Restoration of Natural Systems Diploma

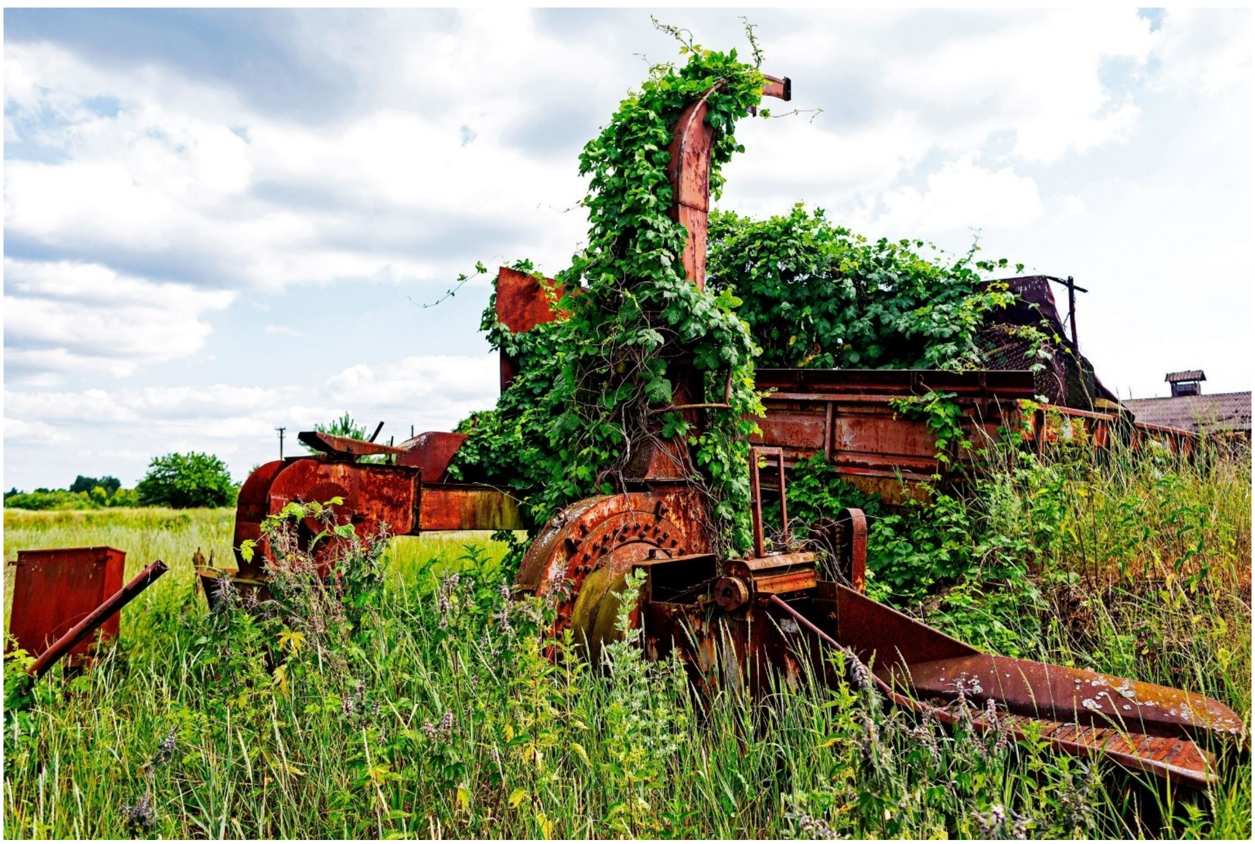
Final Project

~ ER390 ~

UVIC

<u>Mount Lehman Hayfield to Forest Restoration</u>

Andrew Fawcett



(Pearce, 2023)

Abstract

Abandoned farmland is a "silent driver of biodiversity change" globally and has been identified as in need of ecological restoration (Pearce, 2023). This report outlines our efforts to restore the ecological functions of a local agriculturally disturbed land tract. The 2-acre site is critically important for species habitat and connectivity to adjacent forested areas along the Fraser (Stó:lō) River valley in the Lower Mainland of British Columbia.

The site was previously utilized as a hazelnut orchard following initial clearcut disturbance, and has since been planted with clover and non-native hay grasses for livestock forage. More recently, the adjacent area around the field's perimeter has supported a Douglas Fir (*Pseudotsuga menziesii*) Christmas tree farm. A lumber mill, on the north side of the river from the property hosts a large volume of floating logs which exemplifies the high rate of regional deforestation. As seen in the Terrestrial Ecosystem Map (TEM) data, the impacts of disturbance increase the presence of foreign species which impede the early and late successional stages of a native plant ecosystem.

Our project's primary goal is to influence the hayfield's early succession towards a native mixed coniferous deciduous forest and increase awareness of native ecosystems and restoration strategies. The farmland has shown signs of early succession over the past few years of not being hayed. Multiple large shoots (>2m) of Red alder (*Alnus rubra*) and Big leaf maple (*Acer macrophyllum*) exist along the eastern boundary nearest the riverside ravine native forest. More of the same species are naturally emerging at an adjacent property, which has been vacant for multiple years during a major house renovation.

