It provides habitat for many types of wildlife, including provincially and federally listed and at-risk species. Conservation of wetlands and forest ecosystems and their wildlife trees will help facilitate wildlife use of campus. These ecosystems also naturally sequester and store carbon, and mature forests become increasingly resistant to high-severity wildfire as they age. Therefore, retention of as much natural area as possible will benefit UBCO management, its wildlife, and its community.

## 6.0 LIMITATIONS

This report has been prepared by Ecoscape and is intended for the sole and exclusive use of Sustainability Office, Campus Planning, for the purposes set out in this report. Ecoscape has prepared this report with the understanding that all available information on the past, present, and proposed conditions of the subject property have been disclosed. Ecoscape has relied upon communications with Sustainability Office, Campus Planning and other information sources to corroborate the documents and other records available for the subject property. Sustainability Office, Campus Planning has also acknowledged that in order for Ecoscape to properly provide the professional service, Ecoscape is relying upon full disclosure and accuracy of this information.

Any use of this report by a third party, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Ecoscape accepts no responsibility for damages, if any, suffered by any third party as a result of actions or decisions made based on this report.

## 7.0 CLOSURE

We trust that this report satisfies the present requirements. Should you have any questions or comments, please contact the undersigned at your convenience.

Respectfully Submitted,

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