University of Victoria
Invasive Species Management Strategy




Office of Campus Planning & Sustainability
Facilities Management
School of Environmental Studies/Restoration of Natural Systems Program
Department of Geography

University of Victoria

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Invasive Species Management Strategy

by

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Acknowledgement of the Territories

The creators of this document acknowledge with respect that the University of Victoria is situated on the traditional territories of the Coast Salish and Straits Salish Peoples, specifically the Lkwungen (Songhees), Wyomilth (Esquimalt) and WS'ANEC' (Saanich) Peoples. As the areas addressed in this plan have been an essential component of these peoples' sustenance and way of life since time immemorial, it is essential that this plan be carried out in a manner which supports Indigenous ways of living and extends these words into meaningful actions.

Acknowledgements

The Campus Invasive Species Management Plan was developed with support from the University of Victoria's Campus Sustainability Fund. Members of the Advisory Committee for the project were: Matt Greeno (Office of Campus Planning & Sustainability), John Ho (Office of Campus Planning & Sustainability), Rhonda Rose (Facilities Management), Peter Roberts (Facilities Management), Ken Josephson (Department of Geography), Gerry Allen (Department of Biology) and Eric Higgs (School of Environmental Studies). Lindsay Kathrens and Julia Jennings, students of the School of Environmental Studies and the Department of Geography, and both previous Volunteer Coordinators of the Ecological Restoration Volunteer Network on campus, conducted research and wrote the original draft. Valentin Schaefer, Academic Administrator of the Restoration of Natural Systems Program, was the Project Supervisor and contributed further research and edits of the final draft of the report.

Executive Summary

The term *invasive species* is applied to exotic/introduced/alien/non-indigenous plant species that demonstrate ecological, social, and economic threats. This plan does not apply to native species demonstrating invasive qualities.

Invasive species are a major threat to natural areas globally and the University of Victoria is no exception. For decades we have seen the campus overrun with English ivy, Himalayan blackberry and other invasive species, some like giant hogweed a hazard to people. In recent decades, the spread of invasive species on the University of Victoria campus worsened resulting in staff, students and faculty beginning to remove invasive species on campus, on an ad hoc basis. Ivy pulls have since become a regular event for clubs such as the ERVN and some classes. Ecological restoration is also as a core component of Facilities Management's mandate. However, governments and community groups have come to realize the need for taking a strategic and well-planned approach to deal with invasive species effectively. In 2012 the District of Saanich released its Invasive Species Management Strategy (ISMS). This program, paired with the Saanich Pulling Together Volunteer Program has had great success thus the University of Victoria has aspired to take a similar approach.

An Ecological Restoration Advisory Committee was formed in 2016, consisting of interested staff, faculty and students brought together by Rhonda Rose of Facilities Management. Rhonda had noticed the various restoration efforts that had been occurring around campus and wished to see a joining of efforts between these groups in order to make restoration more efficient, effective and meaningful on campus. In 2016 the Office of Campus Planning and Sustainability provided a grant that made the development of the campus ISMS possible through the hiring of one student and one UVic alumni to develop a plan for the campus.

The production of the ISMS was a collaborative effort. In addition to those involved from Facilities Management, the Faculty of Social Sciences and the Office of Campus Planning and Sustainability, the two students who played a lead role in researching and writing the strategy met with many stakeholders on campus from different departments, the Office of Indigenous Affairs, course unions, the Ecological Restoration Volunteer Network and many more groups on and off campus. Their input helped to shape the content of this report and the outline of the ISMS. As we learn more about invasive species management in campus this document may change. It is intended to be adaptive and responsive to new information and ideas.

The Invasive Species Management Strategy (ISMS) addresses Goal 2 of the grounds section of the Sustainability Action Plan for Campus Operations 2014-2019 by helping to remove invasive species that threaten the integrity of our natural areas, as well as goals outlined in the University of Victoria 2016 Campus Plan to restore natural areas on campus. Invasive species, in particular English ivy and Himalayan blackberry, have spread aggressively across campus and manual removal is required to stem the invasions. Areas already cleared need to be maintained to prevent re-invasions that undermine the work already done.

The ISMS also relates to the Vision of the Sustainability Action Plan in that it promotes shared responsibility and educates, inspires and motivates students, faculty, staff and community members to steward the natural areas and grounds of the University of Victoria campus. In terms of policy, the ISMS promotes this stewardship of our natural resources and promotes ecological integrity and ecosystem health . Dealing with invasive species on campus is beyond the capacity of Facilities Management alone - the problem is too large. For this reason the ISMS is a helpful tool that allows students, faculty and community members to engage in invasive species removal and monitoring, in turn helping the efforts of

Facilities Management staff.

The ISMS provides a plan and outlines coordination for the removal of invasive species on campus. The ISMS identifies priority areas for action where eradication of invasive species is advisable and offers management practices for other areas where invasive species will be managed. In the accompanying Stewardship Program, methods are proposed for engaging students, community members, and University staff and faculty, in this effort. Opportunities for involvement include volunteer engagement through the Ecological Restoration Volunteer Network, student and staff participation through course work, and the building of partnerships across a diversity of community groups and disciplines. This Strategy aims to provide an adaptive framework to invasive species management on campus, to acknowledge the historical processes that have occurred on these lands and to encourage one to build their own sense of place on this beautiful campus.

The ISMS provides an organizational structure and identifies resources to enable Facilities Management, faculty, students and community members to work together in controlling invasive species on campus. The intended outcomes of the ISMS are as follows:

1. The Invasive Species Management Strategy report
2. Priority sites derived from the existing campus Natural Features Study for faculty and student groups to focus their efforts on invasive species removal
3. A Stewardship Program for Invasive Species based on the District of Saanich's Pulling Together Volunteer Program and the Greater Victoria Green Team's program for volunteer engagement
4. Initial coordination of the Stewardship Program to ensure it is properly implemented and to adjust the program as necessary if there are problems requiring solutions

Actions to Date

To date, there has already been a great deal of interest in dealing with invasive species on campus. The ISMS identifies some of the work done in the past as part of course curriculum by students and faculty of the Restoration of Natural Systems Program (RNS), the School of Environmental Studies, and the Geography and Biology departments.

The Grounds and Environmental Services Department of Facilities Management is responsible for overseeing the management and stewardship of forested and landscaped areas on the University of Victoria campus. Removal of invasive species is prioritized on a daily basis for the grounds crew. It also mentors students in invasive species removal.

The Office of Campus Planning and Sustainability has played a role in putting invasive species removal events in motion through its annual Sustainability Week and Edible Campus UVic initiative.

Student, community and volunteer groups such as the Ecological Restoration Volunteer Network (ERVN) have also demonstrated significant involvement in on campus invasive species removal efforts in recent decades. The ERVN has been particularly active in Cunningham Woods, South Woods, Haro Woods and Mystic Vale in recent years. Other student initiatives include University of Victoria Students' Society (UVSS) clubs such as UVic Parks Club; UVSS advocacy groups and affiliated organizations such as the Vancouver Island Public Interest Research Group (VIPIRG); and course unions such as the Environmental Studies Student Society (ESSA). Community groups that have been active on campus include the Greater Victoria Green Team, Friends of Finnerty Gardens, the Garry Oak Ecosystem Recovery Team and the University of Victoria Child Care Services. Multi-stakeholder partnerships include the Garry Oak Meadow Ecological Restoration Project (GOMER), Ian Ross Memorial Garden,

Lorene Kennedy Memorial Garden and the Bowker Creek Initiative.

Section 1. The need for an Invasive Species Management Strategy

This Invasive Species Management Strategy (ISMS) has been developed specifically for the University of Victoria, for the purpose of guiding invasive species management activities in designated natural and landscaped areas on the University of Victoria campus. The University of Victoria is situated within the Coastal Douglas-fir biogeoclimatic zone, within which naturally occurring Garry Oak Ecosystems are found. These ecosystems persisted due to traditional land use practices of the Lkwungen (Songhees) , Wyomilth (Esquimalt) and WS'ANEC' (Saanich), peoples of the Coast Salish Nation, all of whom used these territories for practices such as burning to maintain the landscapes of their subsistence. These ecosystems have experienced increased negative human disturbances since European settlement. The synergy of various pressures in an area of high human disturbance, in addition to the situation of the region along key transportation pathways, combine to make Coastal Douglas-fir ecosystems highly susceptible to the pervasiveness of invasive species. Subject to high levels of habitat degradation, loss, and fragmentation, as well as shifts in hydrological and soil regimes, and the loss of traditional land management practices, campus ecosystems areas are particularly vulnerable to the spread of invasive species.

Section 2. Strategy Components, Challenges and Best Management Practices

Key **challenges** in invasive species management on the university campus include a lack of continuity where student champions graduate and move on, limited resources where participants juggle many other competing commitments, university budgets with higher priorities, a lack of communication between groups and a lack of communication between successive generations of involved individuals and groups.

The **human dimensions** of invasive species management, such as the social and cultural context in which this work takes place, must be considered but may be difficult to resolve and achieve consensus within short time frames. Invasive species management efforts should proceed in a manner that is considerate of the cultural history embedded within the University of Victoria landscape, and supportive of traditional land management practices, knowledge sharing, and cultural revitalization. Invasive species management initiatives on campus should thus proceed in a manner that promotes inclusion and accessibility, and supports diversity. A diversity of knowledge sharing techniques should be employed and supported in order to promote continuity in the collective memory of campus natural and landscaped areas held by the community.

The **effective management** of invasive species should be strategic and priority based, on the basis of well-informed best practices and ongoing research. Implementing the Stewardship Program would ensure the Strategy's effectiveness, reach and longevity. Strong efforts toward monitoring and evaluating the effectiveness of invasive species removal techniques and approaches should take place regularly. Native plants may be established as an aid to ecological regeneration, given due consideration of site conditions and financial, watering, and safety considerations.

In order for the ISMS to remain effective in the long term, it must employ an **adaptive management** approach to accommodate changes in social, ecological, and cultural conditions. Therefore, it should be implemented using an approach whereby strategies for removing invasive species and engaging participants in the program are flexible, and can be changed in order to ensure continued achievement of desired outcomes.

Section 3. Stewardship Program

The Stewardship Program is comprised of several sections outlining how stakeholders involved in ecological restoration on the University of Victoria campus will carry out the ISMS. It encourages planning and partnerships that are facilitated by a Volunteer Coordinator of the Ecological Restoration Volunteer Network (ERVN), a Work Study position supervised by the Academic Administrator of the Restoration of Natural Systems Program.

Program Components: Regular work parties help to remove invasive species on campus, as well as monitoring of sites where invasive species have been removed in the past will ensure the effectiveness of the ISMS. Work Parties can be facilitated by the ERVN and include UVic class groups, community members, ERVN volunteers or special interest groups (such as scouts, girl guides or environmental clubs), who contact the Volunteer Coordinator to organize an event. The UVic Ecological Restoration Volunteer Network (ERVN) is registered as club with the University of Victoria Student Society (UVSS). Through the UVSS, the club receives limited funds each semester. The ERVN owns some tools, and aditional tools can be borrowed from the Restoration of Natural Systems Program upon contacting the Academic Administrator.

If the restoration plan calls for re-planting of an area, seeds, seedlings or potted plants (usually 4" or 1-gallon size pots) must be sourced. In the past seeds have been obtained from various community donors, and Saanich Native plants, City of Victoria Parks and Fort Rodd Hill National Historic Site. In the future, the Saanich Native Plant Study group plant salvage can be used to source plants. Eventually the ERVN Native Plant Nursery, located at the Campus Community Garden, will be able to provide some plant material for restoration sites.

Roles & Responsibilities: The Ecological Restoration Advisory Committee is an informal partnership formed in 2016 that consists of Facilities Management staff, faculty, the Ecological Restoration Volunteer Network (ERVN), and students with the common passion of restoring the natural areas on the Campus of the University of Victoria together with ecological and social integrity. The Advisory Committee is chaired by the Academic Administrator of the RNS Program.

Facilities management serves the university community and manages the campus grounds, including the natural areas and native plant gardens as well as provide staff support and overall direction for this volunteer program at the University of Victoria, as much as its limited resources allow. One role of Facilities Management in the ISMS is to provide continuity for this program through the administrative structure of the University.

Faculty members who are interested in participating in the Ecological Restoration Advisory committee can offer knowledge and guidance to the evolution and implementation for this program. They can also incorporate invasive species removals and plantings of native species in their curriculum.

The Volunteer Coordinator will communicate with community members who are working on restoration efforts and can help in organizing joint community events, as well as attending community events with the ERVN.

The Academic Administrator for the Restoration of Natural Systems program is the permanent position of support for the Invasive Species Management Strategy and Stewardship Program. The person who holds this position will supervise the Work Study and act as a liaison to communicate with the Volunteer Coordinator and interested parties. Having a permanent faculty member will help the continuity of this project as Volunteer Coordinators move on from the position.

The Community Mapping Collaboratory provides countless connections to work done by the ERVN as well as other related efforts around campus. This online resource links stories, experiences and projects to geographical locations on the Community Green Map. This tool provides geographic and visual referencing for ecological restoration.
The Office of Campus Planning and Sustainability provides some funding for the implementation of the Invasive Species Management Strategy with the Green Fund grant. The office is also a point of continuity and communication for ERVN and other on campus restoration efforts.

Risk Management: Risk management pertains to all volunteers participating in ERVN activities. Students and other volunteers must be informed of the potential risks associated with working outside and with tools. Volunteers must be trained on the proper use of tools and be given an informed consent form to ensure the University is under no liability for injuries that occur during ERVN restoration events. No power tools are to be used by volunteers. The University of Victoria has the same safety standards for volunteers as it does for its own employees. Individuals wishing to volunteer with the ERVN will be given an Informed Consent form that they must sign detailing risks and policies around environmental restoration in the natural areas of UVic.

Section 4. Individual Area Management Plans

Eleven area management plans that are intended to be used as modules are provided for convenient use as course activities on campus. The campus is used as a living classroom and invasive species provide an excellent opportunity to teach ecology, environmental stewardship and community engagement. Each plan has a map showing the area's location on campus, a description of the site, a schematic diagram of the site showing the locations for invasive species removal and instructions for which are the best parts of the site and the best invasive species for removal. The sites are:

Cunningham Woods: These woods are situated south of the Medical Sciences Building, west of the Engineering and Computer Sciences building, and adjacent to Ring Road. Students of the Restoration of Natural Systems Program and volunteers of the UVic Ecological Restoration Volunteer Network have been removing invasive species, including English ivy, English holly, and daphne laurel in the southeastern portion of Cunningham Woods, since March of 2013. High priority species for removal include: yellow flag iris, thistle, English ivy, English holly, Daphne laurel and new grasses.

Bowker Creek: The Bowker Creek area, approximately 5.7 ha in area, is located at the northwest corner of campus, and is comprised of a portion to the west of Parking Lots 8 and 9 (Bowker Creek West) and a portion to the west of the Murray and Anne Fraser building and surrounding the University Club (Bowker Creek East). The Bowker Creek Blueprint was created by the Bowker Creek Initiative (BCI) active in the Capital Regional District to guide management and restoration of the Bowker Creek watershed, based on the visions and goals outlined in the 2004 Bowker Creek Watershed Management Plan. High priority species for removal include: yellow flag iris, thistle, English ivy, English holly, Daphne laurel, new grasses, and Robert's geranium.

Mystic Vale and Hobbs Creek: Mystic Vale and Hobbs Creek are located in southeast corner of the University of Victoria campus. Several student and volunteer groups have engaged in invasive species removal, and stream bank and riparian restoration projects in the area, predominantly within Mystic Vale. In the northernmost corner of Mystic Vale. Students of Environmental Studies 341 are frequently conduct invasive species removal at this site as an introduction to ecological restoration. High priority species for removal include: thistle, English ivy, English holly, Daphne laurel and new grasses.

South Woods: This is a forested area of 11.5 ha located in the southeastern portion of the University of Victoria campus, within the District of Oak Bay bordered by Ring Road to the north, University Drive to

the west, Cedar Hill Cross to the south, and a District of Oak Bay right-of-way to the east. Volunteer groups, including the University of Victoria Ecological Restoration Volunteer Network and the Greater Victoria Green Team, have engaged in invasive species removal in various areas within south woods for several years. High priority species for removal include: yellow flag iris, thistle, English ivy, English holly, Daphne laurel, common periwinkle, Scotch broom and Robert's geranium.

Garry Oak and Camas Meadow: The Garry Oak and Camas Meadow is situated at the southwest corner of the University of Victoria campus, adjacent to Gordon Head Road to the west. On July 22, 2005, members of the Songhees First Nation community, students, and other members of the University of Victoria and surrounding community gathered to engage in a camas harvest in the area. High priority species for removal include: thistle, English ivy, English holly, cyclamen, Daphne laurel and new grasses.

Alumni Meadow: The Alumni Meadow is located at the Henderson Road southern entrance to the campus and is bordered by University Drive to the east, and Cedar Hill Cross Road to the south. The Garry Oak Reclamation Trials, also known as the Garry Oak Meadow Ecosystem Restoration Project (GOMER), was an ecological restoration project that took place in what is now called the Alumni Meadow. It was conducted in 2004 following two years of public engagement, study, and planning. The project involved the establishment of the University of Victoria's first demonstration restoration initiative, with the objectives of conducting research on invasive species removal and native species planting techniques, incorporating public safety and grounds maintenance into a restoration design, and acknowledging First Nations history on the site. High priority species for removal include: thistle, English hawthorn, Scotch broom, English ivy, English holly, Daphne laurel and new grasses.

Haro Woods and Finnerty Ravine: This area is located at the northeast extent of the University of Victoria campus, a 1.46ha area in the southeastern corner of Haro Woods. Remaining portions of Haro Woods are owned by both the Capital Regional District and the District of Saanich. Volunteers of the Ecological Restoration Volunteer Network have participated in invasive species removal in this area in the past. The adjacent Finnerty Ravine exist within University of Victoria property. species removal in portions of Haro Woods and Finnerty Ravine on a number of occasions from 2012-2014. High priority species for removal include: thistle, English hawthorne, Scotch broom, English ivy, English holly, Daphne laurel and new grasses.

Vancouver Island Public Information Research Group Native plant Garden: This is located in the southwest corner of the campus within Ring Road, adjacent to Cunningham Woods. This area was originally named "The MacLaurin Wetlands", as the site houses two ponds. The site was re-named the "VIPIRG Garden" in 2011. The VIPIRG native plant garden was established in 1993 by the VIPIRG Native Vegetation Committee as a project to demonstrate natural forest ecology on the University of Victoria campus and provide a space for users of the campus to relax. The Native Vegetation Committee ceased work in the gardens after a number of years, and efforts were made to revive a VIPIRG Native Plant Working Group in 2011. High priority species for removal include: thistle, morning glory, English ivy, English holly, and new grasses.

Lorene Kennedy Garden: The Lorene Kennedy Garden was established in 2003 in memorial to Dr. Lorene Kennedy, a botanist who made significant financial contributions to the University of Victoria's School of Environmental Studies. Today, the Lorene Kennedy bursary enables numerous Environmental Studies students access to experiential learning opportunities in field schools. The garden is located in the courtyard between the Sedgewick and Harry Hickman buildings in the northwest corner of the University of Victoria campus, within Ring Road. This area is currently managed by Facilities Management staff, and through some student projects conducted in Environmental Studies 341: Ecological Restoration. Little documentation exists regarding involvement with this area by any other group. High priority species for removal include: thistle, English ivy, and English holly.

Ian Ross Memorial Garden: This area is located in the northwestern portion of campus, within Ring Road, and in the courtyard of the David Turpin Building. The Ian Ross Memorial Garden was installed to commemorate Ian Ross, a former owner of Butchart Gardens and supporter of the university. Since its original establishment in 2008, the Ian Ross Memorial Garden has seen little follow-up activity from the University of Victoria community. The area continues to be managed by a small group of Facilities Management staff who do not have the capacity to manage the area to the required extent. High priority species for removal include thistle and where possible, spreading grasses.

Rain Gardens: The two rain gardens addressed in this report are found at the corner of McKenzie Avenue and McGill Road, and at the new addition to the MacPherson Library. Invasive species such as thistle are beginning to appear in these new plantings and early removal of the invasives when they appear will prevent bigger problems later.

At the end of the ISMS report are two reference documents, the Capital Region Invasive Species Partnership (CRISP) Priority Invasive Plant List and the EDRR Filed Sheet for the District of Saanich.

The public engagement report for this project is also found at the end of this report. During the project there were 6 events engaging 108 people for a total of 181 work hours. Planning also occurred for 5 additional events expected to involve 60 additional people and 120 work hours.

Preamble

The ISMS addresses what are commonly referred to as exotic, non-indigenous, introduced, alien, or invasive species. In this document, the term *invasive species* will be used to refer to species which have been introduced outside of their natural distribution, and which may pose ecological, economic, and societal threats, as well as threats to human health (Government of Canada, 2004). This document will take a sole focus on *invasive plant species*, although the need for a plan for dealing with invasive animals and other species may arise in the future. Native species occurring within their natural, historical range, and demonstrating invasive qualities will not be addressed here. The implementation of this plan uses an adaptive management approach, whereby strategies are changed and new strategies for achieving desired outcomes are developed on the basis of well-documented observations of ineffectiveness, underperformance, unintended consequences, or unforeseen obstacles.

Purpose

The purpose of this document is to provide a framework for how ecological restoration on the UVic campus can be done effectively, efficiently and meaningfully. The ISMS outlines the challenges to ecological restoration in a university setting, detailing the barriers of resources, communication and continuity that continually arise when conducting restoration. The Stewardship program component of this document will outline the mechanism by which the Ecological Restoration Volunteer Network will function in organizing ecological restoration activities that happen on the University of Victoria Campus. The aim of this document is to bring together and strengthen ecological restoration efforts already taking place on the University of Victoria campus as well as inspire new restoration initiatives. In this document the roles and responsibilities of stakeholder groups are outlined as well as procedures for risk management. This will ensure ecological restoration at the University of Victoria is carried out in a way that is sustainable, inclusive and structured.

Scope

The primary focus of this strategy is on invasive plant species occurring within the University of Victoria campus lands. The primary areas covered by the strategy are the natural areas identified in the Natural Features Studies conducted in 2007/2008, as well as a number of landscaped areas on campus which are identified in the ISMS. This strategy will engage students, faculty, staff and community members who are interested in ecological restoration on campus. This document outlines some of the possible ways individuals and groups may become involved in ecological restoration efforts. As the program grows more opportunities for involvement will arise and the plan will be adapted accordingly. Keeping partnerships open and ensuring communication between groups is key to the longevity of this program. Students may participate through the University of Victoria's Ecological Restoration Volunteer Network (ERVN), course requirements, or other student volunteer initiatives. Faculty may engage in invasive species removal as a component of course curriculum or outside of courses. Staff include Facilities Management through grounds work and other staff as volunteers. Community members act through their involvement with the ERVN and through community partnerships with various entities within the university. A more detailed scope of the current participants in stewardship of natural areas through invasive species removal are outlined in the Stewardship Program, Section 3.0. As the program progresses and more partnerships are formed, this list can be adapted to grow and include new involvement.

The implementation of this strategy uses an adaptive management approach, where strategies are changed and new strategies for achieving desired outcomes are developed on the basis of well-documented observations of ineffectiveness, underperformance, unintended consequences, or unforeseen obstacles (Clewell, Rieger & Munro, 2005).

Actions to Date

Members of the University of Victoria community have been engaging in invasive species removal for much of the university's history. These efforts include:

The Classroom: Students & Faculty

Restoration of Natural Systems Program
Students in the Restoration of Natural Systems Program are required to develop an ecological restoration project in their final course, ER 390. Several projects have been carried out in campus natural areas to date. These include the following:

- *Cunningham Woods: Restoration Report and Monitoring Plan.* Lexi Fisher, 2013.
- *Restoration of Haro Woods: Designing a Program for University Students to Carry Out On-Campus Restoration.* Andrew MacKinnon, 2013.
- *The restoration of Hobbs Creek's Reach 8 within the Mystic Vale using wattling to control erosion.* Ross McCarter, 2012.
- *An Ecosystem Valuation of Mystic Vale.* Sacha Doucet, 2012.
- *Ecological Restoration in the Mystic Vale: Working with and Furthering Past Restoration Efforts.* Megan Vincente, 2012.
- *Ecological Restoration of the Riparian Ecosystem in Mystic Vale/Hobbs Creek, Victoria, BC.* Hannah Oliver, 2011.
- *University of Victoria Garry Oak Meadow Restoration Project.* Magnus Bein, 2005.

Their reports can be found at **urbanecology.ca/rns/** Additionally, RNS students have engaged with other student volunteers to remove invasive species (see Ecological Restoration Volunteer Network below), and plant native species.

School of Environmental Studies
Ecological restoration, of which invasive species removal is a key component, represents one of three pillars of the School of Environmental Studies' educational structure. Students are given opportunities to engage in ecological restoration through various means, including the following:

- **Required volunteer hours:** Courses run through the School of Environmental Studies at times require students to meet volunteer hours requirements, which have in the past provided students with the opportunity to engage in invasive species removal on campus.
- **Instructor-led invasive species removal work parties:** Students of Environmental Studies 341 (Past, Present & Future Ecologies), Environmental Studies 240 (Ecological Processes), and other courses have been engaged in invasive species removal on a number of occasions, as a means of introducing students to the basic principles and actions of ecological restoration and engaging students in activities within campus natural areas.
- **ES 341: Past, Present & Future Ecologies (Formerly Ecological Restoration):** Environmental Studies 341, an introductory course to the field of ecological restoration, has required students to produce ecological restoration prescriptions for various sites. Several of these sites occur within the University of Victoria campus and apply to the areas addressed in this plan. These include the Alumni

Garry Oak Meadow, Bowker Creek, the Garry Oak and Camas Meadow, Mystic Vale, the Lorene Kennedy Garden, the Elliot Garden, the VIPIRG Garden, various rain gardens, and South Woods. Student restoration projects can be found under ES 341 at **www.uvic.ca/socialsciences/environmental/undergraduate/courses/index.php**

- **Community Mapping:** Students in Environmental Studies have been given opportunities through course work to apply community mapping techniques in their study of on-campus restoration among other sustainability initiatives. Examples of this include students' study of past, ongoing and future restoration sites in ES 341: Introduction to Ecological Restoration (see **es341.geog.uvic.ca/geobrowser**) and in surveying UVic's cultural landscape (with ecological restoration as a component) in ES 481: Landscape Reconstruction (see **es481.geog.uvic.ca/**).

Other Departments

- **Department of Geography:** Students in the Department of Geography have contributed to invasive species removal events in the past through their volunteer hour requirements, and by participating in community mapping projects centered around campus natural and landscaped areas.
- **Department of Biology:** Students in the Department of Biology regularly conduct research on species and ecological processes on campus. In particular, the Center for Forest Biology and the University of Victoria Herbarium contribute to overall research on the health of campus ecosystems.

Ecological Restoration Volunteer Network

ERVN volunteers removing English ivy (*Hedera helix*) (left) and sitting around a pile of newly removed invasive species (right) in Cunningham Woods. Photos by Julia Jennings. 2015.

The University of Victoria's Ecological Restoration Volunteer Network (ERVN) Coordinator was established as a Work Study position through the Restoration of Natural Systems Program in 2011. Its purpose is to connect volunteers in the University of Victoria community and beyond with opportunities for participation in ecological restoration efforts on campus and in the region, as well as build the human capacity of local ecological restoration initiatives. Members of the ERVN have

engaged in several invasive species removal efforts on campus since the network's establishment, which are listed below[1]:

- **Cunningham Woods:** This site became an area of focus for the ERVN in early 2013, when ERVN coordinator Lexi Fisher and RNS student Andrew MacKinnon led a number of invasive species removal events with ES 341 courses and volunteers. Lexi Fisher conducted her ER390 Major Project for her RNS Diploma on the site in 2013. Since this time, ERVN volunteers have participated in 1-2 invasive species removal work parties in the area per semester, bringing out an estimated total of 190 volunteers and logging an estimated 310 volunteer hours between January 2013 and October 2015. This is a site of ongoing interest for ERVN volunteers. Other activities have taken place in the area on a regular basis, including native species plantings, plant identification walks, and ecosystem monitoring workshops with The Land Conservancy of BC (TLC). In March of 2016, the ERVN teamed up with TLC to host the first on campus Bioblitz, which brought together over 18 volunteers and resulted in the identification of over 40 plant species and over 20 bird species over the course of 3 hours.

- **Haro Woods:** In the fall of 2012, RNS student and ERVN volunteer Andrew MacKinnon engaged a group of students in invasive species removal in the woods, with the intent of educating participants on restoration and ecosystem mapping techniques. He did his ER390 project on Haro Woods in 2013. The ERVN has since engaged in efforts to remove daphne laurel in partnership with UVic Childcare Services in October 2013, to mitigate potential harm done to children by this noxious invasive than regularly causes respiratory and skin irritation.

- **South Woods:** The ERVN has hosted work parties to remove invasive species in South Woods in the past. Some of these work parties took place throughout 2013. More recently, the ERVN joined the Greater Victoria Green Team to remove invasive species with a group of 10-13-year-old students in the area.

- **Mystic Vale:** The ERVN has connected with RNS student projects in the past, including four ER 390 projects, in order to provide volunteer support. In April 2012, volunteers joined an RNS student to construct wattles along Hobbs Creek in Mystic Vale.

These are just some of the examples of involvement in these areas. Much of the past study, restoration and student projects that have occurred in these areas have gone undocumented or have not been communicated between faculties. Continuing to build connections with faculty and classes that have been involved in the natural areas will allow for more detailed documentation in the future.

[1] For more information about the Ecological Restoration Volunteer Network's past involvement in ecological restoration the University of Victoria's natural areas, please visit web.uvic.ca/~nature/ or the ERVN Facebook page, "UVic Ecological Restoration Volunteer Network" at https://www.facebook.com/groups/uvicervn/

Facilities Management

The Grounds and Environmental Services Department of Facilities Management is responsible for overseeing the management and stewardship of forested and landscaped areas on the University of Victoria campus, while balancing responsibilities of ensuring safety in the campus environment. Removal of invasive species is prioritized on a daily basis for the grounds crew, with efforts in the past including the removal of English ivy from all trees on campus so as to stop the plant's seed cycle, and a heavy focus on removing invasive species, as well as implementing stream bank restoration techniques, in Mystic Vale and Hobbs Creek (Roberts, P., personal communication, August 5, 2016). Facilities Management staff frequently engage with students participating in invasive species removal, demonstrating proper techniques, best management practices, and safety. Additionally, Facilities Management staff assist volunteer groups on campus in disposing of removed invasive species.

Office of Campus Planning & Sustainability

UVic Sustainability Week

To date, the Office of Campus Planning and Sustainability has played a role in putting invasive species removal events in motion through its annual Sustainability Week. On October 8, 2014, the Office of Campus Planning and Sustainability helped to organize two invasive species pulls in Cunningham Woods as a Sustainability Week event on campus, in partnership with the Greater Victoria Green Team and UVic's Ecological Restoration Volunteer Network. The Office played a huge role in 2016 by providing the funds that made the development of this ISMS possible.

Matt Greeno of the Office of Campus Planning & Sustainability (far right), joined by ERVN and Greater Victoria Green Team volunteers. Photo Credit: Amanda Evans. Retrieved from http://www.meetup.com/Greater-Victoria-Green- Team/pages/18210692/Cunningham_Woods_at_UVic_Oct_8_2014/

Edible Campus UVic

In the spring semester 2016, UVic's Office of Campus Planning and Sustainability mobilized and provided support for a student-run investigation of the "feasibility of edible landscapes and other food growth options on campus," a priority laid out in UVic's Sustainability Action Plan (University of Victoria, 2014, p.14; Huggins & Park, 2016). In identifying appropriate sites for the management of land for various kinds of food production, Huggins and Park (2016) chose three sites demonstrating potential for ethnobotanical uses which overlap with sites considered in the ISMS. These include the Ian Ross Memorial Gardens in the

David Turpin Building courtyard, a portion of the Garry Oak and Camas Meadow, and the VIPIRG Garden, all of which already demonstrate significant ethnobotanical value.

Student Volunteer Initiatives

UVSS Clubs

- **UVic Parks Club:** The University of Victoria Parks Club, a club supported by Parks Canada, has teamed up with the Ecological Restoration Volunteer Network in the past for on-campus invasive species removal work parties in Cunningham Woods as well as off campus restoration events to national parks such as Fort Rodd Hill National Historic Site.
- **ERVN:** The **E**cological **R**estoration **V**olunteer **N**etwork builds capacity with local environmental organizations and to help provide the human resources they need to successfully design and implement their restoration projects.

Course Unions

- **ESSA:** The Environmental Studies Student Association (ESSA) is the Undergraduate Course Union for Environmental Studies students at the University of Victoria, and has in the past partnered with on campus ecological restoration initiatives to remove invasive species.

Advocacy Groups & University of Victoria Students' Society

- **UVSS:** Elected members and staff of University of Victoria Students' Society have in the past provided support for the Ecological Restoration Volunteer Network in the form of volunteers and communication assistance. Additionally, the ERVN regularly accesses funding through UVSS Clubs, which allows for the supply of tools and other provisions for volunteers.
- **UVSP:** The University of Victoria Sustainability Project, an affiliated organization of the UVSS, has in the past provided funding allowing for the purchase of supplies and equipment for on-campus invasive species removal efforts.
- **VIPIRG:** The Vancouver Island Public Interest Research Group has a history of engagement in invasive species removal, with records of large scale removal of Scotch broom (*Cytisus scoparius*) from the Garry oak and Camas meadows in 1994/1995 and English ivy (*Hedera helix*) from Mystic Vale in 1998/1999. The Native Vegetation Committee, along with faculty member Brenda Constanzo, worked to install MacLaurin Wetlands, a native plant garden south of the MacLaurin Building, now referred to as the VIPIRG Garden. In 2012, VIPIRG created the Campus Native Plant Garden Working Group to aid in the continued management of this area (Jewenski, 2012).

Community Groups

Greater Victoria Green Team

This network of dedicated ecological restoration volunteers has teamed up with the Ecological Restoration Volunteer Network on a number of occasions to involve volunteer groups in on-campus restoration, both in Cunningham Woods and in South Woods.

Volunteers of the Greater Victoria Green Team and UVic's ERVN remove English ivy (*Hedera helix*) in South Woods.

Friends of Finnerty Gardens
Finnerty Gardens is a public woodland on campus best known for its large collection of rhododendrons. The Friends of Finnerty Gardens are a stewardship group that helps to manage presence of invasive species and weed species in this area. These efforts are very important to help maintain this well-used place on campus for future enjoyment, as well as to prevent the spread of invasive species to other adjacent natural areas on campus.

Garry Oak Ecosystems Recovery Team (GOERT)
The Garry Oak Ecosystems Recovery Team (GOERT) Society is a non-profit organization dedicated to the recovery of Garry oak and associated ecosystems in Canada and the species at risk that inhabit them. The University of Victoria campus has some of the remaining Garry Oak ecosystems in Victoria and GOERT has worked on campus invasive species management and restoration efforts, particularly with the RNS program.

University of Victoria Child Care Services
Child Care Services has teamed up with the Ecological Restoration Volunteer Network to remove the noxious weed daphne laurel (*Daphne laureola*) in Haro Woods, adjacent to the Child Care Services facility. There have also been continued restoration efforts in Finnerty Ravine.

The Land Conservancy of British Columbia (TLC)
The Land Conservancy of BC has partnered up with the University of Victoria's ERVN on a number of occasions to run workshops and invasive species removal events, as well as UVic's first on-campus Bioblitz in the spring of 2016. They have helped by providing instruction, facilitation capacity, equipment, and resources. TLC has also assisted the ERVN with documentation of past invasive species removal efforts and ongoing monitoring in Cunningham Woods.

Multi-Stakeholder Partnerships

Garry Oak Meadow Ecological Restoration Project (GOMER)
The Garry Oak Meadow Ecological Restoration Project was the product of a partnership between the Restoration of Natural Systems Program, Facilities Management, and several community members. Between 2001 and 2004, research and public engagement regarding the Garry oak meadows on campus, and in particular the site on the corner of Cedar Hill Cross Road and University Drive, were undertaken. This resulted in the implementation of

the "first demonstration restoration to take place on campus" (Bein, 2005, p.2). It consisted of test plots in which different methods of invasive species removal and native species plantings were implemented, as well as the re-routing of a foot path, alterations in site hydrology infrastructure, and the installation of a fence. The site was intended to act as a "living laboratory" for restoration and conservation on campus, and the implementation of the project involved several public engagement and education opportunities (Bein & Eastman, 2006, p.1). In 2008, the site was adopted by the University of Victoria Alumni Association, and its management taken up by the School of Environmental Studies in 2012 (Schaefer & Miles, 2013). Currently the site has a large presence of invasive species and will require intense removal and management to be restored.

Ian Ross Memorial Garden
This garden was established in dedication to Ian Ross, a former owner of Butchart Gardens and supporter of the University of Victoria (Schaefer & Miles, 2013). It was intended to be comprised of a number of 'mini ecosystems' and includes several edible and medicinal native plants. There is no irrigation present on this site due to it being a native planting, resulting in many of the garden beds being unable to persist.

Lorene Kennedy Memorial Garden
An edible plant demonstration garden was installed between the Harry Hickman and Sedgewick Buildings in memory of Dr. Lorene Kennedy, a botanist who made significant contributions to the University of Victoria's School of Environmental Studies. The garden was established as a joint effort between Facilities Management and the School of Environmental Studies. Due to lack of maintenance these gardens now require weeding and removal of encroaching invasive species.

Bowker Creek Initiative
The Bowker Creek Initiative (BCI) is a multi-stakeholder group dedicated to the restoration and stewardship of Bowker Creek and its watershed. In 2004, the BCI created the Bowker Creek Watershed Management Plan, which was followed up later by the Bowker Creek Blueprint, a 100-year action plan for restoring the creek, based on the visions and goals outlined in the Management Plan. The University of Victoria represents one stakeholder group of many required to participate in coordinated restoration of the watershed, as Reach 15 of the creek is situated on campus lands (Bowker Creek Initiative, 2012).

Section 1.0 The Need for an Invasive Species Management Strategy

1.1 Purpose of the Strategy

This Invasive Species Management Strategy (ISMS) has been developed for the University of Victoria in order to guide invasive species management activities in designated natural and landscaped areas on the University of Victoria campus. By building on past initiatives and carefully integrating current efforts, this strategy aims to support and strengthen the coordination of invasive species management across disciplines, stakeholder groups, and members of the community of which the University of Victoria is a part, as well as across generations. In so-doing, it aims to bolster the long-term effectiveness, efficiency, and level of engagement exhibited in efforts to achieve heightened ecological integrity in the University of Victoria's natural and landscaped areas through the removal invasive species.

The ISMS exists in compliance with federal, provincial, and municipal recommendations on the management of invasive species[2], and meets the requirements of Official Community Plans (OCPs) adopted by the Districts of Oak Bay and Saanich, both of which the University of Victoria is situated within. Both OCPs demonstrate a commitment to the restoration of native ecosystems through strategies that include the removal of invasive species (District of Saanich, 2008; District of Oak Bay, 2014). The Invasive Species Management Strategy provides a clear means of achieving goal to "[p]rotect and manage the ecological diversity of the natural areas on campus", as is laid out in the University of Victoria Office of Campus Planning and Sustainability's Sustainability Action Plan, as it mobilizes the removal of a significant threat to ecological diversity in these natural areas (Office of Campus Planning & Sustainability, 2014, p.14; Harrop-Archibald, 2007). In addition, the strategy will play a significant role in achieving multiple tenets of the University of Victoria's 2016 Campus Plan, which states:

> *"The University is committed to protecting and restoring designated natural areas on campus"*
> - Section 2.3, Principle 4
> (University of Victoria, 2016, p.31)

> *"iv.* ***Restoration:*** *Engage in plans, implementation activities, and monitoring programs to steward appropriate natural areas back to better health."*
> - Section 3.2.1 Natural Areas
> (University of Victoria, 2016, p.44)

The Campus Plan was developed in compliance with recommendations made by Harrop-Archibald in her 2007 and 2008 University of Victoria Natural Features Studies, which identify invasive species as one of the primary threats to the health of campus natural areas.

