Planning Native Species Reintroductions in a Degraded Garry Oak Meadow in Uplands Park, Oak Bay

By Derek Leschasin

For Dr. Nancy Shackelford

ER390, 2023/2024

Table of Contents

Figures and Tables

Acknowledgements

To begin, I would like to acknowledge the generations of Lekwungen-speaking peoples who have called the lands of so-called Victoria home for millennia, and whose deep interspecies relationships in this place are responsible for the landscapes that we are now trying so desperately to preserve and enhance after decades of colonial degradation of Garry oak ecosystems.

I would also like to thank my partner, Lianne Halle, for providing moral support and some free labour. I appreciate you and couldn't have done it without you!

My thanks as well to Nancy Shackelford and Wiley Thomas, who provided invaluable guidance and knowledge that helped shape the outcome of this project. I know how busy we all are, and I am grateful for all of your time and feedback.

Finally, thank you to all the volunteers who came out for my Make a Difference Week event, the members of the UVic Society for Ecological Restoration, Margaret Lidkea and the Friends of Uplands Park, and anyone else who took an interest in and supported my work!

Abstract

Threatened Garry oak ecosystems represent valuable pockets of biodiversity which are found nowhere else in Canada beyond the southwestern corner of British Columbia. These ecosystems are the product of extended First Nations land management. Since colonisation, their extent has been diminished and their condition degraded due to pressure from development and invasive species, among other perturbations. The cultural and ecological value of these ecosystems makes them a high priority for ecological restoration and conservation.

This report details the initial stages of species reintroduction into a section of Uplands Park, in Oak Bay, southeastern Vancouver Island. As part of a Restoration of Natural Systems project, during the spring and summer of 2024, site assessment and preparation were undertaken, as well as native plant seed collection from adjacent park areas. In the fall of 2024, initial seeding was scheduled to take place in this section. Continued monitoring, planting, and invasive species management will be necessary for long-term success of the project.

Introduction

The world is facing an unprecedented and interconnected set of challenges to global biodiversity (Malcolm et al, 2006). Habitat loss and degradation are some of the biggest factors in the global decline and extinction of untold numbers of species. Ecological restoration is one of the chief emerging strategies to combat and reverse this trend, being defined as “the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed” (Gann et al, 2019, p.15). Restoration seeks to reverse the trajectory of a degraded ecosystem to one that is resilient in the face of global and local change (Gann et al, 2019). Restoration techniques may take the form of short-term interventions followed by passive recovery of an ecosystem, or may involve long-term management through reintroduction of species or disturbance regimes (Shackelford et al, 2019). Rare and threatened ecosystems such as the Garry oak meadows of Uplands Park on southeastern Vancouver Island are prime candidates for ecological restoration, as they are often host to a wide array of endemic and/or endangered species (Cartwright, 2019).

In this document, I describe the history and characteristics of Garry oak meadows and detail the initial stages of a species reintroduction program in a section of Uplands Park.

Southern Vancouver Island and the adjacent southern Gulf Islands are the traditional territories of the Coast Salish peoples. It is important to recognise that the ecosystems described herein are largely the result of the land management practices of the original inhabitants of this region, which shaped many of the characteristics and the historic extent of Garry oak ecosystems and in many areas prevented their succession to more closed Douglas-fir-dominated ecosystems (Lysgaard, 2022; McDadi & Hebda, 2008). Garry oak ecosystems can therefore be thought of as cultural landscapes, the product of reciprocal relationships between humans and other beings (McCune, Pellat, Velland, 2013). Ethnographic research and analyses of charcoal concentrations in local soils suggest that prescribed burning was frequently utilised by First Nations as a land-clearing technique, at a return frequency much higher than is typically seen in Douglas-fir forests in the Pacific Northwest (McDadi & Hebda, 2008; McCune et al, 2013). These prescribed low-intensity fires, along with techniques such as weeding, brush-clearing, and stone removal, were conducted over millennia and would have facilitated the flourishing of open Garry oak ecosystems and the associated forbs, particularly camas (*Camassia*) species, that played such important roles in historic food and cultural systems and remain culturally significant to this day. To Lekwungen-speaking peoples of this area, the two main camas species in this region are known as qʷəɬáʔalʔ, and the to SENĆOŦEN – speaking peoples, ḰŁO,EL. Camas was traditionally an important source of carbohydrates and was traded extensively along the northwest coast (Wickham et al, 2022; Lysgaard, 2022).

These Indigenous land management practises had an unintended consequence: European explorers were struck by the appealing, park-like environs of southern Vancouver Island (see Fig. 1) and chose it for the site of one of the first colonial fortresses in the region (McDadi & Hebda, 2008). Captain George Vancouver remarked that the landscape of what is now Victoria was characterised by “extensive spaces that had the appearance of being cleared by art” (McCune et al, 2013, p. 294). Despite observations such as this, the relationships between First Nations and the landscape were not well understood or even recognised by the Europeans who encountered them (Mcdadi & Hebda, 2008).

The stewardship of the land by local First Nations in what is now Southeastern Vancouver Island, British Columbia, has made this area one of the most biodiverse regions in

Canada, and in the decades since western colonisation, home to some of the most critically imperilled species and ecosystems in the country (Wickham et al, 2022). This region of Vancouver Island falls within the Coastal Douglas-fir (CDF) biogeoclimatic zone, which comprises 0.3 per cent of the total area of British Columbia and covers low-elevation coastal areas along southeastern Vancouver Island, the southern Gulf Islands, and parts of the mainland. It also extends southward into California. The CDF zone is itself under intense human pressure, having the lowest number of large protected areas out of all the biogeoclimatic zones of British Columbia, and is also subject to high levels of anthropogenic activities in the form of widespread development and resource extraction (CFSG, n.d.).

