Augmentation of an Agricultural Pollinator Hedgerow for Habitat and Climate Change

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ABSTRACT

Habitat loss is the leading cause of declining native pollinator populations, raising serious concerns over the reduction in ecosystem services critical to global ecosystems and agriculture. Native plant hedgerows within agricultural landscapes are a solution that provides habitat for insects and increases crop productivity in surrounding areas. This project focuses on enhancing an existing hedgerow at Metchosin Farm in Victoria, BC with the goals of improving forage and overwintering habitat for native pollinators while increasing resiliency to the projected future climate conditions. Modified line intercept surveys, pollinator surveys, ground inspections, and a literature review of climate models were used to assess the characteristics of the hedgerow and anticipate the future site conditions. Insights from these findings informed the selection of native plants adapted to dry soils and tolerant of drought conditions. Significant invasive species removal and sheet mulching was completed in preparation for new plants, along with the installation of several structures that provide nesting and overwintering opportunities for pollinators. Across the work zones, 100% of the invasive species were removed in a first pass, 16 new native plant species were added, increasing species richness by 35%. The hedgerow's bloom period now extends into September, lengthening the foraging window for pollinators. Over the duration of the project, three volunteer events supported community engagement and highlighted the importance of native pollinators in agricultural systems. The installation of new plants and nesting structures in one zone of the hedgerow also provides the farm with a "demonstration" hedgerow for future educational and workshop opportunities. Ongoing monitoring and maintenance of invasive species will be required to prevent competition with the new plantings and we encourage Metchosin Farm to pursue a Bee Friendly Farming certification to highlight the pollinator supportive practices already in place.

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INTRODUCTION

Pollinators are tiny but mighty contributors to global ecosystems and human livelihoods. Most flowering plants on earth rely on animal pollination to reproduce, meaning pollinators like bees provide an essential ecosystem service that maintains terrestrial ecosystems and agriculture. However, evidence shows pollinator populations are declining due to habitat loss and fragmentation, invasive species, pathogens, and climate change (Potts et al., 2010). The consequences of losing pollinators are catastrophic to both wild plant populations and global crop production. 75% of crops used for human food worldwide are reliant on insect pollination (Klein et al., 2007) and the decline of this vital ecosystem service would make it difficult for agriculture to keep up with a growing human population (Garibaldi et al., 2011).

While many farmers use domesticated honey bees to provide pollination services for their farms, wild insects pollinate crops much more effectively than managed ones (Garibaldi et al., 2013). Native bees are more efficient than honey bees, stay active in cooler and rainier weather, and many perform buzz pollination (a behaviour that results in larger, more abundant fruit) (Vaughn et al. 2015). Wild pollinators can greatly boost crop production, but declining populations are also sparse, especially in intensely cultivated areas (Klein et al., 2007). To benefit from wild bees, agriculture needs to support their populations.

Figure 1. A *Mellisodes* (Long-horned bee) female with loose, dry-packed pollen: one of the reasons wild bees are more efficient pollinators than Honeybees which tightly “wet-pack” their pollen.

Habitat loss is the leading driver of pollinator declines, and one primary example is the conversion of natural habitat into agriculture (Kennedy et al., 2013). One way to reintroduce natural habitat for pollinators into these landscapes is through the use of hedgerows. Hedgerows are “living fences” of trees, shrubs, and forbs that have thousands of years of history. Traditionally, their function was to mark boundaries between properties, but they also provide important ecosystem services: they reduce water runoff, stabilize soil, block wind and sound, and create habitat for wildlife (especially when composed of plant species native to the specific area) (Orpet, 2025).

Research demonstrates that establishing native plant hedgerows has positive effects on pollinator abundance, species richness, and diversity within the hedgerow and adjacent fields (Morandin and Kremen, 2013). Beyond pollinators, hedgerows also support populations of beneficial insects: predators and parasitoids that can help control economically important pests on farms, making them useful not just for crop productivity but biological pest management (Morandin et al., 2014). For farms, especially organic farms, hedgerows are a long-lasting, cost effective method for increased pest control and pollination, while also supporting insect populations against decline (Morandin et al., 2016).

The Site

This project is focused on an existing hedgerow at Metchosin Farm, a 10-acre, certified organic seed farm located at the end of Wootton Road on southern Vancouver Island. The farm is situated within the traditional unceded territories of the Beecher Bay Scian’new First Nation, and is surrounded by other small-scale agricultural operations and residential properties in the municipality of Metchosin (Figure 2). The Strait of Juan de Fuca is less than 200m to the east but the property slopes away from the ocean and is part of the small Gooch Creek watershed (Capital Regional District, 2015). Approximately 3 acres of the property are actively farmed for seed crops, while the remaining area is used for hay, farm buildings, an irrigation dugout, and the wooded Sea Bluff trail.

Figure 2. *The embedded map depicts Metchosin Farm's location in Metchosin, and its position relative to other municipalities across the Capital Regional District. The enlarged map shows the farm within the surrounding rural landscape and its close proximity to the Strait of Juan de Fuca.*

Metchosin lies within the Coastal Douglas-fir (CDFmm) biogeoclimatic zone (Government of British Columbia, 2014) where the climate is heavily influenced by a rain shadow cast by the Olympic Mountains in Washington. The resulting "mediterranean climate" is characterized by dry, warm summers, and wet, mild winters.

The hedgerow is currently providing ecosystem services to the farm, but climate change threatens to shift where plants can grow successfully (Feeley et al., 2020). The Capital Regional District is expected to experience warmer days, more frequent heat waves, and reduced summer precipitation (Capital Regional District 2024). These shifts in conditions increase the risk of heat and water stress during the growing season (Hatfield & Prueger 2015; Redden et al, 2014). Projects like this one must consider climate change when designing work and planting plans if the restoration completed is to last in future conditions.

Goals and Objectives

This project was developed to assess the habitat quality for pollinators in the existing hedgerow, identify any gaps in resource availability, and determine vulnerabilities to the predicted local climate changes. Any finding would be addressed through augmentation of chosen sites within the hedgerow. The following Goals and Objectives were outlined:

Goal 1: Increase native pollinator habitat for foraging, nesting, and overwintering.

Objectives:

- Complete a survey of the current hedgerow to document present flowering plants and pollinator nesting habitat potential.
- Reduce invasive plant species in the hedgerow by 90%
- Increase species richness in the hedgerow by at least 30% through a selection of native plants
- Identify gaps in the bloom period, and include species that provide continuous, and extended flowering

Goal 2: Build resiliency in the hedgerow for a changing climate.

Objectives:

- Complete a survey of the hedgerow site conditions and divide the hedgerow into condition zones
- Reduce invasive plant species in the hedgerow by 90%
- While increasing species richness to meet Goal 1, also select plants to increase the number of plants resilient to changing conditions and tolerant of drought

Goal 3: Promote restoration and the use of pollinator hedgerows in agriculture to the Metchosin community and beyond.

Objectives:

- Host a community planting event to encourage discussion of restoration and the benefits of hedgerows in sustainable agriculture
- Deliver a presentation about the project for the Metchosin farm community to promote the use of pollinator hedgerows in the area

METHODS

Site History

The north and east sides of Metchosin Farm are bordered by approximately 400m of hedgerow, which served as the project site (Figure 3). The hedgerow is primarily composed of conifer trees including Leyland cypress (*Cupressus x leylandii*), Douglas fir (*Pseudotsuga* *menziesii*), and some Western redcedar (*Thuja plicata*) (Figure 3). Flowering shrubs have been established at varying densities in front of this conifer "backbone" including an assortment of native, cultivated, and exotic species.

***Figure 3**. Aerial view of Metchosin Farm indicated by the red outline. Property outlined in red, active project site (the Hedgerow) highlighted in orange along the north and east edges of the property. Image obtained from the CRD Webmap, 2025 aerial imagery layer.*

Metchosin Farm and the adjacent field to the east were once a continuous pasture, subdivided in the early 2000s (Appendix A). The conifer trees for the hedgerow were initially planted around 2014 for the main purpose of creating a buffer between the organic practices at Metchosin Farm and the conventional practices on properties to the north and east (F. Hamersley Chambers, pers. comm. 05/13/2025). The dense layer of conifers and their root systems provide a privacy screen and block herbicide, pesticide, and fertilizer run off that could otherwise compromise the farm's organic status.

To provide foraging and nesting resources, flowering plants were added throughout the following years by farm staff and during a planting event hosted by Habitat Acquisition Trust. Creating habitat for wild pollinators and beneficial insects provides valuable ecosystem services to the farm, boosting the farm's productivity and creating better quality crops.

***Figure 4**. View of the northern edge of the hedgerow at Metchosin Farm (picture taken facing east). The dominant tree pictured and throughout the hedgerow is Leyland Cypress (Cupressus x leylandii).*

Plant Inventory

The first stage of the project was to survey the existing hedgerow and establish a baseline of the species present. We used a modified line intercept survey to inventory the initial plant species within the hedgerow, and quantity the coverage of each species.

From June 20, 2025 to June 30, 2025, we laid ten 30m transects consecutively and parallel to the hedgerow. The inventory was taken systematically starting in the southeast corner, designated “0m”, and ending at the edge of the farm’s orchard, “300m”. When a plant species was encountered along the transect, we recorded its start and stop points along the tape in metres. If multiple plants of the same species occurred adjacent to each other, we recorded them as one occurrence in the data.

We consulted Pojar and MacKinnon (2014), Roemer and Sanseverino (2025), and iNaturalist to identify any unknown plants when possible. We noted the condition of a plant if it appeared stressed or dead. Following the survey, we compiled additional data from online sources on species’ origin, ideal growing conditions, and typical bloom period.

Plant Inventory Results

Species Richness

We found a total of 46 species within the hedge, with the greatest richness occurring in the shrub layer, which contained 20 species. This was followed by 12 tree varieties, 10 forbs, and 4 invasive species. Several novel fruit tree varieties have been added into the hedge (F. Hamersley Chambers, pers. comm.), but could not be distinguished beyond categorizing them as apple, cherry, or plum (*Prunus spp.* or *Malus spp.*).

Species Abundance

Trees covered 289.5 m of the surveyed area, forming its mature backbone, with smaller and younger trees occurring intermittently in front of this main structure. Leyland cypress was the most prevalent, covering 121m of the surveyed area, followed by Douglas fir and Western redcedar covering 116.2m and 19.1m, respectively.

Shrubs covered 244.9m of the surveyed area (Figure 5). The three most abundant, non-invasive shrubs were Nootka rose (*Rosa nutkana*) covering 66.1m of the area, Snowberry (*Symphoricarpos albus*) covering 85m, and Pacific ninebark (*Physocarpus capitatus*) covering

35.6m. Other native flowering shrubs encountered were Oceanspray (*Holodiscus discolor*), Red elderberry (*Sambucus racemosa*), Hardhack (*Spirea douglasii*), and Blackcap raspberry (*Rubus leucodermis*), but we recorded no more than 10 occurrences of each and the species covered less than 10m of hedgerow each.

Invasive species covered a total of 97.9m of the surveyed hedge. Himalayan blackberry (*Rubus armeniacus*) was the most abundant, covering 56.75m of the surveyed area and accounted for 58% of the reported invasive coverage. Creeping thistle (*Cirsium arvense*) covered 34.3m of the area, Creeping buttercup (*Ranunculus repens*) covered 6.6m, and we found a single Poison hemlock (*Conium maculatum*).

Forbs were the least represented group throughout the hedgerow, covering only 31.6 m of the surveyed area. Bracken fern (*Pteridium aquilinum*), Coastal mugwort (*Artemisia suksdorfii*), and Wormwood (*Artemisia absinthium*) were the most abundant of the forbs, but each covered less than 10m of the surveyed area.

The complete findings of the Plant Inventory are presented in Appendix B.