The ISMS will address the management of invasive species in the following natural areas on campus: Bowker Creek, Mystic Vale/Hobbs Creek, South Woods, Cunningham Woods, the Garry Oak and Camas Meadow, Haro Woods and Finnerty Ravine. It also offers guidance for managing special garden installations such as Lorene Kennedy, Ian Ross Memorial and VIPIRG gardens, as well as rain gardens (see Section 4.0 for specific information on each of these sites). The strategy is meant

[2] For more information on federal, provincial, and municipal strategies for invasive species management, see: Government of Canada, 2004; C. Rankin & Assoc., 2004; August et al., 2012; Wikeem & Wikeem, 2010; and District of Saanich, 2013.

to identify the scope of invasive species management on campus, and sets the stage to be built upon through the work of key partners, including the Ecological Restoration Volunteer Network, Facilities Management staff, University of Victoria students and faculty, and community partners. These participants will engage with the strategy through the Stewardship Program outlined in Section 3.0 of the ISMS. Finally, the ISMS will outline best management practices and priorities for invasive species removal (see Section 2.0).

1.2 Why an Invasive Species Management Strategy?

What are Invasive Species?
The Government of Canada (2004) defines *alien* species as "species of plants, animals, and micro-organisms introduced by human action outside their natural past or present distribution", and *invasive alien species* as "harmful alien species whose introduction or spread threatens the environment, the economy, or society, including human health. Invasive alien species can originate from other continents, neighbouring countries, or from other [regions]" (p.1). Qualities which contribute to the 'invasiveness' of these species include advantageous modes of reproduction, a lack of natural predators in habitats to which they are introduced, and an ability to thrive in climates resembling their native habitats (Garry Oak Ecosystems Recovery Team, 2016; Wikeem & Wikeem, 2010). Invasive species are spread through natural and human-influenced modes. These may include wind, water, wildlife, domestic animals, and human transport pathways (Wikeem & Wikeem, 2010). As processes of globalization have continually overcome spatial and temporal barriers to the transport of goods and people, the pace and extent of this spread has increased significantly (Government of Canada, 2004). The spread of invasive species is further enabled when occurring in conjunction with other forms of ecological disturbance or degradation (C. Rankin & Assoc., 2004; Wikeem & Wikeem, 2010).

Effects of Invasive Species
The International Union for the Conservation of Nature (2016) lists invasive species as one of the most pervasive threats to biodiversity worldwide, citing their ability to alter both abiotic and biotic components of an ecological community, as well as its structure, function, and composition, as drivers of biodiversity loss. Invasive species' effects on ecological integrity may also include the occupation of space and habitat, which serves to outcompete native species; the alteration of nutrient cycling regimes, disturbance regimes, and successional trajectories; and reductions in wildlife forage and seedling recruitment (IUCN, 2016; Government of Canada, 2004; Wikeem & Wikeem, 2010). In Canada, invasive species adversely affect approximately a quarter of species at risk, while in British Columbia, they are listed as one of the most significant threats to Red Listed (endangered or threatened) plants and animals (C. Rankin & Assoc., 2004). Additionally, invasive species have economic impacts as they may affect economically important crops and species, and threats to human health & social well-being, including the erosion of traditional land management practices and threats to culturally important species (such as those used for medicinal purposes by Indigenous Peoples), and the presence of noxious weeds, and increases in fire risk where disturbance regimes have been altered (Government of Canada, 2004; August et al., 2012).

Regional Context
What is today known as the Greater Victoria area, within which the University of Victoria is situated, exists within the Coastal Douglas-fir biogeoclimatic zone; this zone is characterized by its presence within the rainshadow of the Olympic and Vancouver Island mountains, low elevations, "warm, dry summers, and mild, wet winters" (Nuszdorfer, Klinka & Demarchi, 1991, p.82). It contains ecosystem assemblages dominated by Douglas-fir (*Pseudotsuga* menziesii), as well as

Garry oak and associated ecosystems. Garry Oak Ecosystems are systems with naturally occurring Garry oaks (*Quercus garryana*) and "some semblance of the ecological processes and communities that prevailed before European settlement" (Garry Oak Ecosystems Recovery Team, 2003, p.iii), which consist of open meadows to denser stands of mixed trees. Associated ecosystems demonstrate a presence of similar species in variable structures, functions, and assemblages; they include transitional forests with an oak component, "coniferous forests and riparian areas without oak cover, wetlands, and agricultural, urban, and suburban areas" which form "integral components of the landscape" (Fuchs, 2001, p.1; GOERT, 2016; GOERT, 2003).

Ecosystems within the Coastal Douglas-fir biogeoclimatic zone demonstrate high ecological value, exhibiting higher numbers of rare and plant species than other terrestrial ecosystems in British Columbia (Nuszdorfer, Klinka & Demarchi, 1991; GOERT, 2016; Fuchs, 2001). Many of these species occur within—with some limited to—Garry Oak Ecosystems (Nuszdorfer, Klinka & Demarchi, 1991). In addition, Garry Oak and Associated Ecosystems, as well as other assemblages within the Coastal Douglas-fir zone, demonstrate high cultural value; prior to the arrival of European settlers in the region, these heavily managed systems provided sustenance to generations of coastal Indigenous Peoples in the region. In particular, Garry oak meadows were heavily managed through cultivation and controlled burning, and contain camas (*Camassia sp.*), a culturally important species and a key provider of nutrition and sustenance for local Indigenous Peoples (GOERT, 2016; Penn, 2006). Thus, maintaining the ecological integrity of these systems is of vital importance (Fuchs, 2001).

Coastal Douglas-fir ecosystems have experienced numerous modes of disturbance since the arrival of European settlers in the region in the 19th century. Such modes include habitat loss through land conversion for agricultural, industrial, and urban uses, and habitat fragmentation, to the extent that only 5% of the original range of Garry oak ecosystem in the region remains. Another such mode is the depletion of traditional land management and disturbance regimes following the displacement of Indigenous Peoples. The popularity of ornamental flower gardens, usually consisting of introduced species from Europe and other parts of the world, has contributed to the proliferation of species which have naturalized and become invasive (Garry Oak Ecosystems Recovery Team, 2011; Fuchs, 2001; GOERT, 2016). The synergy of these pressures in an area of high human disturbance, in addition to the situation of the region along key transportation pathways, combine to make Coastal Douglas-fir ecosystems highly susceptible to the pervasiveness of invasive species (C. Rankin & Assoc., 2004).

The University of Victoria

The University of Victoria is situated within the Coastal Douglas-fir biogeoclimatic zone, moist maritime subzone (CDFmm) (BC Ministry of Forests, 2016). It straddles two municipalities - Oak Bay to the south and Saanich to the north (Harrop-Archibald, 2007). The campus is located in the headwaters for four drainage systems, including Bowker Creek, Finnerty Creek, the Sinclair drainage system, and Hobbs Creek (RCL Consulting Ltd., 2004). The land on which the University of Victoria campus is now situated has undergone a great deal of change, and has been subject to high levels of disturbance since the arrival of European settlers to the area in the late 19th century (Harrop-Archibald, 2007). Prior to this, the area demonstrated a "mosaic of Douglas-fir and grand fir (*Abies grandis*) forests, Garry oak meadows, forested creek ravines, and wetland habitats" (Lloyd 2004 in Harrop-Archibald, 2007, p.2). With the arrival of settlers to the area and the subsequent removal of traditional land management strategies, the area became home to a suite of activities over time - logging carried out by the Hudson's Bay Company, farming activities, use for military activities, and finally, the construction of Victoria College in 1959, now the University of Victoria (University of Victoria, 2003; Lucey et al., 2002 in Harrop-Archibald, 2007).

Still visible in the University of Victoria campus' remaining forested areas, are a mosaic of different ecosystems of varying assemblages, all of which demonstrate historical significance, provide wildlife habitat, and demonstrate varying degrees of degradation (Harrop-Archibald, 2007). Based on the Sensitive Ecosystems Inventory classification scheme applied in Harrop-Archibald's 2007/2008 University of Victoria Natural Features studies, the University of Victoria's campus contains woodlands, swamps, older second growth forests, riparian areas, recently disturbed areas, and zones with heavily fluctuating water tables. The variety of ecosystems on campus provides increased habitat value, especially for wildlife with complex habitat requirements (Harrop-Archibald, 2007). As Harrop-Archibald (2007) states, "the University of Victoria natural areas function as reservoirs for biodiversity in an otherwise highly urbanized landscape, act as buffers between residential areas and more fragile ecosystems such as riparian areas, and provide wildlife corridors and important habitat niches throughout the campus" (p.47).

Natural areas on the University of Victoria include the following (descriptions are adapted from Harrop-Archibald's (2007; 2008) Natural Features Studies):

> *Garry Oak & Camas Meadow:* Classified as a woodland, this area on the southwest corner of campus is not characteristic of an old Garry oak stand, but demonstrates potential as a woodland habitat. It is comprised of a mosaic of ecosystem structures, ranging from open meadow, to shrub thicket, to dense tree canopy. As of 2003, it contained many critically imperilled red listed species.
>
> *Alumni Meadow*: The Alumni Garry Oak Meadow, a small fenced off area on the corner of Cedar Hill Cross Road and University Drive, was the site of a demonstration restoration project known as the Garry Oak Reclamation Trials, also known as the Garry Oak Meadow Restoration Project (GOMER), in 2004. The area was adopted by the University of Victoria Alumni Association in 2008, and became a focus of the School of Environmental Studies in 2012 (Schaefer & Miles, 2013).
>
> *Finnerty Ravine & Haro Woods:* A small portion of the forested Haro Woods area is owned by the University of Victoria, and contains second growth forest. Finnerty Ravine is a riparian area, demonstrating the remnants of a wetland. Both areas face issues with soil compaction resulting from human use.
>
> *South Woods:* Classified as older second growth forest, this area contains several important native species and demonstrates unusual assemblages, highly variable conditions, and provides a transition zone between woodland habitat and Mystic Vale.
>
> *Cunningham Woods:* An older second growth forest contained within Ring Road, this area has experienced recent changes in hydrological patterns, possibly attributable to adjacent land development, and contains a high number of snags. The area consists of two distinct portions: coniferous woodland in the eastern portion, and a wet depression in the western portion, which has a strongly fluctuating water table.
>
> *Bowker Creek:* A wetland ecosystem and riparian area, this site is the headwaters of a highly disturbed urban watershed; this particular area has experienced high levels of trampling, and shifts in hydrology. It demonstrated the largest diversity of birds observed on campus as of 2007.

Mystic Vale & Hobbs Creek: This riparian area demonstrates high levels of diversity and structural complexity, and contains the oldest recorded trees on campus. Hobbs creek, which runs through the forested Mystic Vale, has experienced significant impacts through changes in impervious surface in the watershed, changes in the water table, water pollution, and erosion from human and dog activity.

The University of Victoria campus also contains several landscaped areas containing various assemblages of native species. They include, but are not limited to, the following:

Elliot Garden: The Elliot Garden, located directly west of the Elliot Building, was established in 2007 by an Environmental Studies 341: Ecological Restoration class, led by professor Val Schaefer. Students in this class created a design, sourced salvaged native plants, and installed the garden. The garden was designed to include an edible garden, a Garry Oak meadow, and a fir forest component (Douhaibi, Robinson & Wong, 2007). A fence was installed after the project's implementation.

First Peoples House Gardens: Surrounding the First Peoples House, a LEED Gold Certified building on campus intended to provide a space for Indigenous students, faculty, and community members, are a number of garden beds planted in 2009 and 2010. These gardens contain a wide variety of culturally and ecologically significant native plants; the presence of these plants, and the spatial situation of these gardens makes this a place of opportunity for students and community members to learn and engage with the land (Curry, 2015). Indigenous folks on campus have expressed the desire to have more control over the management of this garden as well as to have harvesting rights extended for those members of the community wishing to harvest plant species for traditional food, medicine and other uses. Refer to the Recommendations document for further information.

Ian Ross Memorial Garden: Located in the David Turpin Building courtyard, this garden was established with the help of and in dedication to Ian Ross, an owner of Butchart Gardens. It was intended to demonstrate Garry Oak Meadow, coastal bluff, marsh, bog, shady creek, and other native and food bearing ecosystems (Schaefer & Miles, 2013).

VIPIRG Garden: Located across Ring Road from Finnerty Gardens, in the former location of Finnerty Gardens, and directly west of Cunningham Woods, the VIPIRG Garden is a native plant demonstration garden established by the Vancouver Island Public Interest Research Group's Native Vegetation Committee in 1993 (Jewenski, 2012). Originally called the "MacLaurin Wetlands", the area contains ponds, as well as several native food bearing and medicinal species.

Lorene Kennedy Garden: Located between the Harry Hickman and Sedgewick buildings, this garden was established in honour of Lorene Kennedy, a "noted botanist and benefactor of the university's School of Environmental Studies" (Schaefer & Miles, 2013, p.15). The area contains several fern and shrub species, as well as many native plant species demonstrating edible and medicinal qualities (Schaefer & Miles, 2013).

Rain Gardens: A rain garden is a planted depression designed to receive runoff from roads, parking lots and rooftops. They reduce the volume of water entering storm drains. The structure allows water to infiltrate into the ground where it is available to recharge streams. The bacteria in the soil also can attenuate pollution from oils and grease. Rain gardens still contain a connection to the storm drain system to handle large rain events and prevent

flooding. Several rain gardens are located on campus such as outside the McPhearson library and at the corner of McGill Road and McKenzie Avenue.

The Need for Invasive Species Management on Campus

Subject to high levels of habitat degradation, loss, and fragmentation, as well as shifts in hydrological and soil regimes, and the loss of traditional land management practices, campus ecosystems areas are particularly vulnerable to the spread of invasive species (Harrop-Archibald, 2007). The University of Victoria Natural Features studies conducted in 2007/2008 confirmed that common invasive plant species found throughout the region are present and pervasive on the University of Victoria campus. These include English ivy (*Hedera helix*), English holly (*Ilex aquifolium*), and daphne laurel (*Daphne laureola*) – which occur in the majority of campus natural areas – as well as Himalayan blackberry (*Rubus armeniacus*) and Scotch broom (*Cytisus scoparius*), which occur in patches around campus as well (Harrop-Archibald, 2007).

Harrop-Archibald (2007; 2008) clearly points to invasive species as the most significant threat faced by natural areas on the University of Victoria campus, and makes a strong recommendation for the removal of invasive species in all study areas[3]. Based on this and the recommendations set out in the 2016 University of Victoria Campus Plan, and due to a need to strengthen existing efforts at invasive species removal on campus, a strategic approach to invasive species management is needed. While the presence of invasive species demonstrates just one impact to campus natural areas—alongside the "impact of construction and other activities on soil condition and drainage patterns, stormwater management, stream channel erosion, and public access in riparian zones" (Harrop-Archibald, 2007, p.7)—their removal provides one of the most feasible avenues for restoring the ecological integrity of native ecosystems and protecting valuable and rare species in these areas. This effort is but one key component of efforts in *ecological restoration,* which is the "process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" (SER, 2014).

Efforts to remove invasive species on the University of Victoria campus play an integral role in larger scale efforts and strategies for managing invasive species; the Canadian Invasive Alien Strategy (2004), the Invasive Species Strategy for British Columbia (2012), the Invasive and Alien Species Framework for British Columbia (2004), and the Invasive Species Management Strategy for the District of Saanich (2013), all emphasize the need for the spread of invasive species to be prevented and managed through partnerships between stakeholders at all levels (Government of Canada, 2004; C. Rankin & Assoc., 2004; August et al., 2012; District of Saanich, 2013).

[3] Harrop-Archibald (2007; 2008) also makes strong recommendations for the management of specific sites on the University of Victoria campus. In addition to recommendations for invasive species removal on all sites, these site-specific recommendations should be paid careful attention to, on a case-by-case basis.

Section 2.0 Strategy Components and Best Management Practices

Invasive species management on campus should have a positive impact on the environmental, social, cultural, and economic fabric of the university and surrounding community. This requires the implementation of a strategic approach which respects the history of the land, recognizing the value brought forward by all participants. It must also acknowledge the prevalent challenges faced in ecological restoration, ensuring that longevity and adaptive management are given priority.

2.1 Challenges in Invasive Species Management on the University Campus

There are several barriers to the effective management of invasive species on campus that occur in many contexts and on several scales. They include the following:

- **Lack of continuity:** Much of the population on a university campus is highly transient, with most students spending only 4-5 years as part of the campus community. Many other community members are highly mobile as well. As a result, ambitious and well-meaning projects involving invasive species management are often not sustained beyond a few generations of students. This can result in far more negative impacts on ecological health in campus natural areas and gardens than intended. *Therefore*, *structures should be in place to better support and ensure the longevity of efforts across generations of campus community members*.

- **Limited resources:** Invasive species management projects continually face temporal, logistical, and financial constraints. In a community where people often juggle several commitments, it is difficult to ensure continuous participation in invasive species removal efforts. With limited financial support available to be put toward work and research in this area, the majority of invasive species management efforts are carried out by volunteers with limited time and lacking the capacity for continuity. Resources such as tools, plant material, volunteer provisions, and more, are also limited. *Therefore, it is essential that resources be continually maximized and sought out in order to better support invasive species removal efforts*.

- **Lack of communication:** Through the course of the University of Victoria's history, several groups of students, staff, faculty, and community members have engaged in various efforts to remove invasive species and manage campus ecosystems. Often, however, these efforts are not coordinated, and communication between groups is limited. This can result in reduced effectiveness and efficiency of such work. *It is imperative, then, that communication be prioritized and implemented through open and coordinated sharing of knowledge, plans, and data.*

2.2 Considering the Human Dimensions of Invasive Species Management

It is critical for invasive species management efforts to be engaged in with careful consideration of the social and cultural contexts within which they take place. As the Canadian Principles and Guidelines for Ecological Restoration, which extends to invasive species management initiatives, state that the approach to restoring the integrity of ecological systems "must not be limited to only the ecological dimension of the system, but should be extended to and integrated with the social, cultural, an spiritual dimensions with which the ecological dimension has a dynamic relationship", deeming an integral approach "necessary for ecological restoration to achieve positive and long-

lasting outcomes" (Parks Canada & the Canadian Parks Council, 2008, p.11). Social and cultural elements important to consider within the University of Victoria context include:

- **Traditional land management, use & knowledge:** Prior to the arrival of European settlers in the area, the unceded land on which the University of Victoria is now situated was heavily managed to provide sustenance to local Indigenous Peoples. Specifically, Lekwungen speaking Peoples harvested camas in much of this area. Traditional land management strategies contribute to the maintenance of ecological integrity and productivity, particularly within Garry Oak Ecosystems. Fields were regularly burned to prevent shrubs and trees from taking over meadows and the fire had the added benefit of keeping out invasive species (N. Turner, Personal Communiacation, September 21 2016).

  Additionally, the forests, meadows and landscaped areas on the University of Victoria campus pose a great deal of potential as sites in which traditional use, cultural practices, and knowledge sharing may continue to take place. The International Union for the Conservation of Nature places emphasis on the role of Indigenous cultures in "maintaining ecosystem health" ([IUCN, 2016, p.7); the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) asserts Indigenous Peoples' rights to cultural revitalization and access to traditional resources and medicines (United Nations General Assembly, 2007); and both the UNDRIP and the Truth and Reconciliation Commission of Canada (2015) place emphasis on the need to provide opportunities for passing down traditional knowledge among Indigenous Peoples. *Therefore, invasive species management efforts should proceed in a manner that is considerate of the cultural history embedded within the University of Victoria landscape, and supportive of traditional land management practices, knowledge sharing, and cultural revitalization.*

- **Accessibility and inclusion:** The University of Victoria community is one in which individuals and groups of highly diverse identities, histories, worldviews, and abilities live, work, learn, and interact. For invasive species removal efforts to be effective, a wide diversity of people must be included and strong partnerships between stakeholder groups fostered. *Thus, invasive species management initiatives on campus should thus proceed in a manner that promotes inclusion and accessibility, and supports diversity.*

- **Relationship building:** As outlined in Actions to Date above, several groups have been engaging in invasive species removal on the University of Victoria campus throughout the university's history, but often in an uncoordinated manner, and lacking in demonstrated capacity for open communication between groups. In order to ensure that ongoing invasive species removal efforts proceed in a manner which most benefits a diversity of groups on campus, remains conscious of the diverse roles played by various participants and the considerations they must take (see Section 3.0), ongoing relationship building between these groups is essential. *Ongoing and open communication between participant groups should be fostered in order to ensure strengthen relationships between participants working toward common goals.*

- **Knowledge sharing:** A wealth of knowledge on the forests, meadows, and landscaped areas on the University of Victoria campus exists, and is held by individuals across disciplines, groups, and generations. Often, however, such knowledge is lost as a result of a lack in communication between different groups within the community, and across generations of community members. Several means of gathering and sharing knowledge, stories, and information exist, and include the following:

- Establishment of central places, both online and in print form, for data, research and information collection and access
- Employment of mapping techniques and sharing of geographical data, such as is done with the UVic Community Green Map[4]
- Promotion of opportunities for oral sharing of knowledge and experiential learning

A diversity of knowledge sharing techniques should be employed and supported in order to promote continuity in the collective memory of campus natural and landscaped areas held by the community.

2.3 Effective Management of Invasive Species

Effective invasive species management efforts will necessarily include a focus on prioritization, an ongoing involvement in continuous monitoring and evaluation, all as implemented through the Stewardship Program outlined in the ISMS.

- **Strategically focused management:** Individuals and groups implementing invasive species management efforts should be taken on a basis of prioritization, in order to ensure invasive species removal remains focused on species in need of the most immediate attention, in the most culturally important and environmentally sensitive areas on campus. Individual site reports, provided in Section 4.0 of this document, will provide guidance on doing so, which are laid out on the basis of stopping the seed cycle and addressing new invasions early. Additionally, participants, particular those playing a leadership role in invasive species removal on campus should be well acquainted with the following guidelines:
  - Stewardship Program for implementing the ISMS
  - Early Detection and Rapid Response (see Reference Document B)
  - CRISP Priority Species for the Capital Regional District (see Reference Document A)
  - International Union for the Conservation of Nature's *Ecological Restoration for Protected Areas - Principled, Guidelines and Best Practices*[5]
  - Society for Ecological Restoration (SER) guidelines for ecological Restoration[6]

  Invasive species removal efforts should be strategic, priority based and well informed by regionally, nationally, and globally adopted best practices and ongoing research.

- **Implementation of the Stewardship Program:** The Stewardship Program, laid out in Section 3.0 of this document, is the means by which the Invasive Species Management Strategy is to be implemented. Largely based out of the University of Victoria's Ecological Restoration Volunteer Network, a network administered through the university's Restoration of Natural Systems Program, this program aims to reach a large audience of volunteers and participants, while ensuring inclusion of the wider community, roles and responsibilities of different groups of participants, and risk management are well coordinated. *Implement the Stewardship Program and seek to ensure its effectiveness, reach and longevity.*

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[4] Information about ongoing invasive species management efforts can be found on the UVic Community Green Map, an open-source platform for sharing place based data, stories, and information. The UVic Community Green Map can be accessed at http://uviccgm.geog.uvic.ca/

[5] Available at https://www.iucn.org/content/ecological-restoration-protected-areas

[6] See Society for Ecological Restoration, Science & Policy Working Group (October 2004)

- **Ongoing monitoring and evaluation:** Monitoring and evaluation are key components of any effective ecological restoration or invasive species removal project. Monitoring efforts should be taken in following up on all invasive species removal efforts and may include photo-point monitoring at regular intervals, return surveys of experimental plot areas, and efforts to return and observe a site (every two months is recommended) after removal. Ongoing monitoring in UVic's natural and landscaped areas will ensure that the presence of new invasive species is detected early. Evaluation of the effectiveness of techniques, as well as the effectiveness of the Stewardship Program should also be carried out at regular intervals. *In sum, strong efforts toward monitoring and evaluating the effectiveness of invasive species removal techniques and approaches should take place regularly.*

- **Re-establishment of native species populations:** In cases where it is financially and temporally feasible, native plants should be re-introduced. This may speed the regeneration of an area by establishing native plant populations before invasive species may spread. Native plants should be chosen with careful consideration of the following:
    - Suitability to the site, taking into account historical, current, and future site conditions
    - Tolerance of drought, disturbance, and browsing
    - Financial, temporal, and watering constraints
    - Ethics surrounding sourcing locations and methods
    - Ongoing maintenance requirements, despite the common misconception of native plants, gardens, and ecosystems' ability to self-maintain
    - Safety concerns, including sightlines according the principles of Crime Prevention Through Environmental Design (CPTED). This involves planting lower growing closest to pathways and shrub or tree species farther away.

  Native plants may be established as an aid to ecological regeneration, given due consideration of site conditions and financial, watering, maintenance, sourcing and safety considerations.

2.4 Employment of an Adaptive Management Approach

In order for the ISMS to remain effective in the long term, it must be able to adapt to changes in social, ecological, and cultural conditions. Therefore, it should be implemented using an adaptive management approach, whereby strategies for removing invasive species and engaging participants in the program are flexible, and can be changed in order to ensure continued achievement of desired outcomes. This must be done on the basis of well documented, observed ineffectiveness, underperformance, unintended consequences, or unforeseen obstacles (Clewell, Rieger & Munro, 2005). *Most importantly, structures must be in place to assess the effectiveness of the ISMS and Stewardship Program, and make changes necessary for both to remain effective and inclusive.*

Section 3.0 Stewardship Program

Section 3.1 Purpose & Program Overview

The Stewardship Program is the mechanism by which the Invasive Species Management Strategy (ISMS) will be implemented. Overseen by the Ecological Restoration Volunteer Network, and administered through the Restoration of Natural Systems Program, this program aims to better coordinate and strengthen existing efforts at invasive species removal, build on these efforts, and inspire new restoration initiatives to take place on the University of Victoria campus. The Stewardship Program is intended to be carried out in a manner which is inclusive of a diversity of communities and stakeholder groups on and around the University of Victoria campus, and which strengthens cooperative partnerships across these entities. The following sections will outline the components of this program, protocols for involving participants in invasive species removal, the roles and responsibilities of different identified groups within the community, and risk management procedures. Like the ISMS, this Stewardship Program should be carried out with the employment of an adaptive management approach, and with continuous efforts made to gain community feedback on the effectiveness of methods for participant engagement and invasive species management.

Section 3.2 Program Components

These key components will help increase the effectiveness of invasive species management and ecological restoration on the University of Victoria campus effectively, while providing space for adaptive management.

3.2.1 Restoration Planning and Partnerships

The University of Victoria Ecological Restoration Volunteer Network (ERVN) recognizes the need for thoughtful and thorough planning around invasive species removal. A good restoration plan helps to define the goals and objectives of activities and guides the nature, timing and location of work. A good plan also specifies the tools to be used, plant debris management, methods, species and related considerations. It will engage the multiple stakeholders who interact with the natural areas on campus as well as consult with First Nations groups as to how these natural areas can contribute to the revitalization of indigenous communities. The ERVN, consisting of members of the student body, staff and faculty of the University of Victoria, will work together and with these stakeholders to develop restoration plans for each of the natural areas on campus. Various groups participating in ecological restoration activities can then carry out these plans. Restoration plans will be adapted as needed through inclusive and collective decision-making with the leadership of the ERVN.

3.2.2 Volunteer Coordinator Position

The ERVN Volunteer Coordinator is employed under a Work Study position, supervised by the Academic Administrator of the Restoration of Natural Systems Program. Coordinator responsibilities include sending out a weekly newsletter, communication with participants and partners within the community, and documentation of invasive species removal efforts. These responsibilities are explained in more detail in the Work Study resource binder. The Volunteer Coordinator should communicate with the Academic Administrator of the RNS Program as well as others in the restoration and campus community to continually improve ecological restoration on campus.

3.2.3 Work parties

Regular work parties should be held to remove invasive species on campus, as well as ensure monitoring of sites where invasive species have been removed in the past. Continued, active involvement ensures natural areas on campus are both protected and managed for the benefit of future generations. According to the Saanich Pulling Together Volunteer Program, this also leads to reduced waste dumping and unauthorized activity in natural areas. By raising awareness around the value of natural areas on campus we can raise the desire for their stewardship and protection (Saanich Pulling Together Volunteer Stewardship Program, 2011).

Work Parties can be facilitated by the ERVN and may include UVic course participants, community members, ERVN volunteers or special interest groups (such as scouts, girl guides or environmental clubs). These groups can contact the Volunteer Coordinator for access to organizational, informational, and support resources.

The Volunteer Coordinator will be responsible for communicating volunteer events to the University of Victoria and surrounding communities. This will be achieved through the Ecological Restoration Volunteer Network Website (web.uvic.ca/~nature), the nature@uvic.ca listserve, and the Facebook group ("UVic Ecological Restoration Volunteer Network"). Volunteer events can also be coordinated through classroom presentations and direct communication with instructors.

Information about work parties should include dates, times and locations of work, as well as indicate who is running the work party and contact information for the direction of questions or concerns. For work parties where snacks will be provided, RSVPs should be received via email or on the Facebook group when members click "going" to attend an event. At least one-week's notice should be given in order to give participants enough time to RSVP to an event.

Facilities Management staff should be notified of work party details well before the event takes place, and Traffic and Security notified of activities to be taking place.

Example Work Party Layout

9:00 am -The Volunteer Coordinator and other volunteers set up coffee and tea for arriving volunteers. Volunteers sign in and tools and gloves are set out. At this point, volunteers will be invited for welcoming remarks and Territory Acknowledgements.

Protocol for Territory Acknowledgement:

The Territory Acknowledgement should be sensitive to the unique restoration site where the work party is taking place. An acknowledgment of the First Peoples whose traditional territories the work party is taking place on helps remind the volunteer of the historical changes that have gone on in the landscape. The Volunteer Coordinator, or another experienced volunteer should always give the Territory Acknowledgement at the beginning of the work party.

Example Territory Acknowledgement:

"Hello, and welcome to [given site]. I would first and foremost like to acknowledge that we are situated on the traditional territories of the Lekwungen, Wyomilth, and WS'ANEC Peoples of the Coast Salish Nation. It is essential that we keep this in mind as we proceed with our work in this

area. Remaining aware of this helps us to acknowledge in practice the rich history of this land, and educate ourselves on the changes this ecosystem has undergone with time, as well as remain aware of the human dimensions of urban ecosystems such as this one."

10:00 am – Safety procedures, best practices and introductory walk through the site, site history and significant species. Regular and experienced volunteers may start invasive removals, while new volunteers will be asked to fill out informed consent forms and given a site tour.

11:00am-1:00 pm – Before or during invasive species removal in designated areas, the Volunteer Coordinator should take "before" photos of the site areas that are being restored. This will help keep a record of the progress that has gone on in each site and monitor the regrowth of native species after invasive species have been removed.

During the event, the different abilities of individuals must be considered - it is good to have multiple activities available for those who may not be able to pull ivy on the ground. Cutting ivy from around trees is a good activity for those with limited mobility.

During this time the coordinator can walk around, note any changes in the site, answer questions and get to know the volunteers.

1:30 pm – Clean up and snacks. A break for lunch, to gather feedback and consolidate notes. After snacks, final checks for equipment through the site, cleaning of any equipment that has been used and collection of dirty gloves should take place. This is a good opportunity for group photos to be taken. Volunteers should sign in and out with their name in order to keep accurate records of hours spent on ecological restoration and invasive species removal. A section on the sign in sheet should also be left for new volunteers to record their email.

Finally, "after" photos of the areas in the site where restoration occurs should be taken. The debris pile, unidentified species, or other points of interest in the site are also helpful to photo document. Follow-ups and photos from volunteer events should be posted on social media pages, thanking volunteers for their important contributions and providing a general update of the site.

Debris piles should be placed in a visible area if they are to be removed, and Facilities Management notified of their whereabouts for the purposes of later pickup.

3.2.4 Club Registration

The UVic Ecological Restoration Volunteer Network (ERVN) is registered as club with the University of Victoria Student Society (UVSS). Through the UVSS, the club receives limited funds each semester. Funding usually amounts to $150.00 for returning clubs but may increase or decrease depending on the amount of clubs that have registered that year. The club must be ratified with a representative each semester who attends the first UVSS general meeting. More information can be found at https://uvss.ca/student-groups/clubs/. The Volunteer Coordinator will be notified of Clubs' Council dates via email.

3.2.5 Tools, Materials and Funding

Tools

The ERVN owns some tools. More tools can be borrowed from the Restoration of Natural Systems Program (contact the Academic Administrator). A tool count should be conducted every semester or at the end of every work party if time permits. Tools purchased should be brightly coloured or

tagged in order to make them more visible in work areas. Before volunteers use tools or participate in work party activities, an Informed Consent Form must be given out, and safety presentation given. Safety discussions will occur at the beginning of every work party.

Providing volunteers with tools is essential for hosting work parties. Many volunteers are students, or do not have access to their own equipment. Partial funding should be used for the purchase and upkeep of tools, as well as a potential storage place for them on campus. Necessary equipment includes:

- Secateurs
- Hoes
- Loppers
- Gloves
- Hand rakes
- Spades

Safety Note: No chain saws are to be used.

Plants

If the restoration plan calls for re-planting of an area, seeds, seedlings or potted plants (usually 4" or 1-gallon size) must be sourced. In the past seeds have been sourced from various community donors, and Saanich Native Plants; seedlings have been sourced from the native plant nurseries at Saanich Native Plants, Beacon Hill Park, and Fort Rodd Hill National Historic Site. In the future, the Native Plant Study Group plant salvage program can be used to source plants. Eventually the ERVN Native Plant Nursery, located at the Campus Community Garden, will be able to provide some species for transplant into restoration sites. All planting must be discussed with the Ecological Restoration Volunteer Network and species lists should be discussed with Facilities Management. The Coastal Invasive Species Committee has developed a "Restoration Matrix" that can be helpful in matching plant species appropriate for specific site conditions and can be used to assist with plant selection if necessary.

Further Funding Sources

A grant through the UVic Office of Planning and Sustainability's "Green Fund" has provided for the creation of this strategy. Applications for further funding can be made to UVSS entities such as the UVSP and VIPIRG, as well as Vancity, the Evergreen Foundation, Mountain Equipment Co-op and TD Friends of the Environment Foundation, who all have programs that make small grants available for plants and other materials. A more complete list of "Funding and Resources for Island Communities" is available through the Islands Trust website.

A. Saanich Community Matching Funds

A more local source of funding is available through Saanich Community Matching Funds. Details can be found at http://www.saanich.ca/parkrec/community/matchfunds.html. Here are some highlights: The Healthy Saanich Advisory Committee's Community Matching Fund program operates annually. The deadline for submissions is February 28 each year. Projects pertaining to the University of Victoria may include, but are not limited to:

- Park improvements (equipment, gardens)
- Community celebrations & special events
- Native tree/shrub planting restoration projects
- Improvements to the natural environment

Funds may be granted to community-based, non-profit groups and associations for projects that will primarily benefit the neighbourhoods and residents of Saanich. Applicants should have a demonstrated partnership(s), either in-kind or funding, from the community. Partnerships among more than one group in the community would make the project more desirable for matching funds as this would indicate a higher level of interest and resource sharing.

Funding will not be provided for future projects and projects may only start after grant approval. If granted, funds should be used only to further the purpose of the grant application and not be received on behalf of a third party. The maximum grant available is $2,000, awarded to any one particular group. The group must match the amount granted either in funding or in-kind (e.g., volunteer hours, plant donations). The total value of the group's contribution must equal or exceed the grant requested i.e. Saanich normally would not provide funds for more than 50% of the value of a project.

B. University of Victoria Sustainability Project (UVSP).

The University of Victoria Sustainability Project provides grants for special projects that aim to improve sustainability of the University of Victoria and surrounding community. In the past, the Ecological Restoration Volunteer Network accessed this funding in order to build a greenhouse for the Native Plant Nursery in 2014. More information about grant applications can be found at: http://sustainableprojectsuvic.weebly.com/grants.html.

C. The Evergreen Foundation

The Evergreen Foundation is one of Canada's leading funders of community and school greening projects. Since 1991 they have provided over $5.7 million worth of funds to more than 2,500 projects across Canada, ranging from wetland restoration to school ground food gardens. Evergreen's Common Grounds Grants are offered to support community groups in protecting and restoring public urban green spaces. All proposed projects must be open to the community, should have a strong volunteer-involvement component, and must be located entirely on publicly accessible lands.

Community groups must be working in partnership with their municipality or other institutional partner such as federal or provincial government agencies, crown corporations or publicly funded institutions (such as a university or hospital). More information can be found at: http://www.evergreen.ca/en/funding/grants/

D. TD Friends of the Environment
The TD Friends of the Environment Foundation supports green initiatives across the country. In order to apply for a grant the applicant must be a registered Canadian charities with a Charitable Registration Number (CRN), part of an indigenous group, an educational institution or a municipality. This project must connect Canadians with public green spaces through green infrastructure or programming. More information about requirements and grant applications can be found at https://fef.td.com/funding/

3.2.6 Hands on Learning Opportunities and Volunteer Appreciation.

Once at the beginning of each semester, the ERVN will hold a training and recognition event for volunteers. Volunteers will be asked about their interests and questions about ecological restoration on campus. The purpose of hosting these events is for volunteers to stay current in restoration, as well as to let volunteers know that they are greatly appreciated. Throughout the

semester the Volunteer Coordinator will invite expert community members, staff, students and faculty of the university to give educational walks around the natural areas on the University of Victoria campus, to raise awareness and increase the knowledge of those interested in protecting them. Volunteers are also encouraged to share their own knowledge and experience at club meetings and work parties.

3.2.7 Partnerships

Partnering on restoration plan development is encouraged and may include community group members or other organizations such as The Greater Victoria Green Team, Parks Canada, The Land Conservancy (TLC), The Garry Oak Ecosystems Recovery Team or Habitat Acquisition Trust, environmentally focused UVSS clubs and course unions, University of Victoria courses and programs, and other members of the UVic community.

3.2.8 Communication

Communication is vital for the longevity and resilience of a volunteer program. It is important that an environment in which constructive feedback and open, collaborative decision making around restoration and invasive species management on the UVic campus be created through the implementation of the Stewardship Program. Methods for gathering feedback on a semester by semester basis should be considered – such as in the form of surveys and feedback forms – should be strongly considered in order for the program to stay up to date with participants' experience of the program, and their interactions with campus spaces.

The approach of The Saanich Pulling Together Volunteer Program is "*Open and respectful communication*" (Saanich Pulling Together Program; Components, 2011). This resonates with the goals and objectives of the Stewardship Program at the University of Victoria. Through ecological restoration, volunteers can pose questions towards their relationship with nature, and foster a greater sense of stewardship for UVic's natural areas. Questions and concerns will be responded to mainly by the Volunteer Coordinator, as this is the position that the most directly in contact with participants. In person inquiries are the most beneficial, as they can be addressed right away and more intimately. However, some questions can be answered via email or social media.

Other ecological restoration based groups, or groups who are interested in attending a volunteer event are also encouraged to contact the Volunteer Coordinator to organize an event.