The CDF zone is typically dominated by Douglas-fir (*Pseudotsuga menziesii*) woodland with associated species such as Western red cedar (*Thuja plicata*) and Grand fir (*Abies grandis*). More open sites are dominated by Garry oak (*Quercus garryana*) ecosystems, with associated tree species such as Arbutus (*Arbutus menziesii*) and a large number of native forbs and grasses (CFSG, n.d.). The Indigenous land management practices described above created much more open habitat than would have occurred naturally in this region, in which Garry oaks and associated species could thrive (Lysgaard, 2022).

Garry oak ecosystems are broadly categorised into two main types: deep soil "parkland" with examples of large Garry oaks, relatively flat topography with more readily available soil moisture, and shallow-soil, rocky ecosystems with more limited moisture and shrubbier tree growth. (McCune et al, 2013). Within these two broad types is considerable variation determined by microtopography such as rock outcroppings, seeps, and vernal pools (Lea, 2011: Fairbarns, 2020). Canopy cover in these ecosystems varies from shaded woodland to open savannah-type environments. Historically, Garry oak ecosystems were dominated by forbs and native grasses, including Great camas (*Camassia leichtlinii*) and common camas (*Camassia quamash*), Bare-stem biscuitroot (*Lomatium nudicaule*), checker lily (*Fritillaria affinis*) and blue wildrye (*Elymus glaucus*) (Lysgaard, 2022). However, this coverage is now variable due to the expansion of understory species such Common snowberry (*Symphoricarpos albus*) and Nootka rose (*Rosa nutkana*) in the absence of regular land-clearing prescribed fires tended by Indigenous peoples (Fairbarns, 2020). In Canada, these ecosystems host multiple endemic and over one hundred threatened species across all taxas. Many of these and other species are in decline as Garry oak ecosystems currently occupy approximately 10 per cent of their historic range. This decline has

implications not only for biodiversity, but for the maintenance and restoration of Indigenous cultural practices (Lysgaard, 2022).

With the colonial displacement of First Nations from much of their territories has come the gradual degradation and diminishment of Garry oak ecosystems in their Canadian range (Lysgaard, 2022; McCune et al, 2013). Development and other land use changes, the absence of a fire disturbance regime, and incursions by invasive species are the most significant threats these ecosystems are currently facing. Most of the surviving remnants of Garry oak ecosystems represent the thin soil, rocky form, with deeper-soil ecosystems being the first to be developed after colonisation. The best examples in the Victoria region are largely limited to public parks, including Uplands Park (Parks Canada, 2006a). Uplands Park is notable for preserving various forms of Garry oak ecosystems, including rock outcroppings, seeps, and vernal pools, as well as deep-soiled Garry oak woodland (Thomas, 2019). Beginning in 2023 through 2024, as part of the Restoration of Natural Systems program at the University of Victoria, I initiated a project to develop a native species planting plan for one area of Uplands Park that had been recently cleared of woody invasive plants but has low diversity and coverage of native forbs and grasses. The project goals and objectives are outlined below in Table 1.

Goals:
To restore the degraded area identified in Fig. 2 to a condition analogous to more intact areas of Uplands Park, thereby enhancing biodiversity and habitat within the park.
To identify and preserve as far as possible the diminished community of native plants found on the site.
To utilise the site to provide volunteer and educational opportunities in ecological restoration for the general public.
Objectives:
Conduct a survey of native and invasive plant species found on the site.
Conduct a survey of physical site conditions and create maps for reference in planting.
Research and develop a list of native plant species suitable for planting on the site.
Research management of the invasive plant species found onsite, and plan at least one volunteer event to remove/manage invasive species in preparation for planting.
Obtain seed and develop a plan for planting in fall 2024.

Table 1. Goals and objectives for Uplands Park RNS project.

Figure 1. Uplands Park, 1915, photographer unknown. Colourized image courtesy of Ken Josephson, University of Victoria. Note the open landscape as opposed to present day shrubby growth in the park.

Study Area

Uplands Park, located in the municipality of Oak Bay, British Columbia, is an urban park of 31 hectares in size, bordered by single-family residential areas on three sides and the Strait of Georgia to the east. It is bisected by the thoroughfare of Beach Drive (see App. 1). The park is a popular spot for dog-walking and features multiple trails and a boat launch. It is also near several local attractions such as Willows Beach and the Oak Bay marina. While being a popular park for recreation and its scenic views, Uplands Park is also host to many threatened and endangered species, many of which are not found anywhere else in Canada outside of this region (Thomas, 2018). There is an active community-based volunteer organisation, the Friends of Uplands Park, which is working to manage invasive species within the park boundary. As of writing, this group

has accomplished the near elimination of flowering Scotch broom within the park (Thomas, 2019).

This site lies within the traditional territories of the Lekwungen-speaking peoples (part of the larger Coast Salish group of peoples), represented today by the Esquimalt and Songhees First Nations. Uplands Park is only one part of a greater landscape that was not only managed for camas harvesting as described above, but contained settlements, spiritually significant features, and the largest burial mound and cairn cemetery yet identified in the region (Thomas, 2019). During the initial colonisation period and the evolution of the settler community that would become Oak Bay, Indigenous residents were pushed off the land and untold numbers of graves were intentionally destroyed or disturbed by settlers (Rudisuela, 2020). Uplands Park became part of a matrix of crops and pastures in the 19th century, but escaped the widespread urban development that now characterizes much of the rest of Oak Bay (McCann, n.d.). There are no known Indigenous archeological features present on the site discussed here (W. Thomas, personal communication, August 2023).

