Species and Ecological Communities of the University of Victoria Campus

Larissa Bron
Restoration Co-op Student, Summer 2020

Territorial Acknowledgement

The university acknowledges with respect the Lekwungen peoples on whose traditional territory the university stands, and the Songhees, Esquimalt, and WSÁNEĆ Peoples whose historical relationships with the land continue to this day.

Executive Summary

This report is complementary to previous student reports within campus natural areas and includes new syntheses from species observations on campus. Over 15, 000 observations were reviewed, representing 785 species, of which 29 flora and fauna species are identified as a conservation concern when compared to global, federal, and provincial conservation status ranks and listings. This list was further distilled to 16 conservation concern species that likely have significant habitat on campus, aligning with the reporting requirements for the *OP 10: Biodiversity* credit section in the Association of the Advancement of Sustainability in Higher Education's (AASHE) Sustainability Tracking, Assessment, and Rating System (STARS). Compiled within the report is information about campus natural areas and species observations, providing a baseline of current campus conditions for use in natural area management planning and future study within the campus' "living laboratory."

The university has committed to protecting and enhancing natural areas on campus. These are places which need intervention to revive the characteristic ecosystem processes and habitat features being lost to threats, most prominently invasive species and habitat degradation. To assist in natural area management planning, species and ecosystem data is compared using the *British Columbia (B.C.) Conservation Framework*. Results from this comparison identified the appropriate management actions for each ecological community within natural areas, with land stewardship and protection, as well as monitoring and reporting projected to benefit all natural areas. Additionally, five natural areas are recommended for restoration action which could positively impact up to 13 conservation concern species on campus.

The list of all species observations, with associated conservation rankings, is available on the *Restoration Futures Lab Database* available on GitHub (https://github.com/nancyshackelford/Shackelford-lab), and relevant reports are available on the *Restoration of Natural Systems Programs Archives* hosted on the Open Science Framework (OSF) (https://osf.io/fdum3/).

Glossary

Biodiversity: "Biodiversity is short for biological diversity – the variety of life in all its forms. It includes genes, species and ecosystems, and the processes that link them, an ensemble that many people think of simply as Nature (Austin et al., 2008)."

"British Columbia is the most biologically diverse of Canada's provinces and territories, and includes many regionally, nationally, and globally significant species and ecosystems (Biodiversity B.C., 2010)."

Conservation: "Preservation, especially of the natural environment (B.C. CDC, n.d.a)."

Ecological Community: "A naturally occurring unit of vegetation with relatively uniform species composition, physical structure, and characteristic environmental requirements, within a designated location (B.C. CDC, n.d.a)."

Ecological Integrity (also, Quality): "A measure of the current ecological condition (structure, composition, and function) of an ecosystem compared to similar ecosystems operating within the bounds of natural or historic ecological processes and disturbance regimes (B.C. CDC, n.d.a)."

"When [ecosystems] become simplified through the loss of component parts or processes, they lose their ecological resilience - the ability to withstand and adapt to natural or human-caused disturbances (Austin et al., 2008)."

Ecological Restoration: "The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (SER, 2004)."

Ecosystem: "An interacting system of living organisms including their relationships with each other and with their non-living environmental surroundings (Biodiversity B.C., 2010)."

Endangered: "Facing imminent extirpation or extinction (B.C. CDC, n.d.a)."

Species: "Includes all entities at the taxonomic level of species, including interspecies hybrids as well as all subspecies and plant varieties (B.C. CDC, n.d.a)."

Vulnerable: "Particularly sensitive to human activities or natural events (B.C. CDC, n.d.a)."

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Figure 1: Coastal communities surround the UVic campus (UVic, n.d.).

The University of Victoria (UVic) Gordon Head campus is located at 48.4634° N and 123.3117° W, on southeastern Vancouver Island, British Columbia, Canada and straddles the Oak Bay and Saanich municipalities within the Greater Victoria region. The climatic conditions of the region are strongly influenced by the Pacific Ocean and the rain-shadow effect from the surrounding Olympic and Vancouver Island mountains, resulting in a Mediterranean climate which supports unique vegetation complexes representative of the Douglas-fir biogeoclimactic zone (Meidinger & Pojar, 1991). This relatively small biogeoclimactic zone is recognized for contributing significantly to **biodiversity** values within Canada by providing habitat for numerous rare and **endangered** species (B.C. Ministry of Environment, 1999; Ward et al., 1998), as well as being of great **conservation** concern (Austin et al., 2008).

The built environment of campus is compact with clustered low-rise buildings immersed in a natural setting comprised of both natural and landscaped areas. Most natural areas surround the west and south sections of the Ring Road and include the satellite properties of Haro Woods and Finnerty Ravine northeast of campus. The predominant **ecosystem** is second-growth forest, providing a lush green backdrop of towering trees, supported by a diverse understory of shrubs, ferns and forbs (Costanzo et al., 2000). Interspersed throughout the forests are meadow, riparian, wetland, and woodland features which are environmentally important and contribute to the aesthetic, educational, and ecological values for the campus and greater community.