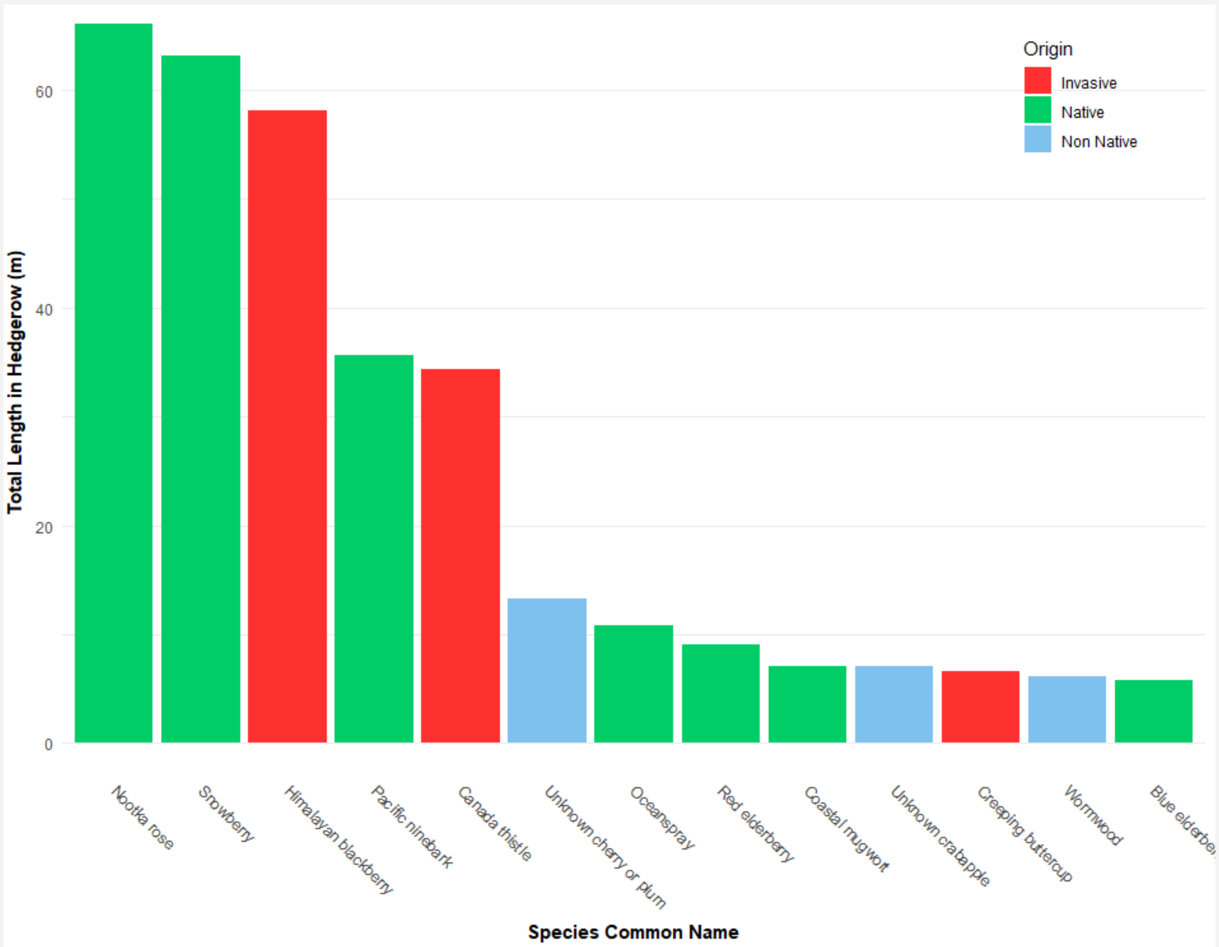

Figure 5*. The most 13 commonly encountered flowering plant species (x axis) and the amount of hedgerow each species covered in metres (y axis). Nonflowering species and species with less than 5 metres of coverage are not presented.*

Vitality

We observed all Western redcedar exhibited browning and drying of branch tips, indicating stress and reduced vitality. In more severe cases, plants were deceased. By mid-summer, Pacific ninebark and Hardhack were also showing signs of water stress, evidenced by wilting and browning leaves that were beginning to drop.

Ground Inspections

A better understanding of the growing conditions and soil properties of the hedgerow was required to make informed plant selections. We selected two locations representative of slope position, aspect, and light conditions to conduct ground inspections. Site 1 represented the lowest elevations of the hedgerow, positioned in the mid-lower slope on a gentle incline. Site 2 represented the higher elevations, positioned on the upper slope position in the northern corner of the hedgerow.

We collected ground inspection data according to the protocols established in the *Field Manual for Describing Terrestrial Ecosystems 2nd Edition* (Province of BC, 1998). We excavated soil pits in each of the sites to a depth of 60cm using a Forester shovel. We described soil characteristics following the protocols outlined in the *Field Manual for Describing Terrestrial Ecosystems 2nd Edition* (Province of BC, 1998) and The Canadian System of Soil Classification, 3rd Edition (Agriculture Canada, 1995). The completed data sheets for Sites 1 and 2 are presented in Appendix B (Tables 5, 6).

We used the data collected to predict the relative soil and moisture regimes following Appendices 4-6 in *A Field Guide for Site Identification and Interpretation for the Vancouver Forest Region, Land Management Handbook #28* (Green & Klinka, 1994), which we then utilized to determine the hedgerow's specific site series within the CDFmm.

Ground Inspection Results

Site 1 was located on the mid-lower slope of a gentle incline with an aspect of 282° NW and a slope of 4%. The soil was well-drained, moderately-textured loam and we encountered a strongly cemented horizon at a depth of 24.15cm. We found the site had a moderately dry to fresh moisture regime and a medium nutrient regime.

Site 2 was located at the upper slope of the hedgerow with an aspect of 306° NW and a slope of 9%. The soil in this site included larger, semi-angular cobbles that we did not encounter in Site 1. We found charcoal fragments in the A horizon and the soil was well-drained, moderately-textured silty-loam. We found the site had a subxeric to submesic moisture regime and a medium nutrient regime.

Both sites moisture and nutrient regimes fall into the expected range of a Douglas-fir - Salal (01 Fd-Salal) site association. The typical vegetative community of this site association includes a tree layer dominated by Douglas-fir, with some Grand fir (*Abies grandis*) or Western redcedar; a shrub layer of Salal (*Gaultheria shallon*), Dull Oregon-grape (*Berberis nervosa*) and Snowberry; and a herb layer of Bracken fern, Trailing blackberry (*Rubus ursinus*), and Western trumpet honeysuckle (*Lonicera ciliosa*) (Meidinger and Pojar, 1991). This prediction is consistent with the nearby wooded area of the Sea Bluff trail in the southwest corner of Metchosin Farm.

The complete findings of the Ground Inspections are presented in Appendix C.

Pollinator Surveys

To better understand the pollinator populations present in the hedgerow at the start of this project, we conducted four catch-and-release pollinator surveys between June 30 and July 11, 2025. The survey was designed following recommendations made by Dr. Lora Morandin (pers. comm. 06/05/2025)

We selected four sites, three within the hedgerow and one control. The control site was located on the southwestern edge of Metchosin Farm's hayfield, approximately 85m away from the hedgerow. The three other sites were along the hedgerow, representative of the general vegetation communities with blooming plants in them. The three sites were at 10m ("Southeast"), 130m ("East"), and 260m ("North").

We measured a 30m section of the hedgerow at each site to survey, which we then divided into two equal-length zones for each surveyor to complete. Each half was surveyed by both of us for 20 minutes each to keep survey-effort equal across the 30m. We conducted surveys in sunny, calm conditions when pollinators would be most active.

We attempted to catch any pollinator seen visiting a flower, and if successful they were vialled, placed inside a cooler with ice packs, and we recorded the flower they were visiting. While butterflies were not captured, we recorded any species observed during the survey period. The cool environment slows the metabolism of the insect temporarily, reducing stress and the possibility of the insect overexerting itself while captured. Once cooled, we used eye loops to identify each pollinator to the lowest taxonomic order possible. We consulted iNaturalist, the BC Native Bee Society Genera Sheets, and the Wildlife Preservation Canada Bumble Bees of Coastal BC ID cards to aid identification.

Figure 6*. View facing northeast of the “Southeast” pollinator survey site. The main flowering species in this survey was Himalayan blackberry. Flagging tape and transect tape were used to mark the extent of the survey area.*

Pollinator Survey Results

We recorded a total of 86 pollinators over the course of the four surveys (Table 1), including at least 20 different species from 16 genera of insects. The most abundant genus of pollinator captured was Bumblebees (*Bombus*), and the most abundant species of Bumblebee captured was the Yellow-faced bumblebee (*Bombus vosnesenskii*). European honeybees (*Apis mellifera*) were the next most encountered genus, totaling 6 bees captured. Five other genera of wild bees were captured during the survey, with the most common genus captured being Furrow bees (*Halictus*).

Three species of wasp were captured including predatory and parasitoid species (genus *Philanthus* and family *Ichneumonidae*). Three species of hoverfly (family *Syrphiade*) were captured whose larvae are known to eat aphids.

We researched the nesting behaviours of each group and compiled the findings in Table 1 below. The nesting habitats of encountered bees include tunnels underground, abandoned rodent burrows, holes in coarse woody debris left by beetles, and hollow plant stems.

Figure 7*. Three of the most frequently captured species pictured in the vials following a cooling period on ice. B. vosnesenskii (22 individuals captured), B. vancouverensis vancouverensis (10 individuals captured), and A. melifera (6 individuals captured).*

Table 1*. A summary of the insect pollinators captured or observed (Butterflies) during the four pollinator surveys. A total of 86 insects from 16 genera were recorded. The typical nesting and overwintering habitat, and typical forage are presented for each general grouping of pollinator.*

Group ***Genera Encountered***	**Individuals Captured**	**Nesting/Overwintering Habitat**	**Forage**
Bumblebees *Bombus*	48	Opportunistic cavity nesters	Generalists
Ground-nesting Bees *Colletes, Halictus, Melissoes, Andrena*	7	Tunnels excavated into sunny, exposed soil	Generalists Some Specialists (Asters, Brassicas, Camas, etc.)

Honeybees *Apis*	6	Hives	Generalists
Cavity-nesting Bees *Megachile*	1	Plant stems or existing cavities in woody debris	Generalist Some Specialists (Lupins, Asters, etc.)
Wasps *Dolichovesupla* *Ichneumonidae* *Philanthus*	3	Leaf litter, under tree bark, or plant stems	"Incidental" pollinators
Hoverflies *Eupeodes* *Syritta* *Toxomerus*	3	On plants, in soil, or under plant debris	Pollen and nectar as adults, Aphids and small caterpillars as Larva
Butterflies *Limenitis* *Papilio* *Pieris*	10	Leaf litter or on their host plants	Generalist nectar and pollen

Literature Review and Climate Projections

To gain a greater understanding of projected climate change in the Pacific Northwest, we conducted literature searches and an informal interview with local climate expert Dr. Richard Hebda. Search terms included, but were not limited to; *future climates of the Pacific Northwest, climate change in the Willamette Valley–Puget Trough–Georgia Basin Ecoregion*, and *future distribution of the Coastal Douglas-fir moist maritime zone*.

Insights from the interview and literature review informed our selection of an appropriate Global Climate Model (GCM) and emission scenario for generating climate projections. We chose Datasets from the Representative Concentration Pathways (RCPs) of the Coupled Model Intercomparison Project Phase 5 (CMIP5) over the Shared Socioeconomic Pathways (SSPs) of CMIP6 for several reasons. First, CMIP5 data has been available for a longer period, resulting in a larger body of literature using RCP projections. Second, RCPs are based on land use, greenhouse gas emissions, and air pollutants, whereas SSPs have greater complexity by integrating socioeconomics and global policy into its calculations (Climatedata 2026). The inclusion of future societal change introduces additional uncertainty that is beyond the scope of this project; therefore, RCP datasets were considered sufficient.

Assuming that greenhouse gas and aerosol emissions will continue to rise throughout the century, we selected RCP8.5 as the most plausible scenario for this analysis. Using data generated by ClimateData.ca, we evaluated projected 30-year normals to account for natural climate variability, and to detect long term trends in seasonal precipitation, maximum and minimum temperatures, and maximum consecutive dry days for Metchosin, BC.

Climate Change and Biogeoclimatic Envelopes

Across Canada, all emission pathways project continued warming of air temperatures with little difference between scenarios over the next two decades (Climatedata 2026). Low and high emission scenarios significantly diverged in the late century, with national average increases of 1.8°C, and 6.3°C, under RCP2.6, and RCP8.5, relative to the 1986-2005 reference period (Bush et al 2019). In southwestern BC, annual precipitation is projected to rise, although summer rainfall is expected to decline by 30% under RCP8.5 by late century (Bush et al. 2019). Seasonal extremes are projected to intensify. Heavy fall and winter rain events will increase waterlogging and flooding, while hotter, drier summers will cause greater evaporation, reduced surface water, and lead to more frequent soil moisture deficits (Walter 2018; Bush et al 2019; Capital Regional District 2024). Extreme heat events are expected to become 10X more frequent, with the current 1 in 50 year hottest day becoming a 1 in 5 year event by 2050 (Bush et al 2019).

The magnitude of change already underway is demonstrated by the observed 23% shift in climate envelopes at the beginning of the century relative to the baseline established by BEC systems in the 1970s (Mahony et al. 2018). Late century, novel climates are predicted along the coast of BC at low elevations of Haida Gwaii, south Vancouver Island, and the Lower Mainland under the RCP8.5 emissions pathway (Mahony et al. 2018). Coastal Washington may serve as a climate analog for CWH and CDF zones within the Georgia Basin (Mahony et al. 2018). As climate variables have varying relevance to specific species, each with their own set of tolerances, novel temperature and precipitation patterns may lead to unexpected ecological responses and novel species associations (Williams et al. 2007; Mahony et al. 2018).