Site Conditions

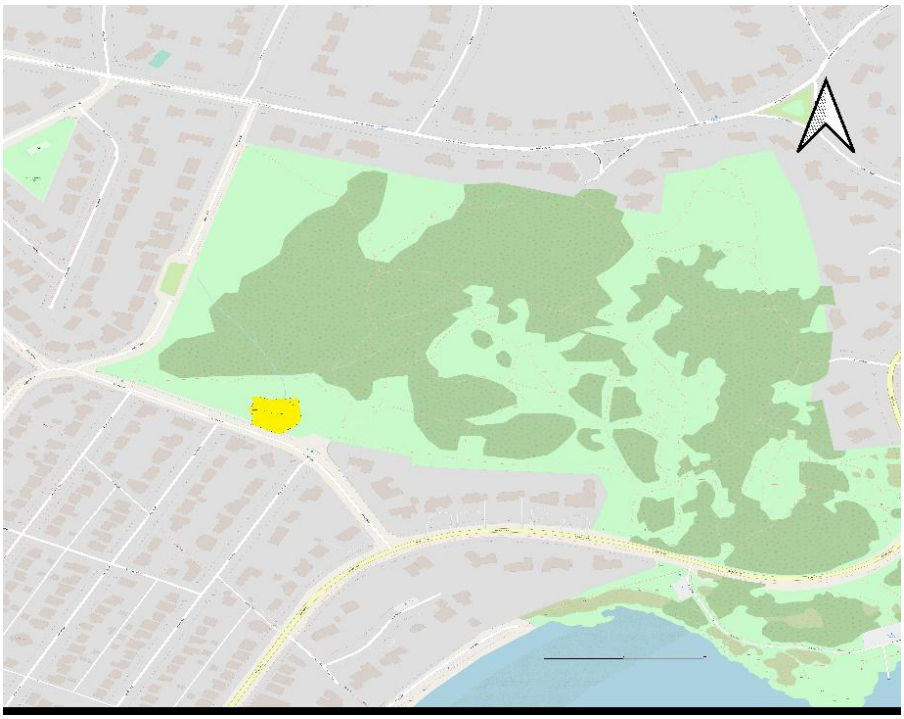

Figure 1. Location of the restoration site within Uplands Park.

The restoration site is located on the western side of Uplands Park, adjacent to the park boundary which is demarcated by a drainage ditch which lies parallel to Dorset Road (see Fig. 2). Elevation at the site is approximately eighteen meters above sea level. It receives unobstructed sunlight from the south, and the terrain consists of a slope not exceeding five degrees, with a northeasterly aspect.

Uplands Park is heavily influenced by the climate of the CDF zone, which is characterized by cool winters with high levels of precipitation, and warm, very dry summers with frequent drought (Bennett et al, 2013). The soil type in this section of the park is slow-draining Tolmie soil, which means that this site experiences wet conditions throughout the winter and spring months, though this is influenced somewhat through the presence of drainage ditches adjacent to the site and running throughout the park, which were constructed for agricultural purposes by early European colonists (Thomas, 2018).

Restoration on this site is made somewhat more feasible due to its unique location within the park. On two sides, drainage ditches restrict public access, and access is restricted on the remaining two sides by thick vegetation and seasonal inundation. The effects of recreational use such as trampling or digging by dogs are therefore mitigated in this scenario, which could benefit native species more sensitive to this type of disturbance (Parks Canada, 2006a; 2006b).

The site is bordered on three sides by dense stands of deciduous trees and shrubs, both native and invasive. One-seed hawthorn (*Crataegus polyacantha*) is present throughout the park and will continue to be a management issue. A non-native sycamore maple (*Acer pseudoplatanus*) is growing on the other side of Dorset Road and seedlings from this tree continue to pop up along this side of the site. In the eastern side of the site, the vegetation structure is becoming dominated by shrubs, notably June plum (*Oemleria cerasiforumus*) and Nootka rose (*Rosa nutkana*). The remainder of the site is heavily infested by non-native grasses and other introduced forbs, including creeping thistle (*Cirsium arvense*) and crow garlic (*Allium vineale*).

In 2022, as part of an ongoing plan to manage invasive woody species in Uplands Park, a section of the park approximately 1954m² was targeted for removal of Himalayan blackberry (*Rubus* armeniacus) and one-seed hawthorn. This area was further identified as a priority area for replanting with native plant species associated with Garry oak ecosystems as a means of

enhancing biodiversity within the park and the surrounding region (W. Thomas, personal communication, August 2023).

Figure 2. View from centre of restoration site, looking east.

Methods

In the spring of 2024, I began my fieldwork in order to complete the objectives outlined in Table 1. I first conducted an inventory of plant species extant on the site to identify persisting native plant species and problematic exotic species that might present opportunities or challenges to a planting program. I began my plant surveying April, to align with the seasonality of Garry oak ecosystem species, the majority of which shoot and bloom during the wetter winter and spring months. Both annual and perennial bulb species either enter dormancy or complete their life cycles before the droughty summers (Fairbarns, 2020). Prior to conducting my field work, I carried out a literature review of Garry oak ecosystem species consulted a list of species previously identified within Uplands Park was (Brayshaw, 1991).

