

Stabilizing the Purple Sanicle (*Sanicula bipinnatifida*) sub-population and increasing density of native plants in a highly altered Garry Oak ecosystem remnant in Rithet's Bog Conservation Area in Saanich, BC.

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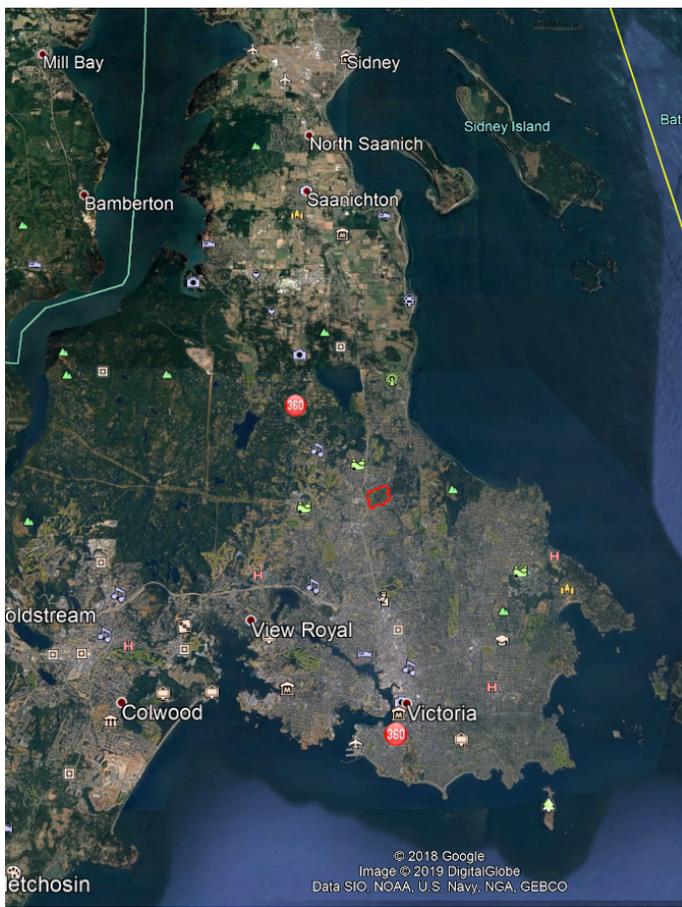
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Introduction

Rithet's bog is a 42-hectare nature reserve that was donated to the City of Saanich by the Guinness family after being drained and farmed since the late 1880's (Golinski 1995). Rithet's bog is the last large bog on southern Vancouver Island. The central bog is classified as a coniferous treed bog, while the rest of the reserve contains valuable wetland habitat for migrating birds and native frogs well as moist meadows that support native butterflies, and Garry oak remnants around the perimeter (Hartwell, 2010; Voicescu, 2018). This combination of habitats is known to support many threatened and endangered species including the common ringlet, the red-legged frog, and purple sanicle, as well as a multitude of other more common species (Hartwell, 2010).



Above: Image from google earth showing the location of Rithet's bog in Saanich, BC outlined in red.

Purple Sanicle (*Sanicula bipinnatifida*) is a perennial forb with a very restricted range in Canada. It is red-listed in British Columbia and found only on Vancouver Island in Canada, although it is common down the coast through Oregon into Baja California (Miskelly, 2007). *S. bipinnatifida* flowers in early spring between early May and late June, produces seeds between late July and August, and then dies back. It has a large taproot and basal rosette of leaves, leading to a branched flowering stalk. Flowering likely occurs in or after the second year (Zevit 2010). It is thought that germination may be a limiting factor, and juvenile mortality is high during the first winter. Although once found at 5 locations in Rithet's bog, only 3 sub-populations (sub-populations 1 and 3) could be relocated in 2007, and the status of 2 of the remaining (4 and 5) could not be confirmed in 2018 (Miskelly, 2007). The last sub-population (sub-population 2) of purple sanicle plants is found on the South-East side of the park, directly adjacent to the path and is the focus of the project. All the observed plants are located within approximately 5ft of the path. It is thought that a significant amount of seed falls onto the path and is lost each year, limiting recruitment from seed. In addition, the topography of the site prevents the seed from moving in another direction except under external influence such as transport by animals. Another factor limiting establishment of new plants may be competition from non-native grasses on site (Miskelly 2007). The soil is a hard clay, called Saanichton clay by Golinski (1995), and the site is very dry during the summer, creating challenging conditions for growth.