Dr. Hebda anticipates major shifts in the vegetative community and suggests that Metchosin may revert to a more prairie-like state. He notes that the rate of change is far more rapid than current projections, as we are already experiencing the climate once expected for 2050. He believes our approach can no longer be conservative, and that the best way forward is to plan to adapt to the most extreme projections for 2080 (R. Hebda, pers. comm. 08/13/2025). The same sentiment is being followed by The Capitol Regional District, which proposes a ‘no regrets' strategy, planning to adapt to the climate projections of SSP5-8.5 emission scenario, the expanded use of fossil fuels worldwide (CRD 2024).

Statistically Downscaled Global Climate Projections

We analyzed datasets from CMIP5, RCP8.5 we obtained from Climatedata.ca for Metchosin, BC. The projections indicate that by the late century, nighttime minimums and daytime highs will increase by an average of 4.65°C across all seasons, with the greatest warming observed during summer months. The last day of spring frost is expected to occur as early as the end of January. Annual precipitation is expected to increase by 9.4%, with a slight reduction in summer rainfall. The duration of consecutive dry days is anticipated to become 9 days longer. All projected climate changes are reported relative to the 1951–1980 historical reference period. Regional projected climate data can be found in Appendix D (Tables 1-4).

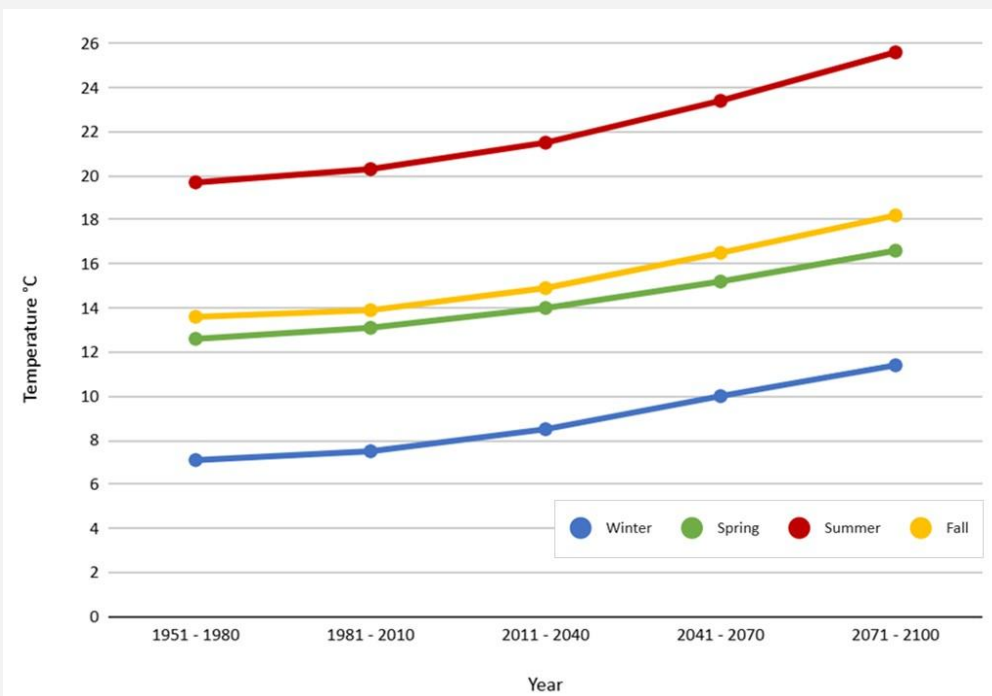

***Figure 8**. Historical and projected 30 year average median seasonal temperature maximums for Metchosin BC under RCP8.5 emission pathways (Climatedata 2026)*

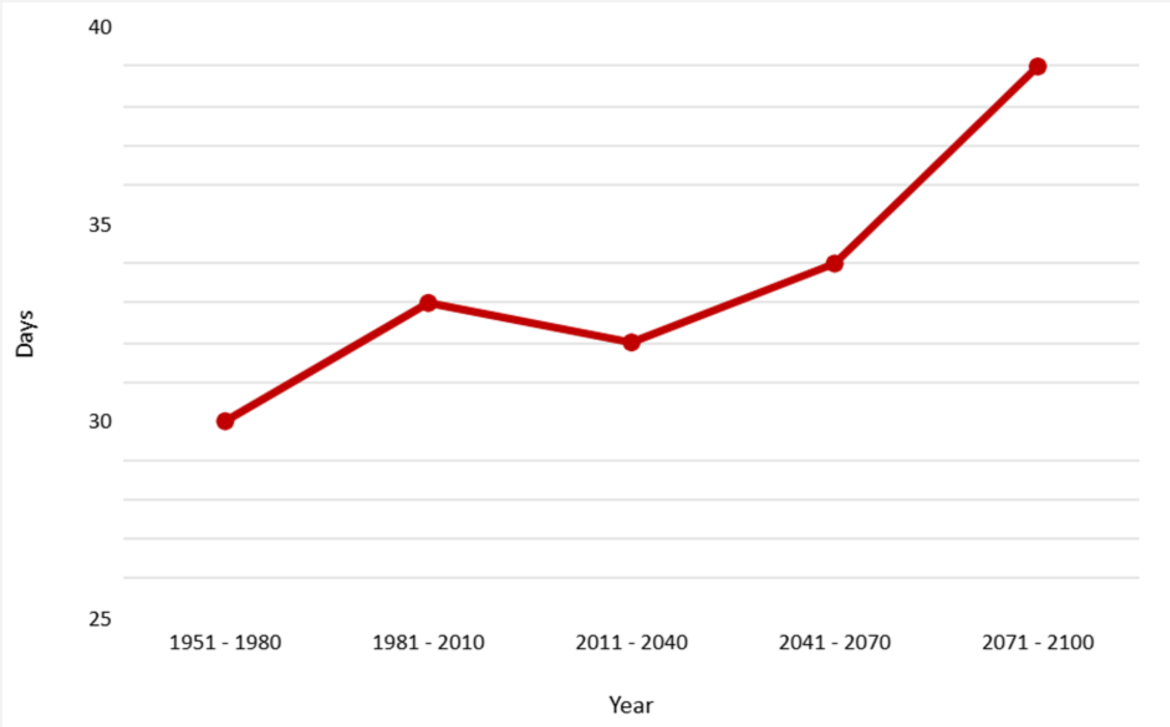

Figure 9*. Historical data and projected 30 year average annual maximum number of consecutive dry days for Metchosin BC under RCP8.5 emission pathways (Climatedata 2026)*

Climate Change and the Hedgerow

With the prediction of increased temperatures and longer, drier summers it can be expected that the plants in the hedgerow adapted to cooler, moister habitats will struggle in future conditions. This is already supported by our observations made during this project in the summer of 2025, as we noted Pacific ninebark, Hardhack, and Western redcedar to be stressed, dry, or dead.

An irrigation dugout captures rainwater on the farm, and some of this supply is allocated to the hedgerow during extended dry, hot periods, although seed crops are prioritized during water shortages (F. Hamersley Chambers, pers. comm.). Should watering of the hedgerow cease in the future, it is likely some species of plant will die off. Pacific ninebark is the third most common flowering shrub in the hedgerow (Figure 5), and losing this species would create a gap in the flowering diversity. A decrease in plant species richness will make it harder to support a diverse pollinator community.

Planting drought-tolerant, well-adapted species as soon as possible will give them as much time as possible to mature and establish before gaps in the hedgerow are created by less-adapted species dying off.

WORK PLAN

Establishing Working Zones

From the data we collected during the Plant Inventory and Ground Inspections, we identified four general zones of the hedgerow (Figure 10). The defining characteristics of each zone and the work plan established for each one are presented in Table 2 below.

Figure 10*. Depiction of the four work zones of the hedgerow. Image obtained from the CRD Webmap, 2025 aerial imagery layer.*

Table 2. *The observed characteristics of each section of the hedge that were taken into consideration when designating the "zones". Each zone was given a specific work plan to maximize work under a limited time frame.*

Zone A **(0-80m)**	
Characteristics: Southernmost section of the site Lowest elevation, located at the mid-low section of a gentle slope from the northeast Slightly wetter Soil Moisture Regime and Soil Nutrient Regime than northern hedgerow sections Some areas shaded by mature Douglas first to the south Located outside of the Metchosin Farm deer fence **Large patches of well-established Himalayan blackberry covering 30.2m of the hedgerow, some Creeping thistle and Creeping buttercup present**	**Work Plan:** Remove the Himalayan blackberry patches including below-ground root systems Weed out Creeping thistle and Creeping buttercup Sheet mulch areas of invasive removal Fill in areas of removal with deer-tolerant plants Transplant moisture-loving shrubs from other areas of the hedgerow to wetter areas of Zone A
Zone B **(80-190m)**	
Characteristics: Middle, eastern section of the site Mid-slope on the same gentle slope from the northeast Conifer backbone continuous, partially sunny conditions on flowering shrubs as the conifer shade morning light until early afternoon Mature, well-established flowering shrubs including roses, Snowberry, elderberries, Pacific ninebark, etc. Novel fruit trees planted in front of the hedgerow with mulched ground between them and the flowering shrubs No large patches of invasive plants, **some single Himalayan blackberry plants present throughout**	**Work Plan:** Removal scattered Himalayan blackberry plants with their root systems No planting planned for this section as the zone is well-established with little planting space and few gaps for invasive species establishment. Low priority for work

Zone C (190-250m)

Characteristics:	Work Plan:
Northeastern corner of the hedgerow	Remove Creeping thistle and Poison hemlock
Upper slope location	Sheet mulch areas of invasive removal and grassy sections of the hedgerow in preparation for planting
Partially sunny conditions as conifers shade morning light until early afternoon	Transplant moisture-loving species to cooler, moister location in Zone A
Scattered, smaller flowering shrubs. Not densely established like Zone B	Plant drought/partial-sun tolerant plants and forbs among the remaining shrubs
Several moisture-loving species noted including Pacific ninebark and Hardhack	
Bark mulch mostly weed free, **a large patch of Creeping thistle present and one Poison hemlock plant**	

Zone D (250-300m)

Characteristics:	Work Plan:
Northern edge of the hedgerow along the northern property line of Metchosin Farm	Dig out grass-infested mulch
Mid-slope location and south facing, receiving >8 hours of sunlight each day	Sheet mulch with fresh bark chips where grass was removed
Sparsely planted with only two patches of Snowberry, some very young fruit trees, and Leyland cypress saplings	**Construct a "Demonstration Pollinator Hedgerow":**
Mulched ground is thoroughly invaded by agronomic grasses	Fill gaps in the shrub layer with a wide diversity of drought and sun-tolerant native plant species
Located closest to farm infrastructure including the Seed House where tours and workshops take place	Install examples of nesting and overwintering habitat structures

We focused our activities on areas with the greatest potential for increasing biodiversity and climate resiliency within the budget and timeframe of this project. We prioritized areas with low plant density (Zones C and D) or dominated by invasive species (Zone A). With the exception of some targeted invasive plant removal, we did not work in areas that were well established and densely planted (Zone B). These areas were considered low-priority as mature plants suppress weeds by casting shade on the ground below (S. Kubicek pers. comm. 09/12/2025; K. Miskelly, pers. Comm. 09/23/2025) and little room in the hedgerow remained for additional flowering shrubs.

Invasive Removal and Site Preparation

We contributed a total of 86 capstone hours and 8 volunteer hours to the removal of invasive species throughout the hedgerow. We targeted different populations of invasive species at times of the summer prior to them dispersing seed.

We put the most time into the removal of Himalayan blackberry within Zone A. The two well-established patches were designated as Blackberry Patch #1 and #2. We followed procedures outlined in Metro Vancouver Region's *Best Management Practices for Himalayan Blackberry* (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021), cutting canes to just above ground level using secateurs and loppers. Once roots were accessible, we excavated them using a shovel or mattock, removing as much root material as possible. We extracted single blackberry plants embedded within Zones B, C, and D once the majority of the above-ground material in Blackberry Patch #1 and #2 was removed.

We hand pulled Creeping thistle in Zone C at the base to remove both aboveground biomass and as much root material as possible. We extracted rhizomes and root networks of Creeping buttercup in Zone A using a gardening knife and hand pulling. We carefully pulled the single Poison hemlock plant in Zone C by hand while wearing thick disposable gloves and protective clothing.

We collected all invasive plant material on tarps and transported it to a designated burn pile on-site, with the exception of the Poison hemlock which we bagged and disposed of in the garbage. After removal was concluded in a section, we leveled the ground with a rake and laid pieces of cardboard overlapping to smother any invasive regrowth. Following the recommendations outlined in *Guidelines for Mulching in Garry Oak and Associated Ecosystems* (McCoy & Costanzo 2013), we transported bark mulch from piles on-site and spread it over the cardboard to a depth of 2-3 inches.

