



# Research Colloquium 2010 Proceedings



Photo by Chris Junck

**Pacific Forestry Centre  
Canadian Forest Service  
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## **RARE SPECIES BIOLOGY**

# **A COMPARATIVE ANALYSIS OF THE EPIPHYTE COMMUNITIES FOUND ON GARRY OAK BARK AT THE COWICHAN GARRY OAK PRESERVE AND THE LANSDOWNE CAMPUS OF CAMOSUN COLLEGE**

**Anne Anderson and Angela Lougheed**

Royal Roads University

Very little is known about epiphytic populations on Garry oak. Therefore, the purpose of this study is to broaden the scientific community's knowledge regarding epiphytic populations found on the trunks of Garry oak trees. The report details the study of epiphyte population distributions on Garry oak trunks at the two sites. The report includes multivariate analysis using PCORD and Minitab statistical software to compare the abundance and diversity of epiphytes on Garry oak bark on three different levels:

1. Between the two sites
2. Between the cardinal directions of the trees
3. Between the tree's size classes within each site

Methodology for the experiment involved a sample design of eight trees with two size classes at each site. The "small" size class included trees with circumferences between 1.0 m and 1.5 m; trees with circumferences greater than 1.5 m were in the "large" size class. Trunks were sampled at a height of 1.3 m using 10 cm x 10 cm square mesh grids; each grid was one cm<sup>2</sup>. Three grids were placed per cardinal direction of the tree (sample unit). A sequential sampling design (i.e., alternating intersections) of 50 intersections per grid was chosen. A sewing needle was inserted at the upper right corner of the marked intersection on the grid, and the epiphyte touched by the pin was recorded. The data collected were analyzed using various statistical tests.

The data were found to have a right-skewed distribution; therefore, a Kruskal-Wallis test was used to test for significant differences in the mean percent cover of epiphytes between the sites. This analysis showed that there was no significant difference between the sites in regards to mean percent cover. The alpha diversity analysis revealed several patterns in the data. Overall, it was found that the Lansdowne site had greater species richness and evenness than the Cowichan (Maple Bay) site. The comparison between the cardinal directions showed that the west sides of the trees at the Lansdowne site had greater species richness and lower evenness. However, at the Cowichan (Maple Bay) site, north sides of the trees had greater species richness and lower evenness. The size-class comparison revealed that smaller trees at Lansdowne had higher species richness and evenness than trees in the larger size class. Comparison at the Cowichan (Maple Bay) site revealed the opposite; larger trees had slightly higher values for species richness and evenness. A two-way-ordered TWINSpan analysis separated the species into two groups based on their abundance characteristics. This analysis also grouped sample units with other sample units within the site that had similar abundance and diversity characteristics. With the exception of a few anomalous sample units, we found a distinct separation in species abundance and diversity between the sites. A cluster analysis produced a dendrogram that illustrated the two distinct sample unit groups. Reciprocal averaging analysis supported the findings of the TWINSpan and cluster analyses regarding the separation of the sample units into two distinct groups (Lansdowne and Cowichan site).

## **MACOUN'S MEADOWFOAM (*LIMNANTHES MACOUNII*): "CANARY IN A COAL MINE"**

**Adolf Ceska**  
Consultant

Macoun's meadowfoam was first collected by John Macoun "in ditches at Victoria" - May 7, 1875. It is endemic to southern Vancouver Island and adjacent islands. In 1956, the same year it was proclaimed extinct by Hitchcock et al. (Vascular plants of the Pacific Northwest), it was rediscovered on Trial Island and in Oak Bay, Victoria. In 1998, a large population of a plant that looks like Macoun's meadowfoam was found in California in a cabbage field. Californian plants exhibit striking morphological and physiological differences, raising a question re their taxonomical relation to our plants.

In our 1988 COSEWIC Report we reported 52 subpopulations over 24 sites. The 2004 COSEWIC update includes 28 sites. We then compared the size of the subpopulations, by number of plants, between 2004 and 1988. From the 52 subpopulations we reported in our 1988 COSEWIC report, 16 (30.8%) disappeared, 14 (26.9%) declined, 10 (19.2%) remained the same and 12 (23.1%) increased in number of individuals. The majority of subpopulations that disappeared were small subpopulations and most of them were outcompeted by introduced perennial grasses.

There are two major threats to Macoun's meadowfoam: human activities and the competition of introduced grasses and forbs. Only a small subpopulation of Macoun's meadowfoam is protected in the Trial Island Ecological Reserves.

