# Restoration Summary and Recommendations for Mount Sutil Galiano Island

**Report Produced by**
**Odin Scholz B.Sc.**
**Galiano Conservancy Association**
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## Contents

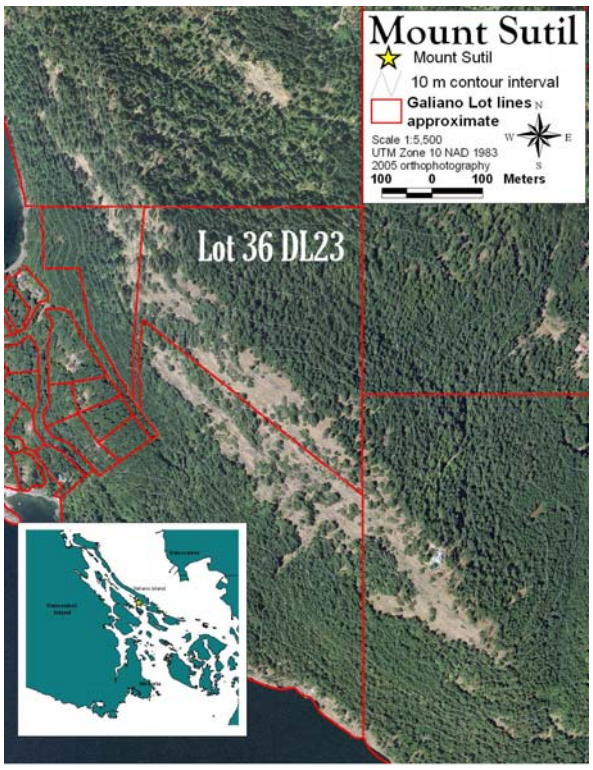

**Introduction** ..... 1
**Context** ..... 1
**Site History** ..... 2
Logging ..... 2
Windthrow ..... 2
Fire ..... 3
Browse ..... 3
Exotic species ..... 4
History of Restoration Treatment ..... 4
**Methods** ..... 4
**Results** ..... 7
Vegetation ..... 7
Exotic Species ..... 7
Douglas-fir Encroachment ..... 8
**Discussion and Recommendations** ..... 9
Invasive Species ..... 9
Conifer encroachment ..... 11
Native Plant Propagation ..... 13
**Conclusion** ..... 14


## Figures


Map 1 Mount Sutil 1
Table 1 Polygon details from Islands Trust Fund Mapping for polygon (5496) 2
Map 2 2009 Ecosystem Polygons 5
Table 2 Mt. Sutil broom polygons as of fall 2009 (Map 2) 6
Table 3 The Number and Type of Native and Non-Native Life forms 7
Map 3 Mount Sutil Broom Polygons 7
Map 4 Douglas-fir Encroachment 8
Fig 4 Diameter Class/Density graph 9
Table 4 Other Herbaceous Exotic Species of Concern 10
Table 5 Invasive Grasses to watch out for 11
Table 6 Location of Suppressed Oaks 13

# INTRODUCTION

This is a restoration plan for lot 36 of DL 23 owned by the Galiano Conservancy Association since 2000. The restoration recommendations address the Garry Oak and Associated Ecosystems found along the Southern Boundary of the Lot and the mature forest edge that borders the meadowlands. This report summarizes past surveys, including searches for species at risk, and restoration work carried out on the site combined with recent site visits to make recommendations for future restoration work. The Garry Oak Associated Ecosystems of Mt. Sutil are in relatively healthy condition compared to much of the Garry Oak ecosystems of the Southern Vancouver Island and the Southern Gulf Islands. The principle restoration issues for the meadow bluff sites are the control and eradication of the invasive shrub Scotch broom (*Cytisus scoparius*) and the control of invading Douglas-fir (*Psuedotsuga menziesii*) saplings upon Garry Oak trees.




**Map 1.**

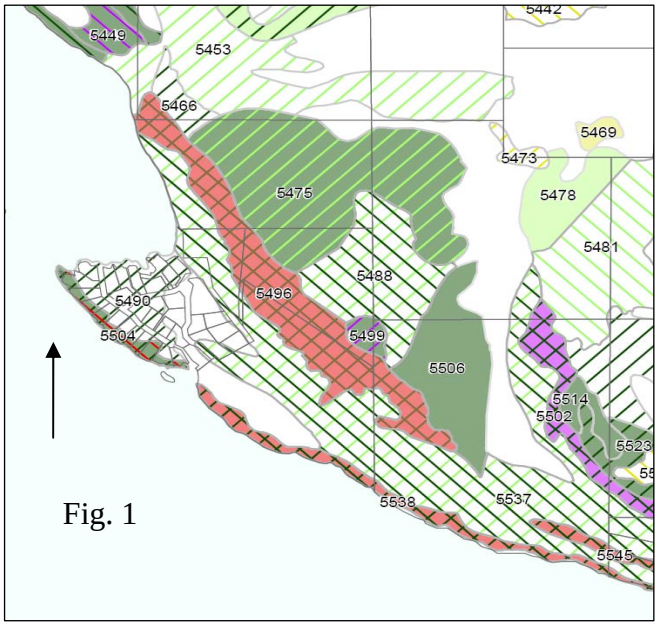



Fig. 1

# Context

Mount Sutil on Galiano Island is part of the Coastal Douglas Fir moist maritime biogeoclimatic zone in South western British Columbia (Meidinger and Pojar, 1991). Garry Oak and Associated Ecosystems in South Western British Colombia, are at the northern extent of their biogeoclimatic range in North America. Less than 5 % of the original expanse of the ecosystem type remains (GOERT, 2002). Of the remaining Garry Oak Ecosystems most suffer from habitat loss, fragmentation, exotic species invasion, altered fire regime, cessation of traditional management practices and other ecological stressors. The Garry Oak Ecosystems Recovery Team currently states that 116 species have federal recognition as being at risk.

| Table 1. Polygon details from Islands Trust Fund Mapping for polygon (5496) (Fig. 1) | | |
|---|---|---|
| %cover | Type | Structural Stage |
| 40% | Coastal Cliff, | Sparse bryoid |
| 40% | Older Forest conifer | Douglas Fir Arbutus, Old Forest |
| 20% | Older Forest broadleaf | Garry Oak- Brome (or mixed grasses) |

Galiano Island is a long and narrow land feature situated South-East to North-West in the Georgia Strait (Map 1). Mount Sutil lies on the South end of the island facing South-West towards Saltspring Island. The island's orientation supports Garry Oak and Associated Ecosystems on the warm, steep, shallow soils of the South West side of the Island. Garry Oak and associated ecosystems cover approximately 3% of Galiano's landscape (Emmings and Erickson, 2004). The Garry oak ecosystems owned by the Galiano Conservancy on Mount Sutil are part of the broadest contiguous Garry Oak and Associated ecosystem areas on Galiano Island. This patch of Garry Oak and associated ecosystems is mapped as polygon 5496 (Fig. 1) on the Islands Trust Fund's 1:20,000 "Galiano Island Sensitive Ecosystems Mapping 2005" (ITF, 2009). This polygon is characterized in Table 1.

The Garry Oak Ecosystems of Lot 36 of DL 23 are 5.8ha of the 27% of Garry Oak and associated ecosystems that have been protected through land acquisition on Galiano Island. The Garry Oak and associated ecosystems of Mt. Sutil have been recognized as relatively intact examples of a Garry Oak Ecosystems by renowned botanist Hans Roemer, who surveyed the site in 2004 and whose surveys are part of this plan.

# Site History

### Logging

Most of the forested lands of Galiano Island have been logged at least twice over the past 100 years. The forests on Mount Sutil are fairly unique in that they appear to have been logged only once, and in a selective rather that clear cut manner. It is apparent that the logging event took place during the 1950's, based on a tree ring core of a tree that was nestled in behind three large stumps on the forest-meadow edge. The tree rings revealed the tree was released 55 years ago. It appears that Douglas-fir trees were the main focus of the logging that at times straddled the cliff edge. Many large Douglas-fir trees were left behind to seed into the newly created gaps and disturbed soils. This logging event created conditions for the dense infilling of Douglas-fir saplings and young trees along the forest meadow edge.

### Wind throw

There area also a significant number of wind throw trees found up along the ridge top zone of the Mount, wind is a major disturbance factor in the CDF ecosystem, and it is possible that in the wake of the logging event many residual trees succumbed to the wind.

## Fire

**Fig 2** Broom regeneration in Polygon I summer 2009, Photo point 10

The historical presence of fire is evident on Mount Sutil in the charring that exists on many of the larger Douglas Fir Trees. A large diameter Douglas-fir tree was determined to have established on the site since the last fir as it was growing right beside a large charred Douglas-fir snag. The tree core taken from the living Douglas-fir showed the tree to be 100 years old meaning the last fire on Mount Sutil was pre 1910. Other cores could be taken to firm up the historical dates of the most recent fire at the site. Fires are a natural phenomena of the CDF and a personal communication with the Galiano Island Fire Chief revealed that there was one lightening started fire in the last 15 years on the South end of the Island that required extinguishing. Agee (1993) states that fires return intervals in Douglas-fir forests was likely between 10-30 years, due to natural causes. Cultural burning is well documented in deeper soiled Garry Oak ecosystems (Pellatt etal., 2007) suggesting burn intervals of 1-5 years. It is unclear whether cultural burning would have been applied to a shallow soiled site such as found on Mt. Sutil.