On April 10, 2024, I conducted a transect survey of plant species at the site. A baseline transect was established at 48°26′26.4′′, -123°18′8.4′′, running forty-five meters east to west. At 15-meter intervals, transects were run north to south across the baseline to the edges of the site. An inventory of plant species observed on and adjacent to the transects was then compiled. Plant

identification was achieved through consulting the INaturalist app, and Pojar & Mackinnon's *Plants of the Pacific Northwest Coast* (2014). The transect survey method was chosen due to its tendency to maximize coverage of study sites while minimizing overlap, and to eliminate the tendency of surveyors to avoid difficult terrain. Subsequently on May 6, May 27, and June 25th, 2024, supplementary meander searches were carried out so as to minimize the chance of omitting species that were present on the site but were not covered by the transect patterns, as well as to identify late-blooming species which may be more difficult to detect in earlier stages of their life cycles (ANPC, 2012). I formatted the results of these surveys into a table for reference in guiding future plantings (see App. 1). In conjunction with the native plant surveys, I conducted a visual assessment of the physical conditions on the site. This assessment was done to note the light and moisture conditions as well as the unique microtopography which characterizes the site. The data gathered from this surveying was used to create a map with ArcGIS software that can be referenced for future planting (see App. 4).

This restoration site, and Uplands Park in general, as been infested with many invasive plant species (see App. 1) which are the subject of an ongoing invasive species management plan for the park (Thomas, 2018). Following ground assessment of the site, I selected a section of the site for the first stage of native plant species seeding, with an area of approximately 70 m^2, based on the lower density of invasive grasses, patches of bare soil, and its proximity to dense patches of camas (see App. 5). This section of the site is exposed to full sun, subject to less seasonal inundation, and is devoid of vernal pools. Despite some favourable conditions, two of the more problematic invasive forbs, creeping thistle and crow garlic, were present on this section of the site.

As a supplementary action to the program of herbicide application against invasive species that the District of Oak Bay is employing (Thomas, personal communication, June 1, 2024), I organised a volunteer event on June 1, 2024, as part of the Society for Ecological Restoration's Make a Difference Week. Make a Difference week is a global initiative prompted by the United Nations Decade on Ecosystem Restoration, in which volunteer groups in multiple countries coordinate events during one week in June (SER, n.d.). To solicit volunteers for the event at the site in Uplands Park, promotional posts were created for Instagram and Facebook with the assistance of the local University of Victoria chapter of the Society for Ecological Restoration. Emails were sent to University of Victoria student groups and the Friends of

Uplands Park, and event details were posted on the District of Oak Bay website. I also obtained the expertise of Wiley Thomas, a biologist and restoration practitioner who has worked for several years in Uplands Park, to provide guidance on best practises and species identification for volunteers present at the event.

On the day of the event, eleven volunteers arrived to assist in deadheading and removing crow garlic and creeping thistle. While the initial goal of the event was to limit the spread of these invasive species by removing the flowering heads before they could seed, volunteers found that the soil was sufficiently moist for the crow garlic to be manually removed. Creeping thistle's strategy of spreading through rhizome growth means that hand-pulling is not an effective control method, and volunteers focussed on removing the flower heads in advance of herbicide treatment in the late summer/fall (Thomas, personal communication, June 1). After two hours of labour, the group was able to remove seven garbage bags of biomass from the site. A subsequent visit to the site on June 25, 2024, with one volunteer, resulted in an additional bag of biomass being removed after an hour of labour.

Figure 3. Allium vineale.

As part of the native species planting plan developed for the site, a list of potential species for planting was developed by cross-referencing with previous plant surveying conducted

in Uplands Park (Brayshaw, 1991) and my own plant surveys, as well as with species observed to be present in adjacent park areas. These suggested species were formatted into a table which includes light and moisture requirements as well as suggested methods of propagation (see App. 2).

Figure 4. Lomatium nudicaule seeds.

In preparation for fall planting on the site, several varieties of salvaged seeds were collected in accordance with the planting list. *Camassia quamash* seeds, totalling 255 grams, had been previously salvaged by Wiley Thomas (Thomas, personal communication, July 3, 2024), and were sorted and cleaned of debris and seeds from other plant species during the summer of 2024. On July 26 and August 1, I also collected *Lomatium nudicaule, Camassia leichtlinii, Toxicoscordion venenosum, Triteleia hyacinthina, and Juncus ovalis* seeds from a nearby section of Uplands Park (see Fig. 5). Additional seeds of *Juncus tumulicola* were previously gathered by

Wiley Thomas and will be included in the planting plan (Thomas, personal communication, July 26, 2024).

Results

Ground inspection at this site determined that the slow-draining soils present here result in partial inundation of the site during the rainy winter months, particularly in the northern section. These conditions have also resulted in forming several vernal pools in the northern section which persist into the late spring even as other areas dry up. The southern section of the site along Dorset Road is somewhat raised and the driest soil conditions can be found there. In summary, soil conditions at this site can be characterised as wet to dry, varying according to seasonality and microtopography. The presence of vernal pool habitat at this site in a relatively undisturbed state underlines the importance of the area for conservation and restoration (see Fig. 6). Once widespread, vernal pools have been diminished and threatened by development and recreational activities across southern Vancouver Island. Parks Canada has identified vernal pools as critical habitat for at least six endangered plant species (2006b).

Figure 5. Vernal pool area during summer dry period.

The results of the plant species survey revealed the presence of more than fifty species on the site, the majority of which were non-native (see App. 1). In addition to creeping thistle and crow garlic, there is a high proportion of invasive agronomic grasses including orchard grass (*Dactylis glomerata*), colonial bentgrass (*Agrostis capillaris*) and *Bromus* species. Despite the pressures from invasive plant species, there were twenty native species identified in the survey. There is a significant population of small camas and great camas present on this site, largely on the northern and western portions. Other native species identified on the site were present either as remnant populations that have either persisted or were present due to sporadic seeding initiated outside the scope of this project . The red-listed and COSEWIC-listed plantainleaf buttercup (*Ranunculus alismifolius*) has previously been seeded around the vernal pools and is establishing(Thomas, personal communication, August 2023). Additionally, this site is one of the last remaining identified remnant habitats for the endangered COSEWIC-listed foothill sedge (*Carex tumulicola*), which is present in the wetter northern sections of the site (COSEWIC, 2008, Thomas, personal communication, April 10, 2024).