UVic has recognized the value of this natural capital by promoting initiatives to protect, enhance, and increase connectivity between existing natural areas. The Campus Plan (UVic, 2016) identifies natural areas as being protected from development through environmental covenants restricting development. Major developments within natural areas are not being considered and any upgrades to pathways, service lines, and underground services are to be informed by special studies on ecological and community impacts. As well, a "green ring" of ecological corridors surrounding the Ring Road is planned to support protected areas. The development of the green ring includes plans for increasing connections between campus natural areas and preserving the **ecological integrity** and functioning within the natural areas. The green ring is intended to contribute to local ecological systems by providing a habitat network that supports native flora and fauna.

1.0 Landscape Management

"Create and maintain a campus landscape that minimizes environmental impacts, enhances biodiversity and maintains aesthetic values."

Grounds mission in the Sustainability Action Plan 2020-2021

Figure 2: Salal (Gaultheria shallon) is a native plant added in campus landscaping.

Campus natural areas are primarily managed by UVic's Facilities Management department and guided by the *Sustainability Action Plan (SAP)* (UVic, 2020). In addition, UVic has two volunteer networks that complete restoration activities on campus. Facilities Management is responsible for the stewardship of campus lands and buildings, as well as assisting in planning and implementing sustainability strategies on campus. Within the SAP, there are three grounds goals which involve working on the invasive species management program, completing and implementing an integrated pest management plan, and reducing the quantity and improving the quality of stormwater released from the campus. The grounds team works to reduce environmental impacts, sustain natural landscapes, and contribute to community environmental quality through actions such as:

1) Allowing some landscaped areas to naturalize by reducing mowing and watering. These efforts save water and provide habitat for insects and animals.
2) Planting native species when appropriate in landscaping features to complement the regional landscape.
3) Reducing landfill waste by composting or creating mulch from garden waste.

Figure 3: Volunteers removing invasive plants on campus.

Facilities Management and the Office of Campus Planning and Sustainability also collaborate with volunteer groups to address the significant, compounding pressures threatening the ecological quality of campus natural areas. Volunteers from the campus Ecological Restoration Club (ERC) and the Greater Victoria Green Team have helped to support natural areas by decreasing impacts from invasive species, recreational use, and development pressures through restoration. These volunteer groups practice **ecological restoration** techniques such as invasive species removal and native species planting, slope stabilization, and trail reconstruction. A major component within these activities is community outreach, engaging the campus and greater community in stewardship activities and communicating the value of natural area conservation. Currently, Mystic Vale and the Garry Oak Meadow are focal points for student-led campus restoration. These projects are guided by the School of Environmental Studies and the Restoration of Natural Systems Program, which oversees restoration trials in campus management, including planning, implementation, monitoring, and adaptive management. The results from these trials will contribute to increasing the efficacy of campus restoration, while connecting the community in stewardship action.

2.0 Campus Natural Areas

Multiple student projects have studied the campus natural areas, most recently resulting in geospatially referenced datasets, ecosystem classifications, and management recommendations. Both the *Natural Features Study, Phase 1 & 2* (Harrop-Archibald, 2007, 2008a, 2008b) and the *Sensitive Ecosystem Inventory* (Hebb & Schaefer, 2017) include discussions and datasets describing campus natural areas and associated unique features. Within these studies, campus natural areas have been described by institutional boundaries (Figure 4, Table 1) and distinguished by the presence of sensitive ecosystem components and **ecological communities**.

All natural areas share a prominent second-growth forest structure. Within and surrounding these forests are sensitive ecosystem components which add complexity to the campus landscape, creating habitat for a variety of **species**. The sensitive ecosystem components were identified by Harrop-Archibald using a modified classification adapted from the *Sensitive Ecosystems Inventory* (Ward et al, 1998). The four identified units are older second-growth forest, riparian areas, wetlands, and woodlands (Table 2) - each representing unique ecosystems that are ecologically significant and are decreasing in extent regionally (Ward et al., 1998).

Harrop-Archibald also classified campus natural areas into site series units. This is the basic ecosystem unit recognized by the B.C. government, based on the Biogeoclimactic Ecosystem Classification (BEC) framework (B.C. Ministry of Forests, 2009). The BEC system is the standard classification system used in describing ecosystems across disciplines, providing a systematic approach for planning and executing ecosystem management (Pojar & Meidinger, 1991). During their fieldwork on campus, Harrop-Archibald mapped the dominant vegetation and soil characteristics in each natural area using Terrestrial Ecosystem Mapping methods, resulting in site series classifications. These classifications have been translated to the equivalent BEC variants within the Coastal Douglas-fir Moist Maritime (CDFmm) zone for comparison using conservation tools (Table 3). The South Woods Wet section was omitted from the map as further sampling is needed to verify the **ecological community** present.