The bedrock atop Mt. Sutil is conglomerate lying on sheets of sandstone. The conglomerate is prone to small and larger rock slides. One recent slide is apparent on the 1998 ortho photo. In many places on the SW slopes the upper soil is very coarse broken conglomerate that is prone to down slope movement when disturbed. Many trees on the slope show impact scars from falling rocks. It is likely a combination of edaphic conditions on the shallow, steep, hot, SW facing slopes that maintain the Garry Oak ecosystem and fire on the ridge tops where the soils are slightly deeper in pockets

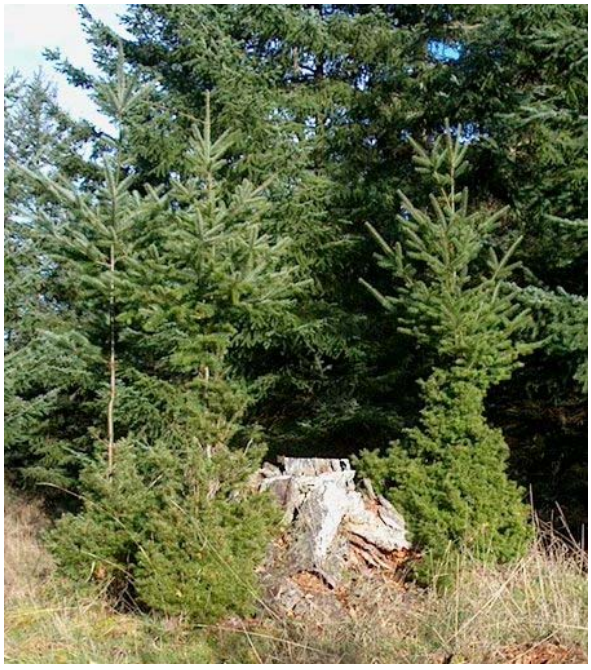


**Fig. 3** *Deer browse on young Douglas-firs.*

## Browse

Black tailed deer have a definite presence on Mt. Sutil. Heavily used trails zigzag across the Mountain face creating disturbed microsites and transporting seeds of both exotic and native plants. Many of the encroaching Douglas-fir seedlings on the upper ridge show heavy browse (fig. 3). Most of the Scotch broom appears dense, compact and rounded the result of heavy browsing (fig. 2). Visual observation of the site has yet to reveal any Garry Oak seedlings, a possible result of deer browse. Several oak seedlings were found growing in thick patches of broom during the

initial clearing of the site. Once the broom was removed the Oak seedlings disappeared presumably due to deer browse. Even without the broom removal it is highly unlikely that the oak seedlings would have made it to the sapling stage

There is anecdotal evidence that domestic goats once roamed the mountain side but this has not been the case within the past twenty years. Hikers seldom wander up through the site because of the location, steepness of the terrain and lack of legal public access.

**Exotic Species**

Exotic species are present on the site the most obvious being Scotch Broom. Scotch broom has been on Galiano Island for upwards of 100 years, and it is possible that broom was introduced to the site during the 1950's logging event. The broom patches near the summit of the Mountain seemed to have the largest and oldest plants at the time of removal efforts were begun in 2004. There are also invasive grass and herb species found throughout the site including rose campion (*Lychnis coronaria***)** concentrated near the summit. Exotic annual grasses including *Bromus sterilis*, *Vulpia bromoides* and *Cynosurus echinatus* are frequently found across the site. The Conservation Data Center species occurrence data base includes *Allium amplectens* (***S3***), *Meconella oregana* (S1/COSEWIC E), *Plagiobothrys tenellus* (S1/ COSEWIC T), *and Yabea Microcarpus*(S1S2), *Clarkia amoena var. caurina* (S3) . The CDC occurrence reports note the presence and invasion of Scotch broom as a threat to these rare species.

## History of Restoration Treatments

The Galiano Conservancy Association began extensive broom removal from the Garry Oak and Associated Ecosystems of Mt. Sutil in the summer of 2003. Prior to this a small amount of broom was removed on New Years day in 2000 from around the summit of the mountain. In 2003 a sweep was made across the ridge top from the North West edge of the property following the ridge top to the South West property line. As part of this project, additional pockets of broom were cleared from the adjacent property to the West on the Steep South Facing slope. This project was continued in the summer of 2004 completing the intial sweep of the Mountain for large broom plants. The result of this effort was to remove all of the broom from Lot 36 of DL 23.

At the time of removal the broom stands were a mixture of large mature plants with some juveniles mixed in. The densest concentrations were around the summit of the mountain to the South East. Due to project funding schedules the initial cut commenced at the beginning of August after the plants had already gone to seed. Cut broom plants were hauled into the adjacent forest where there was minimal vegetation growth and left to decompose on site. Some of the disposal sites were among encroaching Douglas-fir pockets a fact that should be considered when planning thinning treatments.

During the ensuing summers of 2005-2006 succeeding broom seedlings were hand pulled from polygons treated in 2003-2004 as resources allowed. The polygons were swept from the west property edge east.

# Methods

The Galiano Conservancy Association has been focusing restoration efforts on Mt. Sutil over the past 7 years. This restoration report compiles :

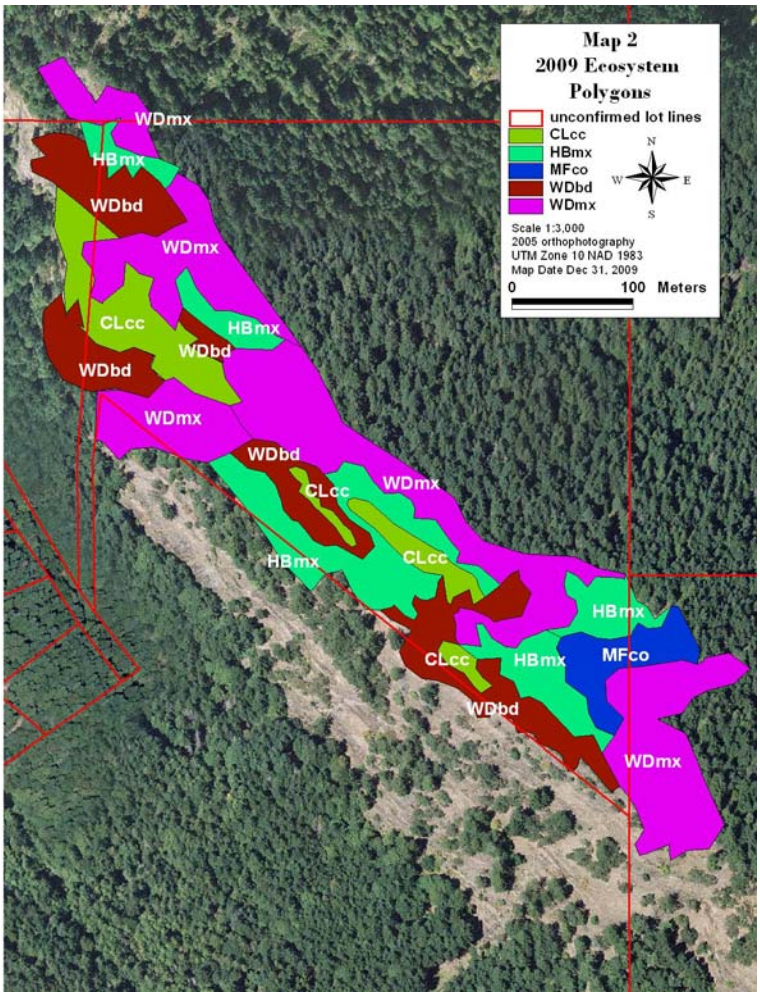
- Air photo interpretation was used to classify the ecosystems on Mt. Sutil.
- Existing data from Four separate vegetation surveys to identify the vegetation growing on Mt. Sutil's Garry oak associated ecosystems.

- Field surveys and GPS mapping conducted to map the locations of Scotch broom dominated polygons as well as sites of Douglas-fir encroachment.
- Several forest plots conducted to represent forest stand structure past and present.
- Several older Douglas-fir trees cored to gain insight into the past history of the site.
- Photo monitoring plots that were first established in 2003 and re-shot in 2009.

In 2003 ecosystem polygons were drawn based on the interpretation of 1998 orthophotography. Ground based vegetation surveys using 5X5m representative plots were carried out with botanist Harvey Jansen in spring of 2004 recording vegetation occurrence by ecosystem type. Four broad polygon types were defined as follows;

1. Conglomerate Rock outcrop (RO)
2. Grass dominated (GR)
3. Woodland Broadleaf (WDbd)
4. Woodland Mixed (WDmx)

The extent of these polygon areas were adjusted in 2009 based on much finer detailed ortho imagery taken in 2005 (Map 2).




Map 2

A second inventory survey was carried out during the summer of 2004 by Hans Roemer. Hans used 5X5 m plots to inventory some to the more intact native grass ecosystems on Mt. Sutil. He subjectively placed plots looking to characterize the perennial native grass communities of the SW facing Mt. Sutil lands.