*Post scriptum:* James Miskelly & Tracy Cornforth found the largest known population of Macoun's meadowfoam on Rocky Point at the firebreak of the DND Ammunition Depot. This population has been successfully maintained by regular plowing in late spring.

# **RARE BRYOPHYTES OF GARRY OAK ECOSYSTEMS**

**Terry McIntosh, PhD**

Consultant

Recent studies of bryophytes in Garry oak and related ecosystems not only have been critical in better defining population and other attributes of known rare species but also have increased the known regional diversity of this group of plants. At least 18 dry coastal mosses are listed by BC's Conservation Data Centre and 3 are listed on SARA (Species at Risk Act) and COSEWIC (Committee on the Status of Endangered Wildlife in Canada). A number of others, as well as a few liverworts, deserve a conservation listing at some point.

Population, distribution, and threat attributes have become much better understood for a number of rare species, in particular rigid apple moss (*Bartramia stricta*). Although only one new population of rigid apple moss has been observed recently, even with more-intense inventory, it has been found to be significantly more common and widespread at known sites than previously documented. Results of these studies indicate that inventory remains an important aspect of biodiversity studies in this rich and threatened ecosystem.

# **FIELD STUDIES OF THE LARVAL BIOLOGY OF PROPERTIUS DUSKYWING (*ERYNNIS PROPERTIUS*)**

**Devin Methven and David Clements**

Trinity Western University

During the summer of 2009 we conducted field studies on the natural history of a specialist butterfly *Erynnis propertius* (Lepidoptera: Hesperiidae), the Propertius duskywing. In an attempt to determine the preferred habitat range of this Garry oak (*Quercus garryana*) specialist, in its northernmost range, enclosures were established in three meadows (Twin Lichen, Spring Meadow and THB) on Trinity Western University's Crow's Nest Ecological Research Area (CNERA) on Salt Spring Island. Adult females were captured and placed in the enclosures, allowing larvae to be raised from eggs through five of the six instars. These captive observations aided in the accurate larval identification in the field, which was conducted during the months of June and July. Transects were established in each of the meadows, and the inner and outer regions of each Garry oak tree were examined for *E. propertius* larvae at a variety of heights. We found that *E. propertius* larvae represented 13% of the total larval observations; three other Lepidopteran species were also fairly abundant in our Garry oak transects. The *E. propertius* larvae "preferred" the outer most regions of the tree canopy and, were more prevalent at heights between a range of 2.5 m - 3.0 m from the ground. We also examined the relationship between the tannin concentrations in *Q. garryana* leaves and the "preferred" location *E. propertius* larvae. These field studies will aid in developing methods for monitoring *E. propertius* on Garry oak trees through accurate larval identification. The new insights on larval feeding behavior represent a step towards developing recommendations for managing Garry oak habitat to enhance *E. propertius* populations.

# **WILL CLIMATE CHANGE DISRUPT BIO-CONTROL OF WINTER MOTH ON GARRY OAK?**

**Jens Roland**

University of Alberta

The control of winter moth (*Operophtera brumata*) in Victoria and on the Saanich Peninsula, B.C., was attributed to the impact of parasitism by an introduced tachinid fly and to predation by resident beetle predators in the soil. Warmer winters favour the early emergence of the pest winter moth but not of the introduced fly due to its diapause. Earlier emergence of the pest due to climate warming may reduce rates of parasitism by the introduced fly due to reduced synchrony in their respective time of emergence. Reduced moth mortality due to poor parasite synchrony may allow populations under control to erupt.