Above: A flowering purple Sanicle plant at Rithet's bog. Photo by Ryan Chan.

This project deals with the reduction of non-native plants, and introduction of natives, as well as the promotion of purple sanicle growth in a small area of Rithet's Bog located below the development on Emily Carr drive on the south-east side of the. Some work has previously been performed in this area including a 2007 survey by James Miskelly (Miskelly, 2007). A small section of wooden fencing was installed along the path where the purple sanicle is found. This project builds on these previous works, including recommendation to reduce non-native grass competition by Miskelly 2007 in order to improve the native community of this Garry oak remnant.

The site contained very high amounts of non-native plants. Some natives such as *Sanicula bipinnatifida*, *Sanicula crassicaulis*, *Elymus glaucus*, *Danthonia californica*, and *Quercus Garryana* were present, but the area was dominated by non-natives such as *Daucus carota*, *Festuca* sp., *Rubus armeniacus*, English Hawthorne and others. Rubble in the form of bricks was also found in the soil on site, possibly from nearby residential developments.

This project has four goals:

- 1- Stabilize purple sanicle population, establish possibility for growth and persistence into future including climate change by establishing population at plateau on top of slope
- 2- Utilize both seed and seedlings (plugs) of purple sanicle to collect information on growth, allow collection of differences in growth in the future through monitoring of the site
- 3- Establish and increase population of native species that can persist into the future in the face of climate change
- 4- Increase the density of native plants on site including grasses, herbs, and forbs.

Methods

A preliminary round of regular maintenance was performed in mid-march 2018 while the purple sanicle plants were still small by hand-trimming all grass within the wooden enclosure. Removal of species took place between late July and late October after the purple sanicle had died back for the season.

The boundaries of the site were marked out using large stakes. Two belt transects were performed on site perpendicular to the path to determine the species composition of the plant community. A secondary survey was done by Kristen and James Miskelly from Saanich Native plant and combined with the information gained from the transects to compile a species list for the site. The original species composition of the site is as follows, with native species in bold and non-natives in non-bold (Saanich Native Plants, 2018).

Danthonia californica

Trifolium pratense

Daucus carota

Hypochaeris radicata

Dactylis glomerata

Festuca rubra

Anthoxanthum odoratum

Rubus armeniacus

Elymus glaucus

Bromus hordeaceus

Poa pratense

Schedonorus arundinacea

Bromus carinatus

Quercus garryana

Bromus commutatus

Symphoricarpos albus

Tragopogon porrifolius

Sanicula bipinnatifida

Pteridium aquilinum

Two *Carex tumulicola* individuals were also found in close proximity (within 5 metres) of the site.

Several removal methods were used for undesirable and non-native species for this project. For species such as *Daucus carota* or *Tragopogon porrifolius*, the plants were removed by hand, by pulling firmly on the stems. For Himalayan blackberry or similar shrubby plants, a shovel or weed wrench was used to pry up the roots (GOERT, 2002; GOERT, 2003). A weed-wrench is also effective for young Hawthorn and Nootka rose. Tarps were used to smother young annual grasses on the top of the hill to create a site for out-planting of purple sanicle. The tarps were installed September 23rd and removed November 18th. Large perennial grasses were removed using a hook knife or shovel, taking care that as much root material as possible is removed while also leaving as much soil as possible. Table 1 shows the primary species targeted for removal as well as the methods used.

Table 1. Species targeted for removal from the site including removal methods and their source literature.

Species	Removal Method	Future management	Source
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Blackberry	Hand removal, weed wrench, trowel/shovel	Remove canes and root crowns manually as they re-sprout until eradicated	GOERT 2002
Purple Salsify	Hand removal	Hand removal where found	Personal communication, James Miskelly 2018
Queen Anne's Lace	Hand removal	Hand removal where found	
Hawthorn	Pull out/remove small individuals by hand, cut larger individuals as low to the ground as possible	Continue to pull and cut.	GOERT 2003
Tall fescue	Remove roots with hook knife/trowel/shovel	Continue to remove new growth and any remaining growth	Personal communication, James Miskelly 2018
Annual fescue	Smother with tarp (8 weeks) then rake	Repeat over other areas where necessary	Personal communication, James Miskelly 2018
Orchard grass	Remove with hook knife/trowel/shovel	Repeat if new individuals are found	GOERT 2007

Invasive species removal was done primarily on the slope uphill of the area outlined by the wooden fence to avoid disturbing soil where the purple sanicle are present, however some English Hawthorne and Nootka Rose was removed from the area using a weed wrench.