A third vegetation survey was carried out by Emily Gonzales as part of her PH.D thesis. Emily carried out fairly intensive surveys of the herbaceous communities of the flatter ridge top of Mt. Sutil with particular focus around summit. Emily's survey plots were each 1-m² and were selected randomly after identifying candidate plots meeting the following criteria: < 5% exposed rock, < 10% slope, no canopy closure, > 10 m to an adjacent plot. Her crew identified all plant species and estimated their cover in each plot by using a 1-m² quadrat divided into one-hundred 10 cm x 10 cm cells and estimating the area covered by each species rooted in the plot to the nearest ½ cell. Their sampling effort was approximately one plot/200 m² (Gonzales, 2008). Vegetation plot locations were mapped on GIS software (Map 2).

**TABLE 2 Mt. Sutil broom polygons as of fall 2009 (Map 2)**

| POLY ID | NOTES | Veg Type | Broom Density 2009 | Area meters² |
|---|---|---|---|---|
| A | Two eco types convex conglomerate | Grass/ Moss Herb | Clear | 110 |
| B | convex conglomerate | Moss/herb | Clear | 10 |
| C | Close mature fir canopy | Moss/herb | Clear | 0 |
| D | Convex conglomerate | Moss/herb | Clear | 10 |
| E | heavy disturbance 74% slope | Herb/loose rock | Clear | 10 |
| F | 63% slope | Grass/herb | Clear | 10 |
| G | North sloping | Grass | Med | 20 |
| H | About 30 plants Conglomerate, Roe | Moss/Rf | Med | 10 |
| I | Broom moss, conglomerate ridge fo | Moss/grass | Med-High | 30 |
| J | Sparse broom plants | Grass | Low | 10 |
| K | Broom thicket | Grass/Garry Oak | High | 100 |
| L | Shoulder site thicket High Carex inops | Grass/herb | High | 60 |
| M | 3 dense patches and sparse indivi | Grass/ Moss | Med-High | 80 |
| N | Thicket | Grass | High | 10 |
| O | Oregon grape patch | Grass/ Oregon | Med | 20 |
| P | Sparse | Grass | Med | 4 |
| Q | Mixed sparse to thick | Grass | Med-high | 250 |
| R | Mixed density | Grass | High | 30 |
| S | Fairly dense | Grass/herb | High | 40 |
| T | Mostly cleared (MEC 2009) | Grass | Clear-low | 200 |
| | | | TOTAL | 1014 |

On January 26, 2010 a survey of bryophytes and lichens was carried out by Terry McIntosh and members of the Galiano Conservancy Association. A list of species identified appears in the appendix. The vegetation survey data from the three surveys was pooled to represent the site.

A Trimble Recon GPS unit was used to gather data points on Mt. Sutil. Existing and known patches of broom were mapped on the ground. Points were gathered at the outer edges of the areas where broom has been a dominant cover species. The points were joined in after transferring the information to GIS. Similarly, the outside edges of sites of Douglas fir-encroachment were recorded and later mapped. Individual Garry Oak trees that were suffering under encroaching Douglas-fir trees on the upper flatter portion of the Garry oak ecosystems are were mapped.

Several 3.99m circular plots were thrown to indicate density of Douglas-fir regeneration and mature stand on the edge of the open ridge top. A 30m plot was thrown to indicate pre-logging stand densities by counting the large old trees and large stumps in the plot. A 16inch increment bore was used to core several older Douglas-fir trees and the rings were counted to indicate dates of past fire and logging events.

Sixteen Photo monitoring points were established in 2003 and 12 were re-shot in 2009. The 2003 photo points were established at sites where there was a high density of broom. The 2003 photos were taken with a HP C618 Photosmart Digital camera with a 1:2.4-4.0, 5.2mm-15.5mm Pentax lens. At 10 meters from the camera a 2m stick or a 1 meter board was held or placed in the ground. Lens height, distance and azimuth to the measuring stick were recorded along with details on a reference point to assist in the location of the photo point. Photo points were recorded with the GPS when re-shot in 2009.

# RESULTS

**Table 3. The Number and Type of Native and Non-Native Life forms**

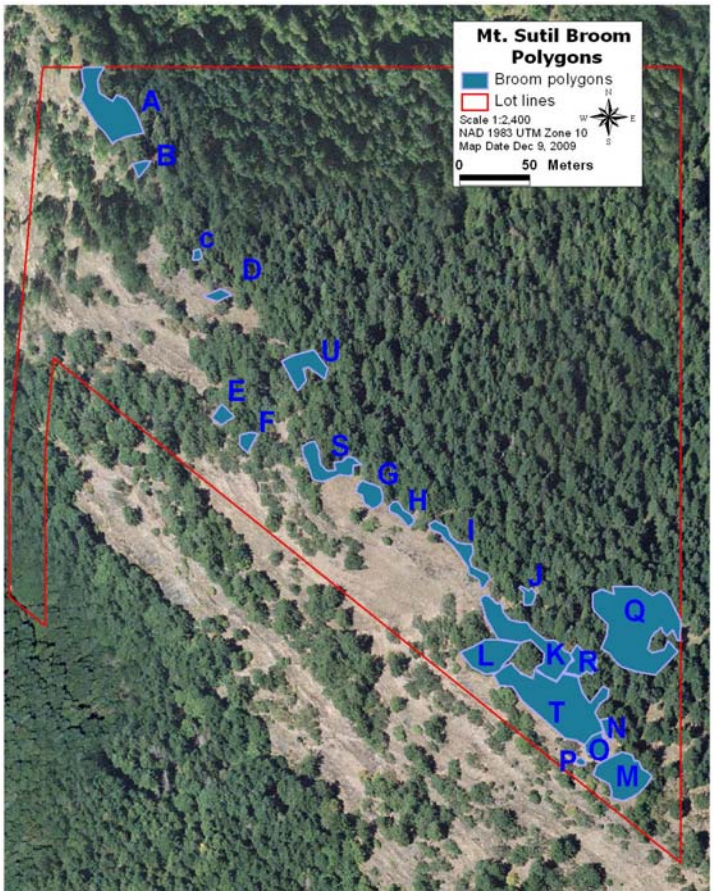
| *Form* | Native | Non-native |
|---|---|---|
| Fern | 2 | 0 |
| Lichens(all sp.) | (1) | 0 |
| Moss | 6 | 0 |
| grass | 13 | 16 |
| herb | 56 | 19 |
| sedge | 3 | 0 |
| shrub | 3 | 1 |
| tree | 4 | 0 |
| | 87 | 36 |

## Vegetation

Of the three vegetation surveys of the site a total of 115 species were observed growing on Mt. Sutil (See Appendix). Of these 82 species were native and 34 exotic (Table 3). Of the 35 exotic species 16 are grasses and 18 herbs. The one non-native shrub is Scotch broom. The complete species list appears in the appendix. Of the species identified during these surveys includes S1, Red listed *Yabea microcarpus* and S3,Blue listed *Allium amplectens*, *Allium acuminatum* and *Clarkia amoena var. caurina*. Previously *Meconella oregana* (S1/COSEWIC E) and *Plagiobothrys tenellus* (S1/ COSEWIC T) were identified at the site but were not observed during these three surveys.