## **INVASIVE SPECIES EFFECTS**

### **ECOLOGY, BIOLOGY AND CONTROL OF SOME EXOTIC-INVASIVE WEEDS ON FEDERAL LANDS IN BRITISH COLUMBIA, CANADA**

**Raj Prasad, J. Benner and S. Bundel**

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Scotch broom (*Cytisus scoparius*), gorse (*Ulex europaeus*), daphne (*Daphne laureola*) and English ivy (*Hedera helix*), are four prominent, invasive plants that pose a serious threat to Garry oak and associated ecosystems on federal lands in Victoria, British Columbia. These plants colonize disturbed areas quickly, form dense monospecific stands, remain persistent for a long time and defy any easy eradication program. They suppress and inhibit the growth of native plants and ultimately arrest forest succession. Several federal departments including the Department of Environment, Department of National Defense, Department of Fisheries and Oceans, Department of Indian Affairs and Parks Canada have expressed great concerns regarding their rapid incursion, adverse impacts and the resulting degradation of native habitats. With a grant from the Department of Environment and the Department of National Defense, we conducted research to examine the population dynamics, phenology and control methods of these invasive plants on federal lands near Victoria, B.C. Of the methods of control tested, including manual cutting, application of a registered herbicide (Release-triclopyr), a fungal bioherbicide (*Chondrostereum purpureum*), and a commercial plastic mulch, it was found that the mulch and herbicide treatments provided 100% efficacy on reducing resprouting of all four invasive species. While one bioherbicide (*Fusarium tumidum*) was very effective on Scotch broom under greenhouse conditions, it was not applied under field conditions. The other bioherbicide (*Chondrostereum purpureum*) produced a variable response when applied under field conditions. Manual cutting was found to be the least effective. A novel prospective bioagent (*Phomopsis* sp. *denovo*)

was isolated from dying and dead samples of daphne from the field. Results from laboratory, greenhouse and field observations suggest that it may hold great potential for control of daphne. Continued and additional research is necessary to determine the appropriate formulations of these bioagents, as well as the effectiveness of the different and integrated control treatments over a period of years. A new technology using superheated water (Aquacide) to kill vegetative shoots of gorse did not offer long term control, nor was it found to be cost effective.

**Key words:** alien invasive weeds, bioherbicide, forestry

# **PLANT-MEDIATED IMPACT OF AN INVASIVE OAK-GALL WASP ON A NATIVE SPECIALIST BUTTERFLY: *ERYNNIS PROPERTIUS***

**Kirsten M. Prior and Jessica J. Hellman**

University of Notre Dame

A foliar gall-forming wasp, *Neuroterus saltatorius*, was recently introduced on to Vancouver Island, British Columbia. In its native range it occurs at low, non-damaging, levels on its host plant, Garry oak (*Quercus garryana*). In its introduced range, however, it occurs at much higher densities where it may have substantial impacts on *Q. garryana* and associated species, such as the threatened oak-specialist, the propretius duskywing (*Erynnis propretius*). Gall-formers can manipulate their host plants in several ways. They can assimilate nutrients such as nitrogen from plant tissue into their inner nutritive gall tissue. Also, they can increase the metabolism of phenols such as tannins and lignin that they concentrate in their outer protective gall tissue. Despite their ability to manipulate their host plants, the role of gall-formers as competitors is relatively unknown. Caterpillars of *E. propretius* occur on oak leaves contemporaneously with *N. saltatorius* galls. We predicted that this invasive gall-former affects this native butterfly by altering the foliar quality of oak leaves that caterpillars feed on. In the gall-former's introduced range, we stocked enclosures with caterpillars on trees that varied in gall-former density. Biomass production of butterflies was lower in enclosures on high-density than on low-density trees because over-wintering caterpillars were smaller and fewer of them enclosed into adults the following spring. To see if *N. saltatorius* induced changes in foliar quality, we measured host plant quality before and after gall induction on 30 trees each at two sites (Government House and Cowichan Preserve). We found a positive relationship between gall-former density and the percent change in foliar C:N, a negative relationship between gall-former density and the percent change in foliar water at Cowichan, and no relationship between the percent change in protein-binding capacity (i.e., phenolics) and gall-former density. Additionally, there was a negative relationship between foliar nutritional quality and butterfly performance. Our results provide evidence for a plant-mediated

impact of *N. saltatorius* on *E. propertius* suggesting that this gall-former could act as a competitor at high densities.

Prior, K.M., J.D.K. Dzurisin, S.L. Pelini, and J.J. Hellmann. 2009. Biology of larvae and adults of *Erynnis propertius* at the northern edge of its range. *The Canadian Entomologist* 141: 161-171.

Prior, K.M., and J.J. Hellmann. 2010. Plant-mediated impact of an invasive oak-gall wasp on a specialist butterfly: a test of interspecific competition with a gall-forming insect. *Ecology*, in press [doi: 10.1890/09-1314].