Figure 4: A map of the landscaped and natural areas of UVic (UVic, 2016).

Table 1: Campus Natural Areas - Institutional Boundaries

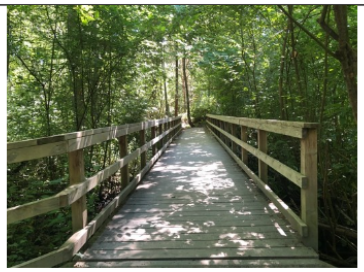


Figure 1: Bowker Creek

Bowker Creek is the headwaters for the Bowker Creek watershed which drains into the ocean south of campus. There are moist areas, including swamp, which support stands of black cottonwood trees (*Populus trichocarpa*).

Figure 2: Cunningham Woods

Cunningham Woods is a continuation of the forests inside the Ring Road. This forested area has both dry and moist sections due to the fluctuating water table, indicated by the seasonal flooding in the west section during winter months.

Figure 3: Garry Oak and Camas Meadow

The **Garry Oak Meadow** is the largest non-forested area on campus, with sections of exposed bedrock, woodland, and open meadow areas.

Figure 4: Haro Woods

UVic owns a parcel of **Haro Woods**, and the other sections are shared between Saanich and the Queen Alexander Foundation. There is an adjacent ravine property with steep-sided gulleys along **Finnerty Creek**.

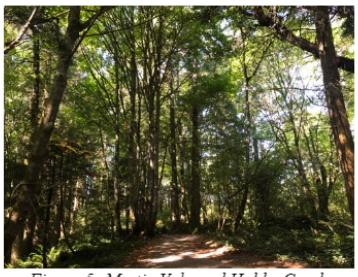
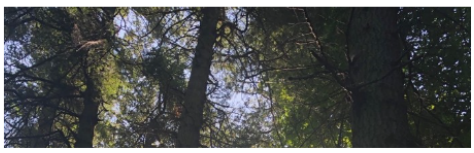


Figure 5: Mystic Vale and Hobbs Creek

Mystic Vale is forested with riparian sections. **Hobbs Creek** flows into the forested Mystic Vale from the southeast and continues through the steep-sided gulley to discharge into the ocean at Cadboro Bay.

Figure 6: South Woods

The **South Woods** is a transitional forest between the Garry Oak Meadow and Mystic Vale. There are moist and dry sections and water from this area drains into Mystic Vale.



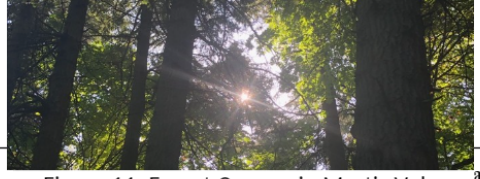


Figure 11: Forest Canopy in Mystic Vale

Figure 12: Gulley in Mystic Vale

Figure 13: Swamp in Bowker Creek

Wetland: Areas where the water table is at or near the surface of the soil - water presence can be constant or seasonally dependant (EPA, 2018).

Wetlands are found in Bowker Creek and Cunningham Woods. The wetlands on campus support trees and are considered swamps.

Figure 14: Woodland in Garry Oak Meadow

Woodland: Transitional areas between open and closed canopy ecosystems, such as grasslands and forests, with a canopy cover less than 50% (Ward et al, 1998). Woodlands have a diverse understory including shrubs, forbs, and grasses.

There are woodlands surrounding most natural areas.

Table 3: Campus Natural Areas - Biogeoclimactic Zone Variants and Ecological Communities