Section 3.3 Roles and Responsibilities

The Ecological Restoration Advisory Committee is an informal partnership comprised of Facilities Management staff, faculty, members Ecological Restoration Volunteer Network (ERVN), and students with the common passion of restoring the natural areas on the Campus of the University of Victoria together with ecological and social integrity. The Advisory Committee is chaired by the Academic Administrator of the RNS Program. From the beginning the recommendations of the Advisory Committee have been supported by a Volunteer Coordinator who operates in the Restoration of Natural Systems Program through an annual Work Study position. Below, the roles and responsibilities of key players in the Stewardship Program will be outlined. These roles will all work in unison toward environmental integrity of the campus, adding to its vibrancy and promoting social well-being.

3.3.1 Facilities Management

"Facilities Management is a diverse and dynamic group of professionals. We are dedicated to the provision of support services necessary to promote excellence in the teaching, research and community service activities at the University of Victoria."

- University of Victoria Facilities Management Webpage (2016)

The Grounds Department of Facilities Management serves the university community and manages the campus grounds, including the natural areas and native plant gardens. These natural areas include Bowker Creek, Mystic Vale/Hobbs Creek, South Woods, Cunningham Woods, the Garry Oak and Camas Meadow, the Garry Oak Alumni Meadow and Haro Woods/Finnerty Ravine. There are also several areas on campus that have been designated as native plant gardens including the VIPIRG garden, the First Peoples House Native Plant garden, the Ian Ross Memorial Gardens, the Lorene Kennedy Native Plant Garden, and the various rain gardens installed on campus. The ISMS Individual Areas Management Plans (Section 4.0) will only address the VIPIRG garden, the Ian Ross memorial gardens, the Lorene Kennedy Native Plant garden and two rain gardens. An online map of these areas was created by the Community Mapping Collaboratory and can be found at: web.uvic.ca/~wanthony/maps/Sherlock-Holmes-Scroll-Driven-Navigation.htm

Facilities Management will provide staff support and overall direction for the Stewardship Program at the University of Victoria, to the extent that its limited resources allow. The role of Facilities Management in the ISMS is to provide support, institutional memory, and continuity for this program through the administrative structure of the university. The Volunteer Coordinator will communicate the areas in which volunteers are working to Facilities Management staff so that debris piles of invasive species can be removed. Facilities Management will also conduct tree hazard assessments and advise on invasive species management. Facilities Management is responsible for the overall development, management, operation and maintenance of these natural areas and gardens. However, it requires support from volunteers and community members to help maintain them.

Here is a brief list of Facilities Management means of participation in this program:

- Oversee invasive species removal planning by participating in the Ecological Restoration Advisory Committee
- Provide safety training and invasive species removal workshops for Volunteer Coordinators, and ensure safety of the campus environment and the public in general
- Review proposals for new invasive species management projects
- Liaise with the Volunteer Coordinator for updates on campus invasive species management efforts
- General oversight, stewardship, support, continuity, resource provision

Facilities Management is the permanent core structure between students and faculty in the Ecological Restoration Advisory Committee. Since Facilities Management is a permanent presence on campus, it will be the ongoing point of contact for the coordination of the invasive species management activities within university administration.

3.3.2 Faculty Members

Faculty members that want to participate in this program can do so in a variety of ways. Faculty interested in participating in the Ecological Restoration Advisory Committee can offer knowledge and guidance on the evolution and implementation of this program. The Volunteer Coordinator can

also act as a resource for faculty members who may be interested in incorporating invasive species removal or local ecosystem education into their classes. Discussing the most feasible ways for faculty and their classes to participate will be a next step in implementing this program. This could involve eventual module development for easier incorporation of these efforts into curricula. The Department of Geography and the School of Environmental Studies house several courses with material related to invasive species management and ecological restoration; additionally, interest exists in several other departments and programs for involving students in such activity, including the Indigenous Studies Program, and the departments of Biology, the Centre for Forest Biology, Earth and Ocean Sciences, and UVic's Environmental Law Centre. This program aims to be interdisciplinary in nature, and should involve ongoing networking and outreach with a multitude of programs to ensure diversity is encouraged.

Suggestions for potential faculty involvement in this program include:

- Hosting educational talks about ecological restoration and native plants on campus
- Class volunteer hours and encouragement to participate through required volunteer hours
- In-class talks and promoting restoration activities in related courses
- Involvement with the Ecological Restoration Advisory Committee
- Making students aware of ecological restoration events happening through the ERVN by promotion in class or through networks
- Participating in events such as BioBlitz's and invasive species removal events as educators

3.3.3 Volunteer Coordinator

The Volunteer Coordinator is employed through a Work Study position administered through the Restoration of Natural Systems (RNS) program. The applicant is accepted through the Work Study program and hired as the Volunteer Coordinator for the Ecological Restoration Volunteer Network. The Work Study is supervised by the Academic Administrator for the Restoration of Natural Systems program and employs one student over the academic year (September through April). The Volunteer Coordinator is responsible for a variety of tasks surrounding the Stewardship Program.

Position Skills and Requirements

- Well-developed leadership and organizational skills
- A passion for the natural world
- Enjoys being outdoors
- Able to use Microsoft Office to create excel spreadsheets and report documents
- Willingness to work in most weather conditions happily
- Adequate physical fitness and ability to work in off path area
- Good interpersonal skills – diplomatic, a clear communicator
- Excellent listening skills and ability to communicate to a larger group
- Follow all risk management and other policies of the University of Victoria
- Report any dangers they observe on the sites to Facilities management

Benefits and Gained Competencies

- Working outdoors and network with others who care about natural areas.
- Being part of the community protecting species and ecosystems at risk.
- Opportunity to leadership skills
- Gaining ecological restoration skills and new ideas

Administrative Duties

- Maintaining a log of work party dates, volunteer names, hours and nature of work done

- Semester reports to the Ecological Restoration Advisory Committee and RNS Academic Administrator
- Sending out weekly newsletters to the ERVN listserve to notify volunteers of events
- Communication with Facilities Management staff to notify of activities and report debris piles for pick-up
- Attending and facilitating meetings and training with other ERVN volunteers

Communication

The Volunteer Coordinator will also act as a liaison between the ERVN and the Ecological Restoration Advisory Committee, and in particular will be responsible for informing Facilities Management of invasive removal activities on campus. Concerns voiced by the students, meeting notes from the ERVN club meetings, as well as general updates on restoration events can be shared at Advisory Committee meetings. The Work Study student should report back on the progress of restoration on campus, updates on volunteer hours and funding status.

The Volunteer Coordinator will communicate with community members who are working on restoration efforts. The ERVN can help in organizing joint community events, as well as attending community events with club members. A list of current community contacts can be found in the ERVN Work Study binder and should be updated regularly when contacts for certain community groups change, or new contacts are made. More information on engagement and meaningful community consultation can be found in the Invasive Species Management Strategy.

Other interested groups on and off campus can contact the Volunteer Coordinator to organize ecological restoration related events, or for support in their own restoration efforts.

It is essential that the Volunteer Coordinator make a strong commitment to building and maintaining relationships and open communication between all Program participants in the University of Victoria and surrounding community.

Managing program hours and data

Volunteer hours are tracked using sign-in and sign-out sheets at each volunteer event. Apart from time in and out, these sheets should include volunteer names and a section for comments/email. After the event, volunteer hours can be added to a cumulative Microsoft Excel spreadsheet for easy archiving and calculation of overall hours

Table 1. Example Volunteer Sign-in

Volunteer Name	Student Number	Time In	Time Out	Comments/Email

Weekly newsletter

The weekly newsletter is sent out to everyone on the listserve who has signed up for the ERVN email list. Emails are collected at each volunteer event, at UVSS Clubs Days, and at community events. Volunteers can also find the email on event flyers and posters. This newsletter should include community restoration events happening during the week, information on club meetings, restoration events happening on campus and other related events. Dates, times and links to further information should also be included.

The email that volunteers can contact for questions, concerns and RSVPs is **nature@uvic.ca**. Information about managing the email account can be found in the ERVN binder that the Volunteer Coordinator receives upon hiring.

Website and Facebook Management

The website URL is http://web.uvic.ca/~nature/ and is currently a blog-style website run through WordPress. Information about login can be found in the Volunteer Coordinator binder. This website is updated semi-frequently with posts about ecological restoration on campus as well as general posts about the practice of ecological restoration. More frequent updates will be shared on the list serve email and through the ERVN Facebook group. This project will result in a new tab being added to this website that will house the Invasive Species Management Strategy documents.

The URL for the ERVN Facebook page is https://www.facebook.com/groups/uvicervn/ The group currently has 495members (September 2016). Posts are managed by the Volunteer Coordinator and can be co-managed by other core members of the ERVN and group admininstrators. Here volunteers can ask questions, post photos and stay updated on restoration events. Facebook events can remind volunteers of upcoming ERVN events, and propose polls for event times to ensure maximum turnout.

Updating the ERVN Work Study Binder

The Volunteer Coordinator binder should be updated at the end of each semester. Information on progress, reports from the natural areas, work party reports and contact updates should be made in order to keep the binder up to date for the next student. Past Work Study students who are willing to leave contact information will be a helpful asset to the next Volunteer Coordinator.

Waivers

Informed consent forms will be given to volunteers who wish to participate in ecological restoration in the natural areas at UVic. This will ensure the University and the Volunteer Coordinator are protected from liabilities and potential injuries that can occur when working outdoors. It is the duty of the volunteer coordinator to ensure all new volunteers have signed the appropriate waiver as well as collect signed waiver forms and maintain in a secure place (such as the Volunteer Coordinator binder), until submitted to the Ecological Restoration Advisory Committee.

Work Party Coordination

The Volunteer Coordinator will communicate information about work parties and invasive species removals to the ERVN restoration community. The Volunteer Coordinator will communicate with Facilities Management and the Ecological Restoration Advisory Committee and organize work parties according to priority restoration areas. Areas will also be prioritized based on community desire to work in these areas.

At work parties, volunteers will have the opportunity to learn about native and invasive plants in the natural areas of the University of Victoria as well as gain hands on experience in ecological restoration. New volunteers will be given an Informed Consent form and an introduction to the restoration site and the best practices in removing invasive species.

Snacks and coffee are usually provided for volunteer events and can be obtained by phoning local coffee shops and bakeries for donations. Starbucks Coffee and Cobs Bread have been generous in the past. Local businesses such as Fernwood Coffee also donate for larger events. Local and

sustainable business should be contacted first in order to support Victoria businesses and reduce the ecological footprint of volunteer events.

Work Party Check–List

- Welcome, introductions, territory acknowledgement and site history
- Health and safety briefing; Review the safety procedures, key issues and common sense — careful work, awareness of others, hazardous waste, wasp and bee stings, caution when using tools, working within the group, leave hazardous waste to be picked up by staff, beware of debris and tree snags point out hazards, location of first aid kit and first aid attendant
- Brief overview of the ERVN, the goals of ecological restoration on campus and your role as the Volunteer Coordinator
- Describe the day's work and methods. Demonstrate tools if needed and explain proper procedures. Deliver key messages to the volunteers — minimize soil disturbance, safe practices, make sure equipment is picked up and stored after use
- Informed consent forms given to new volunteers
- Do a round of names to acquaint volunteers
- Site walk through

UVSS Club

The UVSS Ecological Restoration Volunteer Network club was established by Amanda Evans, an RNS student, through the RNS Work Study position created by Val Schaefer. In order to gain club status through the UVSS and have access to the semester's funding. Being a registered club with the UVSS also gives access to tables for events, lockers to store tools in the SUB, and the ability to reimburse club members for financial contributions.

Recruiting Volunteers and Outreach

Volunteers can be recruited through a variety of methods. One of the most successful for the ERVN has been informing new students about the club by having a booth and presence at a Clubs Days table. This allows students to ask questions about the club, take flyers with invasive species information, learn about upcoming events and sign up for weekly emails. Clubs Days typically occur within the first weeks of each semester but can vary. More information on Clubs Days can be found at https://uvss.ca/all-about-clubs/

Volunteers can also be informed of ERVN activities through classes at UVic. Geography, Environmental Studies, and RNS students classes usually receive the most information about the ERVN through professors aware of the restoration activities on campus. However, many students in other departments and programs have attended events. Brief classroom talks about upcoming events throughout the semester and advertising on chalkboards can also gain new volunteers. Posting on messaging boards can also be a method of advertising for the ERVN, though posters are usually only put up once a semester in order to reduce paper use. Posters must be approved in the Student Union Building at the General Office before being posted anywhere on campus.

Partnering with other UVSS clubs and course unions is another way the ERVN can gain interested volunteers. The UVic Parks Club, Environmental Studies Student Association (ESSA) and the Society of Geography Students (SOGS) have all partnered on events with the ERVN in the past. Reaching out to other environmental organizations and community members can spread the word to more people and increase numbers of volunteers at restoration work parties.

3.3.4 Volunteers

The majority of volunteers in the ERVN in the past have been students at the University of Victoria. More detailed information on the general demographic of ERVN volunteers can be found below. This is likely because of the proximity of the program to the campus and the potentially peer group network of the Volunteer Coordinator. The role of volunteers in the program goes beyond the removal of invasive species. Without the interest of volunteers to learn about stewardship in the natural and landscaped areas there would be little progress for ecological restoration on campus. Invasive species on the University's land are widespread and require extensive removal and monitoring that can only be achieved with many hands. Volunteers will often work in areas predetermined by the Volunteer Coordinator, Facilities Management and the Ecological Restoration Advisory Committee. However, volunteer interest in a particular area can also determine where the ERVN conducts its work. Sensitive areas should be restored with previously experienced volunteers and smaller groups.

Some volunteers choose to make a regular commitment to the ERVN. However, others cannot come to regular events due to school, work and other commitments. ERVN meetings provide volunteers with an opportunity to share ideas and suggestions. Volunteers that have shown a vested interest in the ERVN may be given signing authority for club affairs and can be trained to run work parties if they hold interest. There is also potential for a volunteer to apply to the Work Study opportunity.

Volunteers may take on different roles within the ERVN in order to distribute the work. Volunteers interested in the Native Plant Nursery can help with monitoring and watering at the nursery. Other volunteers may be interested in contacting local businesses for snack and coffee donations. Some potential volunteer roles that may be useful as the network grows are listed below.

- Finances
- Native Plant Nursery coordinator
- Blog updates
- Event photographer
- Arts and crafts coordinator
- Community mapping coordinator

<u>Student Volunteers</u>

Although students are often impermanent at the University, their contributions hold the potential for lasting and positive impact. Student volunteers are recruited at Clubs Days, or through environmentally focused classes, mandatory volunteer hours and personal interest. Volunteers contribute greatly to the program through their ideas and many hours spent dedicated to ecological restoration. In a 2015 survey done through the Ecological Restoration Volunteer Network Facebook page, students expressed interest in participating in more native plant walks, off campus restoration events, overnight restoration events with Parks Canada (for example, work at Pacific Rim National Park has been done in the past), and partnering with other clubs and course unions at the university to have larger events.

<u>Community Member Volunteers</u>

Community members make a significant contribution to on-campus invasive species management. Outreach efforts to engage the community around the university are encouraged. Good relationships with the surrounding communities of the university can be fostered through stewardship, sense of place and ecological restoration. Practicing meaningful community engagement is outlined in the Invasive Species Management Strategy. Community members should be listened to as stakeholders in the process of ecological restoration on campus. Spreading information through social media, the ERVN website, using community message boards and

contacting community associations can increase participation. Community members are also an important part of the ecological restoration program as they are stakeholders who enjoy the natural areas of UVic recreationally, and are also neighbours to the university. Many community members are alumni of the University of Victoria or have gone on to pursue degrees in fields related to ecological restoration. These people are valuable volunteers to this program and contribute to the continuity of restoration efforts as well as connecting the University to its surrounding communities.

3.3.5 Restoration of Natural Systems Program Academic Administrator

The Academic Administrator for the Restoration of Natural Systems program is the permanent position of support for the Invasive Species Management Strategy and Stewardship Program.

The person who holds this position will supervise the Work Study position and act as a liaison to communicate with the Volunteer Coordinator and interested parties. Having a permanent faculty member will help the continuity of this project as Volunteer Coordinators move on from the position. It is the role of the Academic Administrator for the Restoration of Natural Systems program to:

- Post the Work Study position with the job description
- Accept and review applications for the volunteer coordinator Work Study position
- Hire a Volunteer Coordinator for each academic year (September through April) or re-hire a Volunteer Coordinator who wishes to continue the position.
- Meet with the Volunteer Coordinator regularly to review progress and discuss current initiatives of the Ecological Restoration Volunteer Network.

3.3.6 Community Mapping Collaboratory

"Our vision is the engagement of citizens in the creation of healthy, vibrant and sustainable communities. Our mission is to facilitate processes for community engagement, student learning, globally-relevant research, sustainable community development and planning through participatory community and green mapping. Using in person and virtual spaces, the wisdom of communities, the research of academics and the passion of educators and students, the Mapping Network is working toward a new kind of knowledge co-creation."

- Community Mapping Collaboratory Webpage, 2016

The Community Mapping Collaboratory provides countless connections to work done by the ERVN as well as other related efforts around campus. This online resource links stories, experiences and projects to geographical locations on the UVic Community Green Map. This tool provides geographic and visual referencing for ecological restoration. It also provides volunteers with a resource to explore what else is being done in their campus community and find ways to connect efforts for ecological restoration and sustainability at the University of Victoria. This resource fosters a sense of place, experiential and story based restoration efforts, as well as providing community focused continuity for these efforts on campus. More information can be found at http://mapping.uvic.ca/

3.3.7 The Office of Campus Planning and Sustainability

Funding for the implementation of the Invasive Species Management Strategy was made available with the Green Fund grant through the Office of Campus Planning and Sustainability. The Office of Campus Planning and Sustainability provides continuity for this project as an Administrative structure of the University. Opportunities for promotion of ERVN events through the sustainability

webpage include the creation of sustainability stories, a permanent tab for ecological restoration on campus and a promotional banners linking to ERVN events or stories of restoration on campus. More information about sustainability on campus can be found at http://www.uvic.ca/sustainability/

3.3.8 Community Groups & Other Organizations

Organizations and volunteer groups in the community surrounding the University of Victoria often show interest in collaborating with on-campus groups in order to steward UVic's natural areas. These community groups provide added volunteer, organizational, and knowledge capacity that is of great value to on-campus invasive species removal efforts; these groups may reach out to the ERVN Volunteer Coordinator or RNS Program Academic Administrator in order to access such opportunities and build community connections.

The Greater Victoria Green Team

The Greater Victoria Green Team (GVGT) is a group of volunteers dedicated to providing volunteer capacity to existing organizations engaging in existing ecological restoration and invasive species removal projects around the Capital Regional District. This organization can provide volunteer capacity to on-campus initiatives, especially when engaging with nearby schools, community groups, or groups on campus. The GVGT Coordinator will be in touch with the ERVN Volunteer Coordinator or the RNS Program Academic Administrator in order to gain the direction, instruction, and supervision required to engage in on-campus invasive species removal efforts.

3.3.9 Community Engaged Learning for Social Sciences

This newly established role within the faculty of Social Sciences has been put in place in order to connect students and faculty with opportunities for engagement with community groups and initiatives through course work. Invasive species management and ecological restoration on the University of Victoria campus provides an essential opportunity for the coming together of the community in a place where students and faculty live, work and learn. The administrator of this entity will play the role as a point of communication and connection between students of the Faculty of Social Sciences and invasive species removal opportunities on campus.

3.3.10 Indigenous Communities

This document acknowledges the histories that have shaped this landscape and the ongoing need for reconciliation between settlers and Indigenous communities on campus. Members of the Indigenous community on campus therefore have not been addressed extensively in this document as these relationships still need to be rebuilt through meaningful conversation and solidarity. Opening space for the Indigenous community to express how this strategy might help the needs and efforts of the First Peoples' communities on campus must be a constant and ongoing effort on the part of this program. The authors of this document acknowledge that the way we interact with this landscape must consider the colonial processes continually occurring on it. By opening up the conversation to what Indigenous people want to see restored on campus we can begin the path to truth, reconciliation and meaningful partnership. Further, to avoid tokenism, we place accountability and action above written service of these relationships in this document.

Section 3.4 Risk Management

3.4.1 Risk Management

Volunteers participating in ERVN activities must be informed of the potential risks associated with working outside and with tools. Volunteers must be trained on the proper use of tools and be given an Informed Consent form to ensure the University is under no liability for injuries that occur during ERVN restoration events. No power tools are to be used by volunteers.

At the beginning of each work party, new volunteers must be briefed on basic safety by the Volunteer Coordinator. Inherent risks of working in the natural areas at UVic include uneven ground, exposure to pollen and other allergens, insect bites, tree hazards and snags, and potential exposure to noxious plants.

The University of Victoria has the same safety standards for volunteers as it does for its own employees. The procedures and policies summarized below outline the protection of volunteers while working in natural areas and in case of emergencies.

Students conducting invasive species removal as part of classwork are covered by a $2 million liability policy through the university. The instructor for the course handles the Informed Consent forms that students need to have before removing invasive species.

3.4.2 Procedures

The Volunteer Coordinator and other leaders of volunteer events should be aware of these procedures and policies in order to ensure their own safety and the safety of volunteers on University grounds. As the Saanich Pulling Together Volunteer Program states, "[t]he Urban Forest is a vital component of our community"; this statement rings true to the natural areas at UVic as well. Ensuring these policies are followed while working in natural areas will keep community activities safe and healthy.

<u>Procedure for Tree Risk Assessment</u>

One of the goals of this program, as described in the Urban Forestry Strategy, is to protect and enhance the urban forests that occur in the natural areas of UVic. Before this goal, however, comes the necessity of a safe work environment for university staff and volunteers. Tree snags can pose a potential threat to volunteers if they become dislodged. In certain natural areas, such as Cunningham Woods, changing water tables due to development have lead to increased disease in trees and therefore more occurrences of dying trees and tree snags. Careful monitoring of natural areas is necessary to determine whether or not an area is safe in which to work.

Before each volunteer event the Volunteer Coordinators should assess the site and alert volunteers of any hanging branches or other tree debris related hazards. The Volunteer Coordinator is not in a position to formally assess tree safety. Tree health and tree risk management is managed by Facilities Management staff at the University, some of who are trained arborists. Unsafe or unhealthy trees may be removed and left as nurse logs. The goal of Facilities Management is to enhance forest ecology while facilitating human activity in these natural areas and ensuring safety for volunteers.

<u>Procedure for Clean-up of Waste in Natural Areas</u>

As the natural areas at UVic are urban forests and subject to human contact, volunteers may come across garbage and waste while working. General waste should be gathered while working or after

the work party, and the Volunteer Coordinator or event leader should bring garbage bags to the work party for clean up.

Dangerous garbage like glass, metal edges, and wire, should be handled with care, using gloves and shovels to dispose of it, or reporting the materials to Facilities Management for safe disposal. Drug paraphernalia or what may be hazardous chemical waste should be reported to Facilities Management for disposal and should not be handled by volunteers. Campsites should be reported to Facilities Management and not interfered with by volunteers.

3.4.3 Waivers and Informed Consent

Individuals wishing to volunteer with the ERVN will be given an Informed Consent handout detailing risks and policies around environmental restoration in the natural areas of UVic. Volunteers only need to be given the Informed Consent form if they have never volunteered with the ERVN before. Informed Consent documents can be found in the ERVN work study binder which is kept by the Volunteer Coordinator.

While restoration based volunteer work holds many social and ecological benefits, there are certain risks of this work that need to be acknowledged. Injury from wildlife, plants, terrain and equipment can be mostly avoided by implementing safety focused practices. Carrying out work with care and attention can prevent most injuries.

Section 4.0 Individual Area Management Plans

These area management plans are provided for convenient use to be included in course activities on campus. Each plan has a map showing its location on campus, a description of the site, a schematic diagram of the site and instructions for which are the best parts of the site and the best species for invasive species removal. The sites are:

1. Cunningham Woods
2. Bowker Creek
3. Mystic Vale & Hobbs Creek
4. South Woods
5. Garry Oak & Camas Meadow
6. Alumni Garry Oak Meadow
7. Haro Woods & Finnerty Ravine
8. VIPIRG Native Plant Garden
9. Lorene Kennedy Garden
10. Ian Ross Memorial Garden
11. Rain Gardens

Section 4.1 Cunningham Woods

Figure 1. Cunningham Woods on the University of Victoria campus, as indicated by the blue polygon. Source: CRD Webmap. Retrieved July 17, 2016 from https://maps.crd.bc.ca/Html5Viewer/?viewer=public

July 2016

Prepared by Julia Jennings, Lindsay Kathrens & Val Schaefer

Figure 2. Large arubutus tree (left) in southeast Cunningham Woods, and southeast Cunningham Woods taken facing north from Ring Road (right). Continuous invasive species removal took place in this area between 2013 and 2016. Photos by Julia Jennings.

Site Description

Situated within the Coastal Douglas-Fir biogeoclimatic zone, Cunningham Woods is the only remaining forest within Ring Road on the University of Victoria campus. It is situated south of the Medical Sciences Building, west of the Engineering and Computer Sciences building, and adjacent to Ring Road. The area's tree canopy is dominated by Douglas-fir (*Pseudotsuga menziesii*) and grand fir (*Abies grandis*); predominant understory and herbaceous layer species include snowberry (*Symphoricarpos albus*), oceanspray (*Holodiscus discolor*), dull Oregon grape (*Mahonia nervosa*), and trailing blackberry (*Rubus ursinus*)[7]. According to the Natural Features Study conducted by Hilary Harrop-Archibald in 2007, the area contains two distinct portions; a coniferous woodland in the eastern portion, and a wet depression in the western portion. Patches of woodland, swamp, and older second growth ecosystems can be found on this site. Site series classifications include CwBg-Foamflower in the eastern portion, and Cw-Sloughsedge in the western portion (Harrop-Archibald, 2007). The area contains a high number of wildlife trees, providing valuable habitat for cavity nesting species (Harrop-Archibald, 2007). Cunningham Woods is currently the site of a 'Special Study Area' adjacent to the Medical Sciences Building under the 2016 Campus Plan, meaning that the area will be studied further if a need for the space to be redeveloped is identified, and for the improvement of the pathway through the woods for greater visibility at night (University of Victoria, 2016).

Actions to Date

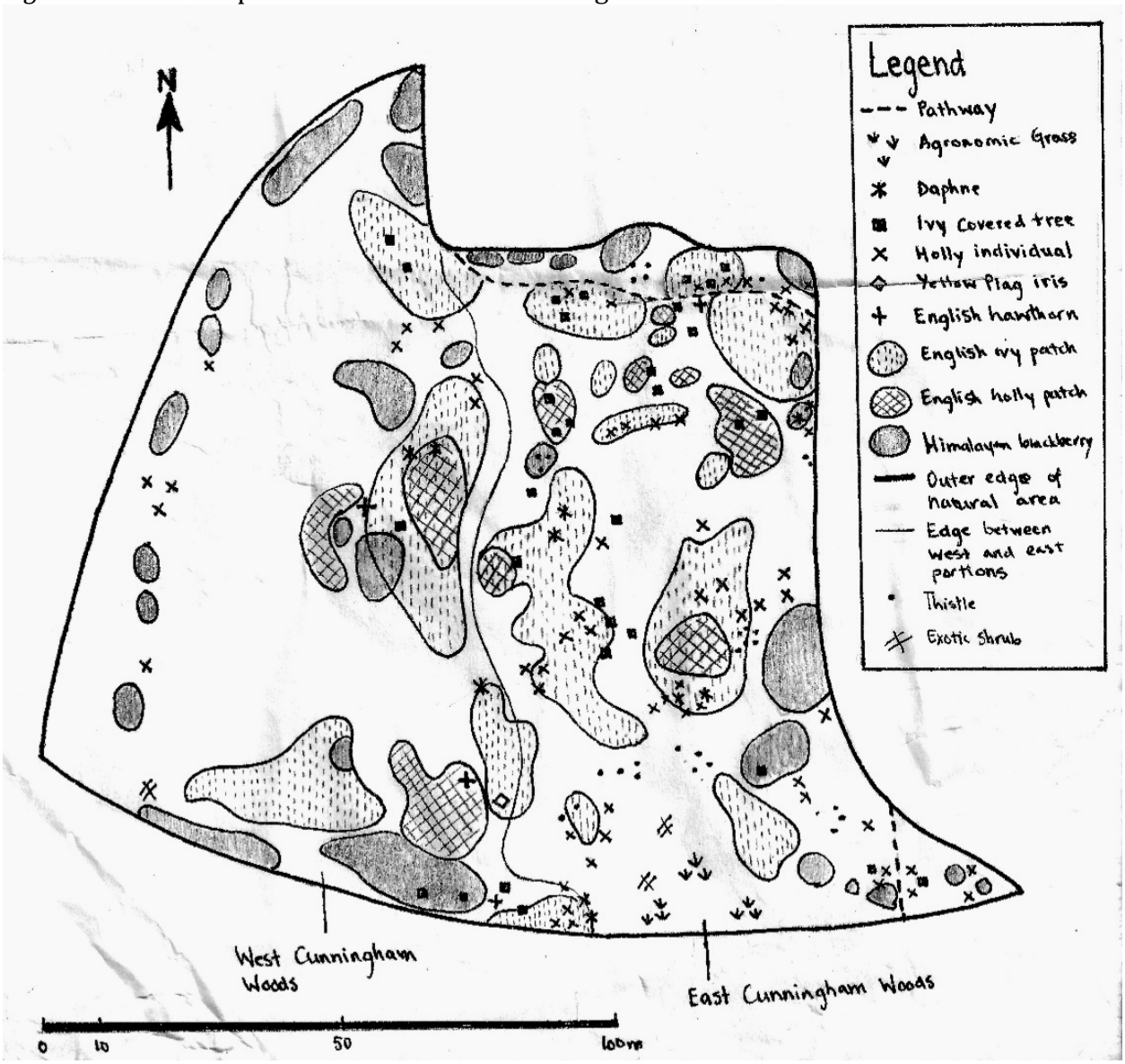
Students of the Restoration of Natural Systems Program and volunteers of the UVic Ecological Restoration Volunteer Network have been removing invasive species, including English ivy, English holly, and daphne laurel in the southeastern portion of Cunningham Woods since March of 2013. Volunteers have participated in one to two invasive species removal work parties per semester between March 2013 and April 2016, recording over 310 volunteer hours by over 190 volunteers during that time.

[7] For a complete list of species found in Cunningham Woods as of 2007, see Harrop-Archibald, 2007.

Invasive Species in Cunningham Woods

Figure 3. English ivy (*Hedera helix*) (top left), Himalayan blackberry (*Rubus armeniacus*) (top right), daphne laurel (*Daphne laureola*) (bottom left), and English holly (*Ilex aquifoliujm*) (bottom right) on the University of Victoria campus. Photos by Lindsay Kathrens.

Figure 4. Invasive Species Distribution in Cunningham Woods



Several invasive species have been found throughout Cunningham Woods, the most predominant of which are English ivy and English holly. Invasive species present in the area as of 2016 include the following (See Figure 4 above for a map of invasive species distribution in this site):

Daphne laurel (Daphne laureola): Small individuals have been identified in various areas within Cunningham Woods. All daphne laurel should be a priority for removal and removed with the use of proper protection. Volunteers should be well informed about possible health reactions to this species.

English ivy (Hedera helix): English ivy can be found growing along the ground and climbing up trees throughout the woods, though much of this species has been removed through continued removal efforts. Ivy climbing up trees should be a priority for removal to prevent the spreading of seed, followed by the removal of ground ivy surrounding native plants and

spreading into new areas, followed by removal in denser patches. Tree climbing ivy should be cut at chest height and the bottom portion removed from the base of the tree; trees from which ivy has been removed should be marked and continually monitored.

English holly (Ilex aquifolium): English holly can be found in dense stands throughout the eastern portion of Cunningham Woods. Once mature, it is difficult to remove as it forms a deep taproot; proper removal involves cutting below the root crown. Efforts at removal should focus on small individuals which can easily be removed by hand. Large individuals should be identified and Facilities Management consulted regarding proper removal, which in many cases will require the use of machinery by trained staff.

English hawthorn (Crataegus monogyna): Some small individuals have been identified in the eastern portion of Cunningham Woods. Small saplings may be removed by hand, while larger trees which require removal with heavy machinery should be marked and reported to Facilities Management staff.

Himalayan blackberry (Rubus armeniacus): Large stands of Himalayan blackberry can be found along the outer edges of Cunningham Woods, with smaller stands scattered throughout. Small individuals should be removed completely by hand. For larger stands, canes which pose potential hazards or which are covering native plants should be cut back; following this, roots should be dug up where feasible with careful attention paid to minimizing soil disturbance. Impassable thickets of Himalayan blackberry may require the use of machinery for removal and are the responsibility of Facilities Management staff.

Thistle (Cirsium spp.): Many individual thistles have been identified in open areas throughout Cunningham Woods and should be removed early and completely to prevent their spread through root and seed dispersal. Flowering portions should be removed before going to seed and seed heads bagged as a preventative measure. Thistles identified to date in Cunningham Woods include Canada thistle (*Cirsium arvense*) and bull thistle (*Cirsium vulgare*), though all identified thistle species should be promptly removed.

Yellow flag iris (Iris pseudacorus): A potential individual Yellow Flag Iris has been found at the border between the east and west portions of Cunningham Woods. Vegetative surveying should be done in this area to ensure no other individuals go to seed and removal of identified individuals should be prioritized.

Ornamental species: Several ornamental species have been located in the woods. Noting potential exotic species and identifying non-native species is important to early prevention of species invasions.

Agronomic grasses: Agronomic grasses spreading from neighboring lawns on campus should be identified early and removed, ensuring the root mass of rhizomatous species is fully removed. Some species identified in the area include orchard grass (*Daxtyils spp.*), poa (*Poa annua*), and rattail fescue (*Vulpia myuros*).

Recommendations

Remove invasive species

Parties engaging in invasive species removal should follow the protocol outlined in the Stewardship Program (Section 3.0). Priorities for invasive species removal should directly follow the CRISP Priority Invasive Plant List, which identifies priority species for control, containment, eradication and prevention (see Reference Document A of the ISMS). Priorities for invasive plant removal in Cunningham Woods are as follows:

High Priority	Yellow flag iris	CRISP listed for containment; eradicate immediately upon identification
	Thistle species	Remove all individuals, contain seed heads
	English ivy	Remove tree climbing ivy
	English holly	Remove small individuals
	Daphne laurel	Remove all individuals
	Agronomic grasses	Remove all small infestations
Medium Priority	English ivy	Remove outliers and ivy around existing native plants
	Himalayan blackberry	Remove small individuals & cut back hazardous canes
	English hawthorn	Remove small individuals
Low Priority	English ivy	Remove dense ground cover
	Himalayan blackberry	Cut down & dig up roots where feasible
Responsibility of Facilities Management	English holly	Removal of large individuals & dense stands
	Himalayan blackberry	Removal of dense thickets with extensive root systems
	English hawthorn	Removal of large individuals
	Noxious species	Removal upon identification

Engage with the Community

Interested members of the University of Victoria and the wider community should be effectively and meaningfully engaged and involved in any efforts to remove invasive species and maintain stewardship of Cunningham Woods. For further information on involvement and the roles played by members of this community, please refer to 3.

Monitor the area

Before and after removing invasive species, photos of the site should be taken from the same point. It is advisable that the group participating in invasive species removal on this site return at least two months after initial removal efforts to photograph the site again and assess the immediate effectiveness of these efforts. This will allow for immediate identification of new individuals or species re-colonizing the site, and will contribute to a larger database of photographic evidence for this site. Photos should be shared with the Ecological Restoration Volunteer Network Coordinator to be placed in the appropriate database. Such photo-based, short term monitoring is differentiated from photo point monitoring, which is further addressed in the Invasive Species Management Strategy.

Engage in further study of the area
It is recommended that this site be studied further to update existing information on species presence, hydrological patterns, and other processes. As the water table fluctuates throughout the year and due to the difficulty of identifying particular species during particular seasons, further study should be engaged in at several points throughout the year. Effective study of this area can be achieved particularly through student efforts in existing course work, and as facilitated by instructors in the classroom; for more information on the potential roles played by different stakeholder groups in studying this area, please see Section 3.

In particular, a portion of Cunningham Woods is currently designated a 'Special Study Area' under the current UVic Campus Plan, meaning that further study of the area will need to take place if the need for development in this area arises (University of Victoria, 2016). Focus on this portion of the forest in study efforts will help build knowledge around the potential effects of development in this space.

Plant native species
Given ample resources, it is advisable that native species be planted in areas where invasive species have been removed according to the ecological requirements of the site. Planting native species can help speed the process of ecosystem recovery by aiding in re-establishing plant communities. This can also be done as a preventative measure, as it allows for immediate reoccupation of newly opened space which is more susceptible to new invasions if left bare. See Appendix A for a list of recommended native species for planting in this site.

Engage in sightline improvement
The main pathway through the northeastern portion of Cunningham Woods was identified as a site in which safety concerns existed during the 2016 Campus Plan public engagement process. This plan suggests improvements to the pathway to ensure improved safety (University of Victoria, 2016). Parties interested in helping combat this issue are recommended to become familiar with these concerns, with the proposals made in the Campus Plan, and collaborate with Facilities Management on potential improvements to the pathway which would best benefit the native vegetation in the area and create the least possible level of disturbance.

Further Information
For further information on this site, see the following documents, both of which can be retrieved at web.uvic.ca/~nature/, or can be found in the Restoration of Natural Systems Library:

Harrop-Archibald, H. (May 31, 2007). *University of Victoria Natural Features Study: Bowker Creek, Cunningham Woods, Upper Hobbs Creek/Mystic Vale.* Victoria, BC: University of Victoria, Restoration of Natural Systems Program.

Fisher, L. (November 2013). *Cunningham Woods: Restoration Report and Monitoring Plan.* Prepared for ER 390, Restoration of Natural Systems Program, University of Victoria.