All the areas cleared of non-native species were densely seeded using a custom seed mix ordered from Saanich Native plants. The species selected for planting were selected from Species recovery documents for purple sanicle and deltoid balsamroot as well as GOERT documents and California ecosystem documents. The species list was altered in consultation with Saanich Native Plants and Fort Rodd Hill to be specifically suitable for the site.

Table 2. Seed mix and quantities obtained from Saanich Native Plants used for seeding cleared ground.

	seeds/m	seeds/g	\$/g	g/m2	\$/m2	total g	total \$
Achillea millefolium	30	3125	\$3.00	0.0096	\$0.03	1.44	\$4.32
Camassia quamash	65	258	\$2.500	0.251938	\$0.63	37.79	\$94.48

Camassia leichtlinii	55	139	\$1.150.395683	\$0.46	59.35	\$68.26
Collinsia parviflora	85	1175	\$6.00 0.07234	\$0.43	10.85	\$65.11
Danthonia californica	50	308	\$1.000.162338	\$0.16	24.35	\$24.35
Eriophyllum lanatum	65	2575	\$5.000.025243	\$0.13	3.79	\$18.93
Luzula subsessilis	55	1389	\$7.000.039597	\$0.28	5.94	\$41.58
Plectritis congesta	55	1012	\$8.000.054348	\$0.43	8.15	\$65.22
Ranunculus occidentalis	40	305	\$5.000.131148	\$0.66	19.67	\$98.36
	500			\$3.20		\$480.60

Zygadenus venenosus, *Lupinus polycarpus*, *Triodanis perfoliata*, and *Crocidium multicaule* are additional species that were selected for planting on-site, but for which seed sources could not be secured for this project. In addition, *Lomatium nudicale* and *Carex tumulicola* seeds were collected from other parts of nearby areas of Rithet's bog and added into the seed mix. *Balsamorhiza deltoidea* seeds obtained from Fort Rodd Hill were planted by hand in areas of deeper soil on the slope where species removal was done, as well as at the top of the slope after the tarps were removed. Approximately 60 *Camassia quamash* bulbs were also planted into cleared soil on site.

Sanicula bipinnatifida seeds from 2016 and 2017 were obtained from Rithet's Bog Conservation Society and sent to the nursery at Fort Rodd Hill to be grown for out-planting in the fall of 2019. Approximately 75% of the seed produced in 2018 at Rithet's bog was collected and split into two. One half was sent to Fort Rodd Hill along with the seed from 2016 and 2017, while the other half was used to directly seed the top of the slope after the tarps were removed. The *Sanicula bipinnatifida* plants grown at Fort Rodd Hill will be planted in the same area at the top of the slope in order to maximize the chances of establishing a source population for seed at the top of the slope.

Camass bulbs were planted approximately 3-5cm deep and 10cm apart in 3 groups of around 20 individuals on the slope. The seed mixes were planted in two separate rounds. The annual seeds were planted in the third week of October 2018 by broadcast seeding into cleared areas of land. The hand-gathered seeds of *Lomatium nudicale* and *Carex tumulicola*

were also spread at this time over the same areas. The perennial seeds, including the *Sanicula bipinnatifida* and *Balsamorhiza deltoidea* were planted in mid-November.