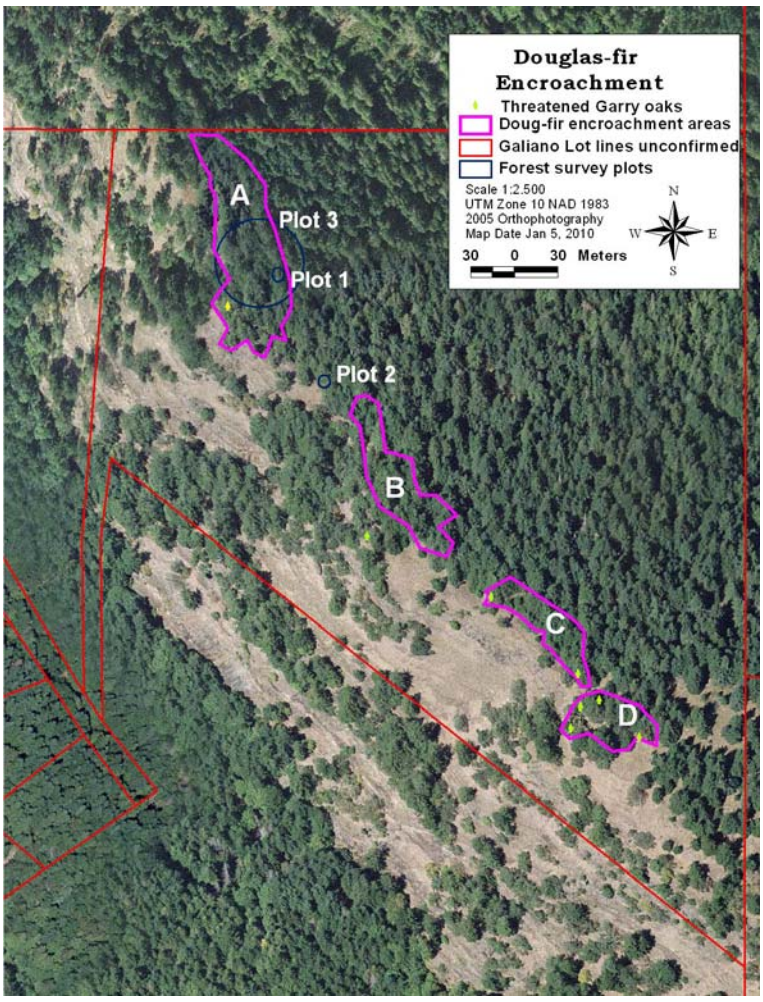
## Exotic Species

Twenty Scotch broom dominated polygons were identified on Mt. Sutil (Map 3). In total .10 hectares 1014 m² of Mount Sutil Garry oak ecosystems have had significant broom cover. Broom was pulled and cut from these polygons beginning in 2003. By the fall of 2009 350m² or 35% of the broom infested polygons had been successfully cleared of broom. In the remaining 65% of the polygons broom was still a dominant species. Most of these plants had germinated post initial removal efforts. The original treatment for broom was carried out in August 2003, this is late in the season as detailed in "Best Practices for Invasive Species Management in Garry Oak and Associated Ecosystems: Scotch Broom (*Cytisus scoparius*)". By the fall of 2009 broom polygons A-F, T and U (Table 2) were cleared regularly enough that all observable broom seedlings were removed. Polygons G through S were cleared of all broom plants during the initial efforts in 2003 and 2004 but not treated as regularly in ensuing years and subsequently are covered in stout juvenile broom plants (Fig.2). In the fall of 2009 a casual observation of expended seed pods on broom plants indicates that approximately 5% of the broom plants produced seeds in 2009. However, pod production does not seem to be very heavy on the plants possibly due to plant age and browsing. There is evidence of re-sprouting from some of the broom plants particularly in polygon D where soils were very shallow and in Polygons N and O that




**Map 3.**

may have been cut as early as 2000. And were cut later in the season the first time they were treated. Most of the broom cut in 2003 from polygons A-F and T did not re-sprout from the base but rather grew as seedlings. There are a few outlying plants that occur outside of the major polygons on bluff faces. Many of these outliers have been cut or pulled over the last 5 years as was possible using a rope and harness to reach safely. These plants continue to be high priority plants for removal as they can lead to new infestations. Many of the broom plants found in shallow outcrops of conglomerate are very difficult to pull without causing heavy soil disturbance. Some of the broom is locked into the rock such that it cannot be pulled, cutting is the only alternative. Therefore timing of treatment becomes very important for these plants as they are prone to re-sprouting. Due to prolonged seed dormancy, lone outlying broom plants and small patches can and will occur throughout the open and woodland zones on Mount Sutil.




**Map 4.**

Several patches of campion rose (*Lychnis coronaria*) have been observed on Mt. Sutil. One patch of plants growing in Polygon T on the SW facing slope just below the summit of the Mountain were hand pulled beginning in 2004 and repeatedly removed through 2009. As of the fall of 2009 there is no obvious sign of campion rose plants growing on the mapped site. This site should be visually monitored on a regular basis to ensure no seedlings re-establish.

**Douglas-fir Encroachment**

Young Douglas-fir trees are filling in many of the gaps created by past logging. To determine the data of the logging event a tree core taken of a Douglas-fir that had been growing in the shadow of three large Douglas-fir trees cut in the historical logging event. The tree rings showed a definite jump in growth when released from the shadows 55 years ago. This puts the logging event in the mid to late 1950's. Historic aerial photography exists from 1952 and the next from 1967. In 1952 logging was active close to the Mt. Sutil lands but most of the forest was intact. By 1967 much of the forest on the north facing slope has been cleared with sporadic residual trees. The logging method was not to

clearcut completely, many old growth trees occupy the Mt. Sutil ridgetop. These trees would have provided the seed to fill in the gaps created during the logging event. Polygons A-C indicate areas at the site where young Douglas-fir trees have in filled.

Two small 3.99m diameter plots (Plot 1 and 2) were swung to provide a comparative sample of the regeneration densities. Plot 1 was in a dense stand of regenerating Douglas-firs and plot 2 in an area where few trees were removed but the original mature forest canopy was maintained such that no trees seeded in.

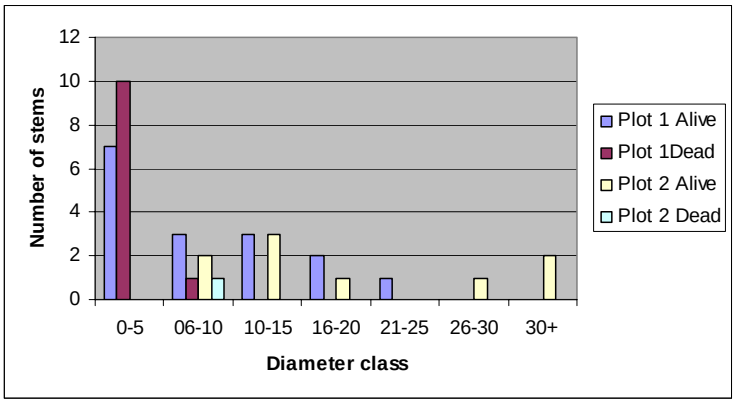



Fig 4

Plot 1 in the dense fir encroachment of zone A revealed a Douglas-fir colonization density of 5200 stems per hectare (sph). Forty percent of these stems died out within the first 10-20 years of growth leaving 3200 sph, 50 years post disturbance (Fig 4). The stand conditions existing in Polygons A-C (Map 4) and characterized by Plot 1 are dense stems forming a tight closed canopy with dead trees in the understory. These conditions are ideal for transferring a ground fire into a crown fire. In Plot 2 the trees are more evenly spread through diameter class and are spaced both horizontally and vertically. Plot 2 forest structure allows for nearly 100% of forest floor vegetation cover by mosses and herbaceous species. In general plot 2 forest type is more fire resistant and more biologically diverse.

# Discussion and Recommendations

**Invasive Species**

Scotch Broom is by far the biggest threat to the ecological integrity of Mount Sutil's Garry oak and associated ecosystems. The efforts that have been undertaken by the Conservancy thus far have been successful in controlling broom in Polygons A-F and T. Polygons A through C show very limited broom regeneration and fairly intact native plant communities in place of the broom with little sign of past broom (Fig 5). Polygon D is a very shallow soiled site dominated by mosses. For the third pass the dense regeneration was removed in the fall of 2009. It was difficult to pull these plants without causing disturbance. It can be expected that this site will continue to be a problem with regenerating broom seedlings but the number should decrease as the years go on. It would be beneficial to seed disturbed portions of this polygon with locally gathered Roemer's fescue (*Festuca roemerii*) grass seed in early spring or fall. Polygon E is steep with rich soils mixed with lots of loose unconsolidated conglomerate making it highly prone to disturbance. More important the rope access trail passes directly through this area and simple foot traffic is going to cause the soil to shift. *This area would be a good place to plant Elymus glaucus plugs and a half dozen fenced Garry Oak trees, to help develop some stability in the soils through time. It would be advisable to investigate alternate hiking roots or ways to reduce the disturbance of the soils while accessing the site, even better would be to secure alternate access from the North end neighbouring properties.* Barring this , there may be a route up the South and East edge of the current access site or an alternate route up through the main bowl near the