## **ECOSYSTEM CLASSIFICATION AND FUNCTION**

### **PATTERNS IN NATIVE AND INTRODUCED PLANT SPECIES IN GARRY OAK MEADOWS: IMPLICATIONS FOR FUTURE TRENDS AND EFFECTIVE MANAGEMENT**

**Joseph R. Bennett, Patrick Lilley, Mark Vellend, and Peter Arcese**

University of British Columbia

Invasive introduced species are considered to be a major threat to the Garry Oak Ecosystem (GOE). While there is a general consensus that this threat is probably increasing, there has been no systematic documentation of patterns of native and introduced species through a broad range of GOE meadows, nor has it been possible to predict future trends in introduced species. As part of a broader collaboration to help understand species distributions in the GOE, we have summarized synoptic patterns in native and introduced species in GOE meadows.

We conducted multi-scale surveys on 86 GOE meadows on Vancouver Island and adjacent islands, including many sites that had not been previously surveyed. Patches were surveyed through their full extent for presence of vascular plant species, and were also surveyed using a total of 602 quadrats for presence and percent cover of vascular plants at the intra-site scale. We found striking differences in the representation of native and introduced species. Contrary to popular conception, native species continue to dominate GOE meadows. While some meadows near Victoria are composed largely of introduced species, most are dominated, both in terms of species richness and percent cover, by native species. Small islands are particularly well-protected, with some exhibiting >90% relative cover of native species.

Models of species richness and geographic spread according to nativeness and long-distance dispersal capacity reveal more ominous

trends. Introduced long-dispersers, on a per-species basis, are more common on both inter- and intra-site scales than any other type of species. Despite having been present on the landscape for <150 years, many have been able to reach the most remote locations, and may continue to expand their populations within sites. Introduced short-dispersers are more likely to be rare on both scales than any species type. However, as many of these species have become invasive in other areas where they have been resident for longer than in the GOE, they probably represent an important future threat, and some may attain levels of dominance that are similar to their native counterparts.

We recommend that conservation efforts increase their focus on protection and preservation of small, isolated islands, as well as monitoring and removing species that can currently be managed but are likely to become threats in the future.

## **FIVE YEARS OF FUNGI SURVEYS ON OBSERVATORY HILL, VICTORIA**

**Oluna Ceska**  
Consultant

In the 2009/2010 season, forty-two visits to Observatory Hill yielded 520 species of macrofungi, of which 139 were found on Observatory Hill for the first time. Since the start of the survey in November 2004, the number of species recorded is 900. From the fall of 2005 to the spring of 2010, mycorrhizal species accounted for 15-27% of the total number found. Many species found on Observatory Hill have not been found previously in Canada. The material I collected on Observatory Hill since the survey began contains at least one undescribed species. The most interesting finds include: *Byssonectria fuispora*, *Claudopus byssisedus*, *Entoloma lignicola*, *Pouzarella* spp., *Leptonia* spp., *Cytidia stereoides*, *Marasmius chordalis*, *Mycena corynephora*, *Squamanita paradoxa*, *Tetrapyrgos subdendrophora*, *Tubaria punicea*, etc. Results of the Observatory Hill macrofungi inventory are available at [www.goert.ca/documents/Macrofungi-Observatory-Hill-2009-2010.pdf](http://www.goert.ca/documents/Macrofungi-Observatory-Hill-2009-2010.pdf) and [www.goert.ca/documents/Macrofungi-Observatory-Hill-2008-2009.pdf](http://www.goert.ca/documents/Macrofungi-Observatory-Hill-2008-2009.pdf).

See also [www.goert.ca/news/2010/05/12/macrofungi-2004-2010](http://www.goert.ca/news/2010/05/12/macrofungi-2004-2010).