Appendix A: Suggested Species for Planting in Cunningham Woods

Species planted in this site should be chosen based on their suitability to the specific conditions of the site, already existing species on campus (see Appendix A: UVic Vascular Plant Species in Harrop-Archibald, 2007, p.52) and in consideration of their tolerance to drought, disturbance, and browsing. Various sourcing methods should be considered, as well as both financial, temporal, and watering constraints. Participants in restoration may choose to plant species in the given site based on desired uses or a chosen theme; themes may include ethnobotanical or medicinal uses, therapeutic gardens, or pollinator attraction. For further guidance on choosing native species to plant, see the 'Resources' tab at http://web.uvic.ca/~nature/, as well as the following resources:

Native Plants in the Coastal Garden: A Guide for Gardeners in the Pacific Northwest by April Pettinger & Brenda Costanzo

Gardening with Native Plants of the Pacific Northwest by Arthur R. Kruckeberg

Propagation of Pacific Northwest Native Plants by Robin Rose, E.C. Chachulski, & Diane L. Haas

Listed below are a broad range of species with potential suitability for planting in Cunningham Woods:

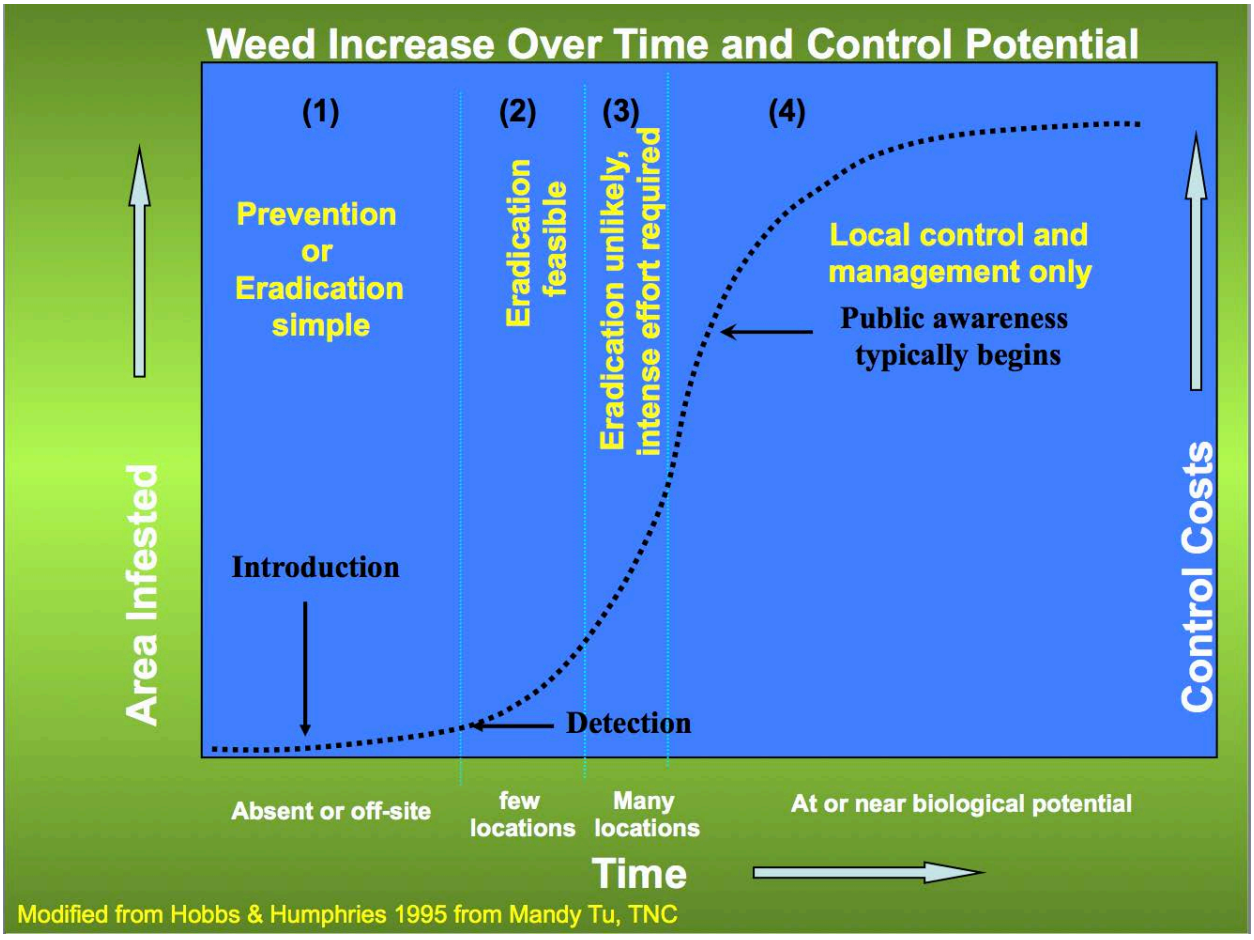
Woodwardia fimbriata Giant Chain Fern
***Symphoricarpos hesperius* Trailing Snowberry**
***Geum macrophyllum* Large Leaved Avens**
***Mahonia nervosa* Oregon Grape (dull)**
Maianthemum dilatatum False Lily-of-the-Valley
Maianthemum racemosum False Solomon's Seal
Mainanthemum stellatum Starry Solomon's Seal
***Polystichum munitum* Sword Fern**
Prosartes hookeri Hooker's Fairybell
***Rosa gymnocarpa* Dwarf (Baldhip) Rose**
Streptopus amplexifolius Twisted Stalk
Taxus brevifolia Pacific (Western) Yew
***Tellima grandiflora* Fringecup**
***Tiarella trifoliata* Foamflower**
***Tolmiea menziesii* Piggy Back Plant**
***Trientalis latifolia* Western Starflower**
Trillium ovatum Western Trillium
Tsuga heterophylla Western Hemlock
Viola sempervirens Trailing Yellow (Evergreen) Violet
***Athyrium filix-famina* Lady Fern**
Dryopteris expansa Spiny Wood Fern
Gymnocarpium dryopteris Oak Fern
Clinopodium douglasi Yerba Buena
Erythronium oregonum White Fawn Lily
Melica subulata Alaska Oniongrass

***Symphoricarpos albus* Snowberry**
Bromus vulgaris Columbia Bromegrass
***Holodiscus discolor* Ocean Spray**
Osmorhiza berteroi Mountain Sweet-cicely
Lilium columbianum Tiger Lily

Early Detection and Rapid Response (EDRR)

Most invasive species follow a typical sigmoid or logistic population growth curve after they invade an area. There is a period of slow population growth (lag phase) where due to small numbers the overall population size grows gradually because of the small numbers of individuals in the founder population. Eventually, as the numbers increase the population begins to grow exponentially, initially at the same earlier growth rate but then the growth rate begins to decline and although the population still grows quickly it is at a slower rate. Finally, the population levels off at a constant phase.

EDRR encourages locating small populations where eradication is still possible to prevent an invasive species from becoming established or spread. Unfortunately public awareness is low at this stage and often by the time the public becomes aware of an invasion the population size is already too large for eradication and control and management are the only feasible options available.



Section 4.2 Bowker Creek

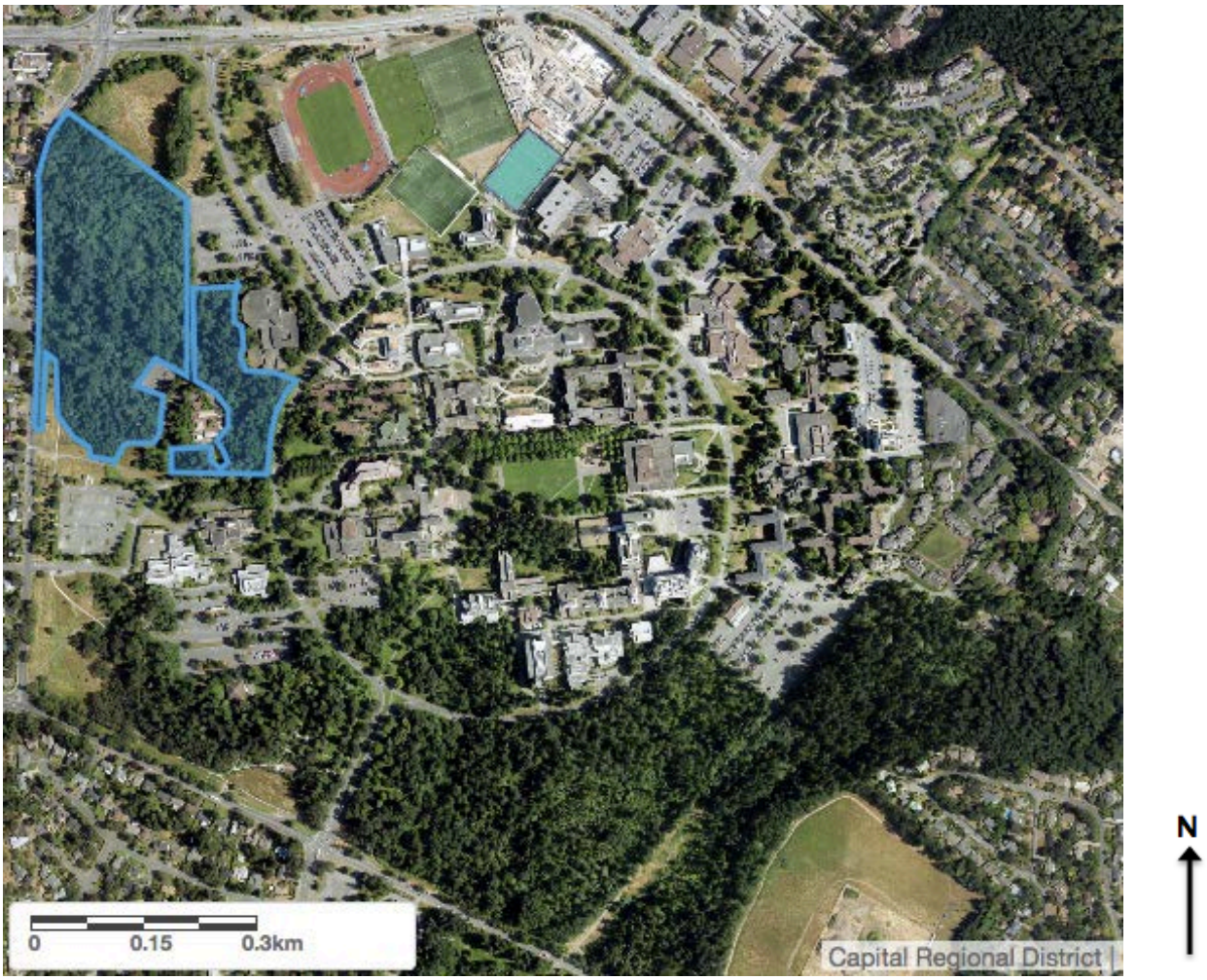


Figure 1. The western (left) and eastern (right) portions of the Bowker Creek natural area on the University of Victoria campus, as indicated by the blue polygons. Source: CRD Webmap. Retrieved August 21, 2016 from https://maps.crd.bc.ca/Html5Viewer/?viewer=public

August 2016

Prepared by Julia Jennings, Lindsay Kathrens & Val Schaefer


Figure 2. Tree climbing English ivy (*Hedera helix*) in the southern portion of Bowker Creek West. Photo by Lindsay Kathrens.

Site Description

The University of Victoria campus is situated on the headwaters of Bowker Creek, 70% of which flows through storm drains to the west from campus "along McKenzie Ave.,…south along Shelbourne St., and southeast behind the Jubilee Hospital, Richmond Elementary School, the Oak Bay Fire Hall, and…discharges into the marine environment near Glenlyon-Norfolk School" (Friends of Bowker Creek in Harrop-Archibald, 2007, p.15). The Bowker Creek area, approximately 5.7ha in area, is located at the northwest corner of campus, and is comprised of a portion to the west of Parking Lots 8 and 9 (Bowker Creek West) and a portion to the west of the Murray and Anne Fraser building and surrounding the University Club (Bowker Creek East) (Harrop-Archibald, 2007). This portion of the creek represents the "only remaining natural floodplain in the watershed", which is heavily altered and disturbed (Bowker Creek Initiative, 2012, p.66). While distinct creek beds can be found in various areas throughout the area (see Figure 4 below), the majority of the area is a wet depression which experiences regular inundation of water in the rainy season. The canopy in Bowker Creek East consists predominantly of bigleaf maple (*Acer macrophyllum*), Douglas-fir (*Pseudotsuga menziesii*), arbutus (*Arbutus menziesii*), and black cottonwood (*Populus trichocarpa*); common shrubs include oceanspray (*Holodiscus discolor*), snowberry (*Symphoricarpos albus*), and dull Oregon grape (*Mahonia nervosa*) (Harrop-Archibald, 2007). The southeastern portion of Bowker Creek West contains remnant Garry oak (*Quercus garryana*) habitat, with several individual oaks competing for light with newly established conifers and invasive species. Areas regularly inundated with water in Bowker Creek West are dominated by black cottonwood and bigleaf maple, while dry areas are dominated by Douglas-fir; dominant shrubs and herbaceous species include red-osier dogwood (*Cornus sericea*), snowberry, Nootka rose (*Rosa nutkana*), oceanspray, Indian plum (*Oemleria cerasiformis*), and bracken fern (*Pteridium aquilinum*) (Harrop-Archibald, 2007)[8]. The area supports a greater diversity of bird species than any other area on campus (University of Victoria 2003). The area contains ecosystem classes including older second growth forest, woodland, swamp, and riparian area, and site series classifications including Cw-Snowberry and FdBg-Oregon grape (Harrop-Archibald, 2007). The Bowker Creek area plays a significant role in habitat provision, hydrology moderation, and water filtration on the campus. Under the 2016 University of Victoria Campus Plan, Bowker Creek West holds designation as a protected area,

[8] For a complete list of species found in Bowker Creek as of 2007, see Harrop-Archibald, 2007.

while Bowker Creek East its surrounding areas are designated 'Expanded Natural Areas', intended to create landscape connectivity throughout the campus; neither area is protected in perpetuity (University of Victoria, 2016).

Actions to Date

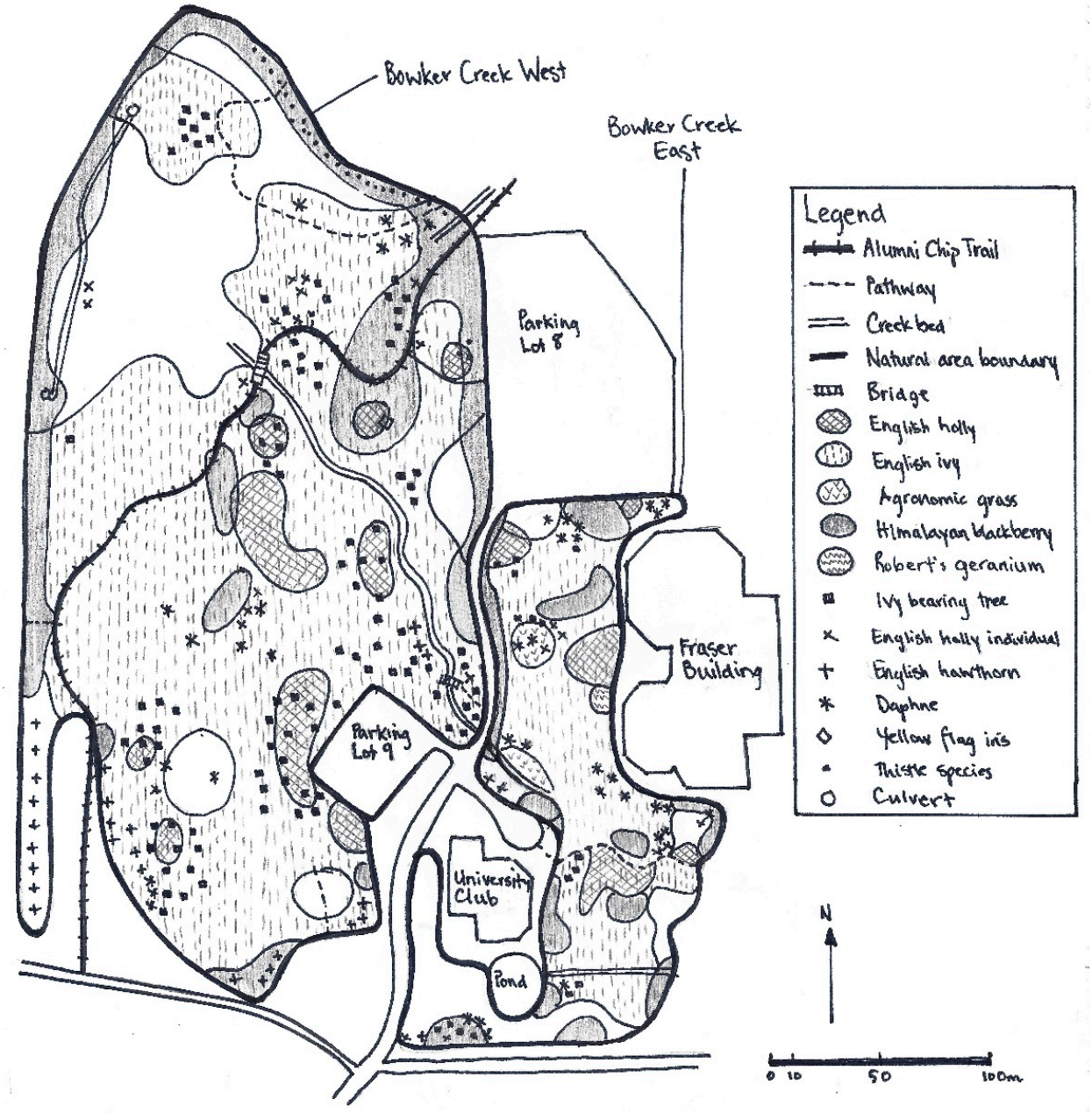
Rapid urbanization in the Bowker Creek watershed in recent decades has transformed what was at one time a salmon bearing stream to a heavily altered watershed in which the majority of the stream now flows through underground culverts (Harrop-Archibald, 2007). In 2011, the Bowker Creek Blueprint was created by the Bowker Creek Initiative (BCI) to guide management and restoration of the Bowker Creek watershed, based on the visions and goals outlined in the 2004 Bowker Creek Watershed Management Plan. The Management Plan was the product of a long-term community consultation process during which visions, goals, and objectives around water flows and quality, and natural areas management in the watershed. The University of Victoria community represents just one stewardship group which must participate in the coordination of improved management of the watershed (Bowker Creek Initiative, 2012). The blueprint recommendations invasive species removal, riparian restoration, riparian buffer widening, and increased plantings of native species in the campus portion of the watershed, which comprises Reach 15 of the stream[9].

Invasive Species in Bowker Creek

Figure 3. English ivy (*Hedera helix*) (top left), Himalayan blackberry (*Rubus armeniacus*) (top right), daphne laurel (*Daphne laureola*) (bottom left), and English holly (*Ilex aquifoliujm*) (bottom right) on the University of Victoria campus. Photos by Lindsay Kathrens.

[9] See Bowker Creek Initiative, 2012, p.98 for further recommendations on appropriate management of Reach 15 in the Bowker Creek watershed.

Figure 4. Invasive Species Distribution in Bowker Creek



Survey of the Bowker Creek area demonstrated a very significant presence of invasive species, the most pervasive of which is English ivy. English ivy can be found growing up a very high number of trees, especially in the southern portion of the area. Large patches of English holly are found throughout, large stands of Himalayan blackberry are found bordering most of the area, and a high number of mature English hawthorn trees can be found in the southern portion of Bowker Creek West. Figure 4 above demonstrates the distribution and approximate location of invasive species throughout both sections. Invasive species present in Bowker Creek include the following:

> *Daphne laurel (Daphne laureola*): Large daphne laurel individuals can be found scattered throughout this area, and are found in more dense numbers in Bowker Creek East. Infestations should be identified and removed in order to contain this species, and large

individuals removed using loppers and appropriate protective equipment. Volunteers should be well informed about possible health reactions to this species.

English ivy (Hedera helix): English ivy is found growing in dense mats and up several trees throughout the majority of Bowker Creek. Ivy climbing up trees should be a strong priority for removal to prevent the spreading of seed and damage to trees, followed by the removal of ground ivy surrounding native plants and spreading into new areas, followed by removal of more dense patches. Tree climbing ivy should be cut at chest height and the bottom portion removed from the base of the tree; trees from which ivy has been removed should be marked and continually monitored.

English holly (Ilex aquifolium): Several stands of English holly have been found in the southeastern portion of Bowker Creek West, as well as throughout Bowker Creek East. Once mature, this species is difficult to remove as it forms a deep taproot; proper removal involves cutting below the root crown. Efforts at removal should focus on small individuals which can easily be removed by hand. The large individuals that exist in this area should be identified and Facilities Management notified, as proper removal will often require the use of machinery by trained staff.

English hawthorn (Crataegus monogyna): Several patches of mature English hawthorn individuals have been found primarily along the southeastern edge of Bowker Creek West. Small individuals may be found throughout the area, which should be removed by hand where feasible. Larger trees which require removal with machinery should be marked and reported to Facilities Management staff.

Himalayan blackberry (Rubus armeniacus): Large patches of invasive blackberry are found along most edges surrounding Bowker Creek. Small individuals may be found and should be removed completely by hand. For larger stands, canes which pose potential hazards or which are covering native plants should be cut back; following this, roots should be dug up where feasible, with careful attention paid to minimizing soil disturbance. Impassable thickets of Himalayan blackberry may require the use of machinery for removal and should be pointed out to Facilities Management staff.

Robert's geranium (Geranium robertianum): A small patch of this herbaceous annual species has been found directly to the west of the Fraser Building in Bowker Creek East, and should be removed early.

Thistle species (Cirsium spp.): Several individual thistles have been found along the northeastern border of Bowker Creek West; a few can also be found in the area along the western edge of Parking Lot 8. All thistle should be removed early and completely to prevent spread through root and seed dispersal. Seed heads should be removed and bagged to prevent further spread.

Yellow flag iris (Iris pseudacorus): A potential individual Yellow Flag Iris has been found just south of the Alumni Chip Trail in the northeastern portion of the Bowker Creek West area. Vegetative surveying should be done in this area to ensure no other individuals go to seed and removal of identified individuals should be prioritized.

Agronomic grasses: A patch of agronomic grasses has been observed in Bowker Creek East, directly to the west of the Fraser building. Agronomic grasses should be identified early and removed, in a manner ensuring the root mass of rhizomatous species is fully removed.

Recommendations

Remove invasive species

Parties engaging in invasive species removal should follow the protocol outlined in the Stewardship Program, Section 3.0. Priorities for invasive species removal should directly follow the CRISP Priority Invasive Plant List, which identifies priority species for control, containment, eradication and prevention (see Reference Document A of the ISMS). Priorities for invasive plant removal in Bowker Creek are as follows:

High Priority	Thistle species	Remove all individuals, contain seed heads
	English ivy	Remove tree climbing ivy
	English holly	Remove small individuals
	Daphne laurel	Remove all individuals
	Yellow flag iris	Remove all individuals
	Robert's geranium	Remove all individuals
Medium Priority	English ivy	Remove outliers and ivy around existing native plants
	Himalayan blackberry	Remove small individuals & cut back hazardous canes
	English hawthorn	Remove small individuals
	Agronomic grasses	Remove individuals and rhizomes where possible
Low Priority	English ivy	Remove dense ground cover
	Himalayan blackberry	Cut down & dig up roots where feasible
Responsibility of Facilities Management	English holly	Removal of large individuals & dense stands
	Himalayan blackberry	Removal of dense thickets with extensive root systems
	English hawthorn	Removal of large individuals
	Other hazardous species	Removal upon identification

Engage with the Community

Interested members of the University of Victoria and the wider community should be effectively and meaningfully engaged and involved in any efforts to remove invasive species and maintain stewardship of Bowker Creek. For further information on involvement of, and the roles played by members of this community, please refer to Section 3of the ISMS. Particularly in the case of Bowker Creek, it is essential to effectively engage and coordinate with key community members who are or have in the past been involved in the management and stewardship of this area, such as the Bowker Creek Initiative.

Monitor the area
Before and after removing invasive species, photos of the site should be taken from the same point. It is advisable that the group participating in invasive species removal on this site return at least two months after initial removal efforts to photograph the site again and assess the immediate effectiveness of these efforts. This will allow for immediate identification of new individuals or species re-colonizing the site, and will contribute to a larger database of photographic evidence for this site. Photos should be shared with the Ecological Restoration Volunteer Network Coordinator to be placed in the appropriate database. Such photo-based, short term monitoring is differentiated from photo point monitoring, which is further addressed in the Invasive Species Management Strategy.

Engage in further study of the area
It is recommended that this site be studied further to update existing information on species presence, hydrological patterns, and other processes. As the water table fluctuates throughout the year and due to the difficulty of identifying particular species during particular seasons, further study should be engaged in at several points throughout the year. Effective study of this area can be achieved particularly through student efforts in existing course work, and as facilitated by instructors in the classroom; for more information on the potential roles played by different stakeholder groups in studying this area, please see Section 3 of the ISMS.

Plant native species
Given ample resources, it is advisable that native species be planted in areas where invasive species have been removed according to the ecological requirements of the site. Planting native species can help speed the process of ecosystem recovery by aiding in re-establishing plant communities. This can also be done as a preventative measure, as it allows for immediate reoccupation of newly opened space which is more susceptible to new invasions if left bare. Further study of this area is needed in order to determine a planting list for this site.

Further Information
For further information on this site, see the following documents:

Harrop-Archibald, H. (May 31, 2007). *University of Victoria Natural Features Study: Bowker Creek, Cunningham Woods, Upper Hobbs Creek/Mystic Vale.* Victoria, BC: University of Victoria, Restoration of Natural Systems Program. (Available online at [x], and in the Restoration of Natural Systems Library upon request)

Bowker Creek Iniative (2012). *Bowker Creek Blueprint: A 100-year action plan to restore the Bowker Creek Watershed.* Victoria, BC: Bowker Creek Urban Watershed Renewal Initiative. (Available at https://www.crd.bc.ca/bowker-creek-initiative/about-bci/plans-and-strategies/bowker-creek-blueprint-a-100-year-plan)

Restoration Design Projects for ES 341, available at web.uvic.ca/~nature/and at www.uvic.ca/socialsciences/environmental/undergraduate/courses/index.php under the ES341 tab:

- Buchanan, C., Zielonka, C., Chiarella, M. & Bryant, M. (2014). *Impervious Surface Restoration: Bio-swales for Bowker Creek*
- Healey, J., Kenning, R., Hamilton, M. & Buckingham, J. (2013). *Removal of Himalayan Blackberry in the Bowker Creek Headwaters*
- Bokor, C., Brett, E., Brennan, J., Gryzbowski, N. & Heidndahl, E. (2008). *Bowker Creek Headwaters Restoration Project*
- Dasanjh, R., Gutman, R., Hansen, M., & Voghell, K. (2009). *Bowker Creek Restoration Plan*

References

Bowker Creek Iniative (2012). *Bowker Creek Blueprint: A 100-year action plan to restore the Bowker Creek Watershed.* Victoria, BC: Bowker Creek Urban Watershed Renewal Initiative. Retrieved August 23, 2016 from https://www.crd.bc.ca/docs/default-source/es-watersheds-pdf/bowker-creek/bowker-creek-blueprint-2011-full-doc.pdf?sfvrsn=0

Harrop-Archibald, H. (May 31, 2007). *University of Victoria Natural Features Study: Bowker Creek, Cunningham Woods, Upper Hobbs Creek/Mystic Vale.* Victoria, BC: University of Victoria, Restoration of Natural Systems Program.

University of Victoria (2003). *Campus Plan 2003.* Victoria, BC: University of Victoria.

University of Victoria (2016). *University of Victoria Campus Plan*. University of Victoria Office of Campus Planning & Sustainability. Retrieved May 23, 2016 from http://www.uvic.ca/campusplanning/assets/docs/Campus-Plan-Update-2015/UVicCampusPlan.01.26.2016reduced.pdf

Section 4.3 Mystic Vale & Hobbs Creek

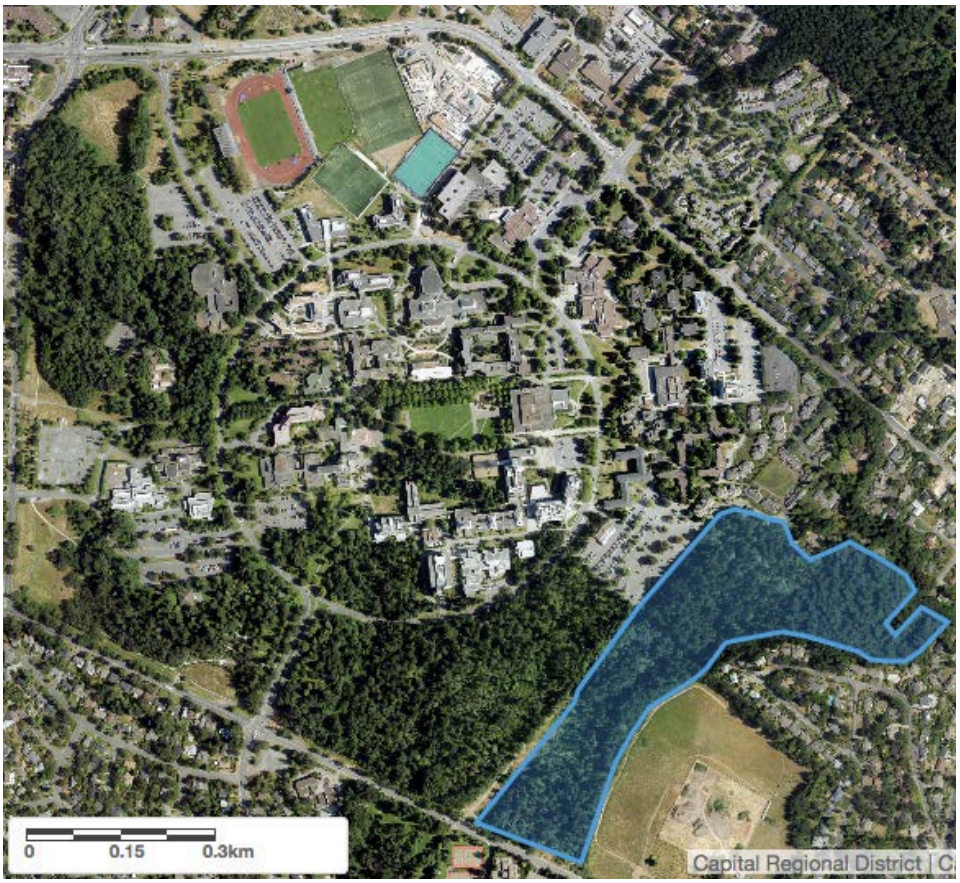


Figure 1. Mystic Vale (comprising the northern portion) and Upper Hobbs Creek (comprising the southern portion) on the University of Victoria campus, as indicated by the blue polygon. Source: CRD Webmap. Retrieved August 21, 2016 from maps.crd.bc.ca/Html5Viewer/?viewer=public

September 2016

Prepared by Julia Jennings, Lindsay Kathrens & Val Schaefer

Figure 2. Hobbs Creek pond in Mystic Vale (left) and the pathway past the Oak Bay easement (left) with Hobbs Creek area to the left. Photos by Julia Jennings.

Site Description

The Mystic Vale and Hobbs Creek are located in southeast corner of the University of Victoria campus. This is an area of high cultural and historical significance, and is today frequented by University staff, students, alumni, community members, and dog walkers. While Hobbs Creek passes through the entire natural area indicated in the blue polygon in Figure 1, the southern portion of the polygon adjacent to the District of Oak Bay is known as Upper Hobbs Creek; the northern portion, in which the pond, the lower portion of Hobbs Creek, and a well travelled pathway are located, is known as Mystic Vale (Harrop-Archibald, 2007). Mystic Vale is protected in perpetuity, while the remainder of the area is classified as a 'protected area' under the current Campus Plan, though not perpetually (see Figure 3 below) (University of Victoria, 2016). This area is situated within the Coastal Douglas-fir biogeoclimatic zone, and demonstrates several unique ecological qualities which merit its classification as a sensitive ecosystem. The area's canopy is comprised predominantly of Douglas-fir (*Pseudotsuga mensiezii),* as well as Black Cottonwood (*Populus trichocarpa),* Bigleaf maple (*Acer macrophyllum*) and Arbutus (*Arbutus mensiezii*) (Harrop-Archibald, 2007)[10]. Mystic Vale and Upper Hobbs Creek are one remaining forested portion within the heavily altered Hobbs Creek watershed, and demonstrate high levels of disturbance from human use and land fragmentation. Human and dog traffic along the pathways adjacent to the creek in Mystic Vale contribute to ongoing soil compaction and erosion, and it is thought that the area north of the pond where Upper Hobbs Creek and Mystic Vale meet may have been a dumping site for excess clay rich soils in the years prior to the University of Victoria's existence. Therefore, the watercourse has been affected by changes to water and sediment flow volumes and disturbance of the riparian area, and demonstrates a lowered level of ecological health as a result (Harrop-Archibald, 2007; Roberts, P., personal communication, August 5, 2016; Lucey & Barraclough. 2009).

[10] For a complete list of species found in Mystic Vale and Upper Hobbs Creek as of 2007, see Harrop-Archibald, 2007.

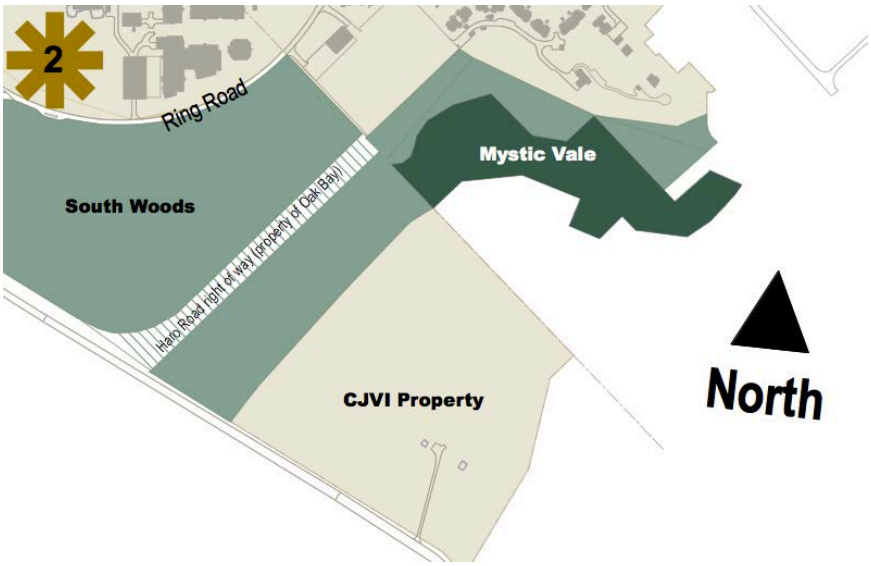


Figure 3. The portion of Mystic Vale which is protected in perpetuity, as indicated by the dark green polygon (University of Victoria, 2003).

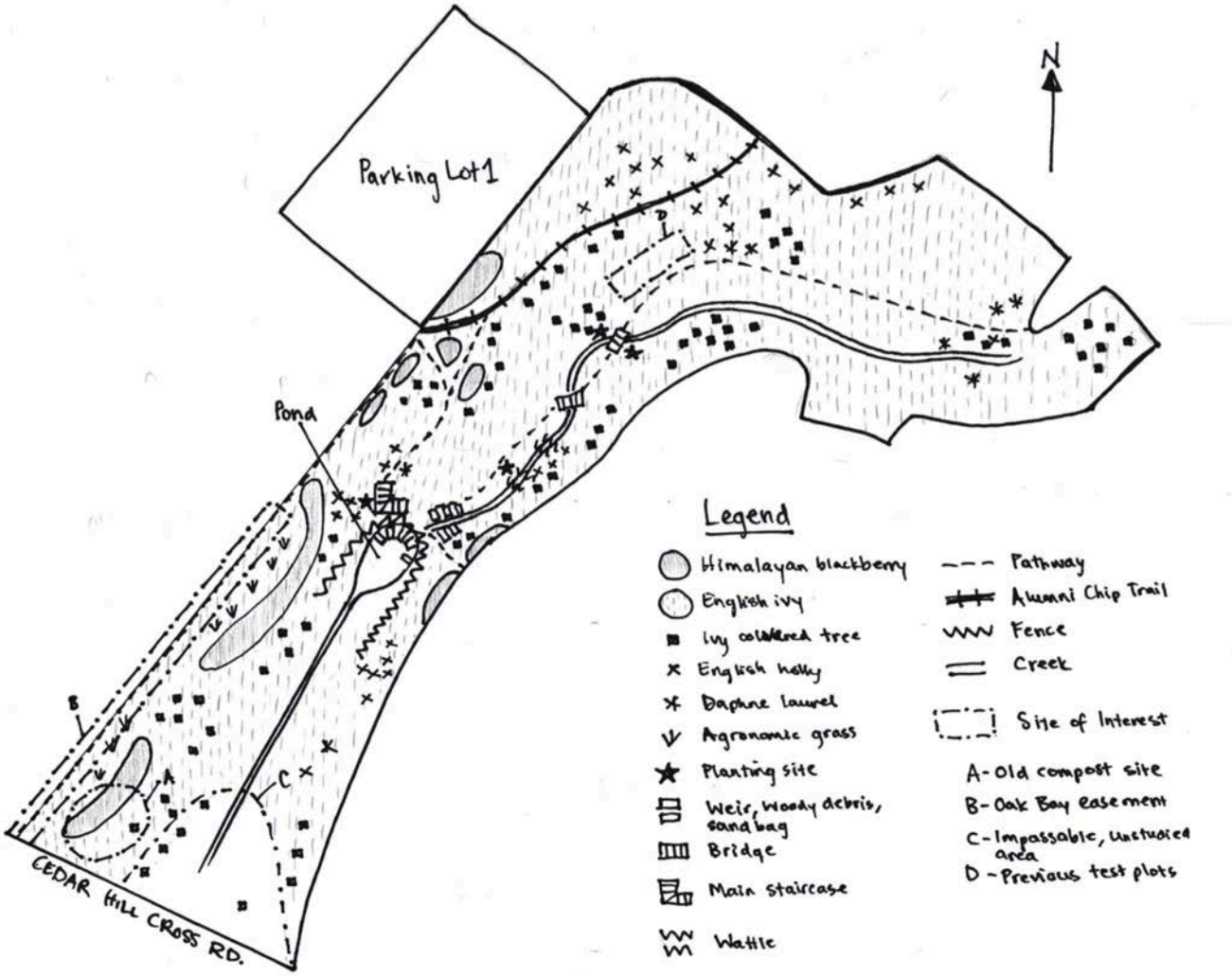
Actions to Date

Several student and volunteer groups have engaged in invasive species removal, and stream bank and riparian restoration projects in the area, predominantly within Mystic Vale. In the northernmost corner of Mystic Vale, students of Environmental Studies 341 are frequently engaged in invasive species removal activities as an introduction to ecological restoration (Eric Higgs pers com). Facilities Management staff have removed all tree climbing English ivy (*Hedera helix*), a great deal of ivy from the ground, and all visible English holly (*Ilex aquifolium*), in previous work, though does not have the capacity to continue managing species re-invasions to the same extent in this area (Roberts, P., personal communication, August 5, 2016). Several test plots in which various methods of invasive species removal and native species plantings were implemented in a portion of the Vale (see Figure 5 for the location of these test plots), though documentation and further information on this effort has yet to be found. Fences have been installed to prevent human and dog traffic in the pond area, followed by subsequent native species plantings and the addition of sandbags and large woody debris in the pond. Sandbags and large woody debris have also been installed in several points along the lower portion of Hobbs Creek to redirect and slow water flow, especially in times of high flow volumes. Wattles, made using hooker's willow (*Salis hookeriana*), have been constructed in the past by Restoration of Natural Systems Program students to aid in stream bank stabilization. Native species plantings and stream restoration techniques have resulted in mixed success in the Mystic Vale area (Roberts, P., personal communication, August 5, 2016). Additionally, ongoing study of the area has taken place, including the 2009 *Hobbs Creek Upper Watershed Assessment*.

Invasive Species in Mystic Vale and Upper Hobbs Creek

Figure 4. English ivy (*Hedera helix*) (left), daphne laurel (*Daphne laureola*) (middle), and English holly (*Ilex aquifoliujm*) (right) on the University of Victoria campus. Photos by Lindsay Kathrens.

Figure 5. Invasive Species Distribution in Mystic Vale and Upper Hobbs Creek



Several invasive species have been found throughout Mystic Vale and Upper Hobbs Creek, the most predominant of which is English ivy. Several stands of English holly and patches of daphne laurel have also been found in the area. Invasive species present in the area as of 2016 include the following (See Figure 4 above for a map of invasive species distribution in this site):

Daphne laurel (Daphne laureola): Small individuals have been identified scattered throughout Mystic Vale and Upper Hobbs creek. All daphne laurel should be a priority for removal and removed with the use of proper protection. Volunteers should be well informed about possible health reactions to this species.

English ivy (Hedera helix): English ivy can be found growing along the ground and climbing up trees throughout this area, despite removal efforts conducted in the past. Ivy climbing up trees should be a priority for removal to prevent the spreading of seed, followed by the removal of ground ivy surrounding native plants and spreading into new areas, followed by removal in denser patches. Tree climbing ivy should be cut at chest height and the bottom portion removed from the base of the tree; trees from which ivy has been removed should be marked and continually monitored.

English holly (Ilex aquifolium): Several stands of English holly are found throughout the area. Once mature, it is difficult to remove as it forms a deep taproot; proper removal involves cutting below the root crown. Efforts at removal should focus on small individuals which can easily be removed by hand. Large individuals should be identified and Facilities Management consulted regarding proper removal, which in many cases will require the use of machinery by trained staff.