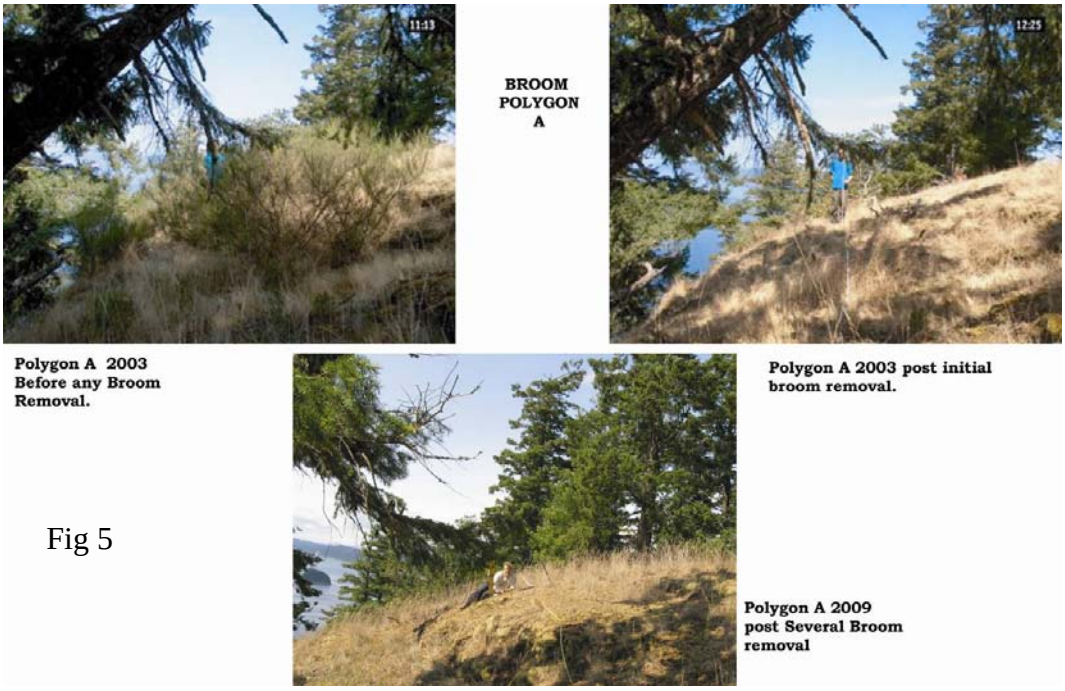



Fig 5

Mountain summit. A further consideration is the rope passes very close to know Yabea microcarpus sites. Disturbance of the known Yabea sites should be avoided entirely or particularly during flowering times. Flowering time is likely April-May but this should be observed and recorded on Mt Sutil. Yabea has been observed in polygons E, F, S and K so particular caution should be exercised when addressing the broom problem in these polygons. Referring to table 2 broom removal priority should be given to the polygons with the low to med broom cover leaving the heavily infested broom polygons until last. Further, if resources are lacking targeting flowering plants only for cutting may broaden the potential impact of the effort. *To protect the shallow soil ecosystems of Mt. Sutil it is preferable that any broom plants over 2 years of age are cut rather than pulled from the ground. Cutting should be carried out when plants are in bloom and before seed set March-June. Cutting may be done at other times of the year but cuts should be done below the fist lateral hair roots, and the stems should be covered with mulch or soil to prevent light stimulating re-sprouting* (Polster personal communication). Small diameter re-sprouts, less than pencil width, may be pulled during the wet winter months when the ground is soft. Care should always be exercised to minimize soil disturbance by placing hands or feet adjacent to stem being pulled to hold the floor in place. Broom often sprouts in dense patches and knee pads should be worn by workers to provide comfort while working as discomfort often leads to an increase in soil disturbance.

| **Table 4 Other Herbaceous Exotic Species of Concern** | | | |
|---|---|---|---|
| **Species** | **UTM's** | **Area** | **Density** |
| **Mullein** | **472 137-<br>5 413 102** | **10m²** | **Plants occur sporadically across bowl area.** |
| **Mullein** | **472 232 –<br>5 412 974** | **10m²** | **9 plants pulled Winter 2010** |
| **Rose campion** | **472 217-<br>5 413 007** | **20m²** | **Repeatedly pulled between 2004- 2010** |
| **Rose campion** | **472 126–<br>5 413 050** | **4m²** | **Pulled winter 2010** |
| **Rose campion** | **472 117–<br>5 413 122** | **5 m²** | **Area partially pulled winter 2010 needs more effort** |

Campion rose and Mullein are two of the larger, more obvious exotic herb species found on Mount Sutil whose populations should be controlled. Campion rose occurs in at least three patches on Mount Sutil. The largest patch occurs in broom Polygon T, the repeated hand pulling of this area has greatly reduced the presence of the plant. A similar strategy should be applied to other known patches of rose campion (Table 4). *Plants should be pulled before summer seed set and if pulled after this seed heads should be bagged and disposed of off site*.

The biennial Mullein (*Verbascus thapsus*) occurs sporadically across the open, exposed bedrock slopes on Mount Sutil. The mullein plants produce a large biomass that takes up lots of ground space, this is significant when considering many of the native herbaceous species in the Garry oak associated ecosystems on Mount Sutil are very small. Mullein produces thousands of seeds in its second year that can lay dormant for over 100 years and the seeds will germinate with soil disturbance. The plants flower sequentially from late June through September depending on the size of the inflorescence. It is recommended that mullein rosettes and flowering stalks be pulled before seeds set in late summer. Cutting plants will not kill the plant and the rosette will bolt. Due to the sensitivity of the soils in the mullein growth sites works should be aware of the need to minimize soil disturbance as much as possible by keeping the surrounding soil surface in place. The long vitality of the seeds means mullein will have a presence in the grassland ecosystems of Mt. Sutil for years. An annual sweep of the site for mullein should be conducted for the first two to three years then every other year after that to prevent any inputs into the site's seed bank. *Plants should be targeted for removal in late June or early July*.
Other exotic species are present on Mt. Sutil in particular exotic grasses. Given the timing of this survey no notable patches of exotic grasses were mapped. Invasive grass species to be aware of on Mt. Sutil are listed below as ranked by the Garry Oak Ecosystems Recovery Team (2007) are listed in

| **Table 5 Invasive Grasses to watch out for.** | | |
|---|---|---|
| Name | Risk ranking | Currently observed on Mt. Sutil |
| Orchard grass (*Dactylis glomerata*) | Highest | NO |
| Velvet-grass (*Holcus lanata*) | High | NO |
| Sweet vernal grass (*Anthoxanthum odoratum*) | Medium | YES |
| Hedgehog dogtail (*Cynosurus echinatus*) | Medium | YES |

Table 5. *If orchard or velvet grass are observed on Mt. Sutil they should hand weeded immediately. Hot spots where these grasses may appear are in the broom patches around the summit of the Mountain and on the face gully access route.*

**Conifer Encroachment**

Garry oak trees are a dominant species on the Mt. Sutil landscape, particularly on the steep South West facing slopes. The Garry Oak trees found on the crest of the Mountain are often being encroached upon by Douglas-fir trees. In 2003 when Scotch broom was first being removed from the mountain two Garry oak seedlings were uncovered growing among several broom thickets. The oaks were protected by piling cut broom around the plants. A year later both seedlings were nowhere to be found. It is likely the plants were browsed by deer. Since these early sightings no oak saplings observed on

the Mountain. The lack of Garry oak seedling recruitment is an issue of concern throughout the species' range in British Columbia (Brian Reader, personal communication).

Fig. 5 Douglas fir secondary layer filling past logging gaps.

Map 3 highlights 8 sites where Garry oak trees are succumbing to Douglas-fir encroachment. Two types of Douglas-fir encroachment have been observed on Mount Sutil. In one case, through decades mature and old growth Douglas-fir trees have gradually expanded their canopies and are now shading out the neighbouring, short stature Garry oak trees. In these situations the *mature fir trees could be climbed and limbed to open up the oak trees to ensure they receive as much light as possible*. It may be appropriate to top or girdle some of the larger firs to create more room for the oaks. The lack of oak regeneration and the stressed appearance of many of the established trees makes treating encroachment around them a priority.

In removing fir encroachment the oak trees will be given more light and the ground around the oaks will receive more light. The ground level vegetative response to the removal of the fir trees should be monitored with permanent plots. *Prior to removing fir trees a detailed vegetation survey should be carried out under the fir trees and a permanent plot established and photographed to monitor the shift in vegetation once the tree canopy is removed.* Areas that have Scotch broom close to them should be monitored closely for broom sprouting after the firs are treated. Release should be scheduled for Fall, Winter or Spring before leaf out.

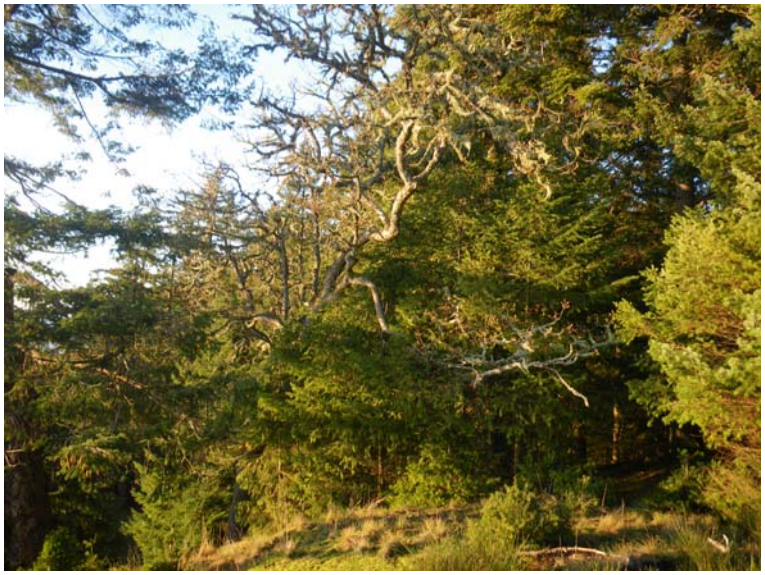


Fig. 6 Douglas-fir trees engulfing Garry oak tree.

The second type of Douglas-fir encroachment on Mt. Sutil is dense stands of young fir trees (<50years old) that have moved into edge gaps opened up during the logging in the middle of the last century (Fig 5,6). These trees are coming in among and through the Garry oaks and if left unchecked will shade the oaks out. These stands need to be thinned or removed from around the oak trees Harrington and Devine (2006) recommend clearing encroaching conifers in a 9-12 meter radius around the oaks

The last fire event to affect Mount Sutil appears to have happened 100 to 150 years ago based on

**Table 5 Locations of Suppressed Oaks.**

| OAK_ID | TYPE | UTM'S | |
|---|---|---|---|
| A | Fir under | 472242.58 | 5413043.17 |
| B | 2 Oaks under big fir | 472215.31 | 5413068.29 |
| C | Oak fir near | 472202.43 | 5413064.00 |
| D | Oak struggling - smothered by fir | 472195.99 | 5413049.18 |
| E | 1 fir to girdle | 472200.71 | 5413086.33 |
| G | Oak under two Old Firs | 472056.58 | 5413180.27 |
| H | Oak with Firs coming up around | 472141.47 | 5413138.66 |
| I | Mature firs branching over Oaks | 471961.23 | 5413337.64 |
| J | Mature fir over Oak | 471918.89 | 5413434.07 |

increment cores of fire scarred, tree large diameter unscarred fir trees and presence of large diameter, low to ground level branches on open grown trees,. Historically mean fire return intervals were of the order of 10-30 years in Garry Oak Ecosystems (Agee, 1993). The logging event of the 1950's created the ideal conditions for young fir encroachment along the upper edge of the site in particular Polygons A, B and C (Map 3). These sites are characterized by shallow soils and dense stands of Young Douglas-fir trees. These stands should be considered for thinning to:

- Reduce the potential structural fire hazard as dense stands act as fuel ladders moving fire from the ground up into the canopy of larger trees.