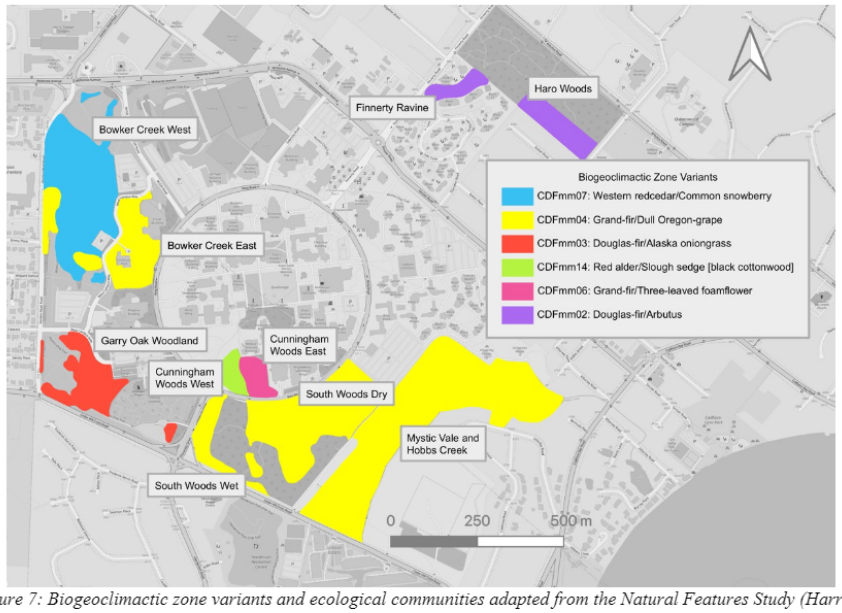


Figure 7: Biogeoclimactic zone variants and ecological communities adapted from the Natural Features Study (Harrop-Archibald, 2007, 2008a, 2008b).

3.0 STARS Reporting Requirements

A list of endangered and **vulnerable** species with habitat on land owned or managed by UVic was created to satisfy the reporting requirements for the *OP 10: Biodiversity* credit in AASHE's STARS (AASHE, 2019). These species were identified from a larger primary list aggregated from observations and then assessed for conservation concern by referencing the B.C. Species & Ecosystems Explorer (B.C. SEE). The data from the primary list is hosted on the *Restoration Futures Lab GitHub*, and the following subsections describe methods used to determine which endangered and vulnerable species have habitat on campus.

3.1 Species Observations

The primary list of species observations, inclusive of flora and fauna, was created using records from the Global Biodiversity Information Facility (GBIF), the UVic Herbarium, and local biologist, James Miskelly. GBIF is an online repository that combines data compiled from collections such as natural history collections and observations from citizen scientists (GBIF, n.d.). The *Checklist of Vascular Plants of the UVic Campus* was compiled by three professors in the biology department, encompassing inventories completed between 1980 and the early 2000s (Costanzo et al., 2000). As well, James Miskelly is a biologist who completed his degrees at UVic, resulting in extensive knowledge of the campus natural areas. In total, 785 species were recorded based on over 15, 000 sightings from these three sources.

Each species within the primary list, along with observed ecological communities, were then entered into the B.C. SEE to determine if any of the conservation designations were applicable (B.C. CDC, n.d.a). The B.C. SEE is an online tool which provides the conservation designations for native species in B.C., as well as relevant reports and mapping data (B.C. CDC, n.d.c).

Figure 16: The Propertius duskywing (Erynnis propertius) is a B.C. red-listed species observed on campus. Photo source: Wikimedia, n.d.a

Conservation designations are separated into status ranks and listings, each having different implications within global, federal, and provincial contexts. All conservation ranking is scientifically based and standardized by NatureServe, resulting in objective information regarding the relative extinction risk for candidates (NatureServe, n.d.). Ranking is dependent on rarity, threats, and trends – all based on occurrence data and specialist reports (B.C. Ministry of Sustainable Resource Management, 2002). Global and provincial ranking is used by provincial and federal governments to determine conservation listings. In B.C., a provincial color-coded list translates these status rankings to simplify communication and streamline conservation priority setting (B.C. CDC, n.d.d). Federally, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) creates a national listing of species at risk, assessed through a formal review process, using the World Conservation Union (IUCN) ranking system. COSEWIC is a group of scientists, independent from the government, which submits the national listing of species at risk for consideration in the Species at Risk Act (SARA) (Government of Canada, 2016). When a species is recognized by SARA in Schedule 1, there is legal protection provided, as well as recovery planning introduced.

3.2 Conservation Concern Species and Ecological Communities

The conservation designations of the species and ecological communities were then assessed to group candidates based on conservation concern. A species was considered to be a conservation concern if considered to be within the following categories:

1) Provincial Red List; Federal Status of E or T: Facing imminent extirpation or extinction, or is **endangered** or threatened (B.C. CDC, n.d.d, n.d.e).
2) Provincial Blue List; Federal Status of SC: Sensitive or **vulnerable** to human or natural disturbance – a special concern (B.C. CDC, n.d.d, n.d.e).

The result of this comparison revealed that 29 observed species and all ecological communities are a conservation concern (Tables 4 & 5), indicating that there is substantial conservation value associated with campus natural areas.

3.3 Species' Habitat Preferences on Campus

The conservation concern species were then assessed for the presence of significant habitat within campus natural areas. Significant habitat is the "...area that contributes substantially to survival or reproduction for a species (B.C. Ministry of Environment, 2009)." The habitat preferences were deduced by reviewing ranges supplied in the *Conservation Framework* and conducting a review of available information (Appendix B). Out of 29 observed conservation concern species, 16 are likely to have habitat within campus natural areas (Table 6).