Figure 11*. Progress of Himalayan blackberry removal in Zone A. Before any removal, the patch of R. armeniacus was approximately 60m^2 (A), plant material was removed by hand and roots systems were excavated (B), following root removal cardboard was placed to smother any regrowth (C), and bark chips were applied overtop (D).*

Nesting and Overwintering Habitat Installations

Most insect pollinators will overwinter as young in the nests their mothers built in the previous year (Moissett and Buchmann, 2010). Much like how a wide diversity of flowering plants can support a wide range of native bee species, the same can be said for nesting habitats. We consulted information on nesting behaviours from Moisset and Buchmann (2010) and recommendations from the Xerces Society guide *Nesting and Overwintering Habitat for Pollinators* (2020) to plan a diversity of nesting and overwintering habitats for native pollinators.

Roughly 70% of native bees like the mining bee families *Andrenidae, Halticidae, and Colletidae* are ground nesters, excavating tunnels in bare, sunny spots with little chances of flooding. Leaving bare or sparsely planted ground in the hedge provides space for these species to dig tunnels for their offspring. Other bees like the mason and leafcutter families *Megachildiae* or *Ceratina* nest in wood cavities or hollow plant stems, usually the dead stems from the previous year's growth. *Bombus* are known as opportunistic cavity nesters, building nests in abandoned rodent burrows, bunch grasses, gaps in leaf litter, or rock piles.

Nesting habitat was considered when making plant selections and several native plants with known hollow stems were chosen (see Table 3). We planned to integrate rock piles, bare soil, and coarse woody debris into the work plan for Zone D where nests would receive the most sun exposure. We sourced rocks from on and off-site and we transported large rounds of coarse woody debris from the lower hay field on-site.

Plant Selection and Sourcing

Once we identified areas of the hedgerow for planting, we developed a species list based on site conditions, projected regional climate, and the habitat needs of pollinators. The list was designed to support a wide range of pollinators with different feeding adaptations, nesting habitats, and active periods throughout the year. To best support pollinators, it is ideal to have at least 3 species in bloom at all times with continuous blooming overlap from early spring to late fall (L. Morandin, pers. comm. 06/05/2025).

We selected plants from native species associated with Garry Oak ecosystems within the CDFmm. This decision was based on projected climate suitability for these species in British Columbia, their high value for foraging and nesting habitat for native pollinators, potential contributions to habitat connectivity in the surrounding area, and their availability from local plant nurseries. Additionally, research shows that wild bees and honey bee alike forage more readily on native plants, even when plants are young in newly-established hedgerows (Morandin and Kremen, 2013).

We reviewed species profiles from the Garry Oak Ecosystem Recovery Team *Plant Propagation Guide* (GOERT 2026b) and the Lady Bird Johnson Wildflower Centre database to select plants that matched the required traits including late summer or fall blooms, adaptation to dry conditions, and tolerance to full or partial sun. We consulted additional resources including *Selecting Plants for Pollinators* (Wojcik & Morandin, 2017), *Native Plants for Pollinators & Beneficial Insects Maritime Northwest* (Lee-Mader et al. 2023), and the Satinflower Nurseries website to refine the list to plants with host-plant value, nesting habitat potential, attraction of beneficial insects, and resistance to deer.

The final species list and sources are presented in Table 3 below. The complete list of species with growing requirements and bloom period is presented in Appendix E.

Table 3*. A categorized list of the plant species selected for planting in the Metchosin Farm hedgerow including where each species was sourced from, and how many plants were installed in the hedgerow. Salvage training and permits were obtained through the Habitat Acquisition Trust to access the Centre Mountain development site.*

Name	Common Name	Source	Quantity
		Shrubs	
Salix scouleriana	**Scouler's Willow**	Hardwood cuttings from Metchosin Farm's nursery	12
Amelanchier alnifolia	**Saskatoon Serviceberry**	Island View Nursery	6
Holodiscus discolor	**Oceanspray**	Island View Nursery Centre Mountain	4
Ribes sanguineum	**Red-flower Currant**	Island View Nursery Centre Mountain	4
Philadelphus lewisii	**Mock Orange**	Satinflower Nursery	4
Berberis aquifolium	**Tall Oregon-Grape**	Centre Mountain	4
Lonicera ciliosa	**Orange Honeysuckle**	Satinflower Nursery	4
Ceanothus thyrsiflorus	**California Lilac**	Island View Nursery	2
		Forbs	
Symphyotrichum chilense	**California Aster**	Satinflower Nursery	50
Achillea millefolium	**Common Yarrow**	Transplanted from Metchosin Farm lawn	40
Eriophyllum lanatum	**Wooly Sunflower**	Transplanted from Coreen Chiswell and Andy Yatsko's native plant meadow in Metchosin	40
Grindelia stricta	**Oregon Gumweed**	Donation from Katy Nelson	25
Solidago lepida	**Canada Goldenrod**	Divided from single plant in Metchosin Farm Field Garden	14
Chamerion angustifolium	**Fireweed**	Transplanted from Coreen Chiswell and Andy Yatsko's native plant meadow in Metchosin	5

Heurchera micrantha	**Small-flowered Alumroot**	Centre Mountain	3
Fragaria chiloensis	**Coastal Strawberry**	Donation from Katy Nelson	2
Grasses			
Bromus carinatus	**California Brome**	Satinflower Nursery	5
Elymus glaucus	**Blue Wildrye**	Satinflower Nursery	5
Festuca reoemeri	**Roemer's Fescue**	Satinflower Nursery	5

***Figure 12**. The "nursery" of native plants collected for the hedgerow (left), and view of potting Oregon gumweed into horse manure to await planting (right). All transplanted and salvaged plants were potted with above-ground biomass cut back to encourage rooting (K. Miskelly, pers. comm.* 09/23/2025)

Volunteer Events

Metchosin Farm periodically hosts school tours to educate students on the importance of seed sovereignty and organic farming. To contribute to Goal 3, we took groups of elementary school students to the hedgerow to teach them about pollinators and hedgerow restoration. On

September 26, 2025, students from Eagle View Elementary helped with sheet-mulching some heavily weeded areas of Zone C. On October 13, 2025, students from Hans Helgessen Elementary planted excess Yarrow (*Achillea millefolium*), Woolly sunflower (*Eriophyllum lanatum*), and Goldenrod (*Solidago canadensis*) plants throughout the mulch in front of the hedgerow in Zone B. This helped establish new flowering plants in an area of lower priority that would not have been planted otherwise.

On November 22, 2025, volunteers recruited through the RNS program and the Gorge Waterway Action Society planted in Zones A, C, and D (Figure 13). The event started with a short discussion of the project's goals, and the importance of hedgerows in supporting pollinator populations in agricultural landscapes. Nine volunteers contributed a total of 18 volunteer hours and added a total of 234 new plants to the hedgerow.

The event was scheduled for November so new plantings would be adequately watered by fall precipitation and have time to establish before the summer dry season.

Figure 13*. Volunteers during the planting event on November 22, 2025 installing native plants in Zone A, "Blackberry Patch #2".*

RESULTS

Invasive Plant Reduction

We successfully removed a total of 97.9m of invasive species from within the work zones (Table 4), achieving a 100% reduction within a first pass of removal. We did not quantify aggressive agronomic grasses in our inventory including Quackgrass (*Elymus repens*), although prevalent throughout the property. We removed these grasses and mulched over approximately 20m of Zone C, and 40m of Zone D.

Table 4*. The distribution of invasive species removed from within the hedge during this project.*

	Invasive Species Removed (m)			
	Himalayan blackberry	Creeping thistle	Creeping buttercup	Poison hemlock
Zone A	38.9	7.4	6.6	-
Zone B	12.25	-	-	-
Zone C	0.2	9.1	-	0.2
Zone D	5.4	17.8	-	-
Total:	56.75	34.3	6.6	0.2

Planting Plans

Zone A

We cleared an area 9.5m by 1.5m (14.25m^2) from Blackberry Patch #1. Roughly 3.5m^2 was taken up by existing shrubs including Tall Oregon-grape (*Berberis aquifolium*) and Snowberry plants, leaving approximately 10.75m^2 available for adding new plants. We added five new species to this area: Hardhack (transplanted from the northeast corner of the hedgerow), Red-osier dogwood (*Cornus sericea*), Canada goldenrod (*Solidago canadensis*), California aster (*Symphyotrichum chilense*), and Scouler's willow (*Salix scouleriana*) (Figure 14).

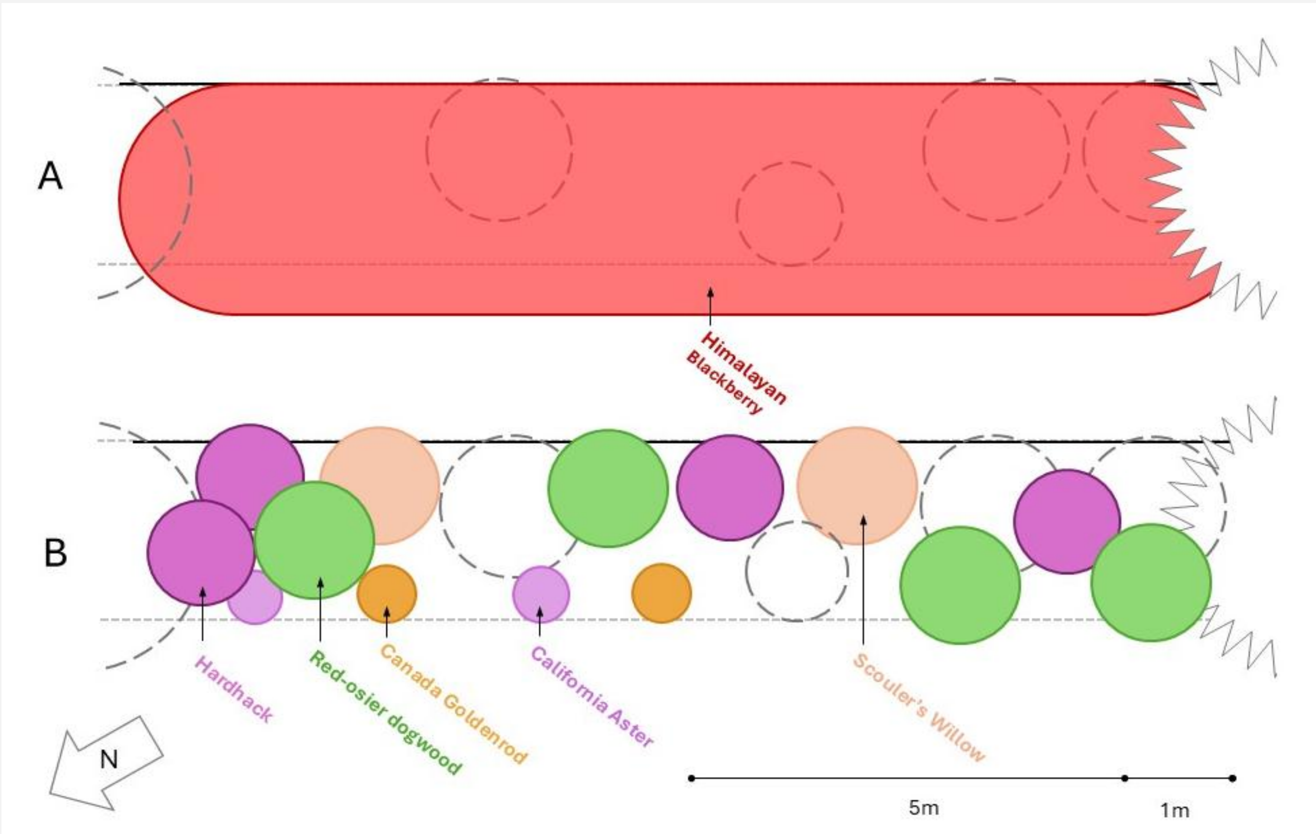

Figure 14. *Plant communities in Blackberry Patch #1 in Zone A. Before the project began (A) the area was dominated by Himalayan blackberry. After removal and sheet mulching (B), the area was planted with 5 new species of native shrubs and forbs indicated above.*

We cleared an area 10m by 2m (20m^2) from Blackberry Patch #2. Roughly 5m^2 was already occupied by existing native trees including three Douglas fir and one Western redcedar, leaving approximately 15m^2 available for new planting. We added nine new species: Tall Oregon-grape, Fireweed (*Chamaenerion angustifolium*), California aster, Oregon gumweed (*Grindelia stricta*), Canada goldenrod, California lilac (*Ceanothus thyrsiflorus*), Scouler's willow, Saskatoon serviceberry (*Amelanchier alnifolia*), and Coastal mugwort (Figure 15).