# **DETECTING CHANGES IN GARRY OAK VEGETATION PLOTS AFTER 4 DECADES: FOLLOWING IN DR. HANS ROEMER'S FOOTSTEPS**

**Jenny McCune**

University of British Columbia

In order to understand how plant communities are changing in response to human disturbance, it is useful to have a historical baseline by which to measure changes. However, such baseline data are often unavailable for many regions and time periods. On the Saanich peninsula of Vancouver Island, Dr. Hans Roemer surveyed over four hundred 20m by 20m relevé plots in the late 1960s as part of his doctoral research. This provides a unique opportunity to quantify the changes in vegetation on the Peninsula in the past 40 years. I used Dr. Roemer's field notes to return to 184 of his plot locations, 43 of which were in Garry oak communities, and resurveyed them using the same methodology. Preliminary analyses show that herbaceous plant richness in Garry Oak plots increased significantly, from an average of 28.4 species to an average of 33.1 species. The total number of herbaceous species found in Garry Oak plots increased from 121 in 1968 to 139 in 2009. Exotic species represented approximately 20% of Garry Oak herbaceous flora in 1968, increasing to 40% by 2009. I looked for changes in plant community composition by using Non-Metric Multidimensional Scaling to ordinate all plots in both years. There seems to have been a much larger shift in herbaceous plant composition in Douglas-fir-dominated communities compared to Garry oak-dominated plots. I hypothesize that this greater change in Douglas-fir-dominated herbaceous flora may be due to a larger degree of fragmentation of Douglas-fir forests between 1968 and 2009, whereas many Garry oak plots were located in fragments that have not changed in size since Dr. Roemer's survey. Future work will aim to determine the relationship between vegetation changes and changes in the degree of human disturbance across the landscape. Using historical data is a valuable way to gain understanding of vegetation changes, and researchers today should consider making and keeping detailed notes on the locations and methodology of their projects in order to provide a baseline for ecologists of the future.

## **RESTORATION**

### **SOUTH PUGET SOUND PRAIRIES 2009 CONSERVATION ACTIONS**

#### **A BRIEF SUMMARY**

**Hannah Anderson**

Cooperative Conservation Program Manager  
The Nature Conservancy

The prairies and oak woodlands of the South Puget Sound are some of the highest quality and largest acreage of this rare and fragmented system remaining in the Willamette Valley-Puget Trough-Georgia Basin Ecoregion. A cooperative of partners including US federal and state natural resource agencies, non-profit conservation organizations and the US military are working together to preserve and restore this fragile system. Our collective work focuses on general prairie restoration as well as recovery efforts for specific species, particularly those that are federal candidates for listing under the ESA (Endangered Species Act): the streaked horned lark, Mazama pocket gopher, Taylor's checkerspot butterfly and mardon skipper butterfly. This presentation will summarize some of the actions conducted by a wide group of partners. The major threats to the prairie oak system include human development, fire suppression, encroachment by conifers and non-native shrubs and grasses. Partners are working exhaustively to control non-native vegetation that changes the structure and composition of the grasslands. To increase our suite of control methods, we are building up a prescribed-fire program with sufficient infrastructure and trained firefighters to be able to use controlled burning reliably as a restoration tool. In 2009, we burned over 130 acres of prairie and oak woodland sites throughout the Puget Sound. However, controlling invasives and restoring ecological processes are not enough. Once an invasive is removed, it must be replaced with native vegetation. We are growing plants and seeds of a wide variety of native species and learning the best strategies to ensure their survival in the field. Ramping up the availability of native seed and our ability

to seed “at scale” is a priority of conservation partners. We are also conducting significant projects to increase the sizes and numbers of our rare species populations. A captive breeding and reintroduction program is in place for the Taylor’s checkerspot butterfly, and we have seen indications of success with animals flying at release sites. We are also monitoring the habitat quality and species populations on sites throughout the South Sound. Through our collective and cooperative efforts we have seen some positive results, including new populations of our target species, habitat conditions for reintroductions being met, and overall improved habitat. We still have a long way to go, but we are learning new and more efficient ways to accomplish our goals. Much of the work presented was funded by the US Department of Defense, US Fish and Wildlife Service and the Natural Resources Conservation Service, and implemented by The Nature Conservancy, Washington Department of Fish and Wildlife, Washington Department of Natural Resources, University of Washington, Joint Base Lewis-McChord, and a dedicated group of volunteers.

For more information visit [www.southsoundprairies.org](http://www.southsoundprairies.org).

## **PRESCRIBED FIRE AT THE COWICHAN GARRY OAK PRESERVE - SEPT 15, 2010**

**Irvin Banman**

The Nature Conservancy of Canada

The deep-soil Garry oak meadows on southeast Vancouver Island were historically managed by First Nations for camas harvest, as foraging areas for elk and deer which were hunted, and also for the procurement of a variety of other plants for food and medicines. The main management tool used to maintain the open meadow or savannah structure was fire, which was used on a cyclical basis in order to control grasses, shrubs and conifer encroachment while promoting the growth of camas, which was a major food source. Since the cessation of routine burning more than 150 years ago when the first European settlers arrived, the remaining meadow fragments that have not disappeared due to urban expansion or agriculture have been invaded by agronomic grasses, native and non-native shrub and tree species and a host of other introduced plants.