Table 4: Conservation Concern Species Observed on Campus[1]

Species	Common Name	B.C. CDC Status Rank	B.C. CDC Listing Status	Global Status Rank	COSEWIC	SARA
Bidens amplissima	Vancouver Island beggarticks	S3	Blue	G3	SC	1-SC
Cardamine angulata	Angled bittercress	S3	Blue	G5		
Carex tumulicola	Foothill sedge	S3S4	Yellow	G4	E	1-E
Chordeiles minor	Common nighthawk	S4B	Yellow	G5	SC	I-T
Clangula hyemalis	Long-tailed duck	S2S3B, S4N	Blue	G5		
Coccothraustes vespertinus	Evening grosbeak	S5	Yellow	G5	SC	1-SC
Contopus cooperi	Olive-sided flycatcher	S3S4B	Blue	G4	SC	1-T
Coreorgonal petulcus	Sheetweb spider species	S2?	No status	GNR		
Cypseloides niger	American black swift	S2S3B	Blue	G4	E	1-E
Dicolonus simplex	Robber fly species	S3S4	Blue	GNR		
Epilobium densiflorum	Dense spike-primrose	S2	Red	G5	E	1-E
Erynnis propertius	Propertius duskywing	S2	Red	G5		
Falco peregrinus	Peregrine falcon	S3	No status	G4	SC	1-SC
Hirundo rustica	Barn swallow	S3S4B	Blue	G5	T	1-T
Larus californicus	California gull	S2S3B	Blue	G5		
Limnanthes macounii	Macoun's meadow-foam	S2?	Red	G2?	T	1-T
Melanerpes lewis	Lewis's woodpecker	S2S3B	Blue	G4	T	1-T
Numenius americanus	Long-billed curlew	S3B	Blue	G5	SC	1-SC
Numenius phaeopus	Eurasian whimbrel	S1S2B	Red	G5		
Nuttallanthus canadensis	Texas toadflax	S3	Blue	G4G5		
Oxalis oregana	Redwood sorrel	S3	Blue	G5		
Parmotrema perlatum	Lichen species	S3	Blue	G3G5		
Patagioenas fasciata	Band-tailed pigeon	S3S4	Blue	G4	SC	1-SC
Phalacrocorax auritus	Double-crested cormorant	S3S4	Blue	G5	NAR	
Phalacrocorax penicillatus	Brandt's cormorant	S1B, S4N	Red	G5		
Potentilla gracilis var. gracilis	Fanleaf cinquefoil	S2	Red	G5TNR		
Progne subis	Purple martin	S3S4B	Blue	G5		
Sanicula arctopoides	Bear's-foot sanicle	S2	Red	G5	T	1-E
Syntrichia laevipila	Twisted oak moss	S3	Blue	GNR	SC	1-SC

1. Conservation status rank and listing symbols are described in Appendix A.

Table 5: Conservation Concern Ecological Communities Within Campus Natural Areas[1]

Campus Natural Areas	BEC Code Variant	B.C. CDC Status Rank	B.C. Listing	Global Status Rank
Bowker Creek (East), Mystic Vale and Hobbs Creek, South Woods (Dry)	CDFmm04 grand fir - dull Oregon-grape (*Abies grandis - Berberis nervosa)*	S1	Red	G1
Bowker Creek (West)	CDFmm07 western redcedar - common snowberry *Thuja plicata - Symphoricarpos albus*	S1	Red	GNR
Cunningham Woods (East)	CDFmm06 grand fir - three-leaved foamflower *Abies grandis - Tiarella trifoliata*	S1	Red	G1
Cunningham Woods (West)	CDFmm14 red alder - slough sedge [black cottonwood] *Alnus rubra - Carex obnupta* [*Populus trichocarpa*]	S1	Red	G1
Garry oak Woodland	CDFmm03 Douglas-fir - Alaska oniongrass *Pseudotsuga menziesii - Melica subulata*	S1	Red	G1
Haro Woods, Finnerty Ravine	CDFmm02 Douglas-fir - arbutus *Pseudotsuga menziesii - Arbutus menziesii*	S2	Red	GNR
South Woods (Wet)	Insufficient data available			