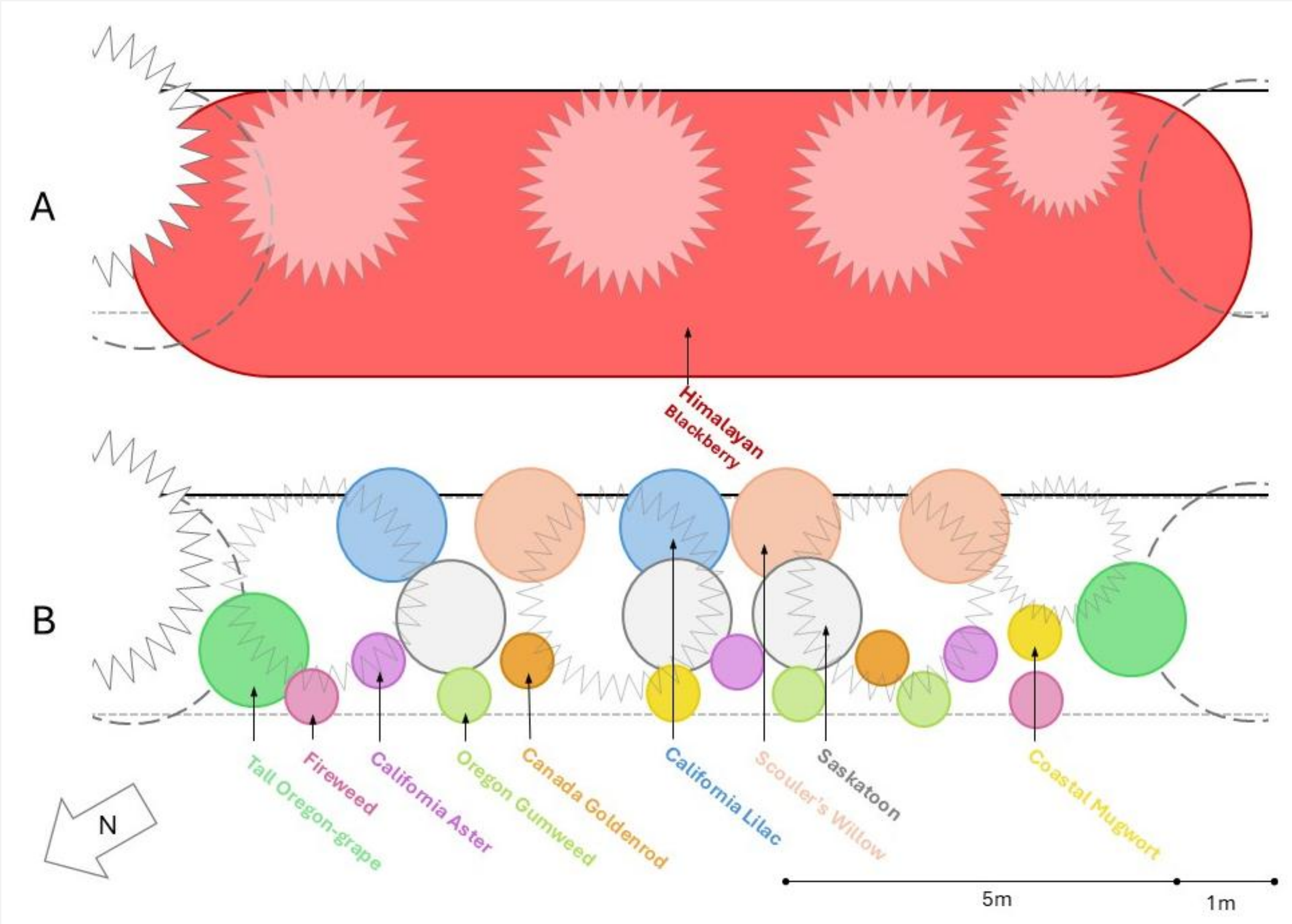

Figure 15. *Plant communities in Blackberry Patch #2 in Zone A. Before the project began (A) the area was dominated by Himalayan blackberry. Four conifer trees were present among the blackberry thicket. After removal and sheet mulching (B), 9 new species of native shrubs and forbs were added as indicated above.*

Zone C

Zone C was the largest planting area, roughly 40m by 1m (40m^2). We found existing shrubs approximately every 2m along this zone, with some larger gaps between. This left approximately 30m^2 available for planting. We added eight new species: Canada goldenrod, California aster, Mock orange (*Philadelphus lewisii*), Red-flowering currant (*Ribes sanguineum*), Orange honeysuckle, Small-flowered alumroot (*Heurchera micrantha*), Scouler's willow, and

Saskatoon serviceberry (Figure 16). Oceanspray and Coastal mugwort were already present in this zone, but we added additional plants to increase their coverage.

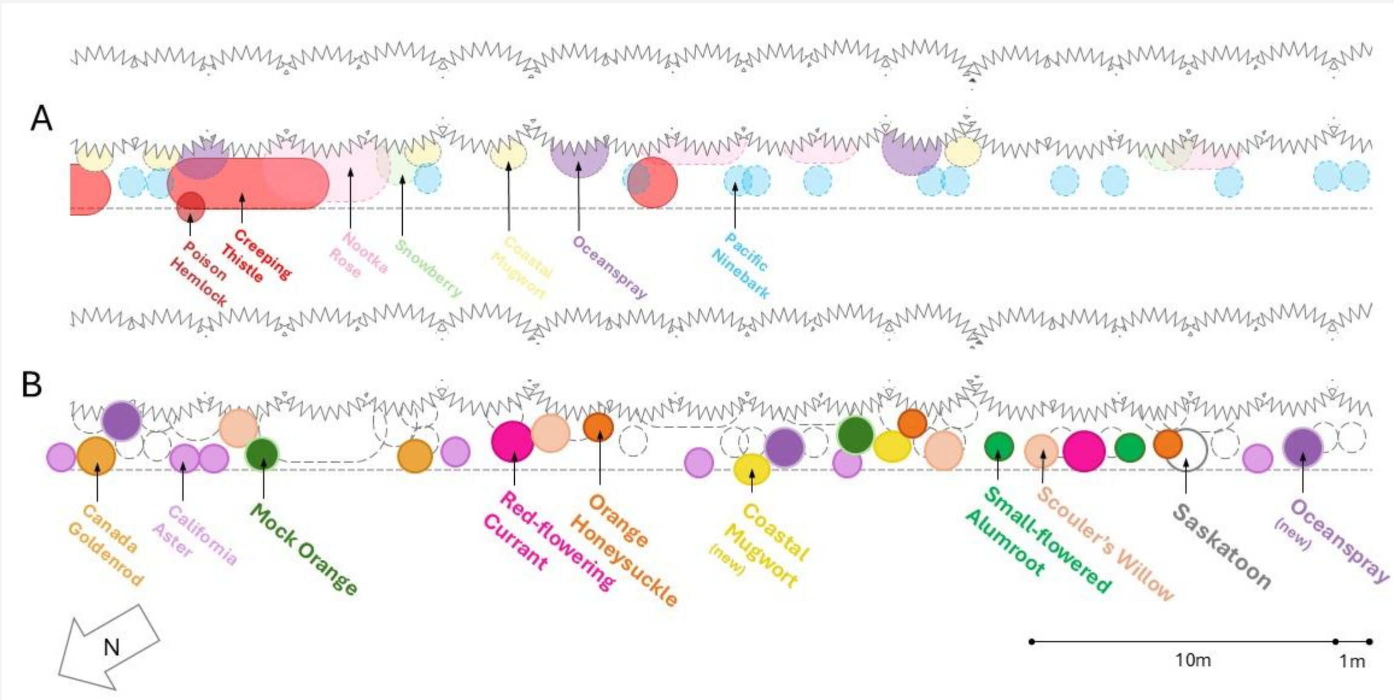

Figure 16. *Plant communities in Zone C. Before the project (A), the zone was planted with some native shrubs and a few patches of Creeping thistle were present. The thistle was removed and areas of the zone were sheet mulched. Following site prep (B), 9 new native species were added, and 2 existing species were expanded as indicated above.*

Zone D

We sheet mulched an area approximately 30m by 1.5m (45m²) in this zone around the existing Leyland cypress and Snowberry shrubs. Roughly 15m^2 was occupied by existing plants and the newly installed nesting habitat rock piles and coarse woody debris leaving approximately 30m^2 available for new planting. We added 15 new species: Coastal mugwort, Wooly sunflower, Common yarrow, Saskatoon serviceberry, Canada goldenrod, California brome (*Bromus carinatus*), Roemer's fescue (*Festuca roemeri*), Blue wildrye (*Elymus glaucus*), Oregon gumweed, Mock orange, Tall Oregon-grape, California aster, Oceanspray, Fireweed, and Scouler's willow (Figure 17).

Zone D received the largest diversity of new species because of its close proximity to the farm entrance and infrastructure, making it the most accessible part of the hedgerow for leading school groups or workshops.

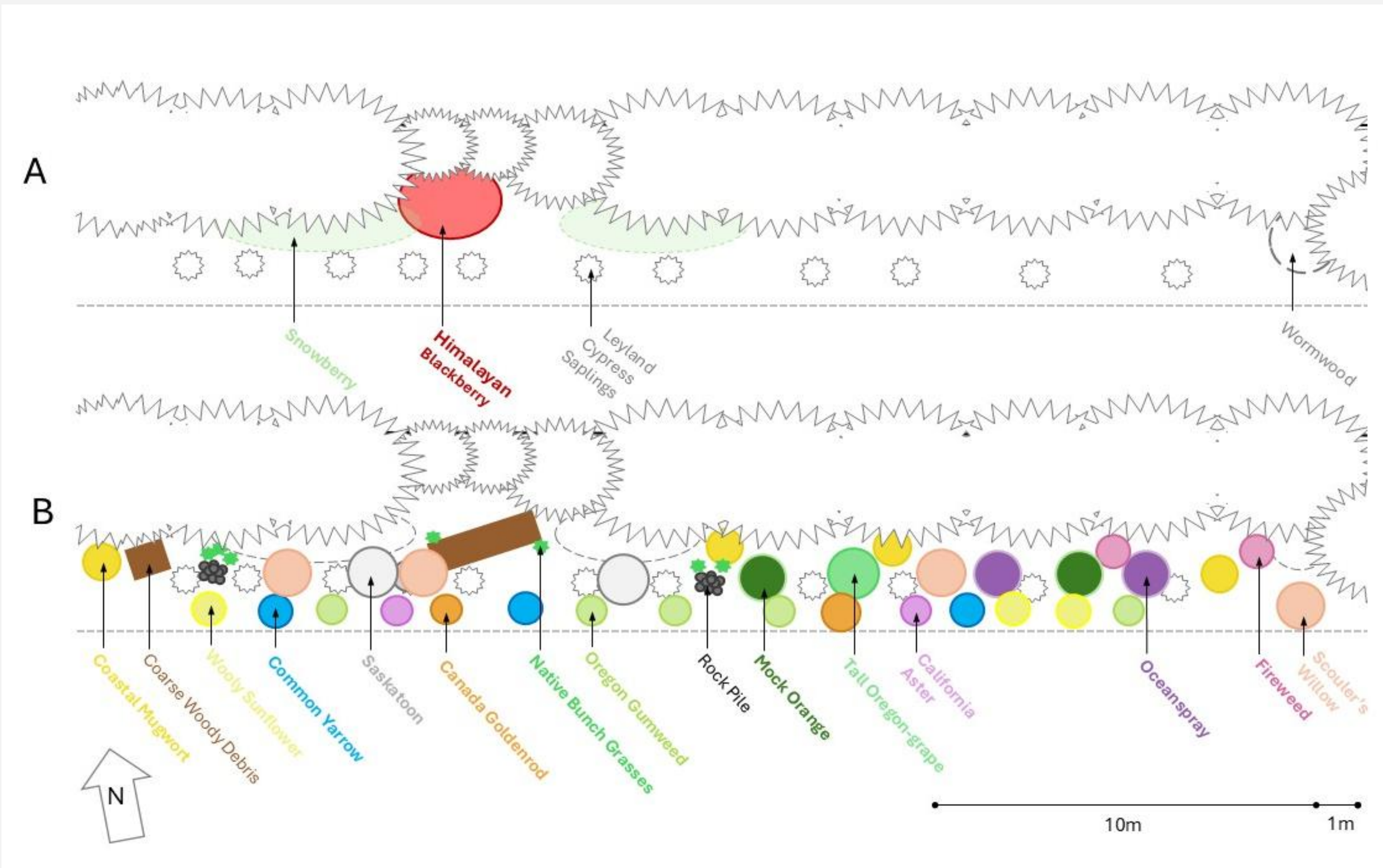

Figure 17. *Plant communities in Zone D. Before the project (A), two patches of Snowberry and several Leyland cypress saplings were present. After new sheet mulching (B), 16 new native plant species were added to this zone as indicated above.*

Increasing Species Richness

Species richness within the hedge was increased by 35%, rising from 46 to 63 species total. We added 18 native species and California lilac, a shrub native to the western United States. Oceanspray, Tall Oregon-grape, and Coastal mugwort were already present in the hedge, however, increasing the redundancy of these species enhances pollination opportunities. All 19 species can tolerate dry soil conditions, and 14 are considered drought-tolerant.