English hawthorn (Crataegus monogyna): Some small individuals have been identified in the area. Small saplings may be removed by hand, while larger trees which require removal with heavy machinery should be marked and reported to Facilities Management staff.

Himalayan blackberry (Rubus armeniacus): Large stands of Himalayan blackberry can be found along the outer edges of Mystic Vale and Hobbs Creek, with smaller stands scattered throughout Mystic Vale. Small individuals should be removed completely by hand. For larger stands, canes which pose potential hazards or which are covering native plants should be cut back; following this, roots should be dug up where feasible with careful attention paid to minimizing soil disturbance. Impassable thickets of Himalayan blackberry may require the use of machinery for removal and are the responsibility of Facilities Management staff.

Thistle (Cirsium spp.): Many individual thistles have been identified in open areas throughout Mystic Vale and Upper Hobbs Creek and should be removed early and completely to prevent their spread through root and seed dispersal. Flowering portions should be removed before going to seed and seed heads bagged as a preventative measure.

Ornamental species: Several ornamental species have been located in the woods. Noting potential exotic species and identifying non-native species is important to early prevention of species invasions.

Agronomic grasses: Agronomic grasses spreading from neighboring lawns on campus should be identified early and removed, ensuring the root mass of rhizomatous species is fully removed.

Recommendations

Remove invasive species

Parties engaging in invasive species removal should follow the protocol outlined in the Stewardship Program, Section 3.0. Priorities for invasive species removal should directly follow the CRISP Priority Invasive Plant List, which identifies priority species for control, containment, eradication and prevention (see Reference Document A of the ISMS). Priorities for invasive plant removal in Mystic Vale and Upper Hobbs Creek are as follows:

High Priority	Thistle species	Remove all individuals, contain seed heads
	English ivy	Remove tree climbing ivy
	English holly	Remove small individuals
	Daphne laurel	Remove all individuals
	Agronomic grasses	Remove all individuals
Medium Priority	English ivy	Remove outliers and ivy around existing native plants
	Himalayan blackberry	Remove small individuals & cut back hazardous canes
	English hawthorn	Remove small individuals
Low Priority	English ivy	Remove dense ground cover
	Himalayan blackberry	Cut down & dig up roots where feasible
Responsibility of Facilities Management	English holly	Removal of large individuals & dense stands
	Himalayan blackberry	Removal of dense thickets with extensive root systems
	English hawthorn	Removal of large individuals
	Noxious species	Removal upon identification

Engage with the Community

Interested members of the University of Victoria and the surrounding community should be effectively and meaningfully engaged and involved in any efforts to remove invasive species and maintain stewardship of Mystic Vale and Upper Hobbs Creek. For further information on involvement and the roles played by members of this community, please refer to Section 3.

Monitor the area

Before and after removing invasive species, photos of the site should be taken from the same point. It is advisable that the group participating in invasive species removal on this site return at least two months after initial removal efforts to photograph the site again and assess the immediate effectiveness of these efforts. This will allow for immediate identification of new individuals or species re-colonizing the site, and will contribute to a larger database of photographic evidence for this site. Photos should be shared with the Ecological Restoration Volunteer Network Coordinator to be placed in the appropriate database. Such photo-based, short term monitoring is differentiated from photo point monitoring, which is further addressed in the Invasive Species Management Strategy.

Engage in further study of the area

It is recommended that this site be studied further to update existing information on species presence, hydrological patterns, and other processes. As the water table fluctuates throughout the year and due to the difficulty of identifying particular species during particular seasons, further study should be engaged in at several points throughout the year. Effective study of this area can be achieved particularly through student efforts in existing course work, and as facilitated by instructors in the classroom; for more information on the potential roles played by different stakeholder groups in studying this area, please see Section 3.

Plant native species
Given ample resources, it is advisable that native species be planted in areas where invasive species have been removed according to the ecological requirements of the site. Planting native species can help speed the process of ecosystem recovery by aiding in re-establishing plant communities. This can also be done as a preventative measure, as it allows for immediate reoccupation of newly opened space which is more susceptible to new invasions if left bare. See Appendix A for a list of recommended native species for planting in this site.

Further activity
Ongoing improvements to the watercourse along Hobbs Creek are a key feature of the work that has been done in Mystic Vale over the last several decades. Situated within a heavily disturbed watershed, this area will require ongoing work in watercourse improvements. Additionally, the possibility of trail re-routing along Hobbs Creek within Mystic Vale should continue to be considered as a measure of mitigation against trampling and erosion due to human activity along the creek's banks.

Further Information

For further information on this site, see the following documents, which can be retrieved at web.uvic.ca/~nature/:

Harrop-Archibald, H. (May 31, 2007). *University of Victoria Natural Features Study: Bowker Creek, Cunningham Woods, Upper Hobbs Creek/Mystic Vale.* Victoria, BC: University of Victoria, Restoration of Natural Systems Program.

Lucey & Barraclough, 2009; Lucey, P. & Barraclough, C. (2009). Hobbs Creek Upper Watershed Assessment – Headwater-based Stormwater Runoff & Erosion and Sediment Profile (Project No. 08.8051). Prepared for Bentley Sly, Manager Grounds & Environmental Services, University of Victoria; Aqua-Tex Scientific Consulting Ltd.

Doucet,S. (2012) *A Valuation of Mystic Vale's Ecosystem Services*. Restoration of Natural System Program, University of Victoria.

McCarter, R. (2012). *Hobbs Creek: Reach 6 Riparian Restoration*. Restoration of Natural Systems Program, University of Victoria.

Oliver, H. (2011). *Ecological Restoration of the Riparian Area at Mystic Vale/ Hobbs Creek*. Restoration of Natural Systems Program, University of Victoria.

Restoration Design Projects for ES 341, available at http://web.uvic.ca/~nature/and at https://www.uvic.ca/socialsciences/environmental/undergraduate/courses/index.php under the ES341 tab:

- Botel, T., Johnson, E., Hibbert, K., Duan, C., Sun, S. (2013). *Canoe Pond: Focused Ecological Restoration in Mystic Vale to Cultivate Community Engagement*

- Chanoine, M., Baum, J., Struthers, D., Campbell, K. (2009). *Towards a Future for Mystic Vale.*

References

Harrop-Archibald, H. (May 31, 2007). *University of Victoria Natural Features Study: Bowker Creek, Cunningham Woods, Upper Hobbs Creek/Mystic Vale.* Victoria, BC: University of Victoria, Restoration of Natural Systems Program.

University of Victoria (2003). *Campus Plan 2003.* Victoria, BC: University of Victoria.

University of Victoria (2016). *University of Victoria Campus Plan*. University of Victoria Office of Campus Planning & Sustainability. Retrieved May 23, 2016 from http://www.uvic.ca/campusplanning/assets/docs/Campus-Plan-Update-2015/UVicCampusPlan.01.26.2016reduced.pdf

Lucey & Barraclough, 2009; Lucey, P. & Barraclough, C. (2009). Hobbs Creek Upper Watershed Assessment – Headwater-based Stormwater Runoff & Erosion and Sediment Profile (Project No. 08.8051). Prepared for Bentley Sly, Manager Grounds & Environmental Services, University of Victoria; Aqua-Tex Scientific Consulting Ltd.

Appendix A: Suggested Species for Planting in Mystic Vale and Upper Hobbs Creek

Species planted in this site should be chosen based on their suitability to the specific conditions of the site, already existing species on campus (see Appendix A: UVic Vascular Plant Species in Harrop-Archibald, 2007, p.52) and in consideration of their tolerance to drought, disturbance, and browsing. Various sourcing methods should be considered, as well as both financial, temporal, and watering constraints. Participants in restoration may choose to plant species in the given site based on desired uses or a chosen theme; themes may include ethnobotanical or medicinal uses, therapeutic gardens, or pollinator attraction. For further guidance on choosing native species to plant, see the 'Resources' tab at web.uvic.ca/~nature/, as well as the following resources:

Native Plants in the Coastal Garden: A Guide for Gardeners in the Pacific Northwest by April Pettinger & Brenda Costanzo

Gardening with Native Plants of the Pacific Northwest by Arthur R. Kruckeberg

Propagation of Pacific Northwest Native Plants by Robin Rose, E.C. Chachulski, & Diane L. Haas

Section 4.4 South Woods

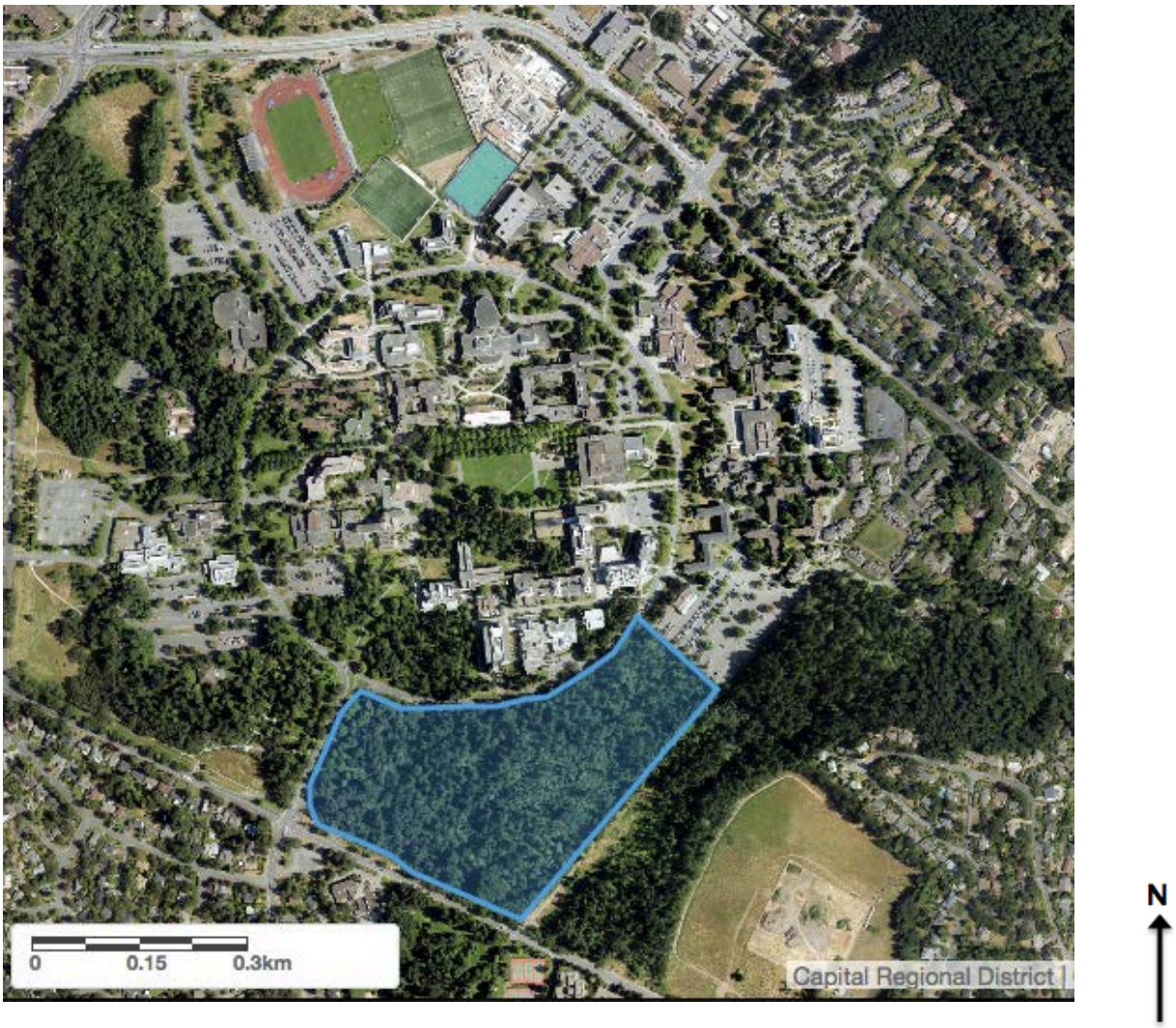


Figure 1. South Woods on the University of Victoria campus, as indicated by the blue polygon. Source: CRD Webmap. Retrieved August 21, 2016 from https://maps.crd.bc.ca/Html5Viewer/?viewer=public

July 2016

Prepared by Julia Jennings, Lindsay Kathrens & Val Schaefer

Figure 2. Large woody debris in an open portion of South Woods (left) and English ivy (*Hedera helix*) growing up a tree (right) in South Woods. Photos by Lindsay Kathrens.

Site Description

South Woods is a forested area located in the southeastern portion of the University of Victoria campus, within the District of Oak Bay, and in the traditional territories of the Lekwungen Peoples. Bordered by Ring Road to the north, University Drive to the west, Cedar Hill Cross to the south, and a District of Oak Bay right-of-way to the east, this area spans 11.5 hectares (Field, 2003). Situated within the Coastal Douglas-fir biogeoclimatic zone, this large tract of forest contains patches demonstrating several species assemblages and structural characteristics; it includes areas demonstrating characteristics of older second growth forest and strongly fluctuating water tables, classified through site series classifications FdBg-Oregon grape and Cw-Black twinberry, respectively (Harrop-Archibald, 2008). Dominant tree species include black cottonwood (*Populus trichocarpa*), Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), and bigleaf maple (*Acer macrophyllum*); predominant understory species include red osier dogwood (*Cornus serisea*) and willow (*Salix hookeriana*), snowberry (*Symphoricarpos albus*), oceanspray (*Holodiscus discolor*), and salmonberry (*Rubus spectabilis*); and predominant herbaceous layer species include dull Oregon grape (*Mahonia nervosa*) and trailing blackberry (*Rubus ursinus*) (Harrop-Archibald, 2008)[11]. South Woods is currently designated a protected area under the 2016 University of Victoria Campus Plan, but does not protection in perpetuity (University of Victoria, 2016).

Actions to Date

Volunteer groups, including the University of Victoria Ecological Restoration Volunteer Network and the Greater Victoria Green Team, have engaged in invasive species removal in various areas within south woods for several years. To date, these groups have not actively revisited or placed

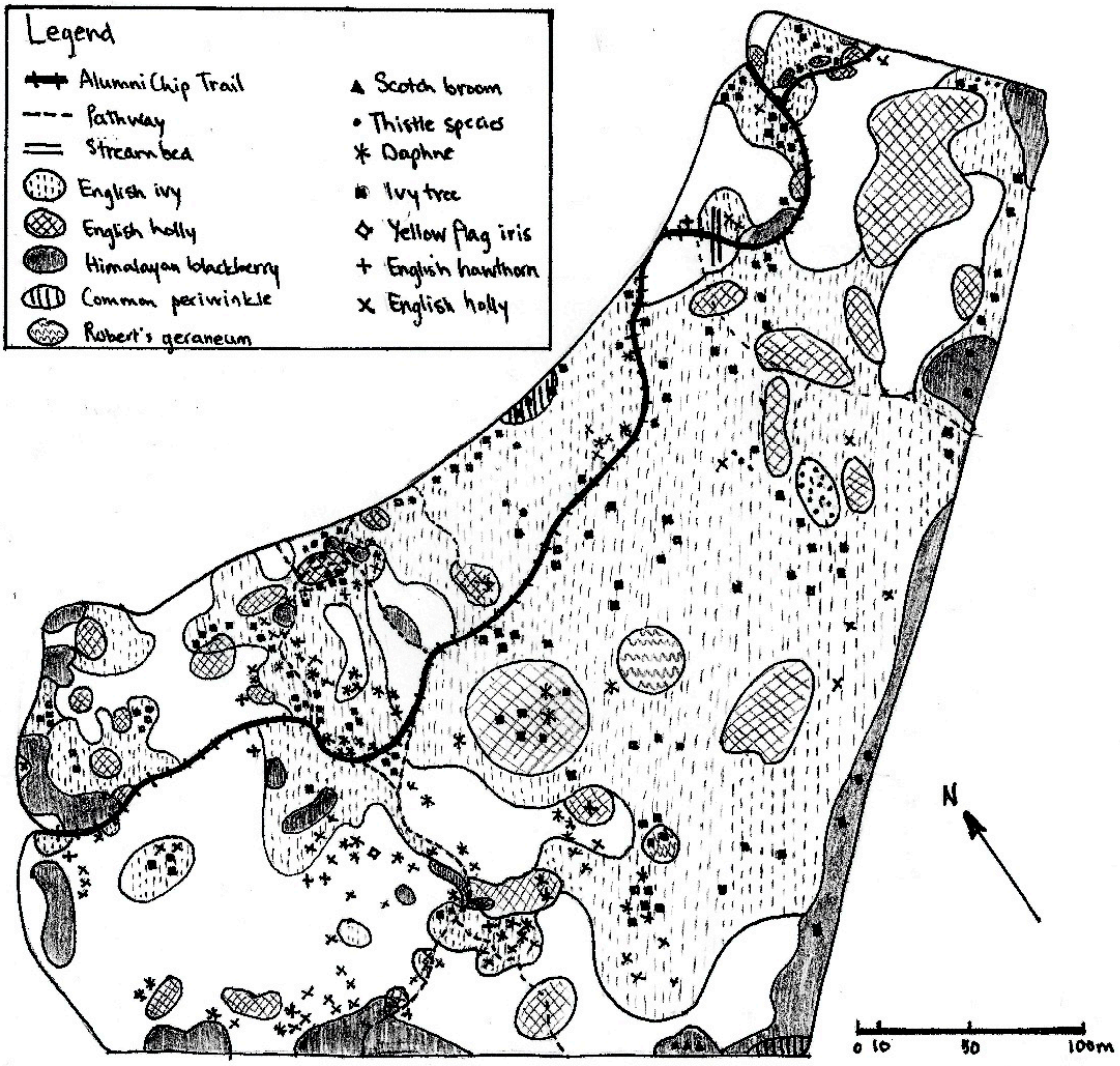
[11] For a complete list of species found in South Woods as of 2008, see Harrop-Archibald, 2008.

focus on any particular portion of South Woods. Additionally, students have engaged in invasive species removal in South Woods through course work [?]. For more information on past initiatives in South Woods and other natural areas, see Actions to Date section of this report.

Invasive Species in South Woods

Figure 3. English ivy (*Hedera helix*) (top left), Himalayan blackberry (*Rubus armeniacus*) (top right), common periwinkle (*Vinca minor*) (middle left), Robert's geranium (*Geranium robertianum*) (middle right), daphne laurel (*Daphne laureola*) (bottom left), and English holly (*Ilex aquifoliujm*) (bottom right) on the University of Victoria campus. Photos by Lindsay Kathrens.

Figure 4. Invasive Species Distribution in South Woods



There is a very strong presence of invasive species throughout South Woods, with the most predominant species including English ivy, English holly, Himalayan blackberry, and daphne laurel. Other species demonstrate a small presence in the area, and have the potential to be eradicated if addressed quickly and effectively. Figure 4 above demonstrates the approximate extent and distribution of invasive species in South Woods. Invasive species present in South Woods include the following:

> *Daphne* laurel *(Daphne laureola*): Large individuals and stands of daphne have been found in areas with dappled shade, or in moist and otherwise clear areas. When removing daphne, volunteers should work carefully to remove small saplings so as to contain infestations. While small individuals can be pulled by hand with the use of appropriate skin and eye protection, larger individuals must be cut below the soil surface using loppers. All daphne should be made a priority for removal. Volunteers should well informed about possible health reactions to this species.

English ivy (Hedera helix): English ivy can be found growing along the ground and climbing up trees throughout most of South Woods, though some of this species has by volunteers in certain areas. Ivy climbing up trees should be a priority for removal to prevent the spreading of seed, followed by the removal of ground ivy surrounding native plants and spreading into new areas, followed by removal of more dense patches. Tree climbing ivy should be cut at chest height and the bottom portion removed from the base of the tree; trees from which ivy has been removed should be marked and continually monitored.

English holly (Ilex aquifolium): English holly is present in dense stands throughout South woods. Smaller scattered individuals are also predominant in the understory. Once mature, this species is difficult to remove as it forms a deep taproot; proper removal involves cutting below the root crown. Efforts at removal should focus on small individuals which can easily be removed by hand. Large individuals should be identified and Facilities Management consulted regarding proper removal, which in many cases will require the use of machinery by trained staff.

English hawthorn (Crataegus monogyna): Many individuals have been identified in the woods, mostly along or close to the pathways and borders of this area. Small saplings may be removed by hand, while larger trees which require removal with heavy machinery should be marked and reported to Facilities Management staff.

Himalayan blackberry (Rubus armeniacus): Large stands of Himalayan blackberry can be found along the outer edges of South woods, as well as throughout the woods and along pathways. Small individuals should be removed completely by hand. For larger stands, canes which pose potential hazards or which are covering native plants should be cut back; following this, roots should be dug up where feasible with careful attention paid to minimizing soil disturbance. Impassable thickets of Himalayan blackberry may require the use of machinery for removal and will be the responsibility of Facilities Management staff.

Common periwinkle (Vinca minor): Two small patches of common periwinkle have been identified along the northwest edge and southeast corner of the woods. This species has the ability to form dense mats and outcompete herbaceous layer species. These patches should be prioritized early on to prevent spread farther into the woods.

Scotch broom (Cytisus scoparius): One small patch of Scotch broom has been found on the southern edge of South Woods. This species should be prioritized for early removal as it has the ability to spread very effectively through seed dispersal, alters soil chemistry, and competes with conifer seedlings and other native plants. New infestations should continually be monitored for.

Robert's geranium (Geranium robertianum): Two patches of this herbaceous annual species have been found in open areas in South Woods, and should be contained.

Thistle species (Cirsium spp.): Thistle has been identified in open areas and along pathways and outer edges in South Woods. All thistle should be removed early and completely to prevent its spread through root and seed dispersal. Seed heads should be removed and bagged to prevent further spread.

Yellow flag iris (Iris pseudacorus): Several potential Yellow flag iris individuals have been identified in South Woods. Vegetative surveying should be done in identified areas to ensure the removal of this species and monitor its spread.

Recommendations

Remove invasive species

Parties engaging in invasive species removal should follow the protocol outlined in the Stewardship Program, Section 3.0. Priorities for invasive species removal should directly follow the CRISP Priority Invasive Plant List, which identifies priority species for control, containment, eradication and prevention (see Reference Document A of the ISMS). Priorities for invasive plant removal in South Woods are as follows:

High Priority	Yellow flag iris	CRISP listed for containment; eradicate immediately upon identification
	Thistle species	Remove all individuals, contain seed heads
	English ivy	Remove tree climbing ivy
	English holly	Remove small individuals
	Daphne laurel	Remove all individuals
	Common periwinkle	Eradicate
	Robert's geranium	Remove all individuals
	Scotch broom	Remove all individuals
Medium Priority	English ivy	Remove outliers and ivy around existing native plants
	Himalayan blackberry	Remove small individuals & cut back hazardous canes
	English hawthorn	Remove small individuals
Low Priority	English ivy	Remove dense ground cover
	Himalayan blackberry	Cut down & dig up roots where feasible
Responsibility of Facilities Management	English holly	Removal of large individuals & dense stands
	Himalayan blackberry	Removal of dense thickets with extensive root systems
	English hawthorn	Removal of large individuals
	Other hazardous species	Removal upon identification

Engage with the Community

Interested members of the University of Victoria and the wider community should be effectively and meaningfully engaged and involved in any efforts to remove invasive species and maintain stewardship of Cunningham Woods. For further information on involvement and the roles played by members of this community, please refer to Section 3.

Monitor the area

Before and after removing invasive species, photos of the site should be taken from the same point. It is advisable that the group participating in invasive species removal on this site return at least two months after initial removal efforts to photograph the site again and assess the immediate

effectiveness of these efforts. This will allow for immediate identification of new individuals or species re-colonizing the site, and will contribute to a larger database of photographic evidence for this site. Photos should be shared with the Ecological Restoration Volunteer Network Coordinator to be placed in the appropriate database. Such photo-based, short term monitoring is differentiated from photo point monitoring, which is further addressed in the Invasive Species Management Strategy.

Engage in further study of the area
It is recommended that further survey of South Woods be undertaken in order to gain a deepened understanding of species assemblages, habitat value, and hydrological patterns on this site; such study should be undertaken at several times throughout the year to ensure seasonal shifts are accounted for. Effective study of this area can be achieved particularly through student efforts in existing course work, and as facilitated by instructors in the classroom; for more information on the potential roles played by different stakeholder groups in studying this area, please see Section 3.

Plant native species
Given ample resources, it is advisable that native species be planted in areas where invasive species have been removed according to the ecological requirements of the site. Planting native species can help speed the process of ecosystem recovery by aiding in re-establishing plant communities. This can also be done as a preventative measure, as it allows for immediate reoccupation of newly opened space which is more susceptible to new invasions if left bare. Further study of this area is needed to determine appropriate species for planting.

Further Information

For further information on this site, see the following documents:

> Harrop-Archibald, H. (January 3, 2008). *University of Victoria Natural Features Study Phase Two: University Cedar Hill Corner Property, Garry Oak Meadow and Camus Meadow Area, Finnerty Ravine, Haro Woods, South Woods, Lower Hobbs Creek/Mystic Vale.* Victoria, BC: University of Victoria, Restoration of Natural Systems Program. (Available online at [x] or in the Restoration of Natural Systems Library upon request)
>
> Restoration Design Projects for ES 341, available at web.uvic.ca/~nature/and at https://www.uvic.ca/socialsciences/environmental/undergraduate/courses/index.php under the ES341 tab:
>
> - Carden, C., Currie, J., Field, J. & Goulden, S. (2013). *Restoration in South Woods*
> - Rombs, R., Filip, N., Chan, K., Elford, L. & Sharuga, C. (2009). *South Woods Restoration Project*

References

Harrop-Archibald, H. (January 3, 2008). *University of Victoria Natural Features Study Phase Two: University Cedar Hill Corner Property, Garry Oak Meadow and Camus Meadow Area, Finnerty Ravine, Haro Woods, South Woods, Lower Hobbs Creek/Mystic Vale.* Victoria, BC: University of Victoria, Restoration of Natural Systems Program.

University of Victoria (2016). *University of Victoria Campus Plan*. University of Victoria Office of Campus Planning & Sustainability. Retrieved May 23, 2016 from http://www.uvic.ca/campusplanning/assets/docs/Campus-Plan-Update-2015/UVicCampusPlan.01.26.2016reduced.pdf

Section 4.5 Garry Oak & Camas Meadows

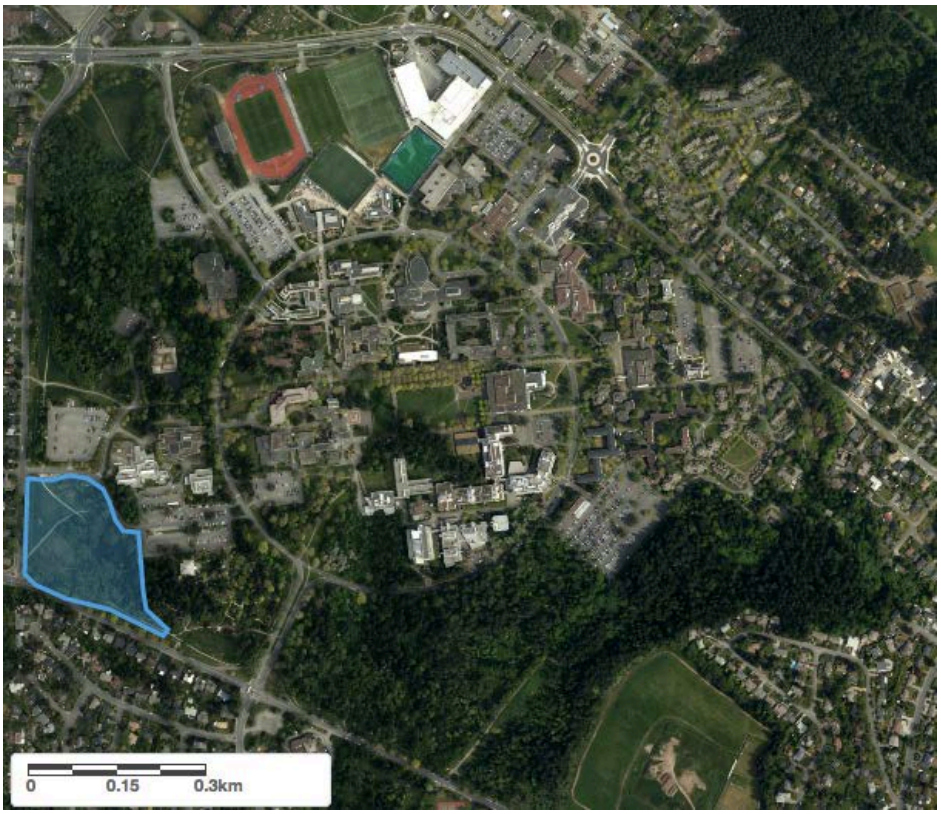


Figure 1. The Garry Oak and Camas Meadow on the University of Victoria campus, as indicated by the blue polygon. Source: CRD Webmap. Retrieved October 8, 2016 from https://maps.crd.bc.ca/Html5Viewer/?viewer=public

September, 2016

Prepared by Julia Jennings, Lindsay Kathrens & Val Schaefer

Figure 1. The Garry oak and camas meadow restoration site (top left), and the camas meadow in bloom (top right and bottom) on the UVic campus. Photos courtesy of Nancy Turner.

Site Description

The Garry Oak and Camas Meadow is situated at the southwest corner of the University of Victoria campus, adjacent to Gordon Head Road to the west and Cedar Hill Cross Road to the south. This area is comprised of a mosaic of structures and species compositions which make up a remnant patch of Garry oak and associated ecosystems, and was once a part of a much larger extent of Garry oak meadow systems (Bein & Eastman, 2006). These ecosystems are rare and provide habitat to a high number of rare species; they also demonstrate a great deal of cultural importance, as these ecosystems have traditionally provided a key source of nutrition and sustenance for local Indigenous Peoples (Nuszdorfer, Klinka & Demarchi, 1991; GOERT, 2016; Penn, 2006). The site includes meadow and rocky outcrop areas, comprised of drought tolerant species and including

camas (*Camassia spp.*), western buttercup (*Ranunculus occidentalis*), shooting star (*Dodecatheon spp.*), and several grass species; areas with Garry oak (*Quercus garryana*) overstory and shrub understory; and areas dominated by Douglas-fir (*Pseudotsuga menziesii*). Indian plum (Oemleria cerasiformis is also common in this area. Additionally, previous study has found one location in which foothill sedge (*Carex tumulicola*), a SARA-listed Endangered Species has been found (Harrop-Archibald, 2008) [12]. This area has thus been designated Critical Habitat in the federal Recovery Strategy for this species (Government of Canada, 2013). Other species at risk use this site, including band-tailed pigeon (*Patagioenas fasciata*) and Propertius duskywing (*Erynnis propertius*).

Actions to Date

The Garry Oak and Camas Meadows have been the site of several studies and cultural practices since the establishment of the University of Victoria. In 2004, a joint project between Facilities Management and Human Resources Development Canada, called the Garry Oak Meadow Ecosystem Mapping and Flora/Fauna Inventory, was conducted as a means of gathering information on native and invasive species present in the area (Kranenburg, 2004). On July 22, 2005, members of the Songhees First Nation community, students, and other members of the University of Victoria and surrounding community gathered to engage in a camas harvest in the area, led by Songhees land manager Cheryl Bryce (M'Gonigle & Starke, 2006; The Ring, 2005 For a number of years, this area has been the site of field method education for students of Environmental Studies 240: Ecological Processes.

Invasive Species in the Garry Oak and Camas Meadow

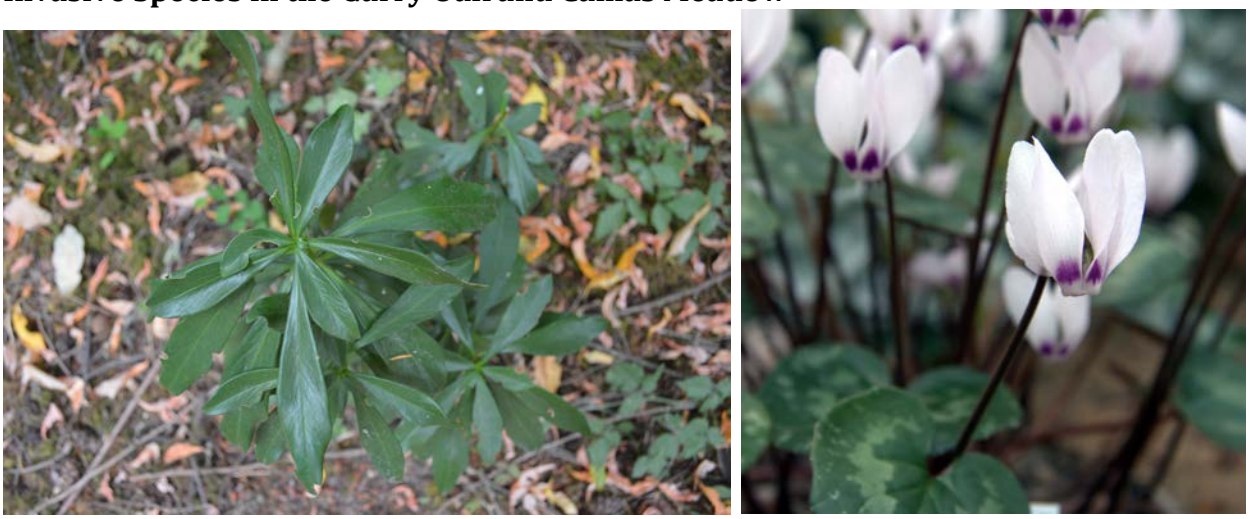
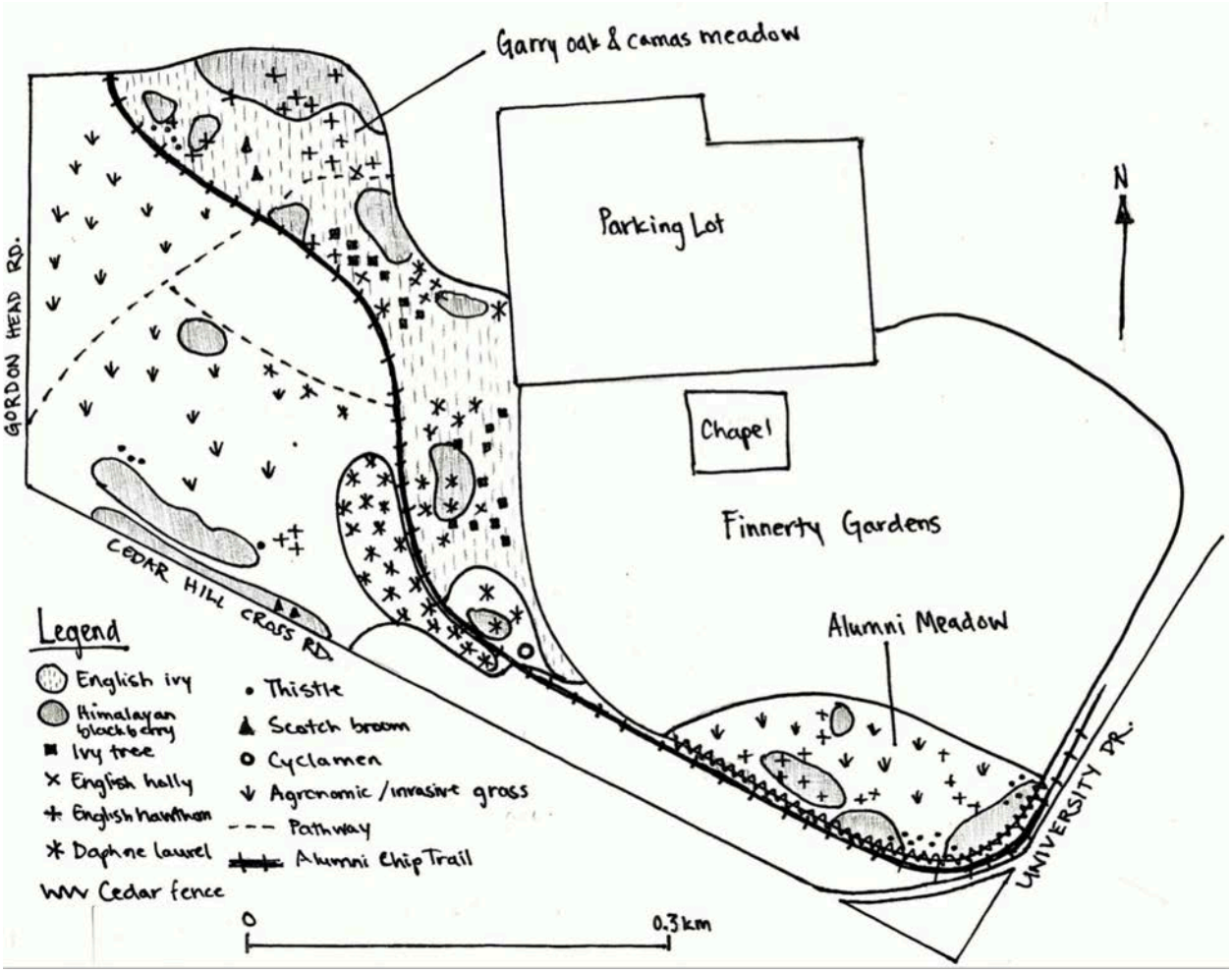


Figure 3. Daphne laurel (*Daphne laureola*) on the UVic campus (left) (Photo by Lindsay Kathrens); and cyclamen (right) (Source: https://en.wikipedia.org/wiki/Cyclamen_pseudibericum).

Figure 4. Invasive Species Distribution in the Garry Oak and Camas Meadow

[12] For a complete list of species found in the Garry Oak and Camas Meadow as of 2008, see Harrop-Archibald, 2008.



Several invasive species have been found throughout the Garry oak and camas meadows, with several large stands of daphne laurel in particular having been identified. Invasive species present in the area as of 2016 include the following (See Figure 4 above for a map of invasive species distribution in this site):

Cyclamen (Cyclamineae spp.): Cyclamen is an emerging invasive species that is particularly dangerous to meadow species. It has been found on a small rocky outcrop near the entrance to the Garry Oak and Camus meadow, along the alumni chip trail. This species has been found in various other places around and near campus and should be monitored for vigilantly.

Daphne laurel (Daphne laureola): Several extensive stands of daphne laurel have been found in the shrubby and wooded areas of this site. All daphne laurel should be a priority for removal and removed with the use of proper protection. Volunteers should be well informed about possible health reactions to this species.

English ivy (Hedera helix): English ivy can be found in much of the wooded area adjacent to Finnerty Gardens, both on the ground and climbing up trees. Ivy climbing up trees should be a priority for removal to prevent the spreading of seed, followed by the removal of ground ivy surrounding native plants and spreading into new areas, followed by removal in denser patches. Tree climbing ivy should be cut at chest height and the bottom portion removed

from the base of the tree; trees from which ivy has been removed should be marked and continually monitored.

English holly (Ilex aquifolium): A few large individual English holly trees have been found in the wooded portions of this site. Efforts at removal should focus on small individuals which can easily be removed by hand when they are found. Large individuals should be identified and Facilities Management consulted regarding proper removal, which in many cases will require the use of machinery by trained staff.

English hawthorn (Crataegus monogyna): English hawthorn can be found in several locations within this site. Small saplings may be removed by hand, while larger trees which require removal with heavy machinery should be marked and reported to Facilities Management staff.

Himalayan blackberry (Rubus armeniacus): Stands of Himalayan blackberry can be found in the wooded areas and along the edges of this site. Small individuals should be removed completely by hand. For larger stands, canes which pose potential hazards or which are covering native plants should be cut back; following this, roots should be dug up where feasible with careful attention paid to minimizing soil disturbance. Impassable thickets of Himalayan blackberry may require the use of machinery for removal and are the responsibility of Facilities Management staff.