1. Conservation status rank and listing symbols are described in Appendix A.

Table 6: Conservation Concern Species Matched with Habitat Preferences on Campus										
Conservation Concern Species		**Bowker Creek (East)**	**Bowker Creek (West)**	**Cunningham Woods (East)**	**Cunningham Woods (West)**	**Finnerty Ravine**	**Garry Oak Woodland**	**Haro Woods**	**CreekMystic Vale and Hobbs**	**South Woods (Dry)**
Scientific Name	**Common Name**									
Bidens amplissima	Vancouver Island beggarticks				■					
Cardamine angulata	Angled bittercress		■	■						
Carex tumulicola	Foothill sedge						■			■
Chordeiles minor	Common nighthawk	■	■	■	■	■	■	■	■	■
Coccothraustes vespertinus	Evening grosbeak	■	■	■	■	■	■	■	■	■
Contopus cooperi	Olive-sided flycatcher	■	■	■	■	■	■	■	■	■
Cypseloides niger	American black swift		■	■						
Erynnis propertius	Propertius duskywing	■	■	■	■	■	■	■	■	■
Falco peregrinus	Peregrine falcon	■	■	■	■	■	■	■	■	■
Hirundo rustica	Barn swallow		■	■			■			
Limnanthes macounii	Macoun's meadow-foam		■	■			■			
Parmotrema perlatum	Lichen species	■	■	■	■	■	■	■	■	■
Patagioenas fasciata	Band-tailed pigeon	■	■	■	■	■	■	■	■	■
Phalacrocorax auritus	Double-crested cormorant		■	■			■			
Potentilla gracilis var. gracilis	Fanleaf cinquefoil						■			
Syntrichia laevipila	Twisted oak moss	■	■	■	■	■	■	■	■	■

4.0 Campus Natural Area Challenges and the Conservation Framework

The campus natural areas are afflicted by habitat degradation, decreased connectivity, and proliferation of invasive species. These complications are widespread and affect each natural area simultaneously – active intervention is often required to restore the ecological function of these ecosystems. A suite of recommendations for managing each campus natural area have been proposed by student reports, most recently in the *Invasive Species Management Strategy* (Kathrens & Jennings, 2016) and the *UVic Campus Restoration Guide* (Hebb & Schafer, 2018). The lists of conservation concern species and ecological communities generated in this report complement previous studies by providing a reference for current conditions and identifying species and ecological communities that would benefit from timely management actions.

Figure 17: Parmotrema perlatum is a B.C. blue-listed lichen species observed on campus. Photo source: Wikimedia, n.d.b

All species and ecological community data gathered
simplifying the use of government tools such as the
Environment, 2009). The *Conservation Framework*
conservation priorities and effective strategies for de
framework is accompanied by a spreadsheet of outpu
habitat features, applicable legislation, and recomme
Each recommendation is suggested based on whethe
monitoring and further study is proposed. These outp
conservation concern species and ecological commu
within natural area management are described in the
Environment, 2009). Alongside implementing action
programs are established to increase efficacy of natu

The recommended actions from the *Conservation Framework* comparison were extracted to outline appropriate measures for supporting campus natural areas (Table 7). Results from this table indicate that all natural areas would benefit from stewardship and protection, as well as planning and compiling status reports. UVic has protected natural areas by restricting development through enacting environmental covenants, and also has contributed to stewardship by undertaking sustainable landscape management practices. Through research and monitoring, UVic could additionally support efforts in planning and compiling status reports by assessing threats, habitat use, and recovery techniques within campus natural areas.

Further, natural areas which have restoration as a recommended action were compared to determine where restoration could benefit the most conservation concern species (Figure 18). Results indicate that targeted restoration within five natural areas could benefit up to 13 conservation concern species. Cunningham Woods and the Garry Oak Woodland were found to have 44% more conservation concern species compared to the next highest found in Mystic Vale and Hobbs Creek. Additionally, the significant amount of conservation concern species present in both Mystic Vale and the Garry Oak Woodland present an opportunity to incorporate these species' habitat preferences to increase the positive impacts from current restoration projects.

Table 7: Conservation Framework Results: Recommended Management Actions for Campus Natural Area Ecological Communities[1]

Action	Bowker Creek (East)	Bowker Creek (West)	Cunningham Woods (East)	Cunningham Woods (West)	Finnerty Ravine	Garry Oak Woodland	Haro Woods	Mystic Vale and Hobbs Creek	South Woods (Dry)
Review status rank									
Compile status report									
Inventory									
Monitor trends									
Review taxonomy and classification									
Planning									
Send to COSEWIC									
List under Wildlife Act									
Ecosystem and habitat protection									
Ecosystem and habitat restoration									
Private land stewardship									
Species and population management									
Review resource use									

1. Explanation of recommended actions available within the online *Conservation Framework Tools* (B.C. Government, n.d.c).