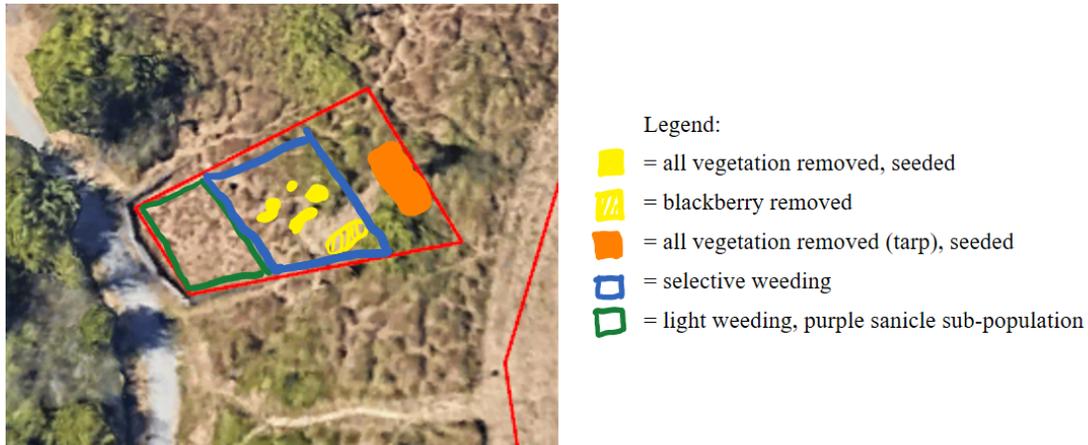


Figure 1. Image of purple sanicle site showing different treatment areas. Image taken from google earth.

Results

Two tarps were used to smother annual bromes which cleared a combined area of approximately 9m². Removal of grasses, blackberry, and other target species took place over approximately 80m² of the total 150m². The total area that was completely cleared and seeded was approximately 13m². This shows a removal of non-native species over 53% of the target area, and an addition of native species (by seed) over approximately 8.7% of the area. This does not include the nursery grown purple sanicle that will be planted in the fall, which was estimated to have an approximate 70% germination. All areas that were seeded in the field showed some growth and germination, but relative success is difficult to determine at this time as many of the plants are too small for positive identification. Monitoring is recommended for a minimum of 5

years to observe the establishment of native plants along with light maintenance to maintain native additions.

Discussion

All the plants that were chosen for seeding at this site are known to be found in similar environments (Garry oak maritime meadows) (GOERT 2003). In addition, species were chosen for their ability to coexist. The few relatively aggressive species that were included in the seed mixes, such as yarrow, were included in small quantities so as to prevent these plants from excluding other native vegetation. Although Garry Oak maritime meadows are often herb and forb dominated with relatively low abundances of grass, future climate change will alter plant communities (CRD, 2017). For this reason, several grass species were included in the seed mix, even though native grasses are already present in some parts of the site from previous work (Hartwell, 2010). However, they were only added outside of the trapezoid with purple sanicle and native grasses. This grass-inclusive community goal is intended to follow the model of Southern communities from the United States (specifically California), where the communities that contain purple sanicle are largely grass-dominated in order to take climate change into account (Begley, 2018; CRD 2017)). Including grass in the seed mix is intended to provide a means for a community transition to follow changing climate conditions in this site while still using native species and creating a community where purple sanicle is known to thrive. In addition, it is thought that the Vancouver Island Ringlet, an endangered butterfly species, may use grasses (both native and nonnative) as a food source (Voicescu, 2018). This provides another motivation for ensuring the presence of grasses on the site.

The other selected species were chosen based on their natural community associations, and their association with specific plants. Plants associated with purple sanicle, Deltoid Balsamroot, Common Camas, and Garry Oak Maritime Meadows respectively in species recovery plans were compiled into a list which was then narrowed by habitat type, growth habit, and ability to co-exist without dominating the space available (Parks Canada Agency, 2006; COSEWIC, 2009).

The success of removal of invasive species in this area in the long term will require some maintenance and ongoing removal, especially in the following 3-5 years while the planted native seeds are establishing. The larger English Hawthorne in particular could benefit in the future from internal controlled herbicide application rather than simply removing new growth which requires continued maintenance indefinitely. Due to the high density of non-native in this site, the goal was simply to introduce native species into the area in such a way that they can persist into the future, and simply to decrease the non-native plant coverage.

Conclusions

This report only covers the initial stages of work on this site. The purple sanicle grown at Fort Rodd Hill must still be planted in the fall. Additionally, many native species do not fully establish for several years, so continued management is necessary in order to assess the full impact and benefit of the project. Minor maintenance including removal of target non-native species would be beneficial to aid in the establishment of the new plants. This project represents

a very small portion of the work that could be done on site, and therefore meets only a portion of the potential of the site. Further removal of non-natives in the future would provide greater area for the establishment of native species and encourage further growth.

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