With climate projections predicting warmer, drier summers in Metchosin, it is likely the existing Hardhack and Pacific ninebark will not survive in their current location within the hedgerow. Hardhack is deer resistant and we transplanted from the upslope position in Zone D to the lower slope in Zone A where soil moisture is greater. This relocation supported the objective of increasing climate resilience while also resolving the challenge of sourcing competitive, deer resistant species for Zone A.

Once the added species mature and bloom, the flowering period of the hedgerow will extend from the current end in mid-July (Table 5) to September (Table 6). The extra two months of forage availability is critical for late-summer and fall species that need access to pollen and nectar to provide their larva with resources before winter. *Bombus* queens that overwinter forage late into the year, building up reserves before hibernation.

Table 5. *The bloom period of flowering species in abundance at the beginning of summer 2025 prior to any additions to the hedgerow.*

Species	Typical Bloom Period						
	MAR	APR	MAY	JUN	JUL	AUG	SEP
Snowberry (*S. albus)*			■	■			
Nootka rose (*R. nutkana*)			■	■			
Pacific ninebark (*P. capitatus*)			■	■			
Tall Oregon-grape (*B. aquifolium*)	■	■	■				
Oceanspray (*H. discolor*)				■	■		
Red elderberry (*S. racemosa*)		■	■				
Coastal Mugwort (*A. suksdorfii*)				■	■		
Hardhack (*S. douglasii*)				■	■		
Blackcap raspberry (*R. leucodermisl*)			■	■			

Table 6. *The bloom period of flowering species installed in the hedgerow during this project. All species listed below are tolerant of dry soil conditions.*

Species	Typical Bloom Period						
	MAR	APR	MAY	JUN	JUL	AUG	SEP
Saskatoon serviceberry (*A. alnifolia*)				■	■		
Scouler's willow (*S. scouleriana*)	■	■					
Red-flowering currant *(R. sanguineum)*		■	■	■			
Mock orange (*P. lewisii)*			■	■			
Oregon gumweed (*G. stricta)*				■	■	■	■
California aster (*S. chilense)*					■	■	■
Common yarrow (*A. millefolium)*				■	■	■	■
Woolly sunflower (*E. lanatum)*			■	■			
Canada goldenrod (*S. lepida)*						■	■
Fireweed (*C. angustifolium)*					■	■	■
Orange honeysuckle (*L. ciliosa)*			■	■	■		

Overwintering and Nesting Habitat Construction

Several of the plant species selected for installation are used by stem-nesting bees including Saskatoon serviceberry, Common yarrow, Canada goldenrod, and California aster. Some original plants are also valuable nest sites including Nootka rose, Snowberry, and Red elderberry. As the newly added plants mature in the following years, stems left each fall will provide nesting habitat for bees in the following spring.

We constructed structures for ground-nesting and cavity-nesting in south-facing, sun-exposed areas of Zone D (Figure 18). Two pieces of coarse woody debris approximately 25-30cm in diameter and 0.5m and 2.5m in length were sourced on-site from a fallen fir tree in the south hay field. We built two stone piles approximately 40cm in diameter and 20cm high from stones sourced on-site and from Victoria. Mineral soil we sourced on-site was used to create exposed ground around the installed structures. We planted native bunch grasses including California brome, Roemer's fescue, and Blue wildrye near the rocks and coarse woody debris for easier identification. These bunch grasses provide habitat for *Bombus* and other ground-nesting species, and California brome and Roemer's fescue also serve as host plants for several native species of butterfly.

***Figure 18**. Coarse woody debris and loose rock piles were installed in Zone D for nesting and overwintering habitat of cavity-nesting native bees. Each feature was installed directly on mineral soil, and bunch grasses were planted around each one as additional Bumblebee nesting habitat.*

DISCUSSION

Hedgerows, especially when composed of native plants, are invaluable for wild pollinator populations in agricultural landscapes where natural habitat may be scarce. While the hedgerow at Metchosin Farm contained a variety of flowering plants, including some native species, gaps in pollinator forage and vulnerabilities to climate change were identified. Our goals for this project included improving the habitat quality for wild pollinators and increasing the resiliency of the hedgerow to climate change.

To meet these goals we set objectives of reducing the coverage of invasive species within the site by 80%, increasing the species richness by at least 30%, extending the bloom period into the fall, and selecting plants with drought-tolerance that could survive warmer, drier summers in the future. By removing 100% of the targeted invasive species at the site in a first pass, we successfully met our invasive species objective and opened up space in the hedgerow to increase species richness. We added 17 new species to the hedgerow, 14 of which are considered drought-tolerant, increasing species richness by 35% and successfully meeting our richness and climate resilience objectives. Finally, we extended the bloom period of the hedgerow two months longer than it originally was, providing more forage opportunities for pollinators.

Our third goal involved creating opportunities to discuss restoration and climate change within the Metchosin community and beyond, raising awareness of the importance of wild pollinators for long-term sustainability in agriculture. The three volunteer events held over the course of the project created opportunities for us to connect with school students, parents, and fellow RNS students about our project and the greater issues we were addressing. These events allowed us to connect with community members from throughout the Greater Victoria region who may not have had prior exposure to environmental restoration. Parents and children from Eagle View and Hans Helgesen joined in working on site prep and other farm activities and showed enthusiasm for learning about the farm and the biodiversity our project supports. Some RNS students who participated in the November planting event were conceptualizing their own capstone projects, making it a valuable opportunity to share our work and support their project development. We hope these experiences leave a lasting impact and foster continued respect and appreciation for nature and wildlife.

We successfully met our project objectives which supported the larger goals set for the hedgerow. We gained substantial experience in planning and implementing a restoration project, and received valuable insights from instructors and field experts whose guidance was instrumental to the project success. Collecting data on the hedgerow through plant surveys, ground inspections, and pollinator surveys was both enjoyable and informative, and the results helped us understand the local pollinator community and the habitat features that directly support it.

A more species rich, dry-tolerant hedgerow is a large benefit for Metchosin Farm. Currently irrigation water for the seed crops is drawn from the dugout on-site and the hedgerow is watered periodically throughout the summer as well. However, with increasingly dry, hot summers, more water will likely be allocated to seed crops with less going to the hedgerow. While some less tolerant species may be lost, it is more likely the added drought-tolerant species will persist without watering. Pollination and pest control ecosystem services are more likely to persist for the farm into future climate conditions.

Education and community outreach is also a huge part of Metchosin Farm’s mission. School groups and educational workshops happen periodically on the farm. The installation of a “demonstration hedgerow” in Zone D provides a backdrop for educational presentations about hedgerows, restoration, wild pollinators, and the importance of sustainable agriculture for students and the public.

Project Constraints

We encountered many challenges when planning and implementing this project that affected our ability to complete certain objectives or likely skewed the data we collected.

Pollinator surveys were only conducted in late June, when few plant species were still in bloom and floral resources were limited to Snowberry, Himalayan blackberry, Creeping thistle, and Cat's-ear (*Hypochaeris radicata*). Different genera of wild bees are active at different times throughout the spring and summer, and some species are specialists on flowers that may have finished blooming by the time we surveyed (Moisset and Buchmann, 2010). Being new to pollinator surveys, our netting speed and technique likely reduced our capture success, and our limited identification experience may have affected our ability to identify species more thoroughly. For these reasons, the pollinators collected should be interpreted as a limited subset of the pollinator community that forages at Metchosin Farm.

We were limited to invasive removal only on Metchosin Farm property, and a substantial amount of Himalayan Blackberry remains in the neighboring pasture adjacent to Zone A. While the above ground biomass was cut back where we could reach, the roots were inaccessible and these areas will require regular maintenance to prevent regrowth. All Creeping thistles present in the hedge during the project were removed, however, a seed bank from previous years likely still exists and patches persisting in the south field may serve as a source of future propagules. Creeping buttercup in Zone A was removed and mulched over entirely. Despite this, new growth has been observed in Spring 2026 from persistent populations within the south hay field. Even with sheet mulching the planted areas, lateral encroachment from surrounding areas remains a risk for invasive species reintroduction.

There are few nurseries in the region that specialize in native plants, and many of the species we hoped to purchase for the project were out of stock. Our limited budget added an additional challenge, and as a result, much of our plant list was supplemented through salvaging or transplanting. This approach required considerable time and physical effort to locate and identify suitable species, excavate root systems, and transport plant material from various locations. Once at the farm, additional time was needed to pot plants, remove above ground biomass, and water regularly which created time constraints for other areas of the project.

Despite the effort involved, transplanting and salvaging plants ultimately helped us meet our species richness goal by broadening the range of species included. Salvaging from rocky outcrops with fast draining soils provided many species that met our criteria for drought tolerance and were well suited for the light conditions within the hedge.

Management and Future Recommendations

Invasive Species and Noxious Weed Management

Monitoring the hedgerow for invasive species regrowth and new occurrences is recommended. Invasive populations will require regular management and removal to reduce the likelihood of reinfestation. By following the recommendations outlined below, the overall effort needed to manage these species is expected to decline over time as soil seed reserves are depleted and remaining root fragments are progressively removed.

Table 7. *Outline for the management of invasive species and noxious weeds following methods recommended by local authorities (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021; Invasive Species Council of BC 2019; King County Washington 2026; Metro Vancouver and the Invasive Species Council of Metro Vancouver 2022).*

	Himalayan blackberry (*R. armeniacus*)
Areas of Concern	● Patches previously located in Zone A, and along the fenceline where removal was not possible due to inaccessibility ● Infestations along the south and west property edges, and within the seed crop fields

Recommended Actions	● Weeding new plants and regrowth from root fragments in late spring or early summer when soil is moist and plants can be pulled more easily ● Cutting canes prior flowering to reduce risk of seed spread ● Massive removal of above ground biomass using hedge trimmers or a flail mower for efficiency. Native Passerine birds nest in blackberry thickets, therefore removal should take place September to March, outside the nesting season ● Cutting is not an effective means of control unless it is conducted multiple times a year for multiple years
Frequency	● Weeding regrowth annually ● Cutting above ground biomass biannually
Canada thistle (*C. arvense*)	
Areas of Concern	● Northeast corner of the hedge in Zone C and Zone D where largest populations were removed. ● Remaining populations in the south hay field
Recommended Actions	● Monitor for regrowth along the hedge and pull new plants ● Pull populations in south field prior to setting seed in June ● If mowing, the most effective time is when thistle is at bud stage
Frequency	● Annually
Agronomic grasses	
Areas of Concern	● Zones A, B, C, and D
Recommended Actions	● Weeding spring and late summer to keep mulch in good condition and prevent grasses from outcompeting the forbs and native bunch grasses planted
Frequency	● Biannually
Creeping Buttercup (*R. repens*)	

Areas of Concern	● Zone A, where Blackberry Patch 1 was removed
Recommended Actions	● Weeding from fall to spring when soil is moist and roots are less likely to break off
Frequency	● Biannually ● Lower priority for removal as it poses the least risk to the taller native shrubs planted in Zone A.
	Poison Hemlock (*C. maculatum*)
Areas of Concern	● Zone C, in the northeast corner
Recommended Actions	● Monitor this area for new plants and regrowth from any residual root fragments late spring or early summer ● Pull young plants when the soil is moist, ensuring plants are removed before flower heads go to seed from April to June
Frequency	● Annually

Management of Leyland Cypress

Due to its competitive nature, rigorous ongoing maintenance of the Leyland cypress, including regular pruning will be required to prevent it from shading out or overtopping flowering plant installations. Many previous plantings by Habitat Acquisition Trust are no longer present because they were planted in line with young cypress trees and have since been outcompeted.

Metchosin Farm may consider removing the saplings planted in front of the backbone of Zone D. This will allow for unobstructed growth of flowering native species, and maintain full sun exposure on areas of bare soil for ground nesting bee species.

Management Practices for Pollinators, Beneficial Insects, and Other Wildlife

Resources for bee-friendly farming practices and supporting native pollinators are presented in Appendix F. Below are our essential recommendations from our research, however we encourage reviewing the resources provided.