Scotch broom (Cytisus scoparius): Small individual broom have been located on the rocky outcrop in the northern portion of this site. Extensive removal of this species has occurred in this area in the past. This species should be prioritized for early removal as it has the ability to spread very effectively through seed dispersal, alters soil chemistry, and competes with conifer seedlings and other native plants. New infestations should continually be monitored for.

Thistle (Cirsium spp.): Several individual thistles have been identified in the meadow, and should be removed early and completely to prevent their spread through root and seed dispersal. Flowering portions should be removed before going to seed and seed heads bagged as a preventative measure. Thistles identified to date in the area include Canada thistle (*Cirsium arvense*) and bull thistle (*Cirsium vulgare*), though all identified thistle species should be promptly removed.

Ornamental species: Several ornamental species have been located in the woods. Noting potential exotic species and identifying non-native species is important to early prevention of species invasions.

Agronomic grasses: Agronomic grasses spreading from neighboring lawns on campus should be identified early and removed, ensuring the root mass of rhizomatous species is fully removed. The most concerning species found in this meadow is meadow foxtail (*Alopecurus pratensis*).

*A potential infestation of cow parsnip has been found in the open grassy area of this site. Further study to confirm this and removal upon identification is required.

Recommendations

Remove invasive species

Parties engaging in invasive species removal should follow the protocol outlined in the Stewardship Program, Section 3.0. Priorities for invasive species removal should directly follow the CRISP Priority Invasive Plant List, which identifies priority species for control, containment, eradication and prevention (see Reference Document A of the ISMS). Priorities for invasive plant removal in the Garry Oak and Camas Meadow are as follows:

High Priority	Thistle species	Remove all individuals, contain seed heads
	Cyclamen spp.	Remove all individuals and monitor for new infestations
	Cow parsnip	Removal upon identification
	Daphne Laurel	Remove all individuals, monitor for regrowth
	English Ivy	Remove tree climbing ivy
	English Holly	Remove small individuals
	Agronomic grasses	Remove all small infestations
Medium Priority	English ivy	Remove outliers and ivy around existing native plants
	Himalayan blackberry	Remove small individuals & cut back hazardous canes
	English hawthorn	Remove small individuals
Low Priority	English ivy	Remove dense ground cover
	Himalayan blackberry	Cut down & dig up roots where feasible
Responsibility of Facilities Management	English holly	Removal of large individuals & dense stands
	Himalayan blackberry	Removal of dense thickets with extensive root systems
	English hawthorn	Removal of large individuals
	Noxious species	Removal upon identification

Engage with the Community

This area hold particular interest and significance to the indigenous communities of the area, as it contains many important and sacred indigenous plant species (Bryce, C., personal communication, 2016; Turner, N.J., personal communication, September 21). Indigenous communities should be consulted and communicated with extensively regarding the restoration of this area. Opening space to hear how this place can best help the needs of these communities as well as continuing to build relationships through respectful and meaningly communication is essential to all restoration activities that might occur in this area. Interested members of the University of Victoria and the wider community should be effectively and meaningfully engaged and involved in any efforts to remove invasive species and maintain stewardship of the Garry Oak and Camas Meadows. For further information on involvement and the roles played by members of this community, please refer to Section 3 of the ISMS.

Implement management strategies for the area

The Natural Features Study conducted by Harrop-Archibald (2008) recommends that regular mowing be implemented in order to prevent the encroachment of shrubs and trees into meadow

habitat. Mowing must take place at certain times of year in order to allow for native plants to set seed; mowing before native plants set seed hinders their ability to regenerate and compete with invasive grasses. Additionally, further study into the possibility for prescribed burning to take place as a management practice in this site should be explored.

Monitor the area
Before and after removing invasive species, photos of the site should be taken from the same point. It is advisable that the group participating in invasive species removal on this site return at least two months after initial removal efforts to photograph the site again and assess the immediate effectiveness of these efforts. This will allow for immediate identification of new individuals or species re-colonizing the site, and will contribute to a larger database of photographic evidence for this site. Photos should be shared with the Ecological Restoration Volunteer Network Coordinator to be placed in the appropriate database. Such photo-based, short term monitoring is differentiated from photo point monitoring, which is further addressed in the Invasive Species Management Strategy.

Engage in further study of the area
It is recommended that this site be studied further to update existing information on species presence, hydrological patterns, and other processes. Further study should be engaged in at several points throughout the year to account for seasonal changes in both biotic and abiotic conditions. Effective study of this area can be achieved particularly through student efforts in existing course work, and as facilitated by instructors in the classroom, and there is potential for follow up on previous studies done in this area. For more information on the potential roles played by different stakeholder groups in studying this area, please see Section 2 of the ISMS.

Plant native species
Given ample resources, it is advisable that native species be planted in areas where invasive species have been removed according to the ecological requirements of the site. Planting native species can help speed the process of ecosystem recovery by aiding in re-establishing plant communities. This can also be done as a preventative measure, as it allows for immediate reoccupation of newly opened space which is more susceptible to new invasions if left bare. See Appendix A for a list of recommended native species for planting in this site.

Further Information

For further information on this site, see the following document(s), both of which can be retrieved at web.uvic.ca/~nature/, or can be found in the Restoration of Natural Systems Library:

Harrop-Archibald, H. (January 3, 2008). *University of Victoria Natural Features Study Phase Two: University Cedar Hill Corner Property, Garry Oak Meadow and Camus Meadow Area, Finnerty Ravine, Haro Woods, South Woods, Lower Hobbs Creek/Mystic Vale.* Victoria, BC: University of Victoria, Restoration of Natural Systems Program.

Bein, M. & Eastman, D. (2006). *University of Victoria Garry Oak Meadow Restoration Project: Progress Report April, 2004 – September, 2005.* Victoria, BC: Restoration of Natural Systems Program, University of Victoria

References

Bein, M. & Eastman, D. (2006). *University of Victoria Garry Oak Meadow Restoration Project: Progress Report April, 2004 – September, 2005.* Victoria, BC: Restoration of Natural Systems Program, University of Victoria

Garry Oak Ecosystems Recovery Team Society (2016). *Garry Oak Ecosystems Recovery Team.* Retrieved June 6, 2016 from http://www.goert.ca/index.php

Harrop-Archibald, H. (January 3, 2008). *University of Victoria Natural Features Study Phase Two: University Cedar Hill Corner Property, Garry Oak Meadow and Camus Meadow Area, Finnerty Ravine, Haro Woods, South Woods, Lower Hobbs Creek/Mystic Vale.* Victoria, BC: University of Victoria, Restoration of Natural Systems Program.

M'Gonigle, M. & Starke, J. (2006). *Planet U.* Gabriola Island, BC: New Society Publishers

Nuszdorfer, F.C., Klinka, K., & Demarchi, D.A. (1991) Chapter 5: Coastal Douglas-fir Zone. In D. Meidinger & J. Pojar (Eds.), *Ecosystems of British Columbia.* Victoria, BC: Province of British Columbia, Ministry of Forests

Penn, B. (June 2006). *Restoring Camas and Culture to Lekwungen and Victoria: An interview with Lekwungen Cheryl Bryce.* Focus Magazine. Retrieved June 3, 2016 from http://www.firstnations.de/media/06-1-1-camas.pdf

The Ring (July-August, 2005). *Harvest Time.* The Ring, 31(7). Retrieved September 10, 2016, from http://www.ring.uvic.ca/05jul07/features/camas.html

Schaefer, V. & Miles, J. (2013). *Restoration Walks in Victoria: A Guide to Several Ecological Restoration Projects in Greater Victoria, BC.* Victoria, BC: University of Victoria. Retrieved July 8, 2016 from https://www.uvic.ca/socialsciences/environmental/assets/docs/RestorationWalksInVictoria.pdf

Appendix A: Suggested Species for Planting in the Garry Oak and Camas Meadow

Species planted in this site should be chosen based on their suitability to the specific conditions of the site, already existing species on campus (see Appendix A: UVic Vascular Plant Species in Harrop-Archibald, 2007, p.52) and in consideration of their tolerance to drought, disturbance, and browsing. The species list should be developed in partnership with the indigenous communities whom hold knowledge of the unceded territories the campus is now situated on. Working with the recommendations of Harrop-Archibald as well as the current climate of this site, indigenous interests in this place should be an integral part of, if not a driver of, any restoration that occurs here. The species list should also be reviewed in accordance with species that have already been recorded in the meadow and Mt Tolmie. This area could be suitable reintroduction habitat for white-top aster, yellow montane violet, and Kincaid's lupine (or Oregon lupine) (Miskelly, J. 2016, P.C)

Various sourcing methods should consider financial, temporal, and watering constraints. For further guidance on choosing native species to plant, see web.uvic.ca/~nature/, as well as the following resources:

Native Plants in the Coastal Garden: A Guide for Gardeners in the Pacific Northwest by April Pettinger & Brenda Costanzo

Gardening with Native Plants of the Pacific Northwest by Arthur R. Kruckeberg

Propagation of Pacific Northwest Native Plants by Robin Rose, E.C. Chachulski, & Diane L. Haas

Listed below are a broad range of species with potential suitability for planting in the Garry Oak and Camas Meadow:

Broad-leaved stonecrop (*Sedum spathulifolium*)
Common camas (*Camassia quamash*)
Chocolate lily (*Fritillaria affinis*, also known as *lanceolata*)
Nodding onion (*Allium cernuum*)
Spring-gold (*Lomatium utriculatum*)
Broad-leaved shootingstar (*Dodecatheon hendersonii)*
Woodland strawberry (*Fragaria vesca*)
Satin-flower (*Olsynium douglasii*)
White fawn lily (*Erythronium oregonum*)
Menzies' larkspur (*Delphinium menziesii*)
Tiger lily (*Lilium columbianum*)

See the Garry Oak Gardener's Handbook and other publications of the Garry Oak Ecosystem Recovery Team for more species and information.

Section 4.6 Alumni Meadow

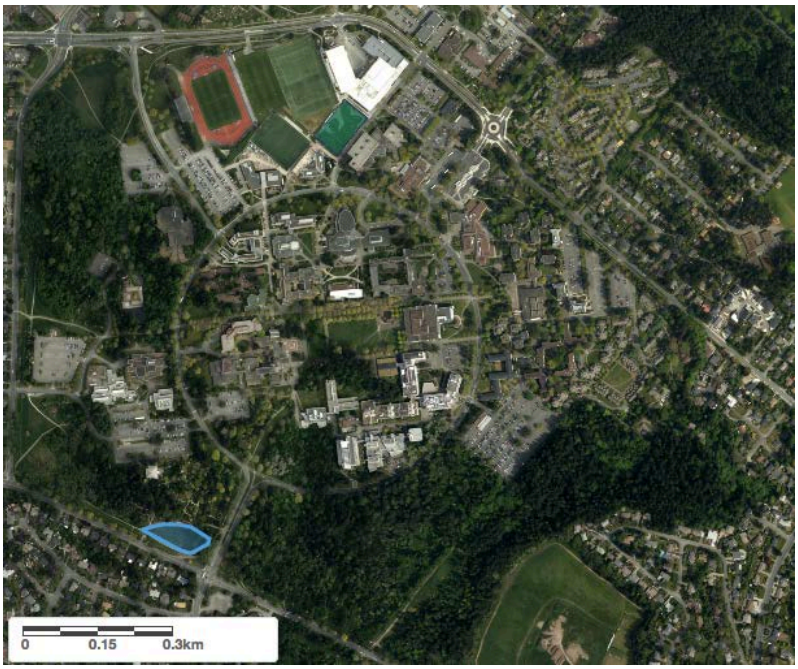


Figure 1. Alumni Garry oak meadow on the University of Victoria campus, as indicated by the blue polygon. Source: CRD Webmap. Retrieved October 8, 2016 from https://maps.crd.bc.ca/Html5Viewer/?viewer=public

Before experiment

Setting up experiment

After experiment

Today – 10 years later

September, 2016
Prepared by Julia Jennings, Lindsay Kathrens & Val Schaefer

This site is located in the southwest corner of the UVic campus, straddling the municipalities of Oak Bay and Saanich. Specifically, the site is situated on the north side of Cedar Hill X Road, between Gordon Head and Lansdowne Roads.

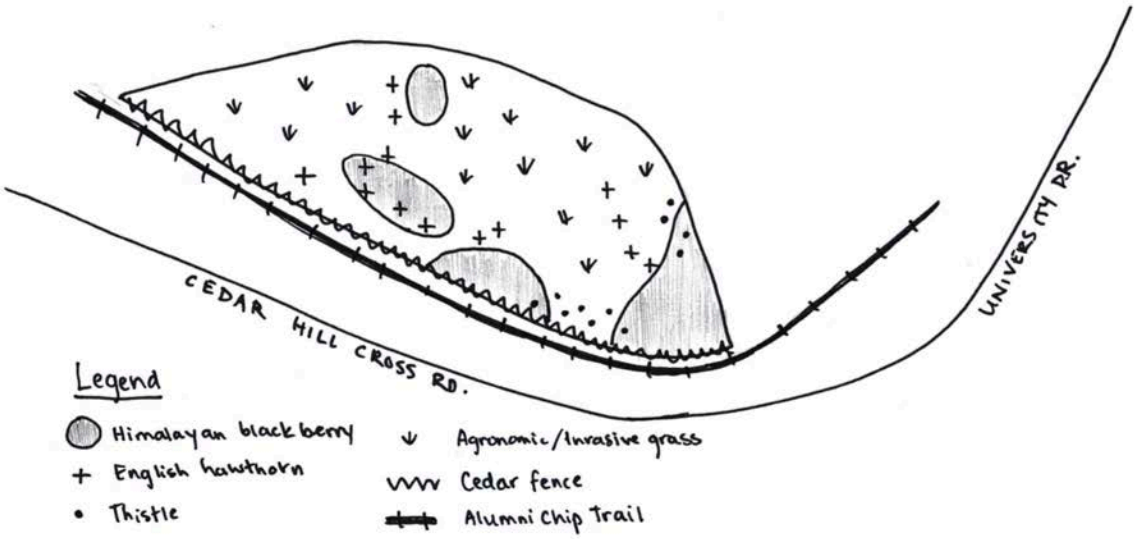
The Alumni Garden was the site of a project to help determine appropriate methods for restoring a highly degraded old-field to a meadow ecosystem (Bein and Eastman 2006). The project was a field experiment to compare different methods of soil preparation and planting regimes to assess optimal ways of controlling exotic species and re-establishing native plant communities, as well as a native plant demonstration garden (University of Victoria 2006). The Garry Oak Reclamation Trials is a joint restoration research project between Facilities Management and the Restoration of Natural Systems program that was initiated in 2003 (University of Victoria 2006). The study area, approximately 3500 m^2, is located on the north side of Cedar Hill Cross Road between Gordon Head and Lansdowne Roads (Harrop-Archibald 2007).

Prior to the initiation of this project, the vegetation in this area was dominated by agronomic grasses and introduced herbs with very few native species (Bein and Eastman 2006). The site today consists of agronomic grass species such as orchard grass *(Dactylis glomerata),* Kentucky bluegrass *(Poa pratensis),* and sweet vernal grass *(Anthoxanthum odoratum).* Many other invasive grasses and weeds are also found on site. Popcorn flower (*Plagiobothrys* sp.), a rare plant in Garry Oak ecosystems, was once found in a shallow depression, that was vernally moist (G. Allen and J. Antos Pers. Comm., 2004 in Harrop-Archibald 2007), but is now extirpated.

This project provided a valuable hands-on educational opportunity for students while at the same time contributing biological and ecological knowledge that can be applied to restoration of other sites on campus and elsewhere in the region. A multifaceted approach was taken towards the restoration of this meadow, including a community participation and consultation process that involved experts, municipalities, community members and students.

The project provided a living laboratory for researching and evaluating restoration and outdoor classroom for teaching and sharing knowledge about the value, protection, and restoration of healthy local ecosystems. The University of Victoria Alumni Association adopted the site in 2008, and in 2012 it became the focus of restoration efforts by students in the Environmental Studies Program at the University of Victoria.

In addition to being completed covered with agronomic grasses there are hawthorne, Scotch broom and Himalayan blackberry becoming established. It would make sense to to at least take out invasive shrubs as they appear. Dealing with the agronomic grasses is a much bigger problem that requires more planning and resources than are available at this time.


CEDAR HILL CROSS RD.
UNIVERSITY DR.
Legend
Himalayan blackberry
English hawthorn
Thistle
Agronomic/Invasive grass
Cedar fence
Alumni Chip Trail

Section 4.7 Haro Woods & Finnerty Ravine

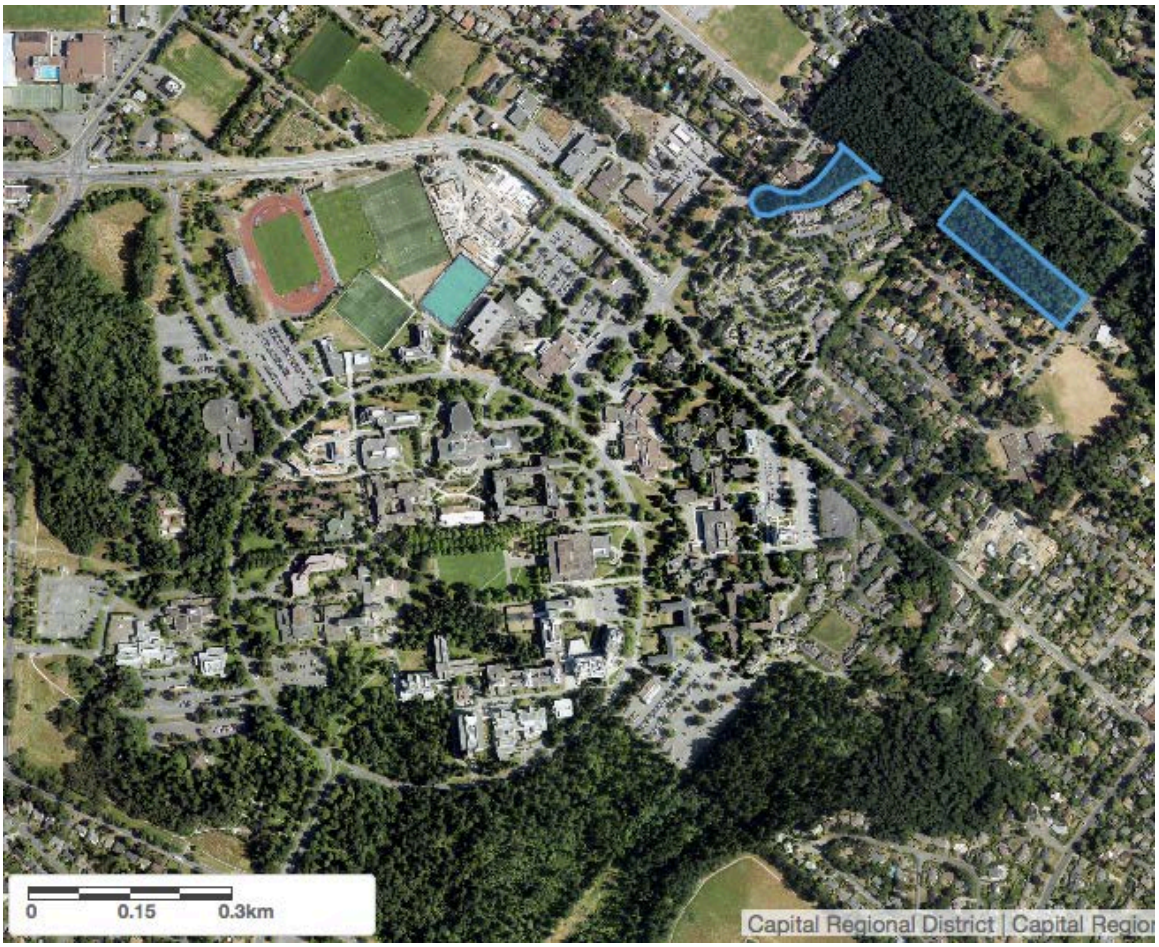


Figure 1. Haro Woods (right) and Finnerty Ravine (left) on the University of Victoria Campus, as indicated by the blue polygons. Source: CRD Webmap. Retrieved August 21, 2016 from https://maps.crd.bc.ca/Html5Viewer/?viewer=public

August 2016

Prepared by Julia Jennings, Lindsay Kathrens & Val Schaefer

Figure 2. Haro Woods (left) and Finnerty Ravine (right). Photos by Lindsay Kathrens.

Site Description

Located at the northeast extent of the University of Victoria campus, a 1.46ha area in the southeastern corner of Haro Woods, and the adjacent Finnerty Ravine exist within University of Victoria property, while the remaining portions of Haro Woods are owned by both the Capital Regional District and the District of Saanich[13]. The University of Victoria owned portion of Haro Woods is protected in perpetuity from development (University of Victoria, 2003). Located within the Coastal Douglas-fir biogeoclimatic zone, this second growth forest area has been given a site series classification of FdPl-Arbutus, and is used heavily by community members for dog walking and mountain biking (Harrop-Archibald, 2008). The University portion of Haro Woods includes Western redcedar (*Thuja plicata*), shore pine (*Pinus contorta,* var. *contorta*), arbutus (*Arbutus menziesii*), and Pacific yew (*Taxus brevifolia*) in the overstory; as well as common snowberry (*Symphoricarpos albus*), Oregon grape (*Mahonia spp.*), and oceanspray (*Holodiscus discolor*) in the understory (Harrop-Archibald, 2008). Finnerty Ravine, which contains Finnerty Creek, is a small gulley primarily dominated by Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), bigleaf maple (*Acer macrophyllum*), and arbutus trees; with a diversity of shrub species and a significant presence of stinging nettle (*Urtica dioica*) and Pacific water parsley (*Oenanthe sarmentosa*) along the creek bed (Harrop-Archibald, 2008)[14].

Actions to Date

Volunteers of the Ecological Restoration Volunteer Network have participated in invasive species removal in portions of Haro Woods and Finnerty Ravine on a number of occasions in the years of 2012-2014. These events have been run through a focus group within the ERVN, organized by RNS student Andrew MacKinnon (see Mackinnon, 2012), and in partnership between the ERVN and University of Victoria Child Care Services to remove invasive and noxious daphne laurel (*Daphne laureola*). For more information on actions to date in this and other areas, see Actions to Date in the ISMS.

[13] For a recent map of property ownership in Haro Woods by the CRD and the District of Saanich, see http://www.saanich.ca/EN/main/parks-recreation-culture/parks/projects-in-saanich-parks/active-projects/haro-woods.html

[14] For a complete list of species found in Finnerty Ravine and Haro Woods as of 2008, see Harrop-Archibald, 2008.

Invasive Species in Haro Woods

Figure 4. Daphne laurel (*Daphne laureola*) (left), and an exotic shrub, possibly cotoneaster (*Cotoneaster spp.*) (middle and right) on the University of Victoria campus. Photos by Lindsay Kathrens & Julia Jennings.

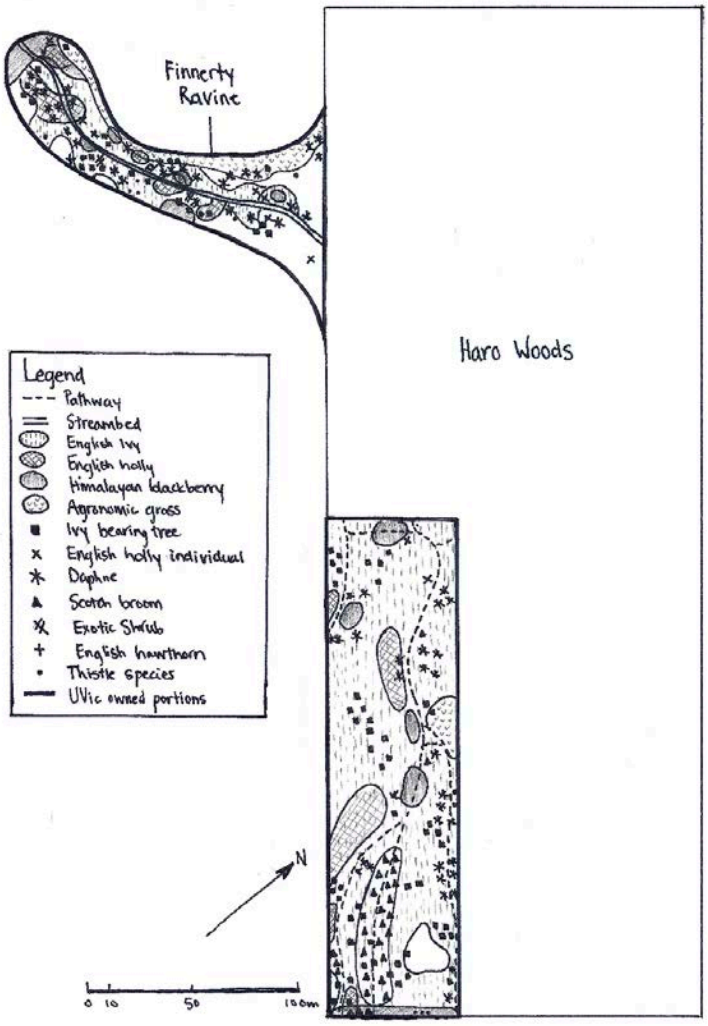


Figure 5. Invasive Species Distribution in Haro Woods and Finnerty Ravine

Several invasive species have been found throughout Haro Woods and Finnerty Ravine, the most predominant of which are daphne laurel, English ivy, English holly, and several stands of Scotch broom in the southeastern portion of Haro Woods. Additionally, several individual exotic shrubs have been identified in Finnerty Ravine and appear to be spreading throughout Haro Woods; these should be taken note of and dealt with in a manner so as to prevent their further spread as their effects on the ecosystem are so far unknown. Figure 5 above demonstrates the distribution and approximate location of invasive species throughout both sections. Invasive species present in Finnerty Ravine and Haro Woods include the following:

Daphne laurel (Daphne laureola): There are many large stands of daphne present in several areas of these woods. Smaller infestations should be identified and removed in order to contain this species, and large individuals removed using loppers and appropriate protective equipment. While efforts at removing daphne have taken place in the past, this task is ongoing and of significant concern due to the forests' adjacency to UVic Child Care Services and the species' noxious character. Volunteers should be well informed about possible health reactions to this species.

English ivy (Hedera helix): English ivy can be found growing along the ground and climbing up trees throughout the woods, however there are several areas that have low density of ivy coverage, or are relatively clear of the species either due to growing conditions or previous removal efforts. Ivy climbing up trees should be a priority for removal to prevent the spreading of seed, followed by the removal of ground ivy surrounding native plants and spreading into new areas, followed by removal of more dense patches. Tree climbing ivy should be cut at chest height and the bottom portion removed from the base of the tree; trees from which ivy has been removed should be marked and continually monitored.

English holly (Ilex aquifolium): There are several dense stands of English Holly in Haro Woods and Finnerty Ravine. Once mature, this species is difficult to remove as it forms a deep taproot; proper removal involves cutting below the root crown. Efforts at removal should focus on small individuals which can easily be removed by hand. The large individuals that exist in this area should be identified and Facilities Management notified, as proper removal will often require the use of machinery by trained staff.

English hawthorn (Crataegus monogyna): Individual hawthorn trees have been found in Finnerty Ravine. Small saplings may be removed by hand, while larger trees which require removal with machinery should be marked and reported to Facilities Management staff.

Himalayan blackberry (Rubus armeniacus): Stands of Himalayan blackberry can be found scattered throughout the woods. Small individuals should be removed completely by hand. For larger stands, canes which pose potential hazards or which are covering native plants should be cut back; following this, roots should be dug up where feasible, with careful attention paid to minimizing soil disturbance. Impassable thickets of Himalayan blackberry may require the use of machinery for removal and should be pointed out to Facilities Management staff.

Scotch broom (Cytisus scoparius) : Large individuals can be found along the eastern edge of Haro Woods, as well as in dense patches and scattered along pathways. This species should be prioritized for early removal as it has the ability to spread very effectively through seed dispersal, alters soil chemistry, and competes with conifer seedlings and other native plants. New infestations should continually be monitored for.

Thistle species (Cirsium spp.): Many individual thistles have been identified along pathways in and edges of Haro Woods and Finnerty Ravine. These should be removed early before going to seed in mid July, and seed heads should be bagged to prevent further spread to other areas or landfills.

Ornamental species: Several ornamental shrub species have been located in the woods; one pervasive species is a potential cotoneaster (*Cotoneaster spp.*). Noting potential exotic species and identifying non-native species is important to early prevention of species invasions; identified individuals should be removed early on as the effects of their spread may be unknown and should be prevented.

Agronomic grasses: Agronomic grasses have been identified in patches both along the northern edge of Finnerty Ravine and in patches in the northern portion of Haro Woods. Agronomic grasses should be identified early and removed, in a manner ensuring the root mass of rhizomatous species is fully removed.

Recommendations

Remove invasive species

Parties engaging in invasive species removal should follow the protocol outlined in the Stewardship Program, Section 3.0. Priorities for invasive species removal should directly follow the CRISP Priority Invasive Plant List, which identifies priority species for control, containment, eradication and prevention (see Reference Document A of the ISMS). Priorities for invasive plant removal in Finnerty Ravine and Haro Woods are as follows:

High Priority	Scotch Broom	Remove all individuals
	Thistle species	Remove all individuals, contain seed heads
	English ivy	Remove tree climbing ivy
	English holly	Remove small individuals
	Daphne laurel	Remove all individuals
	Ornamental species	Remove upon identification
Medium Priority	English ivy	Remove outliers and ivy around existing native plants
	Himalayan blackberry	Remove small individuals & cut back hazardous canes
	English hawthorn	Remove small individuals
	Agronomic grasses	Remove individuals and rhizomes where possible
Low Priority	English ivy	Remove dense ground cover
	Himalayan blackberry	Cut down & dig up roots where feasible
Responsibility of Facilities Management	English holly	Removal of large individuals & dense stands
	Himalayan blackberry	Removal of dense thickets with extensive root systems
	English hawthorn	Removal of large individuals
	Other hazardous species	Removal upon identification

Engage with the Community
Interested members of the University of Victoria and the wider community should be effectively and meaningfully engaged and involved in any efforts to remove invasive species and maintain stewardship of Finnerty Ravine and Haro Woods. For further information on involvement of, and the roles played by members of this community, please refer to Section 3of the ISMS. Particularly in the case of Haro Woods and Finnerty Ravine, it is essential to effectively engage and coordinate with key community members who are or have in the past been involved in the management and stewardship of this area. In particular, coordinating with UVic Child Care Services, the CRD, and the District of Saanich are essential to ensuring effectiveness in managing invasive species in the area.

Monitor the area
Before and after removing invasive species, photos of the site should be taken from the same point. It is advisable that the group participating in invasive species removal on this site return at least two months after initial removal efforts to photograph the site again and assess the immediate effectiveness of these efforts. This will allow for immediate identification of new individuals or species re-colonizing the site, and will contribute to a larger database of photographic evidence for this site. Photos should be shared with the Ecological Restoration Volunteer Network Coordinator to be placed in the appropriate database. Such photo-based, short term monitoring is differentiated from photo point monitoring, which is further addressed in the Invasive Species Management Strategy.

Engage in further study of the area
It is recommended that this site be studied further to update existing information on species presence, hydrological patterns, and other processes. As the water table fluctuates throughout the year and due to the difficulty of identifying particular species during particular seasons, further study should be engaged in at several points throughout the year. Effective study of this area can be achieved particularly through student efforts in existing course work, and as facilitated by instructors in the classroom; for more information on the potential roles played by different stakeholder groups in studying this area, please see Section 3 of the ISMS.

Plant native species
Given ample resources, it is advisable that native species be planted in areas where invasive species have been removed according to the ecological requirements of the site. Planting native species can help speed the process of ecosystem recovery by aiding in re-establishing plant communities. This can also be done as a preventative measure, as it allows for immediate reoccupation of newly opened space which is more susceptible to new invasions if left bare. Further study of these sites are needed to develop an appropriate planting list.

Further Information
For further information on this site, see the following documents, which can be retrieved at web.uvic.ca/~nature/ or can be found in the Restoration of Natural Systems Library:

Harrop-Archibald, H. (January 3, 2008). *University of Victoria Natural Features Study Phase Two: University Cedar Hill Corner Property, Garry Oak Meadow and Camus Meadow Area, Finnerty Ravine, Haro Woods, South Woods, Lower Hobbs Creek/Mystic Vale.* Victoria, BC: University of Victoria, Restoration of Natural Systems Program.

MacKinnon, A. (December 2012) *Restoration of Haro Woods: Designing a Program for University Students to Carry Out On-Campus Restoration.* Prepared for ER 390, Restoration of Natural Systems Program, University of Victoria.

References

Harrop-Archibald, H. (January 3, 2008). *University of Victoria Natural Features Study Phase Two: University Cedar Hill Corner Property, Garry Oak Meadow and Camus Meadow Area, Finnerty Ravine, Haro Woods, South Woods, Lower Hobbs Creek/Mystic Vale.* Victoria, BC: University of Victoria, Restoration of Natural Systems Program.

University of Victoria (2003). *Campus Plan 2003.* Victoria, BC: University of Victoria.

Section 4.8 Vancouver Island Public Interest Research Group Native Plant Garden

Figure 1. The VIPIRG Garden on the University of Victoria campus, as indicated by the blue polygon. Source: CRD Webmap. Retrieved August 21, 2016 from https://maps.crd.bc.ca/Html5Viewer/?viewer=public

September 2016

Prepared by Julia Jennings, Lindsay Kathrens & Val Schaefer

*Figure 2. P*hotos of site (Clockwise from Right : Previously removed site around perimeter of the garden, Entrance Path to the garden, Woodland strawberry (*Frageria vesca*) located in the garden.

Site Description

The VIPIRG Native plant garden is located in the southwest corner of the campus within Ring Road, adjacent to Cunningham Woods. This area was originally named "The MacLaurin Wetlands", as the site houses two ponds. The site was re-named the "VIPIRG Garden" in 2011. Formerly the site of the original Finnerty Gardens, which are now situated across Ring Road from the site, this garden was established with the intent of reinstating native plant communities in a demonstration garden with edible and medicinal plants.

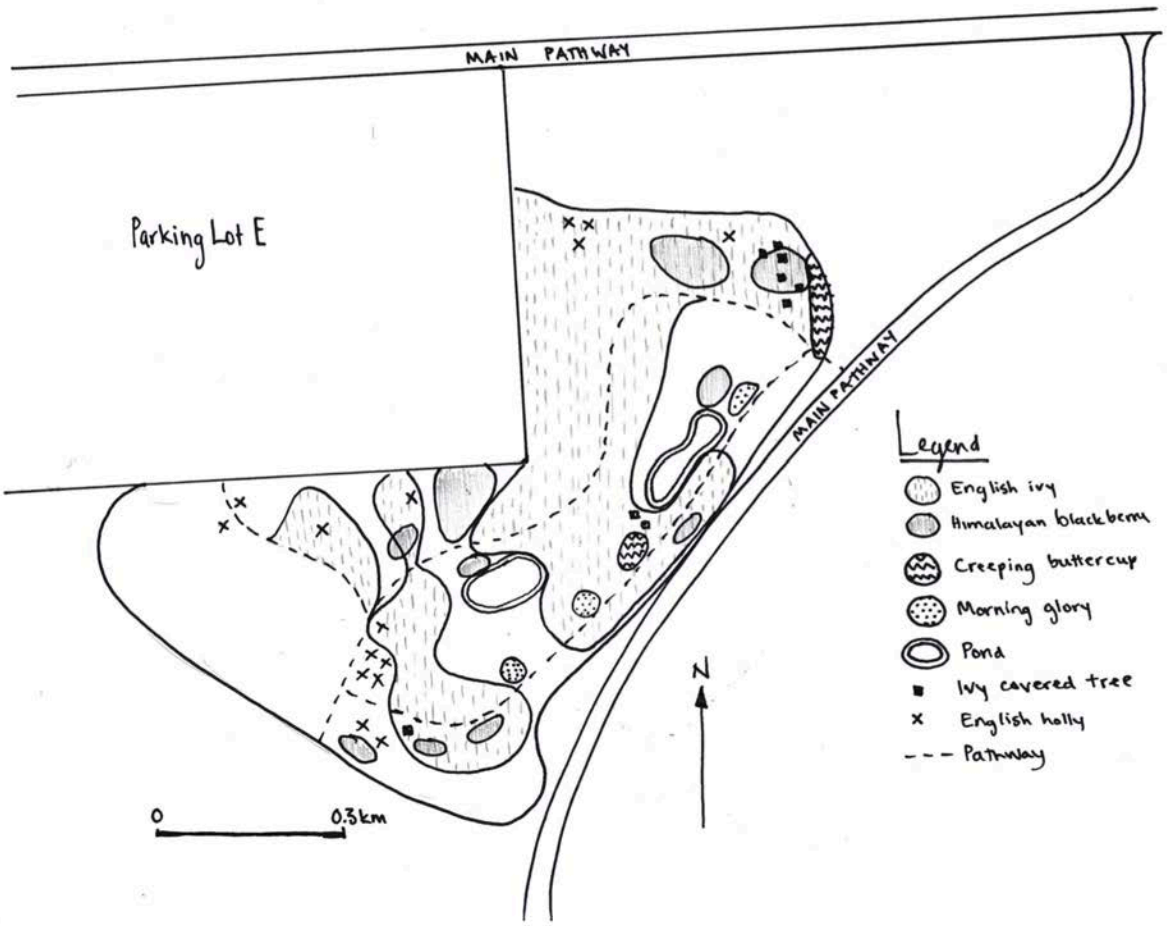
Actions to Date

The VIPIRG native plant garden was established in 1993 by the VIPIRG Native Vegetation Committee, as a project to demonstrate natural forest ecology on the University of Victoria campus and provide a space for users of the campus to relax (Jewenski, 2012). The Native Vegetation Committee ceased work in the gardens after a number of years, and efforts were made to revive a VIPIRG Native Plant Working Group in 2011. The group was intent on "focusing on pulling invasive plant species and planting native plants at the Native Plant Garden beside Maclaurin Building, at UVic in the homelands of the Lekwungen Peoples…working with facilities management around removing ivy and other invasive plant species, focusing on reinstating plants that are useful for Lekwungen families, and looking into using the garden as an education tool, an informal native plant 'nursery', and an example of what restoration can look like" (Jewenski, 2012). However, the garden has since been largely unattended by its original stewards and is now maintained by Facilities Management staff.

Invasive Species in the VIPIRG Gardens

Figure 3. English ivy (*Hedera helix*) (top left), Himalayan blackberry (*Rubus armeniacus*) (top right), English holly (*Ilex aquifoliujm*) (bottom left), and morning glory (bottom right) on the University of Victoria campus. Photos by Lindsay Kathrens & Julia Jennings.

Figure 4. Invasive Species Distribution in the VIPIRG Gardens



Several invasive species are moving into the VIPIRG Gardens from surrounding areas due to a lack of continuous management of the site. Figure 4 above demonstrates the distribution of these species as of August 2016, which are listed below:

Common morning glory (Calystegia sepium): One large individual and one smaller individual have been found climbing up a tree near to the secondary pond at this site. This species has creeping roots and a seedbank that can persist for up to 30 years (Invasive Species council of British Columbia 2014). Since these infestations are relatively small, they should be prioritized so that this species does not spread into other natural areas on campus.

English ivy (Hedera helix): Several large, dense patches of English ivy can be found throughout the site. There is an area along the northern border of the site which may have been cleared previously, however no information regarding these activities has been found to date. Ivy growing up trees and shrubs should be removed immediately to prevent the spread of seed; this ivy should be cut at chest height and the bottom portion removed from the base of the tree; trees from which ivy has been removed should be marked and continually monitored. This should be followed by ivy growing along the ground.