The results of the invasive plant management carried out as part of Make a Difference Week can be considered a success. The equivalent of 22 hours of work yielded a large amount of biomass which was taken offsite by the Oak Bay Parks department. It was also an effective opportunity for education on the species found within Uplands Park. In retrospect, the effectiveness of such events could be improved by making more of an effort to focus volunteer efforts on specific areas, as some participants tended to wander from the main group. Nevertheless, the creeping thistle and crow garlic were considerably diminished in the area identified for phase one of the planting plan. It is notable that while crow garlic has been found to be difficult to remove by hand (Burgess, Williamson & Whitwell, 2022), the volunteers found that hand-pulling was effective in the damp soil conditions they were working in, suggesting that future hand-pulling be carried out in the damper spring months when soils are looser, and the plants are easily identifiable.

A review of the literature regarding reseeding degraded grassland ecosystems indicated that Garry oak species should be planted from seed in the fall or winter months, as most will not germinate without cold stratification and the moist soil from winter precipitation (Hook & Costanzo, 2011). The tentative timeline for initial planting in the Uplands Park site was set for October 2024. Planting slower-growing species such as camas and bare-stem biscuitroot in

advance of more aggressive native species such as will reduce competitive pressure. Subsequent seeding of native grasses will be done at a reduced density to further ensure that native forbs are not overwhelmed. One source consulted suggested that forb to grass seed ratios of 2:1 -3:2 are preferable for this objective when designing seed mixes (Krueger et al, 2014). Using suggested seeding rates from Satinflower Nurseries, which is a local commercial source for native plants, I have calculated the seed weights needed for the 70 m² section of the site for the species collected to date (see table 2).

Species	m²/gram seeds	Grams for 70 m²
Camassia quamash	0.9	78
Camassia leichtlinii	0.5	140
Lomatium nudicaule	0.2	350
Toxicoscordion venenosum	0.5	140
Triteleia hyacinthina	1	70
Juncus ovalis	2.2	32

Table 2. Suggested seeding rates for selected species.

Discussion

The findings contained in this report align with the experiences of other restoration practitioners, who describe restoration in old field sites as one of the most challenging scenarios that can be encountered in the field. The presence of existing native species, which in this case includes at least two rare species, mixed in with an array of agronomic grasses and other invasives, poses challenges for management that are not considerations in more heavily degraded ecosystems in which native species have been extirpated. More aggressive techniques such as tilling or solarization are not appropriate in this context as they may negatively impact extant native species and/or their presence in the existing seedbank (Krueger et al, 2014). The Oak Bay Parks Department is currently conducting a program of selective herbicide application in this and other areas of the park, targeting creeping thistle, crow garlic, English ivy, and Himalayan blackberry. The herbicides being used are Garlon XRT with a 1.4 per cent dilution, as well as Roundup glyphosate, which is a general herbicide. Application takes place in the late summer. To date, herbicide has not been satisfactorily effective on creeping thistle (Thomas, personal communication, June 2024). This species is a persistent and problematic nuisance plant in both

agricultural and natural settings, and research indicates that integrated management including herbicide, mowing/deadheading, and planting of other competitive species is an effective strategy (Davis et al, 2017). It is suggested here that sustained stewardship of this study area in the form of volunteer events such as took place through Make a Difference Week, combined with implementation of the native species planting plan and repeated herbicide application, may reduce coverage of *C. arvense.* Seasonal mowing has also been demonstrated to be effective against *C. arvense,* and if undertaken in this area it may have the added benefit of reducing the vigour of the various agronomic grasses and woody species found on the site (Davis et al, 2017; Krueger et al, 2014).

Research conducted at sites analogous to those found at Uplands Park suggests that management of invasive species is not sufficient for passive regeneration of Garry oak ecosystems to occur. Removal of certain dominant invasive species such as Scotch broom can even have the negative effect of facilitating invasion by other exotic species (Lysgaard, 2022). The absence of historic disturbance regimes in the form of prescribed burning carried out by First Nations peoples, and increased selective herbivory as a result of elevated deer populations in the region, are additional complicating factors (Lysgaard, 2022, Shackelford et al, 2019). If the goal of restoration practitioners is to ensure the long-term persistence of Garry oak ecosystems, it seems likely that long-term stewardship as was practised in the past by First Nations, utilising an array of restoration strategies beyond invasive species management, will be required. Strategies for native plant species reintroduction and planting, such as the one discussed in this report, will be a key aspect of such an approach.

Since the project described in this report is limited to a one-year timeframe, the effectiveness of the work done at this point cannot be properly assessed, due to the seasonality of Garry oak ecosystems. Moving forward however, a plan for fall planting in this site will be submitted to the Oak Bay Parks Department and Friends of Uplands Park. The seeds gathered in the park by myself and Wiley Thomas are scheduled to be broadcast at the site in October 2024, as the first phase of ongoing restoration of this site. The seeding rates in Table 2 were suggested based on optimal conditions, and the presence of the aggressive invasive species at this site may require higher seeding rates for effective establishment, though this will be subject to seed availability (Krueger et al, 2014).

Subject to seed availability and finances for the project, seeds from other species on the planting list will in the future either be salvaged or purchased from local plant nurseries specialising in native species. Purchasing or salvaging seed for planting projects is much more economical than purchasing seedlings from nurseries, and given the feasibility of salvaging from nearby areas of the park, I have thus far decided to pursue this strategy. Beyond economic considerations, this approach also has the advantage of using seed from plant populations that have adapted to site-specific conditions at the park, increasing chances of successful establishment (Krueger et al, 2014). If, however, funding becomes available for planting seasons beyond 2024, the purchase of seedlings should be pursued, as they can be quicker to establish.