- We recommend limiting the amount of mulch applied to the hedge, as excessive mulching restricts access to soil for ground nesting bees and other beneficial insects. If mulching is necessary, leave areas of exposed soil at the bases of the plants to maintain access (McCoy & Costanzo 2013).
- Monitor and maintain the bare soil sections in Zone D by removing weeds and invasive grasses. Where feasible, increase the number of sites with exposed soil in open, and sunny locations, preferably with a south aspect, to enhance habitat for ground nesting bees (Vaughan et al 2015).
- Hand-weeding is the preferred method to minimize soil disturbance
- Delay mowing or haying until late summer, after the peak bloom period has ended, and most bees have emerged from their nests. When mowing, set blades to the highest setting and mow slowly to allow bees time to move away from the equipment (Vaughan et al 2015).
- Retain snags, and leave woody debris within the hedge as these materials provide nesting habitat for bee species that utilize bored wood (The Xerces Society for Invertebrate Conservation 2020).
- When pruning perennials and shrubs or harvesting seed crops, leave some flower stocks and seed heads through winter for wildlife. Prune to varying heights and diameters in early spring for perennials, and late spring for shrubs. Having structural diversity in cavities will attract a broader population of pollinators and other beneficial insects. Bees can nest the same spring that pruning occurs, with larvae developing over

summer. Larva will hibernate over the winter and emerge the following spring (The Xerces Society for Invertebrate Conservation 2020).

Bee Friendly Farm Certification

We suggest Metchosin Farm applies for Bee Friendly Farming Certification through the Pollinator Partnership to build on the work that has been done on the property. This program provides farmers the tools and resources necessary to help preserve and protect pollinators through incremental changes. Meeting the certification standards permits the use of the BFF logo in marketing materials and on websites, allowing consumers to identify products that are produced using environmentally beneficial practices (Pollinator Partnership 2026).

Resources for Pollinator Supportive Farming Practices

Bee Friendly Farming Program Handbook
Pollinator Partnership. 2026.
https://www.pollinator.org/pollinator.org/assets/generalImages/BeeFriendlyFarmingProgram_Handbook_1-1-26-3.pdf

Farming for Bees: Guidelines for Providing Native Bee Habitat on Farms
Vaughan, M., Hopwood, J., Lee-Mäder, E., Shepherd, M.,
Kremen, C., Stine, A., Black, S. 2015.
The Xerces Society for Invertebrate Conservation. https://xerces.org/sites/default/files/2018-05/15-007_04_XercesSoc_Farming-for-Bees-Guidelines_web.pdf

Nesting and Overwintering Habitat for Pollinators and Other Beneficial Insects
The Xerces Society for Invertebrate Conservation
2020.
https://xerces.org/sites/default/files/publications/18-014_02_Natural-Nesting-Overwintering-FS_web.pdf

REFERENCES

Adamson, N., Borders, B., Kay, J., Jordan, S., Gill, K., Hopwood, J., Lee-Mader, E., Minnerath, A. and Vaughn, M. 2017. Pollinator Plants for the Maritime Northwest Region. The Xerces Society for Invertebrate Conservation, Portland, US. https://xerces.org/sites/default/files/2018-05/17-048_03_XercesSoc_Pollinator-Plants_Maritime-Northwest-Region_web-3page.pdf

Bachelet, D., Johnson, B., Bridgham, S., Dunn, P., Anderson, H., Rogers, B. 2011. Climate Change Impacts on Western Pacific Northwest Prairies and Savannas. Northwest Science. 85(2): 411-429. Retrieved from: https://doi.org/10.3955/046.085.0224

Bush, E., Gillett, N., Bonsal, B., Cohen, S., Derksen, C., Flato G., Greenan, B., Shepherd, M., Zhang, X. 2019. Canada's Changing Climate Report. Government of Canada, Ottawa, ON. Retrieved from: https://changingclimate.ca/CCCR2019/chapter/executive-summary/

Capital Regional District. 2015. Watersheds of Greater Victoria. Retrieved April 3, 2026, Retrieved from: https://www.crd.ca/media/file/watersheds-greater-victoria-map-2015

Capital Regional District. 2024. Climate Change Projections for the Capital Region. Retrieved March 19, 2026, from: https://www.crd.ca/media/file/climateprojectionscapitalregion2024

Capital Regional District. 2026. *CRD Public Map Viewer* [Interactive map]. Retrieved from: https://maps.crd.bc.ca/Html5Viewer/?viewer=public&

Climatedata.ca. 2026. Interactive climate maps. Retrieved from: https://climatedata.ca/maps/?var=hottest_day&th=tx_max&dataset=216&dataOpacity=100&labelOpacity=100&lat=62.51232&lng=-98.52539&zoom=4

Darris, D. 2007. Plant Fact Sheet: California brome, *Bromus carinatus* Hook. & Arn. USDA NRCS, Plant Materials Center, Corvallis, Oregon. Retrieved from: https://plants.usda.gov/DocumentLibrary/factsheet/pdf/fs_brca5.pdf

Dyer, D., O'Beck, R., Stannard, M. 2010. Plant Guide: Blue Wildrye, *Elymus glaucus* Buckl. USDA NRCS California State Office, Lockeford Plant Materials Center, California, and Pullman Plant Materials Center, Washington. Retrieved from: https://www.nrcs.usda.gov/plantmaterials/wapmcpg9829.pdf

Feeley, K., Bravo-Avila, C., Fadrique, B., Perez, T., and Zuleta, D. 2020. Climate-driven changes
in the composition of New World plant communities. *Nature Climate Change,* 10: 965-970.

Garibaldi, L. A., et al. 2011. Stability of pollination services decreases with isolation from natural areas despite honey bee visits: Habitat isolation and pollination stability. Ecology Letters, 14(10), 1062–1072.

Garibaldi, L.A., et al. 2013. Wild pollinators enhance fruit set of crops regardless of honey bee abundance. Science, 339(6127): 1608-1611.

Garry Oak Ecosystem Recovery Team. 2026a. Why are they important? Retrieved from: https://goert.ca/about/why-are-they-important/

Garry Oak Ecosystem Recovery Team. 2026b. Plant Propagation. Retrieved from: https://goert.ca/gardeners-restoration/propagation/

Government of British Columbia. 2014. Biogeoclimatic Zones of British Columbia. Ministry of Forests, Lands, and Natural Resource Operations. Accessed from: https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/ecosystems/bec/maps/bgcmap201608.pdf

Green, R.N., Klinka, K. 1994. A Field Guide for Site Identification and Interpretation for the Vancouver Forest Region, Land Management Handbook #28. Province of British Columbia, Ministry of Forests. ISSN 0229-1622, Accessed from: https://www.for.gov.bc.ca/hfd/pubs/docs/lmh/lmh28.pdf =

Hatfield, J., Prueger, J. 2015. Temperature extremes: Effect on plant growth and development. Weather and Climate Extremes, Vol 10, Pages 4-10. ISSN 2212-0947. Accessed from: https://doi.org/10.1016/j.wace.2015.08.001.

Invasive Species Council of BC. 2019. Canada Thistle, Cirsium arvense Factsheet. Accessed from: https://bcinvasives.ca/wp-content/uploads/2021/01/Canada-Thistle_Factsheet_26032019.pdf

Kennedy, C.; Lonsdorf, E.; Neel, M.; Williams, N.; Ricketts, T.; Winfree, R., et al. 2013. A global quantitative synthesis of local and landscape effects on wild bee pollinators in agroecosystems. Ecology Letters, 16(5), 584-599.

King County Washington. 2026. Creeping Buttercup Identification and Control. https://kingcounty.gov/en/dept/dnrp/nature-recreation/environment-ecology-conservation/noxious-weeds/identification-control/creeping-buttercup

Klein, A., Bernard, V., James, C., Steffan-Dewenter, I., Cunningham, S., Kremen, C. and Tscharntke, T. 2007. Importance of pollinators in changing landscapes for world crops. Proceedings of the Royal Society B. 274(1608): 303-313.

Lady Bird Johnson Wildflower Center. 2026. Plant Lists and Collections - British Columbia. The University of Texas. Accessed from: https://www.wildflower.org/collections/

Lee-Mader, E., Murray, A., Pease, C. and Vaughn, M. 2023. Native Plants for Pollinators and Beneficial Insects: Maritime Northwest Region. The Xerces Society for Invertebrate

Conservation, Portland, US. https://xerces.org/sites/default/files/publications/22-023_02_NPPBI%E2%80%94MaritimeNW_web.pdf

McCoy, M. and Costanzo, B. 2013.Guidelines for mulching in Garry Oak and associated ecosystems. Garry Oak Ecosystems Recovery Team. Retrieved from: https://goert.ca/wp/wp-content/uploads/GOERT-Guildlines-Mulching-2013.pdf

Mahony, C., MacKenzie, W., Aitken, S. 2018. Novel climates: Trajectories of climate change beyond the boundaries of British Columbia's forest management knowledge system. Forest Ecology and Management, Vol 410, Pages 35-47. ISSN 0378-1127. https://doi.org/10.1016/j.foreco.2017.12.036.

Meidinger, D. and Pojar, J. 1991. Ecosystems of British Columbia: Chapter 5 - Coastal Douglas-fir Zone. BC Ministry of Forests, Victoria, BC.

Metro Vancouver and the Invasive Species Council of Metro Vancouver. 2021. Best Management Practices for Himalayan Blackberry in Metro Vancouver Region. Accessed 26/05/2025 from: https://metrovancouver.org/services/regional-planning/Documents/himalayan-blackberry-best-practices-management.pdf

Metro Vancouver and the Invasive Species Council of Metro Vancouver. 2022. Best Management Practices for Poison Hemlock in the Metro Vancouver Region. https://metrovancouver.org/services/regional-planning/Documents/poison-hemlock-best-management-practices.pdf

Moissett, B. and Buchmann, S. 2010. Bee Basics: An Introduction to Our Native Bees. USDA Forest Service. Retrieved from https://efotg.sc.egov.usda.gov/references/public/SC/Bee_Basics_North_American_Bee_ID.pdf

Morandin, L. and Kremen, C. (2013). Hedgerow restoration promotes pollinator populations and exports native bees to adjacent fields. Ecological Applications, 23(4): 829-839.

Morandin, L., Long, R., and Kremen, C. (2014). Hedgerows enhance beneficial insects on adjacent tomato fields in an intensive agricultural landscape. Agriculture, Ecosystems, and Environment, 189: 164-170.

Morandin, L., Long, R., and Kremen, C. (2016). Pest Control and Pollinator Cost-Benefit Analysis of Hedgerow Restoration in a Simplified Agricultural Landscape. Journal of Economic Entomology, 109(3): 1020-1027.

Orpet, A. 2025. All About Hedgerows: Why They Help Wildlife and How to Plant Them. The Xerces Society for Invertebrate Conservation. Retrieved from: https://xerces.org/blog/all-about-hedgerows-why-they-help-wildlife-and-how-to-plant-them

Pollinator Partnership. 2026. Bee Friendly Farming Program Handbook. https://www.pollinator.org/pollinator.org/assets/generalImages/BeeFriendlyFarmingProgram_Handbook_1-1-26-3.pdf

Pojar, J. and MacKinnon, A. 2014. Revised Plants of Coastal British Columbia Including Washington, Oregon, and Alaska. BC Ministry of Forests and Lone Pine Publishing.

Potts, S., Biesmeijer, J., Kremen, C., Neumann, P., Schweiger, O. and Kunin, W. 2010. Global pollinator declines: trends, impacts and drivers. Trends in Ecology and Evolution, 25(6): 345-353.

Province of British Columbia. 1998. Field Manual for Describing Terrestrial Ecosystems 2nd Edition, Land Management Handbook #25. ISSN 0229-1622, Retrieved from: https://a100.gov.bc.ca/pub/eirs/finishDownloadDocument.do?subdocumentId=12407

Province of British Columbia. 2026. *BC Soil Survey Map* [Interactive map]. Retrieved March 19, 2026, from: https://governmentofbc.maps.arcgis.com/apps/webappviewer/index.html?id=28dae855df3e42db8edc04319aa2dbf5

Redden, R., Hatfield, J., Vara Prasad, P., Ebert, A., Yadav, S., O'Leary, G. 2014. Temperature, Climate Change, and Global Food Security. In Temperature and Plant Development. Retrieved from: https://doi-org.ezproxy.library.uvic.ca/10.1002/9781118308240.ch8

Roemer, H. and Sanseverino, M. 2025. Native Plants of British Columbia's Coastal Dry Belt: A Photographic Guide. Harbour Publishing.