- Increase biodiversity at the forest meadow edge where it is currently limited to a closed canopy of homogenous species.

- To release Garry oak trees being shaded out by encroaching Douglas-fir.

While surveying the dense fir patches a small accipiter was observed zipping through the dense trees at an unbelievable velocity, obviously capable of exploiting this habitat. Not all of the dense fir stands should be removed as they do provide unique habitat structure. When the stands are being marked out for thinning 50-200m² patches of fir within polygons A,B and C (Map 4) should be retained to maintain this type of stand structure. Conversely, 50-200m² patches may be treated initially and photo and vegetation monitoring could be set up to allow assessment before proceeding with broader scale treatment. The second approach would be more prudent and allow more control if there happens to be a heavy invasive plant seed bank in the soils. Cleared areas would be good locations for planting Garry Oak seedlings and native grass and herbaceous species to speed up site recovery.

It Table 5 lists 8 locations where Garry oaks were observed to be under stress from encroaching Mature and young Douglas-fir trees. There may be additional trees identified for release in the field. If additional trees are treated they should be mapped so locations may be monitored. Cut firs will have to be dealt with on site. Ideally the bulk of the biomass could be hauled from the meadow ecosystem into the adjacent forest to decompose into the forest floor. *Vegetation surveys around the released oaks should be conducted the following two springs and into the future as funds provide. Cleared sites should be monitored for invasive species and tree seedling germination. These areas may be appropriate sites for planting additional Garry oak seedlings to ensure future tree recruitment.* These areas may also be suitable sites for using reintroducing fire as a restoration management tool.

**Native Plant Propagation**

The healthy populations of native plants on Mt. Sutil make it an excellent place for gathering native plant seeds for propagation and restoration purposes. The native grasses in particular Roemer's fescue

and bluejoint wildrye grow in profusion and provide good harvesting as would many herbaceous species. As long as seeds are gathered conscientiously with an eye to limiting disturbance it would be a good idea to include logging flowering and seed maturation dates for key species found on the site. As well as gathering and saving the seeds. The seeds should be used to propagate plants for use at the site and for other restoration purposes. Propagules could be used in the sites opened up by the thinning and broom clearing where necessary including direct seeding of grasses. Any seeding or planting should be monitored with permanent photo points and or vegetation plots.

# Conclusion

The Garry oak and associated ecosystems of Mt. Sutil Galiano Island are in relative good shape when compared to other local and regional sites. The lack of public access, the healthy native plant communities, the existence of rare species and the historical management initiatives make the site worthy of continued restoration treatments. Past disturbances from logging, grazing and the introduction of exotic species has impacted the site and the Galiano Conservancy has been addressing these issues accordingly. Continued restoration treatments will take the form of ongoing invasive species removal, the management of encroaching Douglas-fir trees and monitoring. The removal of Scotch broom has been the main restoration treatment at the site and has proven very successful across the North West side of the property. Continued success will be achieved by targeting all flowering broom in the short term beginning with outliers and sparse polygons moving to dense patches last. Lower priority invasive species including mullein and campion rose should also be treated as soon as possible. Further, vigilant monitoring for high risk invasive grasses should be conducted on a regular basis to prevent their establishment in the areas cleared of broom. Dense stands of Douglas-fir trees at the forest edge should be thinned and pruned in test patches and the resulting effects in the understory assessed. All suppressed Garry oak trees should be freed as much as possible by a combination of pruning, topping, girdling and thinning. The combination of the existing ecological integrity at the site, the restricted access to the site and the commitment to restoration initiatives by the Galiano Conservancy Association will ensure that Mt. Sutil continues to be one of the healthiest examples of Garry Oak and Associated ecosystems in the Southern Gulf Islands.