Effective monitoring is key to any restoration project as it facilitates adaptive management in accordance with species response to restoration techniques (Krueger et al, 2014). As the planting schedule progresses, I will establish photo monitoring points to assess the establishment and coverage of native plant growth and the response of the invasive plant species to the restoration efforts. Photo point monitoring will be conducted in the fall and spring months to capture the seasonal changes on this site.

Given the absence of historic seasonal fires, this site, in common with most Garry oak meadow ecosystems, will require monitoring and long-term interventions to prevent the incursion of both native and non-native woody species (Shackelford et al, 2019). While reintroduction of fire disturbance to site such as Uplands Park have been discussed and in other places implemented, it is important to consider that much of the intergenerational knowledge that Indigenous fire managers carried has been lost through colonial processes (Wickham et al, 2022). Currently, the potential for built-up fuels in the park to create dangerous fires makes such initiatives unlikely, and current practises are focussed on fire suppression (Thomas, 2019). Analogous practises such as thatch-raking and seasonal mowing should be further explored (Krueger et al, 2014).

Conclusion

Garry oak ecosystems such as those found in Uplands Park are prized for their cultural and biodiversity value. It is important to recognise that just as these ecosystems are a product of Indigenous land stewardship, the subsequent need for their restoration is a result of colonial

activities. Given this legacy, it is to be hoped that with increased public awareness, restoration and stewardship of these unique landscapes will become a higher priority for governments and the public at large. There is also an imperative for future work to be decolonial in nature: Indigenous voices should have a leading role in the direction of these activities, and restoration should offer opportunities for strengthening Indigenous cultural practices and ties to the land. In the interim, this small project will proceed in hopes of enhancing the habitat and biodiversity of Uplands Park, while potentially providing future research opportunities for restoration practitioners as best practices for Garry oak ecosystem restoration are further developed.

Works Cited

Alberta Native Plant Council. (2012). *ANPC guidelines for rare vascular plant surveys in Alberta – 2012 update.* http://www.albertapcf.org/rsu_docs/guidelines-for-rare-plant-surveys-in-ab_2012-update.pdf.

Bennett, J.R., Vellend, M., Lilley, P.L., Cornwell, W.K., Arcese, P. (2013). Abundance, rarity, and invasion debt among exotic species in a patchy ecosystem. *Biological Invasions,* 15(3). DOI 10.1007/s10530-012-0320-z

Brayshaw, T.C. (1991). *Wild plants of Uplands Park, Oak Bay.* https://www.uvic.ca/science/biology/herbarium/assets/docs/Uplands%20Park.pdf

Burgess, C., Williamson, J., Whitwell, T. (2022, December 16). Wild garlic & wild onion. https://hgic.clemson.edu/factsheet/wild-garlic-wild-onion-2/

Cartwright, J. (2019). Ecological islands: conserving biodiversity hotspots in a changing climate. *Frontiers in Ecology and the Environment,* 17(6). https://doi.org/10.1002/fee.2058

Centre for Forest Conservation Genetics. (n.d.). *CDF zone*. https://cfcg.forestry.ubc.ca/resources/cataloguing-in-situ-genetic-resources/cdf-zone/

COSEWIC. (2008). *Foothill sedge (Carex tumulicola) COSEWIC assessment and status report.* https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/foothill-sedge.html

Davis, S.**,** Mangold, J., Menalled, F., Orloff, N., Miller, Z., Lehnhoff, E. (2017). A meta-analysis of Canada Thistle (*Cirsium arvense*) management. *Weed Management,* 66(4). https://doi.org/10.1017/wsc.2018.6

Fairbarns, M. (2020). Garry oak ecosystems. In Klinkenberg, B. (ed.), *Biodiversity of British Columbia.* University of British Columbia. https://ibis.geog.ubc.ca/biodiversity/GarryOakEcosystems.html

Gann, G.D., McDonald, T., Walder, B., Aronson, J., Nelson, C.R., Jonson, J., Hallett, J.G., Eisenberg, C., Guariguata, M.R., Liu, J., Hua, F., Echeverria, C., Gonzales, E.K., Shaw, N., Decleer, K., Dixon, K.W. (2019). International principles and standards for the practice of ecological restoration. Second edition. *Restoration Ecology,* 27(S1). https://onlinelibrary.wiley.com/doi/10.1111/rec.13035

Hook, F. & Constanzo, B. (2011). Species propagation and supply. In GOERT, *Restoring British Columbia's Garry oak ecosystems: principles and practices.* https://stewardshipcentrebc.ca/PDF_docs/GOERT/Guides/GOERT-restoration-booklet-all.pdf

Krueger, J.J., Bois, S.T., Kaye, T.N., Steeck, D.M., Taylor, T.H. (2014). Practical guidelines for wetland prairie restoration in the Willamette Valley, Oregon. https://cascadiaprairieoak.org/wp-content/uploads/2014/12/Wetland-Prairie-Guide-FINAL-8_25_14-1.pdf

Lea, T. (2011). Garry oak and associated ecosystems: distribution and description. In GOERT, *Restoring British Columbia's Garry oak ecosystems: principles and practices.* https://stewardshipcentrebc.ca/PDF_docs/GOERT/Guides/GOERT-restoration-booklet-all.pdf.