English holly (Ilex aquifolium): A few small English holly individuals have been found in these gardens, and should be removed immediately to prevent growth into larger, less manageable individuals.

Himalayan blackberry (Rubus armeniacus): Several small individuals, as well as one large stand bordering Parking Lot E, are present in the VIPIRG Gardens. Smaller individuals should be removed completely by hand. For larger stands, canes which pose potential hazards or which are covering native plants should be cut back; following this, roots should be dug up where feasible with careful attention paid to minimizing soil disturbance. Impassable thickets of Himalayan blackberry may require the use of machinery for removal and are the responsibility of Facilities Management staff.

Creeping buttercup (Ranunculus repens): Creeping buttercup is an non-native Ranunculus that often colonizes grassy areas or newly disturbed sites, making it difficult to contain. This species is rhizomatous and forms thick carpets over soils (King County 2016). Where possible, rhizomes should be removed and smaller patches should be targeted before large ones.

Yellow flag iris (Iris pseudacorus): A potential individual Yellow Flag Iris has been found at the in this site. Vegetative surveying should be done in this area to confirm this identification and ensure no other individuals are spreading. This species should be a priority for removal.

Agronomic grasses: Agronomic grasses spreading from neighboring lawns on campus should be identified early and removed, ensuring the root mass of rhizomatous species is fully removed.

Recommendations

Remove invasive species

Parties engaging in invasive species removal should follow the protocol outlined in the Stewardship Program, Section 3.0. Priorities for invasive species removal should directly follow the CRISP Priority Invasive Plant List, which identifies priority species for control, containment, eradication and prevention (see Reference Document A of the ISMS). Priorities for invasive plant removal in the VIPIRG Gardens are as follows:

High Priority	Morning Glory	CRISP listed for containment; eradicate immediately upon identification.
	St. John's Wort (Aarons beard)	Remove all individuals by hand pulling, monitor for new infestations
	Thistle species	Remove all individuals, contain seed heads
	English ivy	Remove tree climbing ivy
	English holly	Remove small individuals
	Agronomic grasses	Remove all small infestations
Medium Priority	English ivy	Remove outliers and ivy around existing native plants
	Himalayan blackberry	Remove small individuals &

		cut back hazardous canes
Low Priority	English ivy	Remove dense ground cover
	Himalayan blackberry	Cut down & dig up roots where feasible
	Creeping buttercup	Remove new growth, moving into dense patches where possible. Remove rhizomatous roots where possible.
Responsibility of Facilities Management	English holly	Removal of large individuals & dense stands
	Himalayan blackberry	Removal of dense thickets with extensive root systems
	Noxious species	Removal upon identification

Engage with the Community
Interested members of the University of Victoria and the wider community should be effectively and meaningfully engaged and involved in any efforts to remove invasive species and maintain stewardship of the VIPIRG Garden. VIPIRG and Facilities Management should be engaged in any efforts in this particular site given their role as stewards of the garden. For further information on involvement and the roles played by members of this community, please refer to Section 3.

Monitor the area
Before and after removing invasive species, photos of the site should be taken from the same point. It is advisable that the group participating in invasive species removal on this site return at least two months after initial removal efforts to photograph the site again and assess the immediate effectiveness of these efforts. This will allow for immediate identification of new individuals or species re-colonizing the site, and will contribute to a larger database of photographic evidence for this site. Photos should be shared with the Ecological Restoration Volunteer Network Coordinator to be placed in the appropriate database. Such photo-based, short term monitoring is differentiated from photo point monitoring, which is further addressed in the Invasive Species Management Strategy.

Engage in further study of the area
It is recommended that this site be studied further to update existing information on species presence, hydrological patterns, and other processes. As the water table fluctuates throughout the year and due to the difficulty of identifying particular species during particular seasons, further study should be engaged in at several points throughout the year. Effective study of this area can be achieved particularly through student efforts in existing course work, and as facilitated by instructors in the classroom; for more information on the potential roles played by different stakeholder groups in studying this area, please see Section 3.

Plant native species
Given ample resources, it is advisable that native species be planted in areas where invasive species have been removed according to the ecological requirements of the site. Planting native species can help speed the process of ecosystem recovery by aiding in re-establishing plant communities. This can also be done as a preventative measure, as it allows for immediate reoccupation of newly opened space which is more susceptible to new invasions if left bare. It is recommended that the original intent behind the VIPIRG Gardens be reflected in new plantings of native species. Plantings

should be discussed with and approved by Facilities Management staff. See Appendix A for a list of recommended native species for planting in this site.

Further Information

For further information on this site, see the following document, which can be retrieved at web.uvic.ca/~nature/ or can be found in the Restoration of Natural Systems Library:

> Harrop-Archibald, H. (May 31, 2007). *University of Victoria Natural Features Study: Bowker Creek, Cunningham Woods, Upper Hobbs Creek/Mystic Vale.* Victoria, BC: University of Victoria, Restoration of Natural Systems Program.

References

Invasive Species Council of British Columbia (2014) *Key Horticulturally Invasive Plants*. Common Morning Glory. Retrieved September 1, 2016 from http://bcinvasives.ca/resources/programs/plant-wise/key-horticulturally-invasive-plants/

Jewenski, M. (2012) *Campus Native Plant Garden Working Group*. Vancouver Island Public Interest Research Group. Retrieved September 1, 2016 from http://www.vipirg.ca/2012/01/campus-native-plant-garden/

Stapleton, A. (2015). *A Biophysical Inventory of the Lorene Kennedy Native Plant Garden*. University of Victoria Restoration of Natural Systems. Retrieved September 1st 2016 fromhttps://dancingwiththewinddotco.files.wordpress.com/2015/12/er312a-final-paper-astapleton.pd

Appendix A: Suggested Species for Planting in the VIPIRG Garden

Species planted in this site should be chosen based on their suitability to the specific conditions of the site, already existing species on campus (see Appendix A: UVic Vascular Plant Species in Harrop-Archibald, 2007, p.52) and in consideration of their tolerance to drought, disturbance, and browsing. Recommended species for planting in place of English ivy include: salal, deer fern and Western trumpet honeysuckle. (Stapleton,2015) Recommended species for planting in place of Himalayan blackberry include Nootka rose, thimbleberry and salmonberry (Stapleton, 2015) Various sourcing methods should be considered, as well as both financial, temporal, and watering constraints. Participants in restoration may choose to plant species in the given site based on desired uses or a chosen theme; themes may include ethnobotanical or medicinal uses, therapeutic gardens, or pollinator attraction. For further guidance on choosing native species to plant, see 'Resources' at web.uvic.ca/~nature as well as the following resources:

Native Plants in the Coastal Garden: A Guide for Gardeners in the Pacific Northwest by April Pettinger & Brenda Costanzo

Gardening with Native Plants of the Pacific Northwest by Arthur R. Kruckeberg

Propagation of Pacific Northwest Native Plants by Robin Rose, E.C. Chachulski, & Diane L. Haas

Section 4.9 Lorene Kennedy Garden

Figure 1. The Lorene Kennedy Garden, located in the northwest quadrant of the University of Victoria campus (top), to the south of the Sedgewick Buildings, and to the north of the Hickman Building (bottom). Source: CRD Webmap. Retrieved July August 21, 2016 from https://maps.crd.bc.ca/Html5Viewer/?viewer=public

August 2016

Prepared by Julia Jennings, Lindsay Kathrens & Val Schaefer

Figure 2. The center portion of the Lorene Kennedy Memorial Garden (left), and a commemorative plaque in the garden (right). Photos by Julia Jennings.

Site Description

The Lorene Kennedy Garden was established in 2003 in memorial of Dr. Lorene Kennedy. Dr. Kennedy, a botanist who made significant contributions to the University of Victoria's School of Environmental Studies; today, the Lorene Kennedy bursary allows numerous environmental studies students access to experiential learning opportunities in field schools. The garden is located in the courtyard between the Sedgewick and Harry Hickman buildings in the northwest corner of the University of Victoria campus, within Ring Road. This native plant garden consists of several tree, some shrub, and several herbaceous layer species, and was planted largely with a focus on edible native plants. In the past this garden included many more rare and native species than are now present. Dr. Nancy Turner reminisces of a black twinberry (*Lonicera involucrate*) bush that she used to show her student. However, due to mismanagement and deer browsing this plant no longer exists (Turner, N.J. 2016, P.C.)

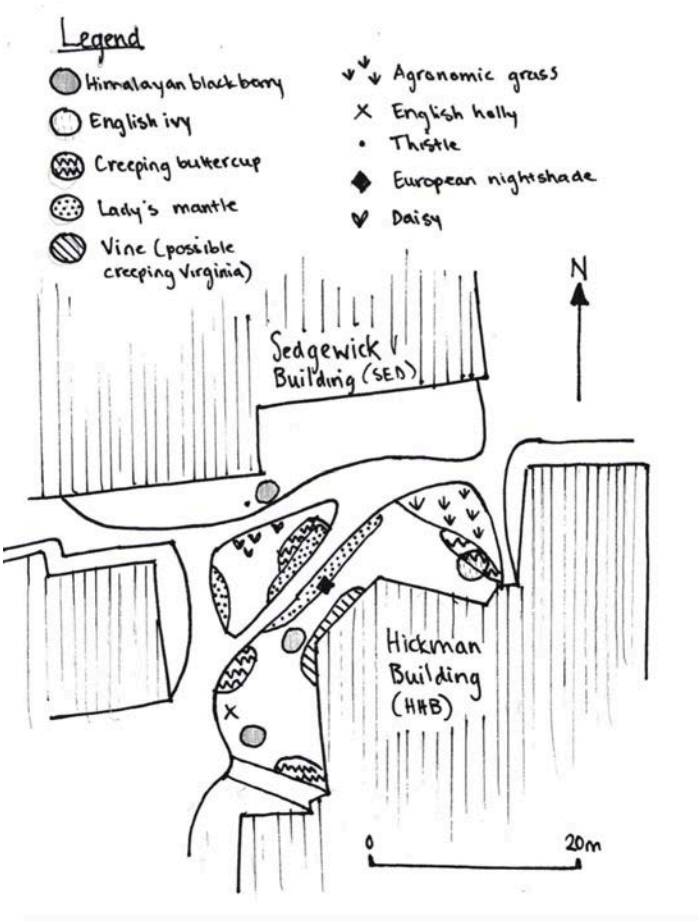
Actions to Date

This area is currently managed by Facilities Management staff, and though some student projects conducted in Environmental Studies 341: Ecological Restoration focus on the site, little documentation exists regarding involvement with this area by any other group.

Invasive & Exotic Species in the Lorene Kennedy Garden

Figure 3. Several exotic species are found in this garden; pictured here are an unidentified climbing vine (left), European nightshade (*Solanum negrum*) (middle), and lady's mantle (*Alchemilla vulgaris*) (right). Photos by Julia Jennings.

Figure 4. Invasive Species Distribution in Lorene Kennedy Garden



Several invasive species have been observed in this site; however, these infestations are small and can be easily managed if responded quickly. The most predominant species are exotic herbaceous and shrub species. Figure 4 above demonstrates the extent of observed invasive and exotic species in this site. They include the following:

Creeping buttercup (Ranunculus repens): Creeping buttercup is an introduced Ranunculus that often colonizes grassy areas or newly disturbed sites, making it difficult to contain. This species is rhizomatous and forms thick carpets over soils (King County 2016). Where possible, rhizomes should be removed and smaller patches should be targeted before large ones.

English ivy (Hedera helix): English ivy can be found in a single small patch in the south west portion of the garden near the Hickman building. This ivy should be removed immediately to prevent a larger infestation.

English holly (Ilex aquifolium): Some small English holly individuals can be found scattered throughout the garden. Once mature, this species is difficult to remove as it forms a deep taproot; proper removal of larger individuals involves cutting below the root crown or removing. Small individuals should be removed entirely and early.

English hawthorn (Crataegus monogyna): Some small individuals have been identified in the garden. Small saplings may be removed by hand, and monitoring for new individuals should continue following this.

Himalayan blackberry (Rubus armeniacus): Several small individuals have been found in the garden, usually interspersed with shrub species. Small individuals should be removed completely by hand, using secateurs to cut down larger stalks if possible.

Thistle (Cirsium spp.): Thistles have been identified in the garden and should be removed early and completely to prevent their spread through root and seed dispersal. Thistles usually go to seed in early to mid-July, but individuals should be monitored due to changing phenology. Seed heads should be removed and bagged to take to the landfill, preventing further spread. Thistles identified to date in the Lorene Kennedy Garden include Canada thistle (*Cirsium arvense*) and bull thistle (*Cirsium vulgare*), though all identified thistle species should be promptly removed.

Agronomic grasses: Agronomic grasses spreading from neighboring lawns on campus should be identified early and removed, ensuring the root mass of rhizomatous species is fully removed.

Ornamental species: Several ornamental species have been located in the garden including Shrubby cinquefoil (*Dasiphora fruiticosa*), lady's mantle (*Alchemilla vulgaris*), European nightshade (*Solanum negrum*), as well as other unidentified exotic species. Noting potential exotic species and identifying non-native species is important to early prevention of species invasions. Further study of the area should be undertaken to determine further action to be taken regarding these exotic species.

Recommendations

Remove invasive species

Parties engaging in invasive species removal should follow the protocol outlined in the Stewardship Program, Section 3.0. Priorities for invasive species removal should directly follow the CRISP Priority Invasive Plant List, which identifies priority species for control, containment, eradication and prevention (see Reference Document A of the ISMS). Priorities for invasive plant removal in the Lorene Kennedy Garden are as follows:

High Priority	Thistle species	Remove all individuals, contain seed heads
	English ivy	Remove tree climbing ivy
	English holly	Remove small individuals
Medium Priority	Himalayan blackberry	Remove small individuals & cut back hazardous canes
	English hawthorn	Remove small individuals
	Ornamental and exotic species	Remove all individuals

Low Priority	Agronomic grasses	Remove all individuals
Responsibility of Facilities Management	Noxious species	Removal upon identification

Engage with the Community
Interested members of the University of Victoria and the wider community should be effectively and meaningfully engaged and involved in any efforts to remove invasive species and maintain stewardship of the Lorene Kennedy Garden. Given that Lorene Kennedy played, and continues to play such an important role in the student experience in the School of Environmental Studies, and given the focus this area takes on edible native plants, this site provides a valuable learning and stewardship opportunity if connected to Environmental Studies course work. For further information on involvement and the roles played by members of this community, please refer to Section 3of the ISMS.

Monitor the area
Before and after removing invasive species, photos of the site should be taken from the same point. It is advisable that the group participating in invasive species removal on this site return at least two months after initial removal efforts to photograph the site again and assess the immediate effectiveness of these efforts. This will allow for immediate identification of new individuals or species re-colonizing the site, and will contribute to a larger database of photographic evidence for this site. Photos should be shared with the Ecological Restoration Volunteer Network Coordinator to be placed in the appropriate database. Such photo-based, short term monitoring is differentiated from photo point monitoring, which is further addressed in the Invasive Species Management Strategy.

Engage in further study of the area
It is recommended that this site be studied further to update existing information on species presence, hydrological patterns, and other processes. Study should be engaged in at several times of year to account for seasonal changes in conditions. Effective study of this area can be achieved particularly through student efforts in existing course work, and as facilitated by instructors in the classroom; for more information on the potential roles played by different stakeholder groups in studying this area, please see Section 3 of the ISMS.

Plant native species
Given ample resources, it is advisable that native species be planted in areas where invasive or undesirable exotic species have been removed, in accordance with the ecological requirements of the site. Further assessment of the site, in addition to consultation with Facilities Management staff should be undertaken prior to choosing native plants to replace removed plants with. A recommended planting list can be found in Stapleton's Biophysical Inventory, below (Stapleton 2015). Further references found in Appendix A.

Further Information
For further information on this site, see the following documents, both of which can be retrieved at web.uvic.ca/~nature/

> Restoration Design Projects for ES 341, available at web.uvic.ca/~nature/ and at https://www.uvic.ca/socialsciences/environmental/undergraduate/courses/index.php under the ES341 tab:

- Brubacher, J., Hodges, K., Gates, K. & Vincete, M. (2009). *The Lorene Kennedy Garden: Back to the Basics.*

References

Stapleton, A. (2015). *A Biophysical Inventory of the Lorene Kennedy Native Plant Garden*. University of Victoria Restoration of Natural Systems. Retrieved September 1st 2016 fromhttps://dancingwiththewinddotco.files.wordpress.com/2015/12/er312a-final-paper-astapleton.pdf

King County (2016) *Creeping buttercup.* Noxious weeds, King County, Washington. Retrieved September 1, 2016 from http://www.kingcounty.gov/environment/animals-and-plants/noxious-weeds/weed-identification/creeping-buttercup.aspx

Appendix A: Suggested Species for Planting in the Lorene Kennedy Garden

Species planted in this site should be chosen based on their suitability to the specific conditions of the site, already existing species on campus (see Appendix A: UVic Vascular Plant Species in Harrop-Archibald, 2007, p.52) and in consideration of their tolerance to drought, disturbance, and browsing. Various sourcing methods should be considered, as well as both financial, temporal, and watering constraints. The Lorene Kennedy Garden was designed to demonstrate primarily edible native plants; this theme should be followed and the original intent of the garden discussed with Facilities Management before native plants are chosen. For further guidance on choosing native species to plant, see 'Resources' at web.uvic.ca/~nature/ as well as the following resources:

Native Plants in the Coastal Garden: A Guide for Gardeners in the Pacific Northwest by April Pettinger & Brenda Costanzo

Gardening with Native Plants of the Pacific Northwest by Arthur R. Kruckeberg

Propagation of Pacific Northwest Native Plants by Robin Rose, E.C. Chachulski, & Diane L. Haas

Section 4.10 Ian Ross Memorial Garden

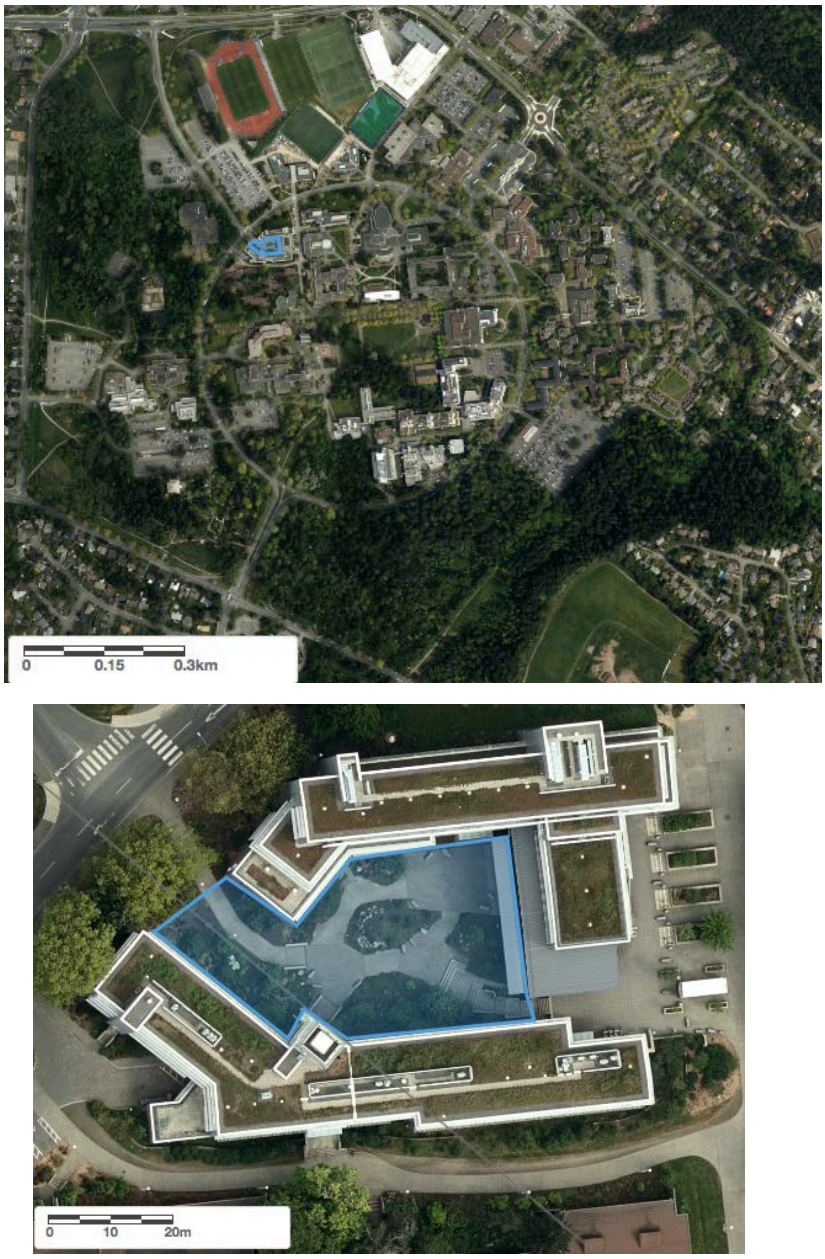


Figure 1. The Ian Ross Memorial Garden, as it is situated on the University of Victoria campus (above), and within the David Turpin Building courtyard (below). Source: CRD Webmap. Retrieved July 17, 2016 from https://maps.crd.bc.ca/Html5Viewer/?viewer=public

August 2016

Prepared by Julia Jennings, Lindsay Kathrens & Val Schaefer

Figure 2. The Ian Ross Memorial Garden within the David Turpin Building courtyard (left), a commemorative plaque (middle), and a portion of the LEED Certified drainage system in the courtyard (right). Photos by Julia Jennings.

Site Description

Located in the northwestern portion of campus, within Ring Road, and in the courtyard of the David Turpin Building, the Ian Ross Memorial Garden was installed in commemoration of Ian Ross, a former owner of Butchart Gardens and supporter of the university (Schaefer & Miles, 2013; University of Victoria, 2008). The garden also acts as a key component of the Leadership in Energy and Environmental Design (LEED) certified David Turpin Building with which is it integrated; the A Wing is situated to the north of the courtyard, and the B Wing to the south (University of Victoria, 2016). Built on a former parking lot, the gardens were established with the intent of integrating several 'mini ecosystems' ranging from forest and meadow to riparian and wetland, in addition to a green roof (see Appendix B for the original garden plan) (Department of Environmental Studies, n.d.; Huggins, 2016). While the area contains many food plants and native species, and demonstrates relatively functional site hydrology, it does not fully demonstrate its originally intended structure and composition (Huggins, 2016). This is in part due to changes made in the landscape plan after the original proposal was made. Due to lack of management capacity, lack of watering in an irrigation-free site, deer browsing, and other barriers related to the small size of the site such as impervious surfaces and higher soil temperatures, a large number of plants intended to be present in the area are not currently present, and many native plants are either dead or dying (Huggins, 2016). Thus, plant diversity has declined significantly in the area since the garden's original establishment.

Figure 3. Original layout of the gardens surrounding the David Turpin Building. For more information on these landscape components, see Huggins, 2016. Source: Huggins, 2016, p.3.

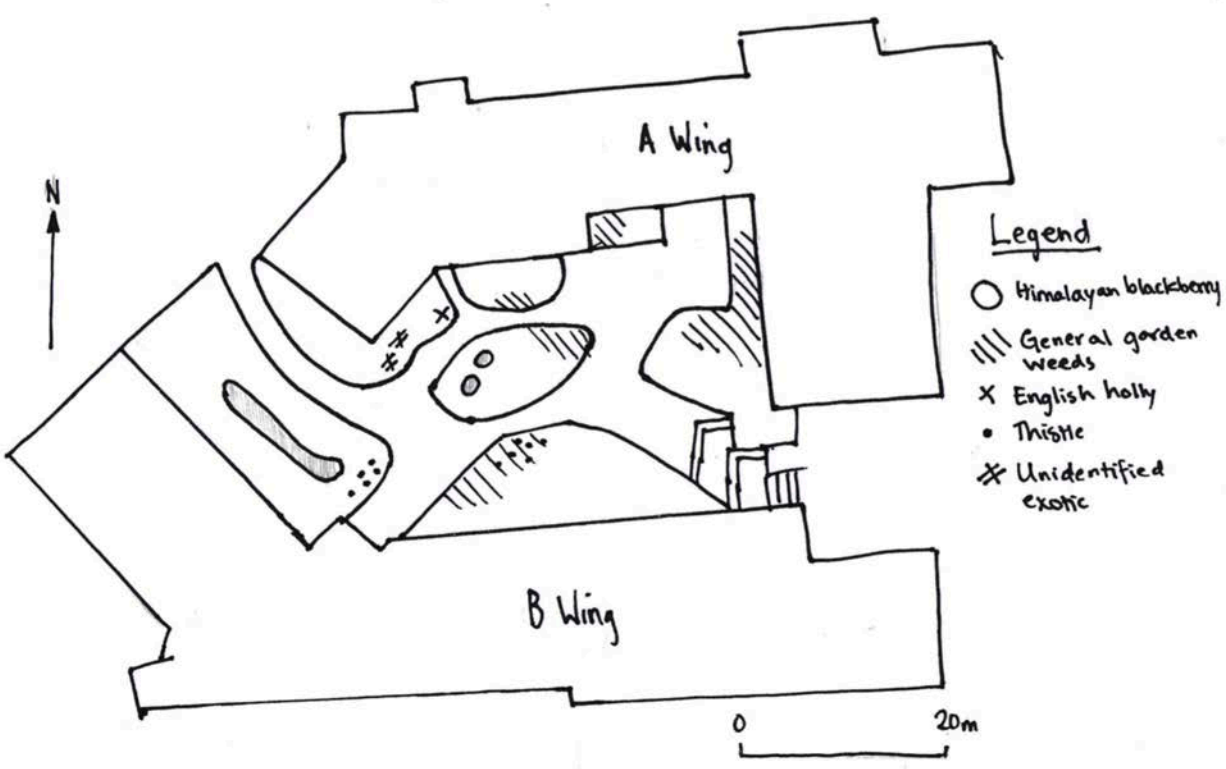
Actions to Date

Since its original establishment in 2008, the Ian Ross Memorial Garden has seen little follow-up activity from the University of Victoria community (Huggins, 2016). The area continues to be managed by a small group of Facilities Management staff who do not have the capacity to manage the area to the required extent (R. Rose, personal communication, July 14, 2016). One student project conducted by Adam Huggins in 2016 has provided updated information on the current state of the gardens, and recent public engagement conducted by Adam Huggins and Heyone Park (2016) through a feasibility study of edible landscapes on the University of Victoria campus has demonstrated that interest in increasing the management capacity for the gardens exists within the community.

Invasive Species in the Ian Ross Memorial Garden

Figure 4. Himalayan blackberry (*Rubus armeniacus*) (left), and Canada thistle (*Cirsium arvense*) (right). Photos by Lindsay Kathrens (left) and Julia Jennings (right).

Figure 5. Invasive Species Distribution in the Ian Ross Memorial Garden



Recent study conducted by Huggins (2016) found a significant presence of "over 30 introduced species" (p.4). Survey in August of 2016 found a presence of both Himalayan blackberry (*Rubus armeniacus*) and thistle species (*Cirsium spp.*), as well as several exotic species. Figure 5 above demonstrates the distribution of introduced species within the David Turpin courtyard. Notable invasive species found in this site include the following:

Himalayan blackberry (Rubus armeniacus): Large stands of Himalayan blackberry can be found along the outer edges of Cunningham Woods, with smaller stands scattered throughout. Small individuals should be removed completely by hand. For larger stands, canes which pose potential hazards or which are covering native plants should be cut back; following this, roots should be dug up where feasible with careful attention paid to minimizing soil disturbance. Impassable thickets of Himalayan blackberry may require the use of machinery for removal and are the responsibility of Facilities Management staff.

Thistle (Cirsium spp.): Many individual thistles have been identified in open areas throughout Cunningham Woods and should be removed early and completely to prevent their spread through root and seed dispersal. Flowering portions should be removed before going to seed and seed heads bagged as a preventative measure. Thistles identified to date in Cunningham Woods include Canada thistle (*Cirsium arvense*) and bull thistle (*Cirsium vulgare*), though all identified thistle species should be promptly removed.

Recommendations

Remove invasive and exotic species

Parties engaging in invasive species removal should follow the protocol outlined in the Stewardship Program, Section 3.0. Priorities for invasive species removal should directly follow the CRISP Priority Invasive Plant List, which identifies priority species for control, containment, eradication and prevention (see Reference Document A of the ISMS). Priorities for invasive plant removal in the Ian Ross Memorial Garden are as follows:

High Priority	Thistle species	Remove all individuals, contain seed heads
Medium Priority	Himalayan blackberry	Remove small individuals & cut back hazardous canes
	Other exotic species	Identify and remove all individuals where possible
Responsibility of Facilities Management	Himalayan blackberry	Removal of large individuals & dense stands
	Other hazardous species	Removal upon identification

Engage with the Community

Interested members of the University of Victoria and the wider community should be effectively and meaningfully engaged and involved in any efforts to remove invasive species and maintain stewardship of the Ian Ross Memorial Garden. In particular, the School of Environmental Studies, the Department of Geography, the Environmental Studies Students' Association (ESSA), the Society of Geography Students (SOGS), and other stakeholder groups based out of the David Turpin Building should be engaged and communicated with regarding this site. Additionally, members of the University of Victoria community involved in the Edible Campus initiative have expressed interest in bolstering stewardship for this area, and demonstrate a valuable opportunity for partnership. For further information on involvement and the roles played by members of the University of Victoria community, please refer to Section 3 of the ISMS.

Monitor the area
A strong recommendation for a monitoring strategy to be put in place for this site has been made, as a means of achieving the proposed goals for the site set out by Huggins (2016). In general, photos of the site should be taken from the same point before and after invasive species removal. It is advisable that the group participating in invasive species removal on this site return at least two months after initial removal efforts to photograph the site again and assess the immediate effectiveness of these efforts. This will allow for immediate identification of new individuals or species re-colonizing the site, and will contribute to a larger database of photographic evidence for this site. Photos should be shared with the Ecological Restoration Volunteer Network Coordinator to be placed in the appropriate database. Such photo-based, short term monitoring is differentiated from photo point monitoring, which is further addressed in the Invasive Species Management Strategy.

Engage in further study of the area
It is highly recommended by the authors of this document, and by Huggins (2016) that further biological and other forms of survey take place on this site at various times of year, and on a continual basis. Further observation of this site through various seasons provides the potential to broaden the knowledge base surrounding this area, and develop a deeper understanding of the benefits, outcomes, and constraints involved in small scale urban restoration projects (Huggins, 2016). Effective study of this area can be achieved particularly through student efforts in existing course work, and as facilitated by instructors in the classroom; such course based involvement on this site provides an especially feasible and valuable learning opportunity, given its location and the intention behind its establishment as a demonstration garden. For more information on the potential roles played by different stakeholder groups in studying this area, please see 3.

Plant native species
Given ample resources, it is advisable that native species be planted in areas where invasive species have been removed according to the ecological requirements of the site, as well as throughout the site where native species have not survived. It is recommended that the original plan be revised and reworked with due consideration of observed barriers to native plant survival in this garden. Huggins (2016) also recommends the installation of deer fencing in the area to prevent further browsing of native and food bearing plant species; this should be taken into consideration when planning new plantings in the area. See Appendix A for a list of recommended references for developing a species list for this site.

Further Information
For further information on this site, see the following documents, which can be retrieved at web.uvic.ca/~nature/:

Huggins, A. (2016). *Case Study: Landscape of the David Turpin Building at UVic.* Prepared for Dr. Richard Hebda, ER 311. University of Victoria. [unpublished]

Huggins, A. & Park, H. (2016). *Edible Landscapes on the UVic Campus.* Victoria, BC: University of Victoria, Office of Campus Planning & Sustainability.

References

Huggins, A. (2016). *Case Study: Landscape of the David Turpin Building at UVic.* Prepared for Dr. Richard Hebda, ER 311. University of Victoria.[unpublished]

Huggins, A. & Park, H. (2016). *Edible Landscapes on the UVic Campus.* Victoria, BC: University of Victoria, Office of Campus Planning & Sustainability.

Schaefer, V. & Miles, J. (2013). *Restoration Walks in Victoria: A Guide to Several Ecological Restoration Projects in Greater Victoria, BC.* Victoria, BC: University of Victoria. Retrieved July 8, 2016 from https://www.uvic.ca/socialsciences/environmental/assets/docs/RestorationWalksInVictoria.pdf

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University of Victoria (2016). *University of Victoria Campus Plan*. University of Victoria Office of Campus Planning & Sustainability. Retrieved May 23, 2016 from http://www.uvic.ca/campusplanning/assets/docs/Campus-Plan-Update-2015/UVicCampusPlan.01.26.2016reduced.pdf

Appendix A: Suggested Species for Planting in Ian Ross Memorial Garden

Species planted in this site should be chosen based on their suitability to the specific conditions of the site, already existing species on campus (see Appendix A: UVic Vascular Plant Species in Harrop-Archibald, 2007, p.52) and in consideration of their tolerance to drought, disturbance, and browsing. In this particular site, original intended vegetative structures and their observed barriers should be considered when planning new plantings in each section. Various sourcing methods should be considered, as well as both financial, temporal, and watering constraints. For further guidance on choosing native species to plant, see [resources → native species plantings at ERVN website], as well as the following resources:

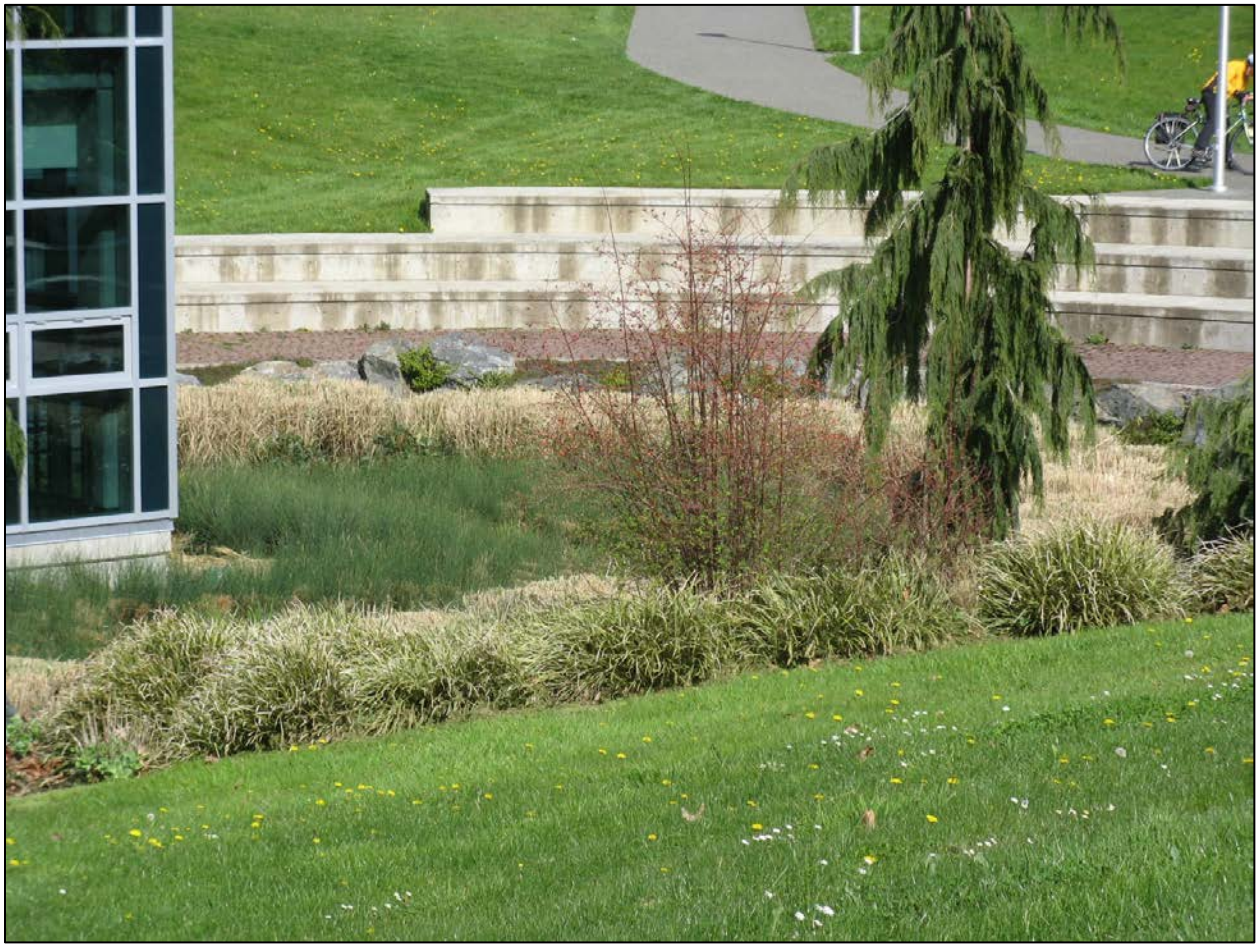
Native Plants in the Coastal Garden: A Guide for Gardeners in the Pacific Northwest by April Pettinger & Brenda Costanzo

Gardening with Native Plants of the Pacific Northwest by Arthur R. Kruckeberg

Propagation of Pacific Northwest Native Plants by Robin Rose, E.C. Chachulski, & Diane L. Haas

Appendix B: Original Plans for Social Sciences & Mathematics (David Turpin) Building Gardens

Section 4.11 Rain Gardens



August 2016

Prepared by Julia Jennings, Lindsay Kathrens & Val Schaefer

In undeveloped landscapes rain percolates into the ground and the water is stored in the ground to add to stream flows. However, cities replace vegetation with large areas of roads and rooftops. The increased stormwater runoff from these impervious surfaces, that average 30% and are as high as 95% in downtown cores, create challenges for existing storm drains. The problem is intensified when cities densify, when storm drains in a neighbourhood may have to accommodate the runoff from more than twice the impervious surface they were designed to serve. Increasing the capacity of the infrastructure by installing larger pipes is prohibitively expensive. An alternative approach to dealing with increased stormwater runoff is to prevent the water from entering the pipes in the first place – to have it infiltrate into the ground instead (Orr et al. 2015).

Rain gardens can accommodate some of the increased volumes of stormwater and can reduce loading in the stormdrain system. Rain gardens occur in a wide range of sizes and shapes. Although the primary role of rain gardens is to reduce loading in storm drains they can also be developed as community assets. They can be incorporated into the curriculum if they are at a university. With some additional planning the vegetation used to landscape a rain garden could be designed to maximize biodiversity. Also, rain gardens can play a role in removing toxins from stormwater runoff and keep them from entering the receiving waters of streams or oceans into which the stormdrains flow. Rain gardens can be especially important in dealing with pollutants during a "first flush", a rain event that occurs after a prolongued dry period when oils, chemicals and pet waste accumulate on roads and are in especially high concentrations in the runoff (Orr et al. 2015).

On campus we find rain gardens at the corner of McKenzie and McGill, and at the new addition to the MacPhearson Library. Invasive species such as thistle are beginning to appear in these new plantings and early removal of the invasives when they appear will prevent bigger problems later.

Mckenzie Avenue Rain Garden

The Mckenzie Avenue Rain garden is located on the corner of McGill Road and Mackenzie Avenue. This garden is split into two sections by a diagonal path running through the centre. This area is bordered by McKenzie avenue to the north, McGill Road to the west and grassy areas to the south and east. This area is a medium sized Roadside Rain Garden which includes an overflow drain (Figure 1). This type of rain garden holds medium biodiversity value, medium storage capacity and medium infiltration (Orr et al. 2015).