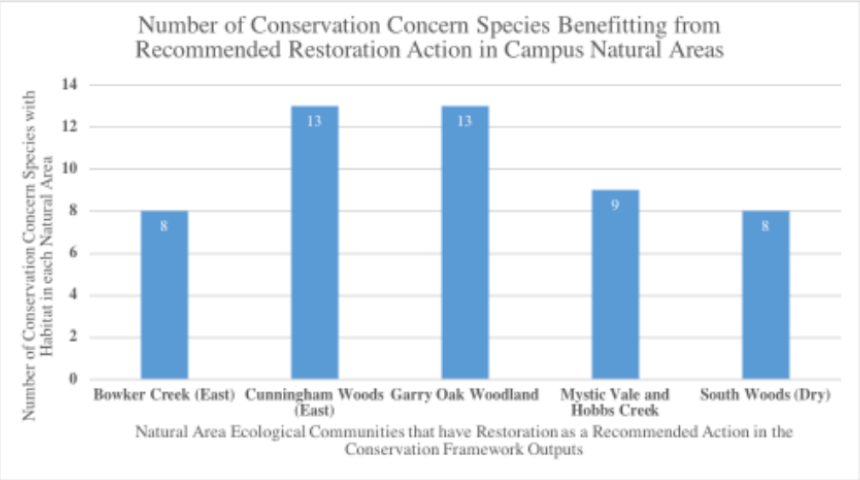


Figure 18: In the Conservation Framework Outputs, five ecological communities were recommended for restoration activities. The number of conservation concern species which have habitat within these areas are compared to determine how many species could benefit from restoration

5.0 Summary

UVic is located in a unique climactic region that is recognized for contributing significantly to biodiversity values within Canada. This diversity is represented within the campus natural areas, a mosaic of forested landscapes that are interspersed with natural features including swamps, meadows, and riparian areas. The heterogeneity of the natural areas provides habitat and connectivity for many flora and fauna species. There is inherent conservation value within these spaces – due to both the value of protecting urban natural spaces from development and also as habitat for 16 conservation concern species. This report includes a compilation of species and ecosystem data, curated to satisfy reporting requirements for AASHE's STARS, now available as a baseline of current campus conditions.

The value of campus natural areas has been recognized as they are protected and are a frequent focus for volunteer, faculty, staff, and student stewardship initiatives. These special places are also being impacted from the effects of human use and are afflicted by habitat degradation, decreased connectivity, and the spread of invasive species. The problems affecting natural areas are complicated, compounding, and happening simultaneously, indicating the need for planned intervention to improve conditions. In an effort to assist in future planning, monitoring, and study for campus natural areas, the species lists is supplied on GitHub and campus reports are compiled within the OSF.

An example of utilizing these data sets is provided which incorporates conservation goals using the *B.C. Conservation Framework*. This set of decision making tools revealed a variety of appropriate management actions for improving conditions for conservation-concern species and ecosystems. Results yielding insight that there are wide-reaching benefits from monitoring, planning, stewardship, and habitat protection, as well as the contributions from ecological restoration, such as directly benefiting conservation concern species. Conservation goals are beneficial for developing timely actions that benefit species and ecosystems that are most in need. Developing focused natural area management and monitoring programs can also prevent the decline of healthy species and ecosystems, distinguishing UVic as a proponent of biodiversity and an ally of the more-than-human world.

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Appendix A: Conservation Rank and Status Symbol Key

Provincial (S) and Global (G) Status Ranks (NatureServe, n.d.)		**B.C. CDC Listing (Native species and subspecies in British Columbia)** (B.C. CDC, n.d.a)		**COSEWIC and SARA Listing (Federal conservation concern)** (B.C. CDC, n.d.b, n.d.c)	
SX/GX	Presumed extirpated	**Extinct**	Species no longer exists.	**XX**	Extinct
SH/GH	Possibly extirpated	**Red**	Species are considered, or are candidates for, Extirpated, Endangered, or Threatened status.	**XT**	Extirpated
S1/G1	Critically imperiled	**Blue**	Species are considered Special Concern - have characteristics that make them sensitive or vulnerable to human activities or natural events.	**E**	Endangered
S2/G2	Imperiled	**Yellow**	Species that are apparently secure and not at risk of extinction. Yellow-listed species may have red- or blue-listed subspecies.	**T**	Threatened
S3/G3	Vulnerable	**Exotic**	Species that have been moved beyond their natural range as a result of human activity.	**SC**	Special concern
S4/G4	Apparently secure	**Accidental**	Species occurring infrequently or unpredictably, outside their usual range.	**NAR**	Not at risk
S5/G5	Secure	**Unknown**	Status unknown due to extreme uncertainty.	**C**	Candidate
S#S#/G#G#	Range (uncertainty) rank	**No Status**	Species that have either not been ranked, or if all subspecies have been ranked, then those are listed as conservation concern.	**DD**	Data deficient
SU/GU	Unrankable				
SNR/GNR	Unranked				
SNA/GNA	Not Applicable (not a suitable target for conservation activities)				
Not provided	Not provided				
S#?/G#?	Inexact rank				
B	Breeding				
N	Non-breeding				
M	Migrant				

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Appendix B: Rationale and Sources used in Determining Conservation Concern Species with Significant Habitat on Campus