Malcolm, J.R., Liu, C., Neilson, R.P., Hansen, L., Hannah, L. (2006). Global warming and extinctions of endemic species from biodiversity hotspots. *Conservation Biology*, 20(2). https://doi-org.ezproxy.library.uvic.ca/10.1111/j.1523-1739.2006.00364.x

McCune, J. L., Pellatt, M. G., & Vellend, M. (2013). Multidisciplinary synthesis of long-term human–ecosystem interactions: A perspective from the Garry Oak Ecosystem of British Columbia. *Biological Conservation*, *166*, 293–300. https://doi.org/10.1016/j.biocon.2013.08.004

McCann, L. (n.d.). *Oak Bay: the making of a suburban landscape.* https://www.oakbay.ca/our-community/history/archives/research/oak-bay-history

McDadi, O. & Hebda, R (2008). Change in historic fire disturbance in a Garry oak (*Quercus garryana*) meadow and Douglas-fir (*Pseudotsuga menziesii*) mosaic, University of Victoria, British Columbia, Canada: A possible link with First Nations and Europeans. *Forest Ecology and Management,* (256), 1704-1710. http://dx.doi.org/10.1016/j.foreco.2008.03.012

Parks Canada. (2006). *Recovery strategy for multi-species at risk in Garry oak woodlands in Canada.* https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/garry-oak-woodlands.html#aut

Parks Canada. (2006). *Recovery strategy for multi-species at risk in vernal pools and other ephemeral wet areas in Garry oak and associated ecosystems in Canada.* https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/garry-oaks-ecosystems.html

Rudisuela, J. (2020, August 15). The forgotten graveyards under Victoria. *Capital Daily.* https://www.capitaldaily.ca/news/indigenous-bones-victoria-burial-mounds-songhees-lekwungen-coast-salish-oak-bay

Shackelford, N., Murray, S.M., Bennett, J.R., Lilley, P.R., Starzomski, B.R., Standish, R.J. (2019). Ten years of pulling: ecosystem recovery after long-term weed management in Garry oak savanna. *Conservation Science and Practice*. https://doi.org/10.1111/csp2.92

Society for Ecological Restoration. (n.d.). *SER's global week of restoration.* https://makeadifferenceweek.org/about/

Thomas, W. (2018). Uplands Park: invasive plant management plan 2018-2025. *Ecorestoration,* 2(2018). https://journals.uvic.ca/index.php/ecorestoration/article/view/18430.

Thomas, W. (2019). *Uplands Park & Cattle Point Management Plan*. District of Oak Bay. https://www.oakbay.ca/sites/default/files/Uplands-Park-Management-Plan.pdf

Wickham, S.B., Augustine, S., Forney, A., Mathews, D.L., Shackelford, N., Walkus, J., Trant, A.J. (2022). Incorporating place-based values into ecological restoration. *Ecology and Society,* 27(3). https://doi.org/10.5751/ES-13370-270332

\

Appendix 1: List of Plant Species Identified at Uplands Park Site

Latin name	Common name	Notes	Native? (Y/N)
Trees			
Common Pear	*Pyrus communis*	One example, transect 2	N
Shrubs			
June Plum	*Oemleria cerasiformis*		Y
Nootka rose	*Rosa nutkana*		Y
Common Snowberry	*Symphoricarpos albus*		Y
Red osier dogwood	*Corus sericea*	In submerged area at northern border	Y
One-seed hawthorn	*Crataegus monogyna*	Seedlings	N
Sycamore maple	*Acer pseudoplatanus*		N
Twinberry honeysuckle	*Lonicera involucrata*		Y
Pacific crabapple	*Malus fusca*		Y
Common privet	*Ligustrum vulgare*		N
Grasses and Forbs			
Blue wild rye	*Elymus glaucus*		Y
Orchard grass	*Dactylis glomerata*		N
Colonial bentgrass	*Agrostis capillaris*		N
Brome fescue	*Festuca bromoides*		N
Yorkshire fog	*Holcus lanatus*		N
Brome	*Bromus spp.*		N
Smooth meadow-grass	*Poa pratensis*		N
Crow garlic	*Allium vineale*		N
Canada thistle	*Cirsium arvense*		N
Himalayan blackberry	*Rubus armeniacus*		N
Greater plantain	*Plantago major*		N
Small camas	*Camassia quamash*		Y
Large camas	*Camassia leichtlinii*		Y
Catchweed bedstraw	*Galium aparine*		N
Slender cinquefoil	*Potentilla gracilis var. gracilis*	Population in transect 2	Y
Common dandelion	*Taraxum officinale*		N
Sword fern	*Polystichum munitum*	One example, by ditch in transect 1	Y
Field horsetail	*Equisetum arvense*		Y
Common vetch	*Vicia sativa*		N
Spurge laurel	*Daphne laureola*		N
English ivy	*Hedera helix*		N
Common groundsel	*Senecio vulgaris*		N
Bull thistle	*Cirsium vulgare*		N
Shepherd's cress	*Teesdalia nudicaulis*		N
Scotch broom	*Cytisus scoparius*	One example, transect 1, since removed	N
Cut-leaved crane's-bill	*Geranium dissectum*		N

Fringed willowherb	*Epilobium ciliatum*		Y
Curled dock	*Rumex crispus*		N
Small-flowered blue-eyed mary	*Collinsia parviflora*	Transects 2 and 4	Y
Fireweed	*Chamaenerion angustifolium*	One example, transect 2	Y
Creeping buttercup	*Ranunculus repens*		N
Sheep's sorrel	*Rumex acetosella*		N
Meadow buttercup	*Ranunculus acris*		N
Shortspur seablush	*Plectritis congesta*	Transects 1, 2 and 4	Y
Common Cat's-ear	*Hypochaeris radicata*		N
Red deadnettle	*Lamium purpureum*		N
Oxeye daisy	*Leucanthemum vulgare*		N
Clover	*Trifolium spp.*		?
Orange honeysuckle	*Lonicera ciliosa*	Transect 4	Y
Trailing blackberry	*Rubus ursinus*	Transect 4	Y
Bur parsley	*Anthriscus caucalis*	Since removed	N
Chickweed	*Stellaria media*		N
Plantainleaf buttercup	*Ranunculus alismifolius*	Red-listed species. Previously planted in vernal pools in transect 3.	Y
Large-leaved lupine	*Lupinus polyphyllus*	Transect 1	Y
Unidentified	*Juncaceae spp.*		?
Starry broomsedge	*Carex pachystachya*		Y
Split-awn sedge	*Carex tumulicola*	Red-listed species	Y
Western marsh cudweed	*Gnaphalium palustre*		Y
White brodiaea	*Triteleia hyacinthine*		Y
Western buttercup	*Ranunculus occidentalis*		Y