At the 52-acre Cowichan Garry Oak Preserve, the Nature Conservancy of Canada (NCC) is once again using fire to control introduced species, mainly grasses for the time being. Based in part on research carried out by Dr. Andrew MacDougall in the past 10 years, and a 5-year study carried out in partnership with the Institute of Applied Ecology out of Corvallis Oregon, prescribed fire is being reintroduced.

It has taken 10 years to establish a rapport with local authorities whose cooperation and permission to burn is essential. The Municipality of North Cowichan, the Ministry of Forests, and the local fire hall approved our burn plan and special permission to burn was granted to burn in early fall. Three units were burned September 15, 2010, the intent being to control grasses and to observe the overall effects of fire. Of the three burn units, one was a study plot set up by Kate Proctor from the University of Victoria to determine, among other things, the response of the native and non-native plant community and of camas in particular.

The method used, once permission was granted and the weather conditions were favourable, was to mow the perimeter of the burn units and then soak them down using NCC's fire-fighting equipment, with water being drawn from nearby Quamichan Lake. Present for the burns were Tim Ennis NCC Director of Land Stewardship for BC, Leah Ballin of NCC, volunteers Dorothea Siegler & Pedro Banman and Irvin Banman of NCC. Don Grantham, an observer from the Maple Bay Fire Hall was also on hand to give the thumbs up for the "light up". The units were each roughly 200 sq meters in size and in a matter of four hours the burns had been safely completed. Since all woody materials had been removed beforehand, and dry grasses were the only fuel, each unit took only about 45 minutes from the time of ignition to the time of soak down.

# **SOCIAL CAPITAL: BUILDING CAPACITY TO SUSTAIN URBAN BIODIVERSITY THROUGH ECOLOGICAL RESTORATION**

**Nathalie Dechaine**  
Royal Roads University

Introduced alien invasive plant species threaten global biological diversity. This research focuses on this problem in the Capital Regional District (CRD) on southeastern Vancouver Island and the Gulf Islands in British Columbia. While local governments recognize the associated costs and risks of doing nothing, they do not have the capacity, knowledge or political will to act on this problem alone. The extent of the problem of alien invasive plant species cannot be addressed by the few formal, small, ecological restoration projects being conducted within the CRD. In response, volunteer groups have approached local governments or have initiated invasive species removal from public lands. In some cases, these well-intended efforts have been without the knowledge or permission of the government agency responsible for those lands. As a means to protect and enhance the sustainability of remnant ecosystems in the increasingly urbanized environment of the CRD, comparative case studies, supplemented with personal interviews identify what community tools and processes most effectively facilitate ecological restoration. In particular, the role of bridging social capital to increase access by volunteer groups to local government, ideally to create novel collaborative partnerships as a means to sustain native plant diversity in the CRD is closely examined.

# **EXPERIMENTAL TRANSLOCATION OF GOLDEN PAINTBRUSH (*CASTILLEJA LEVISECTA*) TO GULF ISLANDS NATIONAL PARK RESERVE**

**Aimee Pelletier**

Ecosystem Scientist, Parks Canada

Parks Canada is the lead agency for recovery of several species at risk associated with Garry oak ecosystems in Canada. A current species at risk recovery effort is the experimental translocation of the endangered golden paintbrush (*Castilleja levisecta*) to Gulf Islands National Park Reserve. In November 2009, approximately 250 golden paintbrush seedlings were transplanted into replicated research plots on one of the Park's small islets. These seedlings were propagated ex-situ in a nursery facility from seed collected on Trial Island, BC. The experimental design will test the effects of supplemental watering and fertilization, helping to address some critical information gaps about the species' growth requirements. Over the next several years the population will be monitored closely to assess seedling survival and establishment. Threats to population establishment, including competition with invasive species and disturbance or herbivory by mammals and birds, will be addressed as required using an adaptive management approach. The experimental translocation will help meet the species-specific recovery goals identified in GOERT's Recovery Strategy for Multi-Species at Risk in Maritime Meadows Associated with Garry Oak Ecosystems in Canada. It is hoped that the information gained from this project will help improve translocation methodology for establishing self-sustaining populations at this and other Canadian locations, and also help determine management options for existing populations that appear to be in decline.