Data collected from the site survey and TEM found two primary site series, including Fd: Salal (DSfsw1) and FdBg: Oregon Grape (DGw1). Surveying the land and collecting data pertinent to the site series was followed by physically removing invasive species and planting native species. The "Basins of Attraction" and "Pathways of Succession for Abandoned Farmland" model by Buchman (2007) provided a theoretical structure to the restoration activities. Additionally, collaborative dialogue with the property owners informed early and ongoing restoration plans. Nearby local landowners with abandoned farmland can apply methods, results, and recommendations from this report to mitigate the adverse effects of deforestation on the related riparian and terrestrial ecosystems.

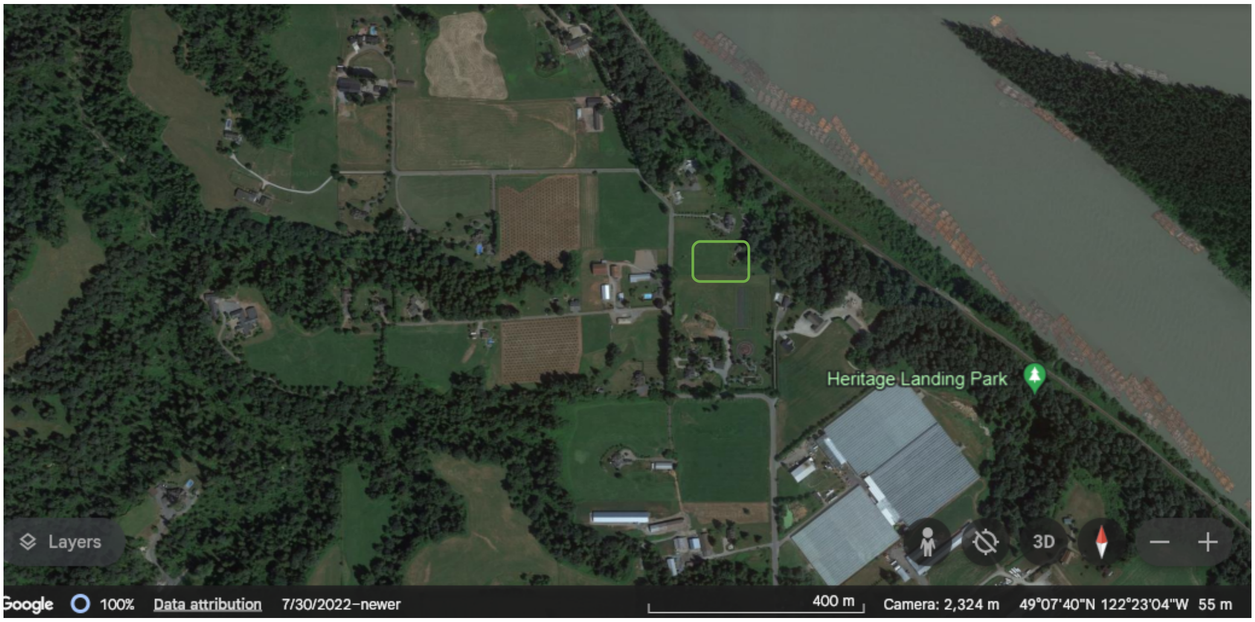
Introduction

The Mount Lehman neighbourhood, a rural suburb of Abbotsford, has been fragmented and damaged by a wide range of land uses. Rural development accompanied by adjoining roads, railroad tracks, power lines, and water drainage infrastructure has made a significant impact on local ecosystems. This area is an agricultural hotspot with activities ranging from livestock, orchards, wineries, vegetable greenhouses, tree farms, and hayfields.

The adverse impacts of these socioeconomic changes can be seen at all scales, including the individual property level. Therefore, individual properties offer important opportunities for restoration, which can benefit the wider neighbourhood and geographical area. Providing a useful example of the ecological work for other surrounding land owners can further amplify the positive impacts of restoration at the property level.