Appendix 2: List of Species for Planting Plan

Species	Latin Name	Soil Moisture	Propagation	Timing	Light Requirements	Source(s)
Garry Oak	*Quercus garryana*	Moist to dry	Seeds, seedings	Fall	Full sun to partly shaded	https://goert.ca/species/quercus-garryana/ https://linnet.geog.ubc.ca/Atlas/Atlas.aspx?scinam=Quercus%20garryana
Black hawthorn	*Crataegus douglasii/gaylussacia*	Moist to wet	Seeds, seedlings	Year-round	Full sun to partly shaded	https://satinflower.ca/products/crataegus-douglasii?_pos=1&_psq=hawthorn&_ss=e&_v=1.0
Scouler's willow	*Salix scouleriana*	Moist to dry	Seeds, cuttings, seedlings	Year-round	Full sun to full shade	https://courses.washington.edu/esrm412/protocols/2011/SASC.pdf
Barestem biscuitroot	*Lomatium nudicaule*	Dry	Seeds, seedlings	Fall	Full sun	https://westernforbs.org/species/barestem-biscuitroot-lomatium-nudicaule/
Few-flowered shooting star	*Primula pauciflora*	Moist to moderately dry	Seeds, seedlings	Fall	Full sun to partial shade	https://plantdatabase.kpu.ca/Plant/dopu
Common camas	*Camassia quamash*	Dry to moderately moist	Seeds, plant division, seedlings	Fall	Full sun	https://goert.ca/species/camassia-quamash/
Farewell-	*Clarkia*	Dry	Seeds, seedlings	Fall	Full sun	https://goert.c

to-spring	*amoena*					a/species/clarkia-amoena/
Fool's onion	*Triteleia hyacinthina*	Moist to wet	Seeds, seedlings	Fall	Full sun	https://courses.washington.edu/esrm412/protocols/2014/TRHY3.pdf https://nativefoodsnursery.com/fools-onion/
Nodding onion	*Allium cernuum*	Dry to moderately dry	Seeds, plant division, seedlings	Fall-winter	Full sun to light shade	https://goert.ca/species/allium-cernuum/
Western buttercup	*Ranunculus occidentalis*	Dry to moist	Seeds, seedlings	Fall	Full sun to partial shade	https://plants.usda.gov/DocumentLibrary/plantguide/pdf/pg_raoc.pdf https://courses.washington.edu/esrm412/protocols/2016/RAOC.pdf
Sea blush	*Plectritis congensta*	Dry to moist	Seeds, seedlings	Summer-fall	Full sun to partial shade	https://wikis.evergreen.edu/pugetprairieplants/index.php/Plectritis_congesta https://courses.washington.edu/esrm412/protocols/2010/PLCO4.pdf
Small-flowered blue-eyed Mary	*Collinsia parvifloria*	Dry to moderately dry	Seeds, seedlings	Early spring	Full sun	https://goert.ca/species/collinsia-parviflora/
Blue wildrye	*Elymus glaucus*	Moderately dry to	Seeds, plant division,	Late summe	Full sun to light shade	https://goert.ca/species/alli

		moderately moist	seedlings	r - fall		um-cernuum/ https://plants.usda.gov/DocumentLibrary/plantguide/pdf/pg_elgl.pdf
California brome	*Bromus carinatus*	Moist to dry	Seeds	Fall	Full sun	https://plants.usda.gov/DocumentLibrary/factsheet/pdf/fs_brca5.pdf
California oatgrass	*Danthonia californica*	Moist to dry	Seeds, plant division, seedlings	Fall	Full sun to light shade	https://goert.ca/species/danthonia-californica/ https://plants.usda.gov/DocumentLibrary/factsheet/pdf/fs_daca3.pdf
Long-stoloned sedge	*Carex inops*	Mesic to dry	Seeds, plant division, seedlings	Fall	Full sun	https://goert.ca/species/carex-inops/
Prairie junegrass	*Koeleria macrantha*	Dry to moist	Seeds, seedlings	Fall	Full sun	https://goert.ca/species/koeleria-macrantha/ https://plants.usda.gov/DocumentLibrary/factsheet/pdf/fs_koma.pdf
Common yampah	*Perideridia gairdneri*	Dry to moist	Seeds, bulbs, seedlings	Fall	Full sun	https://goert.ca/species/perideridia-gairdneri/
Splitawn sedge	*Carex tumulicola*	Wet to dry	Seeds	Fall	Full sun to partial shade	https://www.canada.ca/en/environment-climate-change/services/species-risk-public-

						registry/cosewic-assessments-status-reports/foothill-sedge/chapter-4.html
Oval sedge	*Carex ovalis*	Wet to moist	Seeds	Fall	Full sun	https://satinflower.ca/products/carex-ovalis
Western rush	*Juncus occidentalis*	Wet to dry	Seeds	Fall	Full sun	https://satinflower.ca/products/juncus-occidentalis

Appendix 3: Promotional Instagram Graphic for Make a Difference Week

Appendix 4: Map of Site Conditions

Appendix 5: Map of Fall 2024 Planting Area