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| Summary of Vegetation Surveys on Mt. Sutil 2004 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Vascular species** | **Provincial Status** | | **Form** | H. Jansen/O. Scholz | | | | | E. Gonzales | Hans Roemer./O. Scholz |
| | | | | **Native 1** | **Grass (GR)** | **Conglomerate (RO)** | **Oak Wood (WDbd)** | **Fir-Oak (WDmx)** | **% cover (0.00=trace)** | |
| *Cystopteris fragilis* | S5 | | fern | 1 | | | X | X | 5.31 | 4.13 |
| *Pentagramma triangularis* | S3S4 | | fern | 1 | | X | | | | |
| *Achnatherum lemmonii var. lemmonii* | S3S4 | | grass | 1 | X | | | | 22.83 | 43.75 |
| *Agoseris grandiflora* | S3S4 | | grass | 1 | X | X | | | 0.50 | 0.50 |
| *Agoseris heterophylla ssp. heterophylla* | S4 | | grass | 1 | X | | | | | |
| *Bromus carinatus* | S5 | | grass | 1 | X | | X | | 0.50 | 5.14 |
| *Bromus sitchensis* | S4 | | grass | 1 | X | | X | | | |
| *Danthonia Californica* | S5 | | grass | 1 | | | | | 1.33 | 1.33 |
| *Elymus glaucus ssp. glaucus* | S5 | | grass | 1 | X | | X | X | | |
| *Festuca idahoensis* | UN | | grass | 1 | | | | | | |
| *Festuca rubra ssp. rubra* | S5 | | grass | 1 | | X | | | 32.00 | |
| *Koeleria macrantha* | S5 | | grass | 1 | X | X | | | 1.14 | 2.00 |
| *Melica harfordii* | S3S4 | | grass | 1 | | | | X | | 0.33 |
| *Melica subulata* | S5 | | grass | 1 | | | | X | | 15.00 |
| *Poa secunda ssp. secunda* | S5 | | grass | 1 | | X | | | 6.94 | 2.75 |
| *Achillea millefolium var. lanulosa* | S5 | | herb | 1 | X | | | | 4.50 | 0.00 |
| *Allium acuminatum* | S3 | B* | herb | 1 | X | | | | 1.11 | 1.33 |
| *Allium amplectens* | S3 | B* | herb | 1 | X | | | | | |
| *Allium cernuum var. cernuum* | S5 | | herb | 1 | X | | | | 4.50 | 6.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Brodiaea coronaria ssp. coronaria* | S3S4 | | herb | 1 | X | | X | | 0.00 | 0.00 |
| *Calandrinia ciliata var. menziesii* | S4 | | herb | 1 | | X | | | | |
| *Camassia leichtlinii ssp. suksdorfii* | S4 | | herb | 1 | | X | | | | |
| *Camassia quamash ssp. quamash* | S4 | | herb | 1 | X | | | | | |
| *Cerastium arvense* | S4 | | herb | 1 | X | X | | | 14.88 | 13.17 |
| *Clarkia amoena vars.* | S3 | B* | herb | 1 | | X | | | 0.00 | |
| *Claytonia perfoliata* | S4 | | herb | 1 | X | X | | | 4.00 | 4.00 |
| *Clinopodium douglasii* | S5 | | herb | 1 | | | | | | |
| *Collinsia grandiflora* | S4 | | herb | 1 | X | X | | | | |
| *Collinsia parviflora* | S5 | | herb | 1 | X | X | | | | |
| *Crocidium multicaule* | S3S4 | | herb | 1 | | X | | | 0.50 | 0.00 |
| *Daucus pusillus* | S5 | | herb | 1 | | X | | | 11.50 | 25.00 |
| *Delphinium menziesii ssp. menziesii* | S5 | | herb | 1 | | X | | | 40.00 | 40.00 |
| *Epilobium brachycarpum* | S5 | | herb | 1 | | X | | | 10.00 | 20.90 |
| *Epilobium minutum* | S4 | | herb | 1 | | X | | | 0.67 | 0.67 |
| *Eriophyllum lanatum var. lanatum* | S5 | | herb | 1 | X | X | | | | |
| *Galium aparine* | S5 | | herb | 1 | X | X | | | 4.00 | |
| *Heuchera micrantha var. diversifolia* | S4 | | herb | 1 | | X | | | 6.25 | 0.00 |
| *Hypochaeris glabra* | UN | | herb | 1 | | | | | | 1.00 |
| *Lithophragma glabrum* | S4 | | herb | 1 | | X | | | | |
| *Lithophragma parviflora* | S4 | | herb | 1 | | X | | | | |
| *Lomatium utriculatum* | S5 | | herb | 1 | X | X | | | 0.50 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Lotus micranthus* | S4 | | herb | 1 | | X | | | | 3.00 |
| *Lupinus bicolor ssp. bicolor* | S3S4 | | herb | 1 | | X | | | 1.21 | 0.17 |
| *Madia gracilis* | S3S4 | | herb | 1 | | X | | | 11.00 | 2.67 |
| *Mimulus alsinoides* | S3S4 | | herb | 1 | | X | | | 3.25 | 10.67 |
| *Mimulus guttatus* | S5 | | herb | 1 | | X | | | | |
| *Moehringia macrophylla* | S5 | | herb | 1 | | | | X | | |
| *Montia fontana* | S3S4 | | herb | 1 | | | | | | |
| *Nemophila parviflora var. parviflora* | S5 | | herb | 1 | | | | X | | 0.00 |
| *Orobanche uniflora* | S5 | | herb | 1 | | X | | | | |
| *Osmorhiza berteroi* | S5 | | herb | 1 | | | X | X | | |
| *Phlox gracilis* | S5 | | herb | 1 | | | | | | 0.00 |
| *Plectritis congesta var. congesta* | S5 | | herb | 1 | | X | | | | 0.00 |
| *Polygonum douglasii ssp. spergulariiforme* | S5 | | herb | 1 | | | | | | |
| *Ranunculus occidentalis* | S5 | | herb | 1 | | | | | 0.75 | 0.00 |
| *Sanicula crassicaulis var. crassicaulis* | S4 | | herb | 1 | | | X | X | 3.50 | 0.33 |
| *Saxifraga integrifolia* | S4 | | herb | 1 | X | X | | | 6.25 | 0.00 |
| *Saxifraga rufidula* | S4 | | herb | 1 | | X | | | | |
| *Sedum lanceolatum var. nesioticum* | S3S4 | | herb | 1 | | X | | | | |
| *Sedum spathulifolium var. spathulifolium* | S5 | | herb | 1 | | X | | | | |
| *Taraxacum ceratophorum* | S4 | | herb | 1 | | | | | 0.50 | |
| *Thysanocarpus curvipes* | S3 | B* | herb | 1 | X | X | | | | |
| *Trifolium microcephalum* | S4 | | herb | 1 | | | | | | 0.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Trifolium microdon* | S4 | | herb | 1 | X | | | | | |
| *Trifolium oliganthum* | S4 | | herb | 1 | X | | | | 0.50 | |
| *Trifolium variegatum* | S4 | | herb | 1 | X | | | | | |
| *Trifolium willdenowii* | S4 | | herb | 1 | X | | | | | |
| *Triteleia hyacinthine* | S4 | | herb | 1 | X | X | | | 2.50 | 0.00 |
| *Vicia americana* | S5 | | herb | 1 | | | | | 2.00 | 0.00 |
| *Yabea microcarpa* | S1 | R | herb | 1 | | X | X | X | | |
| *Zygadenus venenosus* | S5 | | herb | 1 | | | | | | 0.00 |
| *div. lichens* | | | lichen | 1 | | | | | 0.25 | 0.25 |
| *Dicranum scoparium* | S4 | | moss | 1 | | | | | 1.50 | |
| *Homalothecium megaptilum* | S3S5 | | moss | 1 | | | | | | |
| *Polytrichum juniperinum* | S4 | | moss | 1 | | | | | | 15 |
| *Racomitrium canescens* | S3S5 | | moss | 1 | | X | | | | 26.40 |
| *Racomitrium heterostichum* | un | | moss | 1 | | | | | | 0.00 |
| *Selaginella wallacei* | S4 | | moss | 1 | | X | | | | 0.67 |
| *Carex inops ssp. inops* | S3S4 | | sedge | 1 | | | | | | |
| *Luzula comosa* | S4 | | sedge | 1 | | | | | 0.67 | 0.20 |
| *Luzula multiflora ssp. multiflora* | S4 | | sedge | 1 | X | X | | X | 0.75 | |
| *Arctostaphylos columbiana* | S3S4 | | shrub | 1 | | O | | | | |
| *Lonicera hispidula* | S5 | | shrub | 1 | | | X | X | 2.17 | |
| *Pachistima myrsinites* | S4 | | shrub | 1 | | X | | | | 0.00 |
| *Acer macrophyllum* | S5 | | tree | 1 | | X | | | 0.75 | 0.00 |
| *Arbutus menziesii* | S5 | | tree | 1 | | O | | | | |
| *Pseudotsuga menziesii var. menziesii* | S5 | | tree | 1 | | | | X | | 20.00 |
| *Quercus garryana* | S5 | | tree | 1 | | | X | X | | 32.50 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Hypochaeris radicata* | SE5 | | herb | | X | | | | | 0.00 |
| *Torilis japonica* | SE1SE2 | | herb | | X | X | X | X | 1.13 | |
| *Agrostis gigantea* | SE5 | | grass | | X | | | | | |
| *Aira caryophyllea* | SE5 | | grass | | X | X | | | 0.50 | 0.60 |
| *Aira praecox* | SE5 | | grass | | X | X | | | 4.00 | 5.50 |
| *Anthoxanthum odoratum* | SE5 | | grass | | X | | X | | | |
| *Arrhenatherum elatius* | SE4 | | grass | | X | | | | | |
| *Bromus diandrus* | | | grass | | | | | | 19.04 | |
| *Bromus hordeaceus ssp. hordeaceus* | SE4 | | grass | | X | | X | | 15.77 | 3.33 |
| *Bromus rigidus* | SE3 | | grass | | X | | X | | | |
| *Bromus sterilis* | SE5 | | grass | | X | | X | | 7.40 | 7.40 |
| *Bromus tectorum* | SE5 | | grass | | X | | X | | 12.33 | 12.33 |
| *Cynosurus echinatus* | SE4 | | grass | | X | | X | | | |
| *Lolium multiflorum* | UN | | grass | | | | | | | |
| *Poa compressa* | S3S4 | | grass | | X | | | | | |
| *Poa pratensis ssp. pratensis* | SE3 | | grass | | X | | | | | |
| *Vulpia bromoides* | SE5 | | grass | | X | | X | X | 0.50 | 2.89 |
| *Vulpia myuros* | SE5 | | grass | | X | | X | X | 0.50 | 2.89 |
| *Aphanes arvensis* | S4 | | herb | | | X | | | | |
| *Athysanus pusillus* | S3S4 | | herb | | | X | | | | |
| *Barbarea orthoceras* | S5 | | herb | | | | | | | |
| *Cerastium glomeratum* | SE5 | | herb | | X | | | | 1.83 | 2.43 |
| *Cirsium vulgare* | SE5 | | herb | | | | | | 5.50 | |
| *Erodium cicutarium ssp. cicutarium* | SE5 | | herb | | | | | | | 0.50 |
| *Geranium molle* | SE5 | | herb | | X | | | | 0.72 | 0.50 |
| *Lactuca muralis* | SE5 | | herb | | | | | X | | |
| *Lychnis coronaria* | SE4 | | herb | | X | | | | | 2.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Myosotis discolor* | UN | | herb | | | | | | | |
| *Rumex acetosella* | SE5 | | herb | | | X | | | | 26.40 |
| *Senecio vulgaris* | SE5 | | herb | | | X | | | | 0.67 |
| *Sonchus asper* | SE4 | | herb | | X | X | | | | |
| *Stellaria media* | SE4 | | herb | | X | X | X | | | |
| *Taraxacum laevigatum* | SE4 | | herb | | X | | | | | |
| *Veronica arvensis* | SE4 | | herb | | | X | | | 0.56 | 0.00 |
| *Vicia hirsuta* | | | herb | | | | | | 0.67 | |
| *Vicia sativa* | | | herb | | | | | | 3.44 | 1.63 |
| *Cytisus scoparius* | SE5 | | shrub | | X | | X | | | |

## Bryophytes and Lichens of Garry oak Habitats on Mt. Sutil, Galiano Island, 2010

Collections and observations made on January 26, 2010; field crew: Terry McIntosh, Odin Scholz, Ken Millard, Tyla Crowe, Trisha Nettleship, and Sophie-Anne Blanchette (Galiano Island Conservancy)