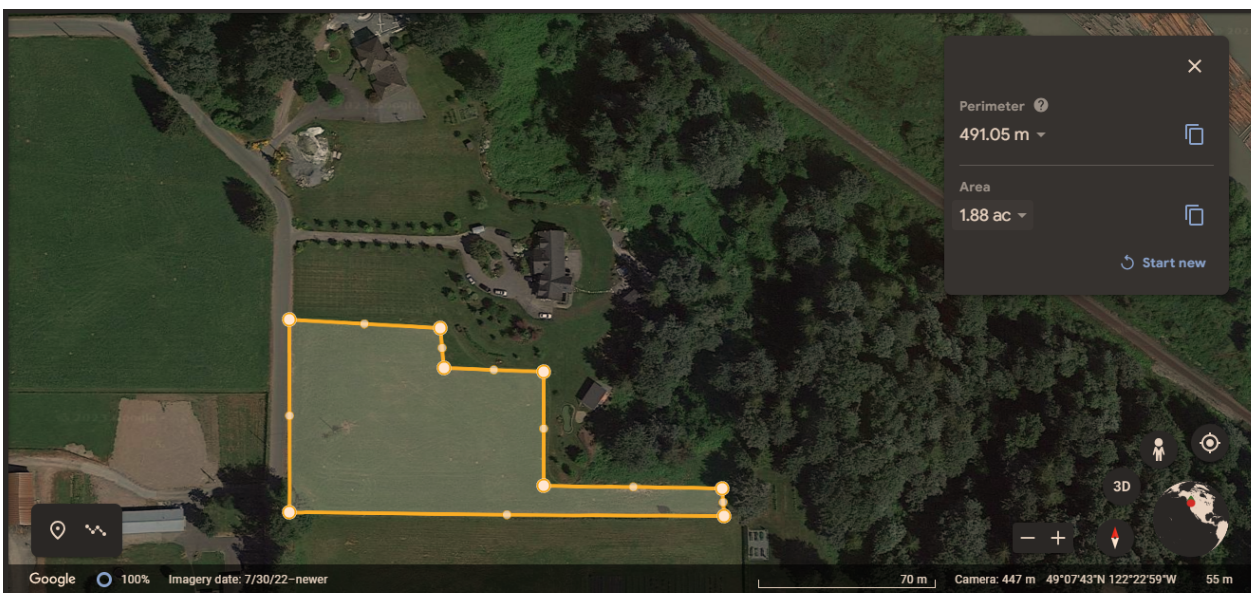
This project focused on one property in the Mount Lehman neighbourhood outlined below in Figure 1.

Figure 1: Aerial Map, Google Earth (green oval = site of inquiry)



The designated restoration site is a 2-acre polygon, approximately 100m x 50m within the 6914 Mt. Lehman Road property quadrant.

Figure 2: Aerial Map, Google Earth (49.12811783600068, -122.38420279080289)



My goal for the ER390 project is to apply knowledge and field skills from the RNS program towards the restoration of this hayfield disturbed by deforestation and agricultural activity. The primary goal is to influence the old field's early succession towards a native mixed coniferous deciduous forest and includes the following subgoals:

- Objective 1.1: Determine likely direction of successful forest development by conducting a complete TEM
- Objective 1.2: Reduce invasive species cover
- Objective 1.3: Increase the presence and abundance of early successional native tree species

A secondary project goal is to increase awareness of native ecosystems and restoration strategies, including:

- Objective 2.1: Engage hayfield property owners in restoration strategies
- Objective 2.2: Plan long-term engagement activities
- Objective 2.3: Provide a practical example of natural restoration for nearby landowners

Methods

The selected site is separated from a lavender farm to the south by a metal fence. A paved rural road along the west boundary and a lane way to the north complete the hayfield perimeter. There is drainage system installed in the northwest corner of the hayfield which has made the conditions drier, thus altering the soil moisture regime. A hydro power line runs diagonally from the southwest to the northeast corner of the hayfield. The eastern edge of the site gently slopes downward into a large ravine which is the nearest and most abundant source of both native and invasive species.

We completed the TEM site assessment tool during the first week of the project. Findings from the TEM established the plant community site series and informed our following tree planting activities throughout August '23 & September – October '24. Necessary supplies for executing the field restoration project were acquired early on in the process with assistance from the landowners. We since applied to both the Lorene Kennedy Grant through the UVIC RNS department and the Trans Canada Trail "Planting for Tomorrow Program" for compensation.

Terrestrial Ecosystem Map

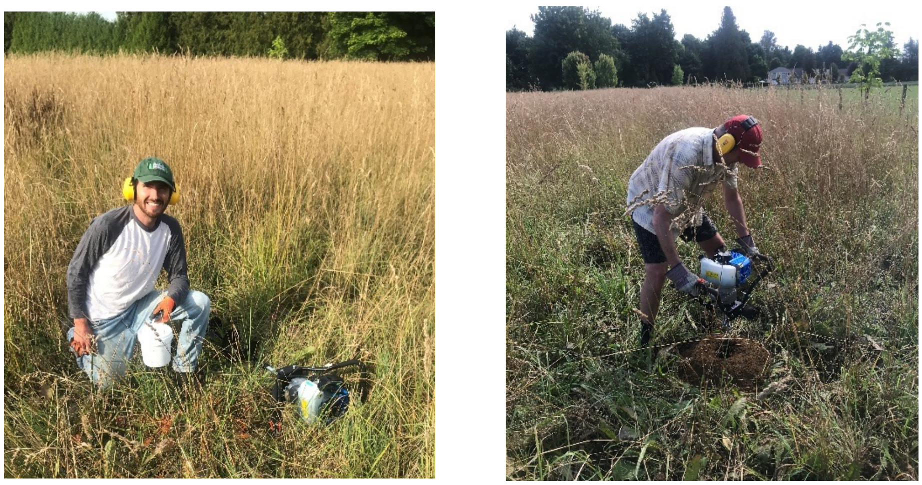
The site survey involved completing a TEM based on data from the ground inspection forms. I began by