Translocations of three other plant species at risk to Parks Canada lands are in the planning stages. These include translocation of coastal Scouler's catchfly (*Silene scouleri*) to Gulf Islands National Park Reserve, and translocation of seaside birds-foot lotus (*Lotus formosissimus*) and white-top aster (*Sericocarpus rigidus*) to Fort Rodd Hill National Historic Site of Canada.

# **INTRODUCING TRADITIONAL BLUE CAMAS (*CAMASSIA LEICHTLINII* AND *C. QUAMASH*) CULTIVATION PRACTICES INTO A GARRY OAK (*QUERCUS GARRYANA*) MEADOW PRESERVE IN BRITISH COLUMBIA**

**Kate Proctor**

University of Victoria

Cultivation of blue camas (*Camassia quamash* and *C. leichtlinii*) bulbs played an important role for thousands of years in the cultures of Indigenous Peoples of western North America. Despite the fact that traditional blue camas cultivation, including harvesting and various management actions at different scales, likely helped to shape and maintain the Garry oak meadow plant community, reintroduction of this practice is seldom incorporated into restoration or management projects (Beckwith 2004; Penn 2006). I propose that this stems from a scarcity of studies addressing the effects of anthropogenic soil disturbance on soil conditions and plant community composition in deep soil Garry oak meadows (Beckwith 2004; MacDougall and Turkington 2005). My research endeavours to clarify a number of these uncertainties surrounding the compatibility of blue camas cultivation practices with ecological restoration and conservation of biological diversity in Garry oak meadows. Building upon the doctoral work of Brenda Beckwith (2004), I have developed a study that examines the ecological effects of camas management on the Garry oak plant and soil communities. I aim to address the following questions:

- 1) How does the simulated traditional harvesting of existing blue camas populations at varied intensities affect the weight and abundance of the bulbs and a range of demographic variables (e.g. height, flowering and fruiting potential) of blue camas individuals?
- 2) What effect does simulated traditional blue camas harvesting have on overall plant community composition and abundance (e.g. percent cover) within an herbaceous community currently supporting blue camas?
- 3) What effect, if any, does simulated traditional blue camas harvesting have on soil pH, soil moisture, availability of nutrients, and compaction of soil?

In the spring of 2009, I established 60 one-meter-square experimental plots at the Nature Conservancy of Canada's Cowichan Garry Oak Preserve near Duncan, BC. I collected base-line data of the abundance and diversity of plant species using a grid method. I measured and recorded the height, and counted the number of fruits, number of aborted fruits and number of aborted flowers for all mature blue camas plants within my plots. In the summer of 2009, I experimentally introduced the harvest of blue camas bulbs into my sites at three different intensities (0%, 50%, and 100%). Directly after all of the plots were harvested, I installed two cation and two anion PRS (Plant Root Simulator™) nutrient probes into each plot. I am currently in the process of collecting data regarding soil pH, moisture, compaction and temperature.

During the spring and summer of 2010, I will re-sample plant species abundance and diversity, as well as camas demographics in all sixty plots. After the blue camas has gone to seed, all mature blue camas bulbs will be harvested and weighed from half (30) of the total plots. The remainder of the camas bulbs in these 30 plots will be dug up, counted by species and weighed.

In addition to my field study, I am also conducting interviews during the spring of 2010. The proposition of integrating blue camas harvesting practices with existing restoration and management initiatives in Garry oak ecosystems raises questions regarding the current interest, opportunities, challenges and potential approaches to making this integration a reality. To investigate these issues I will interview interested individuals and land managers from Vancouver Island First Nations and non-First Nations communities. I will also organize an informal focus group discussion with interested First Nations and non-First Nations land managers (and others with an interest in the research). This discussion will explore possible strategies to introducing alternative forms of management, such as co-management, and harvesting of blue camas bulbs into Vancouver Island parks and preserves.

Beckwith, B.R. 2004. The Queen Root of this Clime: Ethnoecological Investigations of Blue Camas (*Camassia leichtlinii*, *C. quamash*: Liliaceae) and its Landscapes on Southern Vancouver Island, British Columbia. PhD. Dissertation. University of Victoria, British Columbia.

MacDougall, A.S. and R. Turkington. 2005. Are Invasive Species the Drivers or Passengers of Change in Degraded Ecosystems. *Ecology* 86(1):42-55.

Penn, B. 2006. Restoring Camas and Culture to Lekwungen and Victoria: An Interview with Lekwungen Cheryl Bryce. *Focus Magazine*. June.

## **ADDITIONAL PUBLICATIONS OF INTEREST**

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