Table B1: Species with Significant Habitat on Campus

Scientific Name	Common Name	UVic Natural Area Habitat	Rationale
Bidens amplissima	Vancouver Island beggarticks	Cunningham Woods (West).	Wetland with stror
Cardamine angulata	Angled bittercress	Bowker Creek (West) and Cunningham Woods (East).	Moist forest areas.
Carex tumulicola	Foothill sedge	Garry oak woodland and South Woods.	Observed in these with Garry oak me
Chordeiles minor	Common nighthawk	All natural areas.	Forages in open ar and nests on groun
Coccothraustes vespertinus	Evening grosbeak	All natural areas.	Mixed coniferous- growth forests.
Contopus cooperi	Olive-sided flycatcher	All natural areas.	Include forest and
Cypseloides niger	American black swift	Bowker Creek (West) and Cunningham Woods (East).	Wetland.
Erynnis propertius	Propertius duskywing (butterfly)	All natural areas.	Garry oak ecosyste used.
Falco peregrinus	Peregrine falcon *ssp. Increasing concern	All natural areas.	Forest and wetland
Hirundo rustica	Barn swallow	Buildings, Garry Oak Ecosystem, Bowker Creek (West), and Cunningham Woods (East).	Buildings for nesti grassland/shrub co
Limnanthes macounii	Macoun's meadow-foam	Garry Oak Woodland, Bowker Creek (West), and Cunningham Woods (East).	Includes wet fores
Parmotrema perlatum	Lichen species	All natural areas.	Older second grow
Patagioenas fasciata	Band-tailed pigeon	All natural areas.	Includes forest and
Phalacrocorax auritus	Double-crested cormorant	Bowker Creek (West), Garry oak woodland, and Cunningham Woods (East).	Includes wetland a
Potentilla gracilis var. gracilis	Fanleaf cinquefoil	Garry oak woodland.	Includes forest, gra only observed here
Syntrichia laevipila	Twisted oak moss	All natural areas.	Present on Garry o oaks inside Ring R

Table B2: Species Without Significant Habitat on Campus		
Scientific Name	**Common Name**	**Rationale**
Clangula hyemalis	Long-tailed duck	Not within Capital Regional District (CRD). Observation is a lab specimen.
Coreorgonal petulcus	Sheetweb spider species	Not enough information.
Dicolonus simplex	Robber fly species	Not within CRD. Limited species information.
Epilobium densiflorum	Dense spike-primrose	None.
Larus californicus	California gull	Not within CRD.
Melanerpes lewis	Lewis's woodpecker	Not within CRD.
Numenius americanus	Long-billed curlew	Not within CRD.
Numenius phaeopus	Eurasian whimbrel	Unlikely on campus or even West Coast.
Nuttallanthus canadensis	Texas toadflax	Unlikely habitat - hasn't been observed since 1983.
Oxalis oregana	Redwood sorrel	Not within CRD.
Phalacrocorax penicillatus	Brandt's cormorant	Coastal species; no significant habitat on campus.
Progne subis	Purple martin	All natural areas; population exclusively nests in human-made bird boxes.
Sanicula arctopoides	Bear's foot sanicle	No salt spray, unlikely habitat.

Appendix B: References

All species were reviewed against the Conservation Framework Outputs range data (B.C. CDC, n.d.a). Then, the following species were reviewed to determine habitat preferences. Three species were omitted from the search due to unlikely range near UVic or insufficient published data.

1. Bidens amplissima (Environment Canada, 2015; UBC, n.d.a).
2. Cardamine angulata (UBC, n.d.b).
3. Carex tumulicola (GOERT, 2010).
4. Chordeiles minor (COSEWIC, 2007; The Cornell Lab, n.d.a).
5. Coccothraustes vespertinus (Martell, 2015).
6. Contopus cooperi (B.C. CDC, 2009, 2010a).
7. Cypseloides niger (B.C. CDC, 1995a, 2015a).
8. Epilobium densiflorum (GOERT, 2012).
9. Erynnis propertius (GOERT, 2003; UBC, n.d.c).
10. Falco peregrinus (B.C. CDC, 1996).
11. Hirundo rustica (B.C. CDC, 1994a; COSEWIC, 2011).
12. Larus californicus (B.C. CDC, 1994b).
13. Limnanthes macounii (B.C. CDC, n.d.b).
14. Melanerpes Lewis (B.C. CDC, 1995b, 2015b).
15. Numenius americanus (The Cornell Lab, n.d.b).
16. Numenius phaeopus (B.C. CDC, 1990; The Cornell Lab, n.d.c).
17. Nuttallanthus canadensis (Illinois Wildflowers, n.d.).
18. Oxalis oregana (UBC, n.d.d).
19. Parmotrema perlatum (Go Hiking, n.d.).
20. Patagioenas fasciata (B.C. CDC, 2010b).
21. Phalacrocorax auritus (B.C. CDC, 1995c).
22. Potentilla gracilis var. gracilis (B.C. CDC, n.d.c).
23. Progne subis (B.C. CDC, 2019).
24. Sanicula arctopoides (GOERT, 2011).
25. Syntrichia laevipila (B.C. CDC, n.d.d, 2007)

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