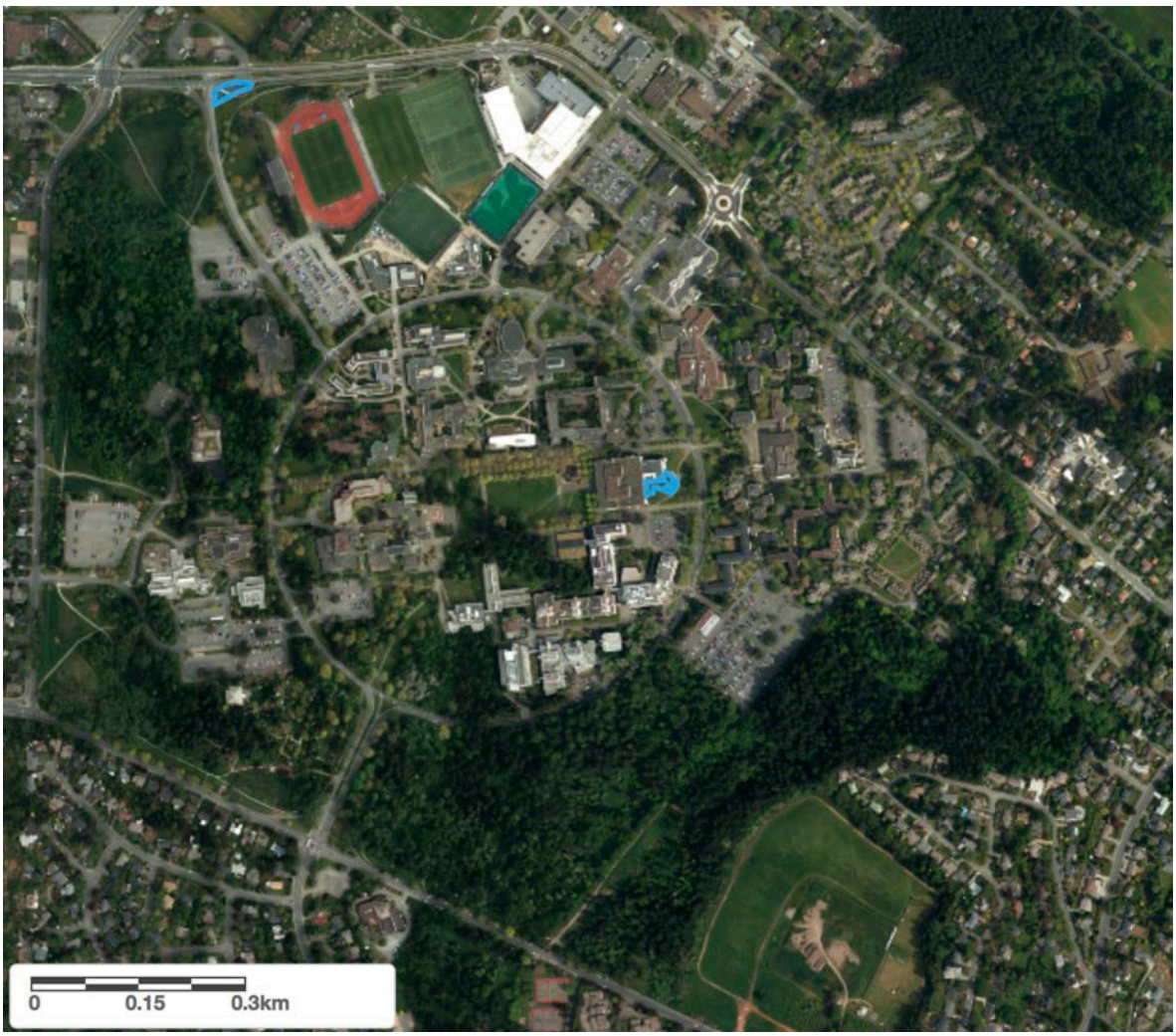


Figure 2. The Mackenzie rain gardens (top left) and the McPhearson rain gardens (bottom right) at the University of Victoria, as indicated by the blue polygons. Source: CRD Webmap. Retrieved July 17, 2016 from https://maps.crd.bc.ca/Html5Viewer/?viewer=public

McPherson

The McPherson Rain garden is located on the Southeast side of the McPherson Library and Mearns Centre for Learning, below the concrete seating area. A landscaped area is attached to this garden.

Invasive Species in the McKenzie and McPherson rain gardens:

Figure 3. Invasive Species in the McKenzie Avenue rain garden

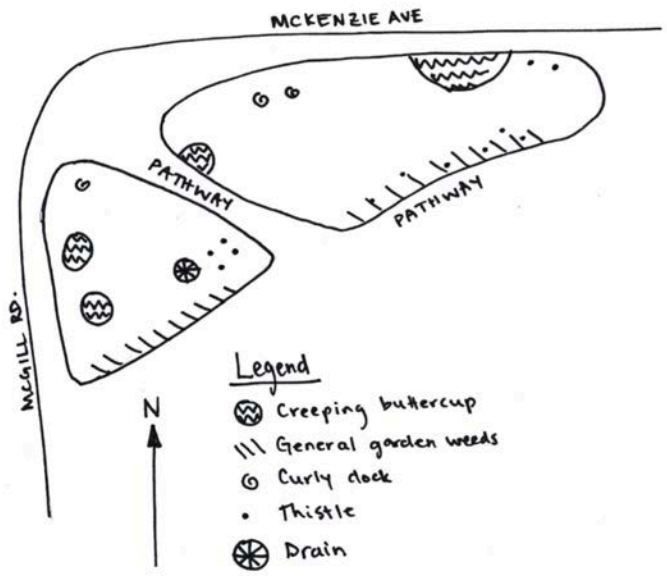
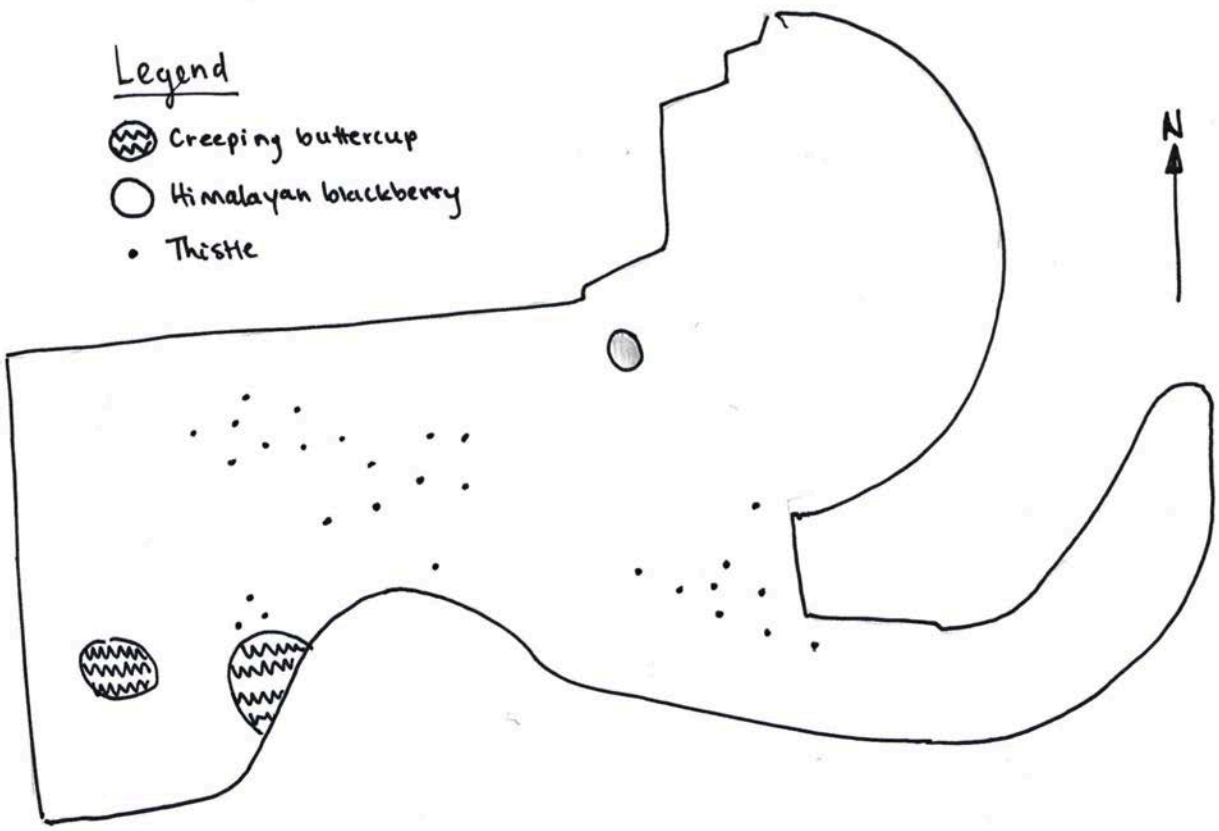


Figure 4. Invasive species in the McPherson rain garden



The most pervasive invasive species in these rain gardens are noxious weeds, thistle (*Cirsium sp.*) and weed plants.

Invasive species present in the McKenzie rain gardens as of 2016 include the following (See Appendix A for a map of the extent and distribution of invasive species in this site):

Himalayan blackberry (Rubus armeniacus): There are a few blackberry individuals located in the rain garden, however many have been mowed back so removal should wait until the root mass can be identified.

Canadian thistle (Cirsium arvense): Many individual thistles have been identified throughout this area and should be removed early and completely to prevent their spread through root and seed dispersal.

Bull thistle (Cirsium vulgare): Several individuals have been found at this site, mainly along the periphery of the garden.

Agronomic grasses: Agronomic grasses spreading from neighbouring lawns on campus should be identified early and removed, ensuring the root mass of rhizomatous species is fully removed.

Weed plants and noxious weeds: Weed plants and noxious weeds are dispersed throughout the garden. These plants should be further studied in order to determine best removal if unknown.

Invasive species present in the McPherson rain gardens as of 2016 include the following (See Appendix A for a map of the extent and distribution of invasive species in this site):

Himalayan blackberry (Rubus armeniacus): There are a few blackberry individuals located in the rain garden which should be removed to prevent the spread of the species in this area.

Canadian thistle (Cirsium arvense): Many individual thistles have been identified throughout this site. They should be removed early and completely to prevent their spread through root and seed dispersal.

Bull thistle (Cirsium vulgare): Several individuals have been found at this site, mainly along the periphery of the garden.

Agronomic grasses: Agronomic grasses spreading from neighbouring lawns on campus should be identified early and removed, ensuring the root mass of rhizomatous species is fully removed.

Weed plants and noxious weeds: Weed plants and noxious weeds are dispersed throughout the garden. These plants should be further studied in order to determine best removal if unknown.

Recommendations

Remove invasive species
Parties engaging in invasive species removal should follow the ISMS and Stewardship Program, as well as consult the invasive species removal best practices and Best Management Practices document. Priorities for invasive species removal should directly follow the CRISP Priority Invasive Plant List, which identifies priority species for control, containment, eradication and prevention. Priorities for invasive plant removal in the rain gardens are as follows:

High Priority	Thistle	Remove all individuals
Medium Priority	Himalayan blackberry	Remove feasible individuals & cut back hazardous canes
	Noxious Weeds	Remove small individuals
Low Priority	Weedy plants	Remove all individuals
	Agronomic grasses	Cut down & dig up roots where feasible

Monitor the area
Continuous monitoring of the site following invasive species removal will ensure that new individuals and species are identified early and kept under control. Regular weeding

Engage in further study of the area

It is recommended that this site be studied further to update existing information on species presence, hydrological patterns, and other processes. As the water entering these sites fluctuates throughout the year and due to the difficulty of identifying particular species during particular seasons, further study should be engaged in at several points throughout the year.

Proper maintenance
Communication is key to ensure these gardens are properly maintained. In the past, gardens have been improperly mowed (Fig 3.). Though this helps to keep down certain invasive species, it also inhibits the growth of plants in the rain garden and reduces its effectiveness.

Install more rain gardens on the UVic campus
The increased impervious surfaces in urban landscapes prevents water from returning to stream flows and can increase stormwater runoff from 30-95% in urbanized areas (Orr 2015 et al.). In the face of a changing climate, mitigation is essential and rain gardens can contribute to the resilience of the UVic campus to these changes. Rain gardens also increase biodiversity and species richnes (Orr et al. 2015)

Further Information

For further information on these rain garden sites, see the following documents:

Jenkins,K.,Griffin,L.,Le BAron, N. and Buchan,R. (2012). Reduction of Impermeable Surfaces Effects: A Rain Garden Proposal. Restoration of Natural Systems Program, University of Victoria. Retrieved September 20th, 2016 from:
https://www.uvic.ca/socialsciences/environmental/assets/docs/course341/Rain_Gardens_Fall2012.pdf
Orr, C. et al. (2015) Enhancing Rain Gardens a Bioengineering Strategies in Municipal Stormwater Management. Restoration of Natural Systems Program,University of Victoria. Retrieved September 30th 2016 from:http://www.urbanecology.ca/documents/Rain%20Gardens/RainGardenReport.pdf

Appendix A: Invasive Species Present in the Rain Gardens [maps] and Recommended Species

Rain Garden and Natural Analogue Recommended Plants
Adapted from Orr et al. (2015)

ULV: Urban landscape value
BR: Biodiversity rating
H: High
M:Medium
L:Low
N:Neutral

Table 1. Recommended Species to Plant in Rain Gardens.

Shrubs	*Cornus sericea 'Kelseyi'*	dwarf red-twigged dogwood	L	H
	Cornus sericea 'Midwinter fire'	midwinter fire dogwood	L	H
	Spiraea japonica 'Little Princess'	little princess spirea	L	H
	Spiraea japonica 'Bumalda'	goldflame spirea	M	H
	Myrica gale	bog myrtle	L	N
	Mahonia aquifolium	tall Oregon grape	H	H
	Philadelphus lewisii	mock orange	H	H
	Physocarpus capitatus	Pacific ninebark	H	N
	Vaccinium ovatum 'Thunderbird'	evergreen huckleberry	M	H
	Ribes sanguineum	red flowering currant	H	H
	Cornus sericea	red-osier dogwood	H	N
	Rosa nutkana	nootka rose	H	N
	Lonicera involucrata	twinberry honeysuckle	H	N
	Shepherdia canadensis	Canada buffaloberry	M	N
Vine	*Lonicera ciliosa*	Western trumpet honeysuckle	H	N
Grasses	*Juncus effusus*	common rush	M	H
	Juncus patens	spreading rush	M	H
	Carex stipata	sawbreak sedge	M	H
	Carex pachystachya	Chamisso Sedge	M	N
	Iris missouriensis	rocky mountain iris	L	H
Ferns	*Polystichum munitum*	western sword fern	H	H
Herbaceous	*Dicentra Formosa*	Pacific bleeding heart	M	N
	Vicia spp.	Vetch	M	N
	Aster spp	Aster	H	N
	Lupinus polyphyllus	large-leaved lupine	H	N
	Hippuris vulgaris	Common Mare's Tail	M	N
	Delphinium menziesii	Menzies' Larkspur	M	N
	Camassia quamash	common camas),	H	N
	Achillea millefolium	yarrow	H	N
	Viola palustris	Marsh Violet	M	N

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Bein, M. & Eastman, D. (2006). *University of Victoria Garry Oak Meadow Restoration Project: Progress Report April, 2004 – September, 2005.* Victoria, BC: Restoration of Natural Systems Program, University of Victoria

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http://www.saanich.ca/living/community/ocp/ocp_adopted_jul808_amended_aug1715.pdf

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Government of Canada (September 2004). *An Invasive Alien Species Strategy for Canada.* Retrieved June 3, 2016 from http://publications.gc.ca/collections/collection_2014/ec/CW66-394-2004-eng.pdf

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Harrop-Archibald, H. (May 31, 2007). *University of Victoria Natural Features Study: Bowker Creek, Cunningham Woods, Upper Hobbs Creek/Mystic Vale.* Victoria, BC: University of Victoria, Restoration of Natural Systems Program.

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Appendices

A. CRISP Priority Invasive Plant List

CRISP Priority Invasive Plants: Status List
Updated October 26, 2015

This priority invasive plant status list for the Capital Region was developed by partners of the Capital Region Invasive Species Partnership (CRISP). This list helps guide priorities in the region including reporting, education, invasive management and planning. Local jurisdictions of the Capital Region may have their own species status (within their jurisdiction), priorities and special concerns.

Prevent Species:

Scientific Name	English Name	Special Concern
Aegilops cylindrica	Jointed Goatgrass	BC*
Ammophila breviligulata	American beachgrass	
Berteroa incana	Hoary alyssum	
Butomus umbellatus	Flowering Rush	BC
Centaurea solstitialis	Yellow Starthistle	BC
Euphorbia esula	Leafy Spurge	
Hydrilla verticillata	Hydrilla	BC
Lepidium draba	Hoary Cress	
Peuraria montana	Kudzu	BC
Phragmites australis ssp. australis	Common Reed	BC
Rhaponticum repens	Russian Knapweed	
Spartina densiflora	Dense-flowered Cordgrass	BC
Spartina patens	Salt Meadowgrass	BC
Spartina anglica		BC
Spartina alterniflora		BC

Group	Description	Name
P	Species not known to occur in the region, but likely to establish if introduced. Eradicate if found.	Prevent
E	Priority species known to occur in limited distribution and low density. Eradicate if found.	Eradicate
CN	Established infestations found in portions of the region. Contain existing infestations and prevent spread to un-infested areas.	ContaiN
CL	Established infestations common and widespread throughout the Capital Region. Focus control in high value conservation areas.	ControL
	Human health hazard	Toxic
	Animal health hazard	Toxic

*BC: indicates species that are on the BC Prohibited List. All reports (and management) need to be forwarded to the Province.
Regularly Updated BC Prohibited List: https://www.for.gov.bc.ca/HRA/invasive-species/Proposed_Prohibited_Noxious_Weeds_June2014.pdf

Eradicate Species:

Scientific Name	English Name	Special Concern
Alliaria petiolata	Garlic Mustard	
Anthriscus sylvestris	Wild Chervil	
Arundo donax	Giant Reed	BC
Centaurea stoebe ssp. micranthos	Spotted Knapweed	
Centaurea militensis	Maltese Starthistle	
Cytisus multifloris	White-flowered broom	
Echium vulgare	Blueweed	
Fallopia x bohemica	Bohemian Knotweed	
Fallopia japonica	Japanese Knotweed	
Fallopia sachalinensis	Giant Knotweed	
Geranium lucidum	Shiny Geranium	BC
Glyceria maxima	Giant Mannagrass	[1]Note
Heracleum mantegazzianum	Giant Hogweed	
Hieracium aurantiacum	Orange Hawkweed	
Hieracium pilosella	Mouse-ear Hawkweed	BC
Impatiens glandulifera	Policeman's Helmet	
Linaria genistifolia ssp. *dalmatica*	Dalmatian Toadflax	
Linaria vulgaris	Yellow Toadflax	
Onopordum acanthium	Scotch Thistle	
Persicaria wallichii	Himalayan Knotweed	
Potentilla recta	Sulpher Cinquefoil	
Silybum marianum	Milk Thistle	
Spartium junceum	Spanish Broom	

Group	Description	Name
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E	Priority species known to occur in limited distribution and low density. Eradicate if found.	**E**radicate
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	Human health hazard	Toxic
	Animal health hazard	Toxic

[1] Eradicate all sites outside of Swan Lake (Swan Lake Nature Sanctuary: contain)

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Contain Species:

Scientific Name	English Name	Special Concern
Ailanthus altissima	Tree of Heaven	
Ammophila arenaria	European Beachgrass	
Buddleja davidii	Butterfly Bush	
Centaurea diffusa	Diffuse Knapweed	
Centaurea nigra	Black Knapweed	
Dipsacus fullonum ssp. sylvestris	Fuller's Teasel	
Hypericum calycinum	St. John's Wort	
Iris pseudacorus	Yellow Flag Iris	
Lysimachia vulgaris	Garden Yellow Loosestrife	
Lythrum salicaria	Purple Loosestrife	
*Myriophyllum aquaticum**	Parrotfeather	
Myriophyllum heterophyllum	Two-Leaf Watermilfoil	
Myriophyllum spicatum	Eurasian Watermilfoil	
Ranunculus ficaria	Lesser Celandine	
Salix alba 'Vitellina'	Golden Willow	
Ulex europaeus	Gorse	

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Control Species:

Scientific Name	English Name	Special Concern
Aegopodium podagraria	Goutweed	
Allium vineale	Field Garlic	
Anthoxanthum odoratum	Sweet Vernal Grass	
Anthriscus caucalis	Burr Chervil	
Arctium lappa	Great Burdock	
Arctium minus	Common Burdock	
Centaurea cyanus	Bachelors Buttons	
Cirsium arvense	Canada Thistle	
Cirsium vulgare	Bull Thistle	
Clematis vitalba	Traveler's Joy	
Conium maculatum	Poison Hemlock	high priority
Cotoneaster horizantalis	Cotoneaster	
Crataegus monogyna	Common Hawthorn	
Crataegus laevigata	English Hawthorn	
Crataegus x ambigua	Russian Hawthorn	
Cyclamen hederifolium	Cyclamen	
Cytisus scoparius	Scotch Broom	
Dactylis glomerata	Orchard Grass	
Daphne laureola	Spurge Laurel	
Foeniculum vulgare	Sweet Fennel	
Hedera helix	English Ivy	mild
Hyacinthoides hispanica	Spanish Bluebell	
Hyacinthoides non-scripta	English Bluebell	
Hypericum perforatum	Common St. John's Wort	
Ilex aquifolium	English Holly	
Lamiastrum galeobdolon	Yellow Archangel	
Leucanthemum vulgare	Oxeye Daisy	
Ligustrum vulgare	European Privet	

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Scientific Name	English Name	Special Concern
Tripleurospermum inodorum	Scentless Mayweed	
Phalaris arundinacea	Reed Canary Grass	
Prunus laurocerasus	Cherry-Laurel	mild
Prunus lusitanica	Portugal Laurel	
Rubus armeniacus	Himalayan Blackberry	
Rubus lacinatus	Cutleaf Evergreen Blackberry	
Senecio jacobaea	Tansy Ragwort	
Soliva sessilis	Carpet Burweed	
Tanacetum vulgare	Common Tansy	
Typha angustifolia	Lesser Cattail	
Typha angustifolia x glauca	Cattail hybrid	
Tragopogon dubius	Yellow Salsify	
Tragopogon porrifolius	Purple Salsify	
Ulmus glabra	Wych or Scots Elm	
Ulmus parvifolia	Chinese Elm	
Vinca major	Large Periwinkle	
Vinca minor	Common Periwinkle	

Note: CRISP maintains a list of other invasive species that are generally widespread and/or are of lower risk but remain a concern when restoring natural areas and for other management issues.

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Crataegus laevigata	English Hawthorn	
Crataegus x ambigua	Russian Hawthorn	
Cyclamen hederifolium	Cyclamen	
Cytisus scoparius	Scotch Broom	
Dactylis glomerata	Orchard Grass	
Daphne laureola	Spurge Laurel	
Foeniculum vulgare	Sweet Fennel	
Hedera helix	English Ivy	mild
Hyacinthoides hispanica	Spanish Bluebell	
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Leucanthemum vulgare	Oxeye Daisy	
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B. EDRR Field Sheet

Capital Region Invasive Reporting

CRISP
Capital Region Invasive Species Partnership

CRISP is asking for your assistance in reporting these high priority species targeted for eradication in our region. Please report to a supervisor or contacts below.

Eradicate Species with Health Hazard Alerts

Giant Hogweed / *Heracleum mantegazzianum*

- Up to 6 m tall
- Spotted stems, grooved leaflets
- Closely resembles cow parsnip

Warning: skin burns, blistering, scarring

Blessed Milk Thistle / *Silybum marianum*

- Up to 2.5 m tall
- White marbling on green leaves
- Large spiny purple flower

Warning: poisoning & injury to livestock

High Priority Invaders for Eradication

Carpet Burweed / *Soliva sessilis*

- Small, up to 7 cm
- Forms "carpet" on turf
- Divided leaves, feathery
- Small, flattened spiny seeds

Garlic Mustard / *Alliaria petiolata*

- Mature: over 1m tall
- Dense mats: young rosettes
- Small, white 4-petal flowers
- Garlic odor when crushed

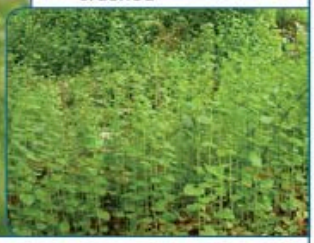


Photo Credits: District of Saanich, Fraser Valley Regional District, C.Richman, Jan Samanek/Bugwood.org, Fred Hook

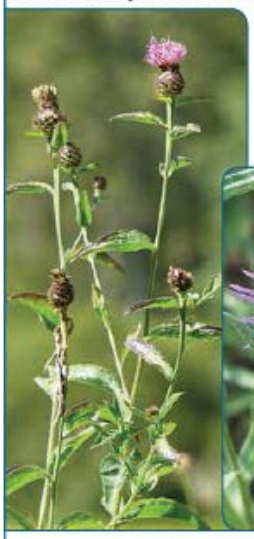
Phone: 1-888-933-3722
Email: crispcoordinator@gmail.com
Online: www.reportaweedbc.ca

Capital Region Invasive Reporting

CRISP
Capital Region Invasive Species Partnership

High Priority Invaders for Eradication

Black Knapweed / *Centaurea nigra*



- 10-80 cm tall
- Leaves: upper narrow, lower lobed
- Flowers rose to purple; bracts black/brown, fringed

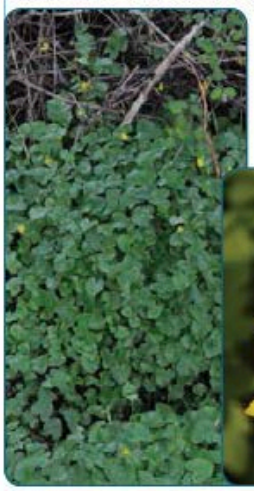
Diffuse Knapweed / *Centaurea diffusa*

- 20-100 cm tall
- Long, hairy divided leaves
- Flowers white to pinkish; bracts urn shaped with short, rigid spines

Spotted Knapweed / *Centaurea stoebe*

- 20-120 cm tall
- Deeply cut, hairy leaves
- Flowers pink to purple; bracts black tipped giving spotted look

Lesser Celandine / *Ranunculus ficaria*



- Buttercup family
- Kidney to heart-shaped dark leaves
- Flowers March to April
- 8-petaled stalked flowers

Photo Credits: BerndH, J.Hallworth, D.Wong/Saanich, C.Richman, E.Sellentin, D. Polster

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Online: www.reportaweedbc.ca

Capital Region Invasive Reporting

CRISP
Capital Region Invasive Species Partnership

High Priority Invaders for Eradication

Yellow Toadflax / *Linaria vulgaris*

- Up to 80 cm tall
- Numerous leaves, one per node
- Soft, lance-shaped pale leaves
- Yellow "snapdragon" flowers

Note: smaller toadflax, longer leaves

Dalmation Toadflax / *Linaria dalmatica*

- 60- 120 cm tall
- Numerous stems
- Light green, waxy leaves
- Heart-shaped with pointed tip
- Yellow with orange "snapdragon" flowers

Scotch Thistle / *Onopordium acanthium*

- Up to 3m tall
- Woody, branched stems with spine-edged wings
- Silver-grey colour: woolly hairs
- Large violet to reddish flowers

Yellow Loosestrife / *Lysimachia vulgaris*

- 1-2m tall with lance-shaped leaves
- Yellow, 5-petaled flowers on tall, softly hairy stems
- Branched flower stems to cluster on top

Photo Credits: B.Stewart, L.Scott, Kendrick Marr/RBCM, J.Hallworth, C.Richman, J.Leekie, R McElroy

Phone: 1-888-933-3722
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Capital Region Invasive Reporting

CRISP
Capital Region Invasive Species Partnership

High Priority Invaders for Eradication

Knotweed Species: Bamboo-like (jointed) hollow speckled stems; large leaves.
Comparisons of Knotweed for identification:

Himalayan Knotweed
Persicaria wallichii

- Up to 3 m tall
- Lance-shaped leaves


Japanese Knotweed
Fallopia japonica

- 1.5-2.5 m tall
- Smaller, heart-shaped leaves with straight base, tip pointed
- Leaves thicker, leathery


Giant Knotweed
Fallopia sachalinensis

- Up to 6 m tall
- Largest, heart-shaped leaves
- Leaves thinner, more flexible


Bohemian Knotweed
Fallopia X bohemica

- 3 to 5 m tall
- Hybrid of Japanese & Giant, characteristics of both


Photo Credits: C.Richman, D. Polster, District of Saanich, A. Rousseau

Phone: 1-888-933-3722
Email: crispcoordinator@gmail.com
Online: www.reportaweedbc.ca

C. Public Engagement Summary: October 4, 2016

Events

October 3 Talk with ESSA in DTB Courtyard
We joined Environmental Studies Students Association Students for their weekly meeting in the David Turpin Building courtyard to tell them about the ISMS, ways to get involved, and to notify them of the upcoming Open House.

Number of people engaged: 7

October 2, 10:00am-1:00pm
Ivy Pull with ERVN Volunteers in Bowker Creek
ERVN volunteers, comprised mostly of geography and environmental studies students, came together to remove English ivy from trees in the southern portion of Bowker Creek West. This is the first time the ERVN participated in a pull in this area, and volunteers learned a great deal about the value of this habitat as well as the extent of invasive species in the area.

Volunteers present: 5
Volunteer hours contributed: 15

October 1, 11:30am-3:30pm
Ivy Pull with Greater Victoria Green Team in Mystic Vale
We joined the Greater Victoria Green Team and participants of Project Serve – an annual day of volunteering taken on by UVic students joining up with non-profit organizations – to remove English ivy from trees in upper Mystic Vale.

Volunteers present: 35
Volunteer hours contributed: 125

Volunteers after the ivy pull (left), and removing ivy during the event (right). Photos by Amanda Evans.


Before (left) and after (right) photos of trees in upper Mystic Vale. Photos by Amanda Evans.

October 24, 10:30am
ES321 Ethnoecology Class
Ivy pull in South Woods.

Number of people engaged: ~40
Volunteer hours contributed: 60

September 26, 3:30pm
Presentation at Society of Geography Students Meeting
We attended a weekly SOGS meeting to reach out to geography students and inform them of the Invasive Species Management Strategy, as well as gauge whether there may be interest among this course union to participate in future events. Students were very receptive to this possibility.

Number of people engaged: ~15

September 20, 3:00-5:00pm
Ivy Pull with ERVN volunteers in Cunningham Woods
We focused our efforts on tree climbing English ivy in the NE portion of Cunningham Woods, along the main pathway, and then moved on to ground ivy in the SE portion of the woods, where we have been working for several years. Volunteers had all pulled ivy before, but had not heard yet about the ISMS; the group was made up primarily of students, with two outside community members participating as well.

Volunteers present: 13
Volunteer hours contributed: 23.5

September 15, 11:30am-11:40am:
Introductory Talk with Eric Higgs' ES 341 Class
We joined Eric Higgs' introductory ecological restoration course (ES 341) in Mystic Vale to discuss the ISMS and invasive species removal on campus with students, before they engaged in an invasive species removal activity. Students then participated in an Ivy Pull with facilities management for ~50 minutes.

Number of people engaged: ~35
Work hours: 17.5

Date	Event	Event Type	Event Location	Number of People Engaged	Work Hours Contributed
September 15	Introductory talk, Eric Higgs ES 341 course	Outreach/ invasive species removal	Mystic Vale	35	17.5
September 20	ERVN ivy pull	Invasive species removal	Cunningham Woods	13	23.5
September 26	SOGS meeting presentation	Outreach	SOGS Room	~15	N/A
October 1	Greater Victoria Green Team & Project Serve ivy pull	Invasive species removal	Mystic Vale	35	125
October 2	ERVN ivy pull	Invasive species removal	Bowker Creek	3	15
October 3	ESSA meeting presentation	Outreach	DTB Courtyard	7	N/A
October 12	Invasive Species Management Program Open House	Outreach	SUB Upper Lounge	45	N/A
October 25	ES321 class ivy pull	Invasive species removal	South Woods	40	60
Total	**8 Events**			**193**	**241**

Upcoming Events:

October 5: Filming with UVic Communications

October 23: Invasive Species Pull in Cunningham Woods with ERVN/The Land Conservancy/ESSA/SOGS/UVic Meditation Club, for Redfish School of Change final project
November 21: Guest Lecture in Teresa Dawson's Geography 101B Class
[Not yet scheduled]: Invasive Species Pull with Residence Group
[Not yet scheduled]: Weeding in DTB Courtyard and/or Lorene Kennedy Garden with ESSA

Meetings

Name	Position/Affiliation
Ruth Young	Director, Office of Indigenous Affairs
Darcy Mathews	Instructor, Environmental Studies/Community Toolshed
Deb George	Cultural Protocol Liason, INAF
Nancy Turner	Ethnobotanist, School of Environmental Studies
Hannah Roessler	Ethnobotanist, School of Environmental Studies
Ken Josephson	Cartographer, Community Mapping Collaboratory
Eric Higgs	Professor, School of Environmental Studies
Matt Greeno	Sustainability Coordinator, Office of Campus Planning & Sustainability
Simon Springer	Professor, Department of Geography
Geraldine Allen	Department of Biology; Herbarium
Peter Constabel	Director, Center for Forest Biology
Rina Odaka	Student & Volunteer, ERVN
Alex Campbell	Student & Volunteer, ERVN
Temily McCutcheon	Chair, ESSA
Alicia Fall	Chair, SOGS
Boma Brown	Director of Internal Affairs, VIPIRG
Teresa Dawson	Professor, Department of Geography
Kristen & James Miskelly	Saanich Native Plants
Tristan Zabourniak	Student & Volunteer, ERVN
Rhonda Rose	Supervisor of Horticulture
Peter Robert	Grounds

Other Communication & Outreach

- Article published in The Ring (October issue)
- Article published in The Martlet (October 6th issue)
- Sharing Open House information through multiple networks

SUSTAINABILITY WEEK, OCT. 10–15

Controlling invasive species on campus

Invasive species management is one of four projects approved and funded this year by the Campus Sustainability Fund

BY PAUL MARCK

Lindsay Kathrens is on a mission to repel the invaders. Whether they lurk in Mystic Vale, Cunningham Woods, Bowker Creek or brush up along campus buildings, Kathrens and her colleague Julia Jennings lead a clutch of up to 40 students engaged in the Invasive Species Management Project at UVic. This small army of volunteers is on the march to eradicate the spread of plant species that threaten native-growing campus flora.

Kathrens, who graduated in June with a double major in environmental studies and geography, says the Invasive Species Project makes classroom studies more meaningful and practical, connecting course work and students with initiatives that are already underway in understanding ecology and campus ecosystems.

"That project has been an opportunity to apply our learning through self-directed studies. It gives people an opportunity to situate learning in place," says Kathrens, now a coordinator with the project. "The natural areas around our campus provide a real place for learning, a living laboratory."

The Invasive Species Management Strategy involves a cross-section of campus stakeholders, including facilities management grounds staff, students, environmental studies faculty and community members to coordinate the removal of invasive species on campus, develop an action plan and identify priority areas for action.

Invasive species management is one of four projects approved and funded this year by the Campus Sustainability Fund, which provides one-time allocations to campus projects that focus on water savings, sustainability awareness and learning opportunities. The fund was created earlier this year with the university's contribution of $100,000 to help the campus community develop and engage in projects that advance the goals of the Sustainability Action Plan.

The Campus Sustainability Fund allows the project to be more strategic and effective with inclusive student participation and educational outreach, explains project leader Dr. Valentin Schaefer of the School of Environmental Studies. "The Campus Sustainability Fund has enabled us to develop 10 area management plans in a format that makes them easy for an instructor to adopt in their course curriculum and engage their students."

Kathrens agrees the funding has been invaluable. "It's allowed us to do work we've been wanting to do for a long time but never had the capacity to do."

Other funded projects

Building on the success of the Revolving Sustainability Loan Fund that was established in 2011, the Campus Sustainability Fund assists in funding projects suggested by members of the university community that further UVic's Sustainability Action Plan.

In addition to invasive species management, three other Campus Sustainability Fund projects got underway this summer:

- District energy system carbon intensity reduction feasibility research—examining alternative energy technologies and their potential integration into the district energy system
- Edible landscapes—with the goal of engaging faculty, staff and students in the investigation, review and design of potential edible landscapes on the UVic campus
- Women and trans bike repair workshop series—a bike repair workshop series for women and the transgender community.

The deadline for new project applications to the Campus Sustainability Fund is Oct. 15. More information: action@uvic.ca

Full story: *bit.ly/uvic-species*

Campus invaders to be pruned with new management strategy

EMILY FAGAN
CONTRIBUTING WRITER

A comprehensive Invasive Species Management Strategy is coming soon to UVic, with a draft of the adaptive management plan to be made available through the Office of Campus Planning and Sustainability in mid-October.

Balancing a growing university with the value of natural spaces is a recurring dilemma. The management strategy is a single effort to make a more focused movement towards the restoration of UVic's natural spaces by steering efforts to manage and remove the campus' invasive species in a coordinated and sustainable way.

The strategy is the result of collaborative efforts across faculties such as the School of Environmental Studies, Facilities Management, and the Office of Campus Planning and Sustainability.

Lindsay Kathrens, a former UVic student and one of the developers at the forefront of the project, believes invasive species to be "one of the most feasible stressors on ecological health in this area that can be dealt with by such a large variety of people in the community from different walks of life."

"On a human scale," she explained, "invasive species are the most tangible way we can, on a small scale, go into an area and try and help native ecology regenerate."

One of the primary invasive species Kathrens and her collaborator, UVic student Julia Jennings, battle is English ivy, which smothers and impedes the growth of other plants. Other threats on the local ecosystem that the strategy focuses on include Scotch broom, English holly, Himalayan blackberry, thistle, daphne laurel, and English hawthorn. The strategy aims to tackle these ecological menaces with targeted invasive species removals, plant walks, native species plantings, and even the repurposing of invasive species in natural plant dyes and ivy weaving.

Jennings and Kathrens both joined UVic's Ecological Restoration Volunteer Network (ERVN) four years ago, and have since witnessed the many challenges their peers face when conducting campus restoration projects. With that in mind, the strategy will also connect the many past and current environmental restoration efforts around campus, as well as provide a place for student's work to be used as a reference and continued—even after they graduate.

In addition, new students interested in implementing restoration projects will be able to use the strategy as a basis for identifying priorities they wish to tackle, and effective ways those goals could be accomplished.

"It's really easy for students to gravitate towards trying to reinvent the wheel," Kathrens said. "[With this strategy], there's a foundation already laid for those things to continue which would make efforts more effective, so we want students and other members of the university community to have access to that information and know where they can offer their skills."

Jennings explained that "students come here for four years and then graduate, and a lot of their projects just get dropped." Kathrens went on to elaborate that she and Jennings began to notice that "continuity was one of the biggest challenges."

However, the new management strategy aims to eliminate that problem: A work study student with the ERVN is to be in charge of keeping the strategy updated with various projects and prioritized areas for restoration, and will also serve as the contact point for anyone looking to get involved. Students and professors will also be able to work with the coordinator if they want to integrate the project into their courses.

Anyone interested in getting involved with the ERVN can attend the management strategy open house on Wednesday, Oct. 12, and connect with students involved in a multitude of restoration projects on campus. The open house will allow students and members of the community to provide feedback and ask questions about the strategy, and will take place in the SUB Upper Lounge from 6:30–8:30 pm.

D. Open House October 12, 2016.

Attendance: 45 – mainly students and some general public

Lindsay Kathrens and Julia Jennings setting up Open House

People at Open House

Julia Jennings pointing to areas of invasive species removal on an aerial photo of the University of Victoria campus to two students attending the Open House