List prepared on T. McIntosh February 8, 2010, annotated Feb 12, 2010

Interesting and real or potentially rare species highlighted in yellow

| **Species** | **Primary Habitat** | **Comments (local status, that is rare, common, etc. refers to within the Mt. Sutil study area only)** | **CDC or other Conservation Status** | **TMc Collection number** (to be completed) |
|---|---|---|---|---|
| **Mosses and Liverworts** (liverworts marked with *) | | | (to be completed; see Comments) | |
| *Anacolia menzeisii* | shaded underhang on outcrop | rare | | |
| *Antitrichia californica* | outcrop and tree bark | common | | |
| *Antitrichia curtipendula* | tree base | rare | | |
| ?*Bellibarbula* sp. | seepy, open outcrop faces | uncommon | may be new to the province (to be sent away for confirmation) | |
| *Brachythecium albicans* | on shaded crevice in open bluff area | rare | | |
| *Brachythecium* sp. | on shaded crevice in open bluff area | rare; resembles B. acutum but small specimen | | |
| *Bryum argenteum* | soil | rare | | |
| *Bryum miniatum* | over rock and thin soil/litter in seeps | rare | | |
| *Bryum* spp. | over rock and thin soil/litter in seeps | common to rare; at least 4 species to be identified | one species may be rare in BC | |

| | | | | |
|---|---|---|---|---|
| *Cephaloziella* sp.* | in seeps among mosses | common | | |
| *Ceratodon purpureus* | on open mineral soil | common | | |
| *Claopodium crispifolium* | shaded outcrop | uncommon | | |
| *Dendroalsia abietina* | Garry oak bark | rare | | |
| *Dicranum scoparium* | on thin soil, amongst litter, and on rock | uncommon | | |
| *Dicranum* sp. | on shaded ledge | rare | | |
| *Didymodon eckeliae* | outcrop | rare | rare in coastal BC; not yet listed by CDC (to be sent away for confirmation) | |
| *Didymodon vinealis* | dry conglomerate shelf | rare | | |
| *Encalypta* sp. | thin soil on outcrop | rare; too young to ID | | |
| *?Entosthodon sp.* | soil in large seepage slope near Selaginella wallacei/Racomitrium elongatum patch | rare; probably all Funaria muhlenbergia (growing for confirmation) | | |
| *Fissidens bryoides* | on soil shaded grotto | rare | | *Eurhynchium oreganum* |
| *Funaria muhlenbergia* | soil in large seepage slope near Selaginella wallacei/Racomitrium elongatum patch | rare | Red List | |
| *Grimmia trichophylla* | exposed rock faces | rare | | *Eurhynchium praelongum* |
| *Hedwigia stellata* | open rock outcrops and rocks | common | | |
| *Homalothecium aenium* | on rock faces and ledges with other mosses | uncommon | | |
| *Homalothecium aureum* | open rock outcrops and rocks | uncommon | | |
| *Homalothecium fulgescens* | tree base | uncommon | | |
| *Homalothecium megatipilum* | shaded forest floor near open Garry oak habitat | | | |
| *Homalothecium nuttallii* | Garry oak bark | common | | |
| *Hylocomium splendens* | forest soil and litter | uncommon | | |
| *Hypnum subimponens* | shaded rock face | rare | | |
| *Isothecium cristatum* | on shaded rock and rock outcrops | rare | | |
| *Isothecium stoloniferum* | on branches | common | | |
| *Kindbergia oreganum* | over shaded soil and litter | common | | |
| *Kindbergia praelongum* | over shaded soil and litter | uncommon | | |
| *Leucolepis menziesii* | on soil along path in forest | uncommon | | |

| | | | | |
|---|---|---|---|---|
| *Metaneckera menziesii* | Garry oak bark | | | |
| moss 1 | seepy outcrop | rare | | |
| moss 2 | seepy outcrop | rare | | |
| moss 3 | seepy outcrop | rare | | |
| *Orthotrichum* sp. | Garry oak bark and branches | rare | | |
| *Orthotrichum ? rupestre* | outcrop | rare | | |
| *Orthotrichum lyellii* | Garry oak bark and branches | uncommon | | |
| *Philonotis capillaris* | on soil in seeps | uncommon | | |
| *Philonotis fontana* | on soil in seeps | uncommon | | |
| *Plagiomnium insigne* | alongside path in forest | rare | | |
| *Plagiomnium venustum* | tree bases in shaded sites (forest); mainly Douglas-fir | rare | | |
| *Pleuridium acuminatum* | on open mineral soil | rare | | |
| *Polytrichum juniperinum* | over thin soil | common | | |
| *Polytrichum piliferum* | over thin soil | common | | |
| *Porella* sp.* | shaded outcrop | uncommon | | |
| *Pterogonium gracile* | outcrop | uncommon | | |
| *Racomitrium elongatum* | over rock and thin soil, also in seeps, but uncommon | abundant; new name: *Niphotrichum elongatum* | | |
| *Racomitrium heterostichum* | rock | uncommon to rare; new name: *Bucklandiella heterosticha* | | |
| *Racomitrium macounii* | rock | uncommon to rare; new name: *Bucklandiella macounii* | | |
| *Rhytidiadelphus triquetrus* | on ground is shaded habitats | common | | |
| *Riccia* sp.* | on thin soil in seepage flat | probably *R. sorocarpa*; growing on deck in Vancouver to mature the spores | | |
| *Scleropodium touretii* | shaded cliff faces | common | | |
| *Syntrichia* sp. | outcrop | rare; very odd species; no idea where it fits | | |
| *Syntrichia* cf *princeps* | outcrop | uncommon | | |
| *Syntrichia* cf. *ruralis* | Garry oak bark | uncommon | | |
| *Syntrichia princeps* | bark, thin soil, outcrops | uncommon | | |
| *Syntrichia ruralis* | on thin soil | common | | |
| *Timmiella crassinervis* | on open mineral soil | rare | | |
| *Tortella* sp. | soil in shaded crevice | rare; a few scraps | | |
| *Tortula muralis* | dry conglomerate shelf | rare | | |
| *Weissia controversa* | thin, shaded soil | rare | | |
| *Zygodon gracilis* | Garry oak bark | common | | |
| | | | | |

| **Lichens (identified by Curtis Björk)** | **Habitat** | **incidental collections; no local status usually available** |
|---|---|---|
| *Arthonia polygramma* | epiphyte on Garry oak bark | Rare in Canada; C. Björk pers comm. |
| *Bacidia rubella* | epiphyte on Garry oak bark | |
| *Calicium salicinum* | epiphyte on Garry oak bark | Rare in BC; C. Björk pers comm. |
| *Caloplaca* cf *ferruginea* | epiphyte on Garry oak bark | A common but undescribed species found in coastal BC south to western Oregon. |
| *Caloplaca* cf *xanthostigmoidea* | epiphyte on Garry oak bark | A somewhat common species that is close to Caloplaca xanthostigmoidea, from which it differs in lacking isidioid upgrowths, and in its arboreal habitat. |
| *Caloplaca sp.* (isidiate) | epiphyte on Garry oak bark | Possibly a new species, not previously known to C. Björk. The thallus consists entirely of scattered globose isidia with a weak basal attachment. |
| *Cladonia* spp. | over thin soil on outcrops and ledges | Common |
| *Cliostomum griffithii* | epiphyte on Garry oak bark | |
| *Collema subflaccidum* | epiphyte on Garry oak bark | |
| *Lecanora hagenii* | epiphyte on Garry oak bark | |
| *Lecanora hybocarpa* | epiphyte on Garry oak bark | |
| *Lecanora pacifica* | epiphyte on Garry oak bark | |
| *Lecidea albofuscescens* | epiphyte on Garry oak bark | |
| *Leptogium* cf *turgidum* | epiphyte on Garry oak bark | A member of the Leptogium plicatile group, all species of which are known only to grow on rock or soil, never on bark. The local material is unusal in having wrinkled, glossy isidia, and in having relatively glossy, unwrinkled lobes. This may represent an undescribed species. Only one other collection is known of this form or species. |
| *Leptogium lichenoides* | epiphyte on Garry oak bark | The mound-forming, finely lacerate local form may best be named as Leptogium pulvinatum, a segregate of Leptogium lichenoides known only from Europe. Forms attributable to Leptogium pulvinatum are common in British Columbia. More work is needed to determine whether this species is truly distinct from Leptogium lichenoides. |
| *Leptogium palmatum* | soil along forest path | |
| *Lobaria pulmonaria* | epiphyte on Garry | |

| | | |
|---|---|---|
| | oak bark | |
| *Nephroma parile* | epiphyte on Garry oak bark | |
| *Normandina pulchella* | epiphyte on Garry oak bark | |
| *Ochrolechia farinaria* | epiphyte on Garry oak bark | |
| *Ochrolechia* sp nov. | epiphyte on Garry oak bark | A sterile sorediate species that does not react to C, K, KC or UV tests. Frequent on oaks in BC. |
| *Opegrapha varia* | epiphyte on Garry oak bark | |
| *Parmelia sulcata* | epiphyte on Garry oak bark | |
| *Peltigera collina* | on mosses on outcrop | |
| *Physcia adscendens* | epiphyte on Garry oak bark | |
| *Physconia enteroxantha* | epiphyte on Garry oak bark | |
| *Ramalina* cf *obtusata* | epiphyte on Garry oak bark | Only juvenile thalli seen; Ramalina obtusata would be a new record for coastal BC. |
| *Ramalina farinacea* | epiphyte on Garry oak bark | |
| *Rinodina hallii* | epiphyte on Garry oak bark | |
| *Sticta fuliginosa* | epiphyte on Garry oak bark | |
| *Umbillicaria polyphylla* | outcrop | |
| Unknown sterile sorediate crust | epiphyte on Garry oak bark | This common species is known from both coastal and interior BC, where it grows in humid habitats with relatively low rainfall. It is characterized by having usnic acid and atranorin, a distinct blackish prothallus, and yellowish-green soredia that rise from whitish areoles. It may be an epiphytic form of Mycoblastus alpinus. |
| *Usnea filipendula* | epiphyte on Garry oak branches | |
| *Usnea intermedia* | epiphyte on Garry oak branches | Rare in Canada, candidate for COSEWIC status. C. Björk pers comm.; may be U. rigida, also rare; The nearest populations of Usnea intermedia are in California and Arizona. The rest of the global range is northwest Mexico and southwest Europe. |
| *Usnea subfloridana* | epiphyte on Garry oak bark | |
| *Usnea substerilis* | epiphyte on Garry oak bark | |
| *Waynea californica* | epiphyte on Garry oak bark | |