Satinflower Nurseries. 2025. Plant Descriptions. Retrieved from: https://satinflower.ca/collections/plants-1

SparrowHawk Native Plants. 2026. Orange Honeysuckle, Lonicera ciliosa. Accessed from: https://sparrowhawknativeplants.com/products/orange-honeysuckle-1?variant=47753785704665

Vaughan, M., Hopwood, J., Lee-Mäder, E., Shepherd, M., Kremen, C., Stine, A., Black, S. 2015. *Farming for bees: Guidelines for providing native bee habitat on farms* (4th ed.). The Xerces Society for Invertebrate Conservation. https://xerces.org/sites/default/files/2018-05/15-007_04_XercesSoc_Farming-for-Bees-Guidelines_web.pdf

Vaughn, M., Mader, E., Guisse, J., Goldenetz-Dollar, J. and Borders, B. 2013. Hedgerow Planting (422) for Pollinators: Western Oregon and Washington - Specifications and Implementation Recommendations. The Xerces Society for Invertebrate Conservation, Portland, OR. https://xerces.org/sites/default/files/2018-05/14-018_04_XercesSoc_HabitatInstallGuide_West-OR-WA_Hedgerow422_web.pdf

Walter, J. 2018. Effects of changes in soil moisture and precipitation patterns on plant-mediated biotic interactions in terrestrial ecosystems. Plant Ecol 219, 1449–1462. Accessed from: https://doi-org.ezproxy.library.uvic.ca/10.1007/s11258-018-0893-4

Williams,J., Jackson, S., Kutzbach, J. 2007. Projected distributions of novel and disappearing climates by 2100 AD. Proc. Natl. Acad. Sci. U.S.A. 104 (14) 5738-5742. Accessed from: https://doi.org/10.1073/pnas.0606292104

Wojcik, V., Morandin, L. 2017. Selecting Plants for Pollinators: A Guide for Gardeners, Farmers, and Land Managers In the Eastern Vancouver Island Ecoregion. Retrieved from: https://www.pollinator.org/pollinator.org/assets/generalFiles/E.Vancouver.Isl.2017.pdf

The Xerces Society for Invertebrate Conservation. 2020. Nesting and Overwintering Habitat for Pollinators and Other Beneficial Insects. https://xerces.org/sites/default/files/publications/18-014_02_Natural-Nesting-Overwintering-FS_web.pdf

Young-Mathews. 2012. Plant fact sheet for Pacific aster (Symphyotrichum chilense). USDA-Natural Resources Conservation Service, Corvallis Plant Materials Center, Corvallis, OR. Accessed from: https://plants.sc.egov.usda.gov/DocumentLibrary/factsheet/pdf/fs_sych4.pdf

Appendix A.

Select Historical Aerial Photographs

In each photograph, the approximate location of Metchosin Farm is indicated by the red arrow. Aerial photographs were retrieved from the Provincial Government imagery finder and the CRD Webmap.

Figure 1. *Aerial photograph of the farm taken in 1964. Property is a single pasture.*

Figure 2. *Aerial photograph from 1997 showing the presence of the irrigation dugout. Single pasture has not been subdivided yet. Tree plantation is visible to the east along the sea bluffs.*

Figure 3. *Aerial imagery from 2014, hedgerow is first visible in aerial photographs*

Figure 4. *Aerial imagery from 2023, shows well-established seed crop fields and hedgerow. Tree plantation has been removed.*

Appendix B.

Full Plant Inventory

Scientific Name	Common Name	Layer	Origin	Length
Cupressus x leylandii	Leyland cypress	Tree	Cultivated Hybrid	121.0
Pseudotsuga menziesii	Douglas fir	Tree	Native	116.2
Symphoricarpos albus	Snowberry	Shrub	Native	85.0
Rosa nutkana	Nootka rose	Shrub	Native	66.1
Rubus armeniencus	Himalayan blackberry	Shrub	Invasive	58.1
Physocarpus capitatus	Pacific ninebark	Shrub	Native	35.6
Cirsium arvense	Creeping thistle	Forb	Invasive	34.3
Thuja plicata	Wester redcedar	Tree	Native	19.1
Prunus spp. / Malus spp.	Fruit trees	Tree	Cultivated	22.7
Holodiscus discolor	Oceanspray	Shrub	Native	10.8
Sambucus racemosa	Red elderberry	Shrub	Native	9.0
Pteridium aquilinum	Bracken fern	Forb	Native	8.9
Artemisia suksdorfii	Coastal mugwort	Forb	Native	7.0
Ranunculus repens	Creeping buttercup	Forb	Invasive	6.6
Artemisia absinthium	Wormwood	Shrub	Non-native	6.1
Sambucus cerulea	Blue elderberry	Shrub	Native	5.8
Symphytum x uplandicum	Russian Comfrey	Forb	Sterile non-native	4.7
Spirea douglasii	Hardhack	Shrub	Native	4.7
Rosa canina	English wild rose	Shrub	Non-native	4.1
Pinus sp.	Unknown pine	Tree	Unknown	3.5
Rubus leucodermis	Blackcap raspberry	Shrub	Native	3.2

Corylus avellana	Hazelnut	Tree	Non-native	3.1
Sambucus nigra	Black elderberry	Shrub	Non-native	3.1
Lonicera periclynmenum	Common honeysuckle	Shrub	Non-native	3.0
Spiraea japonica	Japanese spriea	Shrub	Non-native	2.4
Cornus sericea	Red-osier dogwood	Shrub	Native	2.0
Rubus ursinus	Trailing blackberry	Forb	Native	2.0
Lonicera involucrata	Twinberry	Shrub	Native	1.9
Lonicera pileata	Boxleaf honeysuckle	Shrub	Non-native	1.8
Alnus rubra	Red alder	Tree	Native	1.5
Berberis aquifolium	Tall Oregon-grape	Shrub	Native	1.5
Salix purpurea	Blue arctic willow	Shrub	Non-native	1.4
Weigela florida	Old-fashion weigela	Shrub	Non-native	1.3
Lupinus polyphyllus	Large-leaved lupin	Forb	Native	1.2
Rubus parvilorus	Thimbleberry	Shrub	Native	0.9
Laurus sp.	Laurel	Shrub	Non-native	0.8
Buddleja davidii	Butterfly bush	Shrub	Non-native	0.7
Hesperis matronalis	Dames rocket	Forb	Non-native	0.7
Juncus sp.	Unknown rush	Forb	Native	0.7
Melissa officinalis	Lemon balm	Forb	Non-native	0.6
Quercus robur	French oak (seedling)	Tree	Non-native	0.4
Rubus spectabilis	Salmonberry	Shrub	Native	0.4
Epilobium sp.	Willowherb	Shrub	Non-native	0.4
Castanea sp.	Chestnut (seedling)	Tree	Non-native	0.3
Syringa sp.	Lilac	Shrub	Non-native	0.3

Conium maculatum	Poison hemlock	Forb	Invasive	0.2

Appendix C.

Ground Inspection Results

The tables below summarize the results of two ground inspections conducted on July 11 and 18, 2025 following keys and definition found in *A Field Guide for Site Identification and Interpretation for the Vancouver Forest Region, Land Management Handbook #28,* and *Field Manual for Describing Terrestrial Ecosystems 2nd Edition*. Elevation data obtained from the CRD Public Map viewer, and soil surficial material found using the *BC Soil Survey Map* (Government of Canada 2026).

***Table 1**. Data collected for Plot 1 on 11/07/2025*

Plot#	**1**	**Polygon #**	**1**
Latitude	+48.37776	**Longitude**	-123.52453
Aspect	282° NW	**Elevation**	41.5m
Mesoslope Position	Mid slope	**Slope**	4%
Soil Drainage	Well	**Mineral texture**	Loam (SCL)
Humus Form	Mor	**Root Restricting Layer**	24.15cm
Surficial Material	Morainal Till	**Coarse Fragment content**	<20%
SMR	3	**SNR**	C
BEC	CDFmm	**Site series**	01 Fd-Salal

***Table 7**. Data collected for Plot 2 on 18/07/2025*

Plot#	**2**	**Polygon #**	**1**
Latitude	+48.37919	**Longitude**	-123.52334
Aspect	306° NW	**Elevation**	41.9m
Mesoslope Position	Upper slope	**Slope**	9%
Soil Drainage	Well	**Mineral texture**	Silty (SiL)
Humus Form	Mor	**Root Restricting Layer**	NA
Surficial Material	Morainal Till	**Coarse Fragment content**	20-35%
SMR	2-3[1]	**SNR**	C[b]
BEC	CDFmm	**Site series**	01 Fd-Salal

1-steep south aspects tend to be one class drier

b-on sites with mature broadleaf trees increase nutrient class by one category

Appendix D.
Summarized Climate Data

Table 1. *Historical and projected 30 year average median seasonal temperature maximums and minimums for Metchosin BC under RCP8.5 emission pathways (Climatedata 2026)*

	Seasonal Temperature Minimum / Maximums (°C)			
Date	Winter	Spring	Summer	Fall
1951 - 1980	2.1 / 7.1	4.8 / 12.6	10.3 / 19.7	6.5 / 13.6
1981 - 2010	2.4 / 7.5	5.2 / 13.1	10.8 / 20.3	7.0 / 13.9
2011 - 2040	3.8 / 8.5	6.2 / 14	11.8 / 21.5	7.9 / 14.9
2041 - 2070	5.1 / 10	7.5 / 15.2	13.5 / 23.4	9.4 / 16.5
2071 - 2100	6.7 / 11.4	8.8 / 16.6	15.4 / 25.6	11 / 18.2

Table 2. *Historical and projected 30 year average last day of spring frost for Metchosin BC under RCP8.5 emission pathways (Climatedata 2026)*

Date	1951 - 1980	1981 - 2010	2011 - 2040	2041 - 2070	2071 - 2100
Last Day of Frost	74	69	51	41	31

Table 3. *Historical and projected 30 year average total precipitation for Metchosin BC under RCP8.5 emission pathways (Climatedata 2026)*

	Total Precipitation (mm)				
Date	Winter	Spring	Summer	Fall	Annual
1951 - 1980	469	182	73	317	1041
1981 - 2010	473	182	69	321	1045
2011 - 2040	488	185	65	323	1061
2041 - 2070	519	187	68	347	1121
2071 - 2100	534	192	59	354	1139

Table 4. Historical data and projected 30 year average annual maximum number of consecutive dry days for Metchosin BC under RCP8.5 emission pathways (Climatedata 2026)

Year	1951 - 1980	1981-2010	2011-2040	2041-2070	2071-2100
Number of Dry Days	30	33	32	34	39

Appendix E.

New Plants Selected for the Metchosin Farm Hedgerow

***Table 1**. The required growing conditions, and flowering characteristics of plant species installed in the hedgerow. Information retrieved from online resources (Lee-Mader et al 2023; Wojcik & Morandin 2017; Satinflower 2025; Garry Oak Ecosystem Recovery Team 2026b; Young-Mathews 2012; Sparrowhawk Native Plants 2025;Dyer et al 2010; Darris 2007).*

Species Name	Latin Name	Light Requirements	Soil Moisture Conditions	Drought Tolerance	Bloom Period	Flower Colour
Shrubs						
Amelanchier alnifolia	Saskatoon serviceberry	Full- Partial Sun	Dry-Mesic	No	Jun-Jul	White
Lonicera ciliosa	Orange Honeysuckle	Partial Sun – Full Shade	Dry – Moist	Yes	May-Jul	Orange
Holodiscus discolor	Oceanspray	Full Sun – Partial Shade	Xeric-Mesic	Yes	Jun-Jul	White
Berberis aquifolium	Tall Oregon-grape	Full Sun – Partial Shade	Dry-Mesic	Yes	Mar-May	Yellow
Philadelphus lewisii	Mock Orange	Full Sun – Partial Shade	Dry-Moist	No	May-Jun	White
Ribes sanguineum	Red-flowering currant	Full Sun – Partial Shade	Dry-Moist	Yes	Apr-Jul	Pink
Salix scouleriana	Scouler’s Willow	Full Sun - Partial Shade	Dry-Moist	Yes	Mar-Apr	Yellow
Forbs						
Achillea millefolium	Common Yarrow	Full Sun	Dry-Moist	Yes	Jun-Sep	White
Chamerion angustifolium	Fireweed	Full- Partial Sun	Dry -Mesic	No	Jul-Sep	Pink
Eriophyllum lanatum	Woolly Sunflower	Full Sun – Partial Shade	Dry	Yes	May-Jun	Yellow

Fragaria chiloensis	Coastal Strawberry	Full Sun	Dry-Mesic	Yes	Apr-May	White & Yellow
Grindelia stricta	Oregon Gumweed	Full Sun	Dry-Mesic	Yes	Jun-Sep	Yellow
Heuchera micrantha	Small-flowered Alumroot	Full Sun – Shade	Dry-Mesic	No	May-Jun	Pink
Solidago lepida	Canada Goldenrod	Full Sun	Dry-Moist	No	Aug-Sep	Yellow
Symphyotrichum chilense	California Aster	Full Sun – Partial Shade	Dry-Wet	No	Jun-Sep	Purple & Yellow
Grasses						
Bromus carinatus	California Brome	Full Sun – Partial Shade	Dry- Mesic	Yes	-	-
Elymus glaucus	Blue Wildrye	Partial Shade	Dry-Moist	Yes	-	-
Festuca roemeri	Roemer's fescue	Full Sun	Dry	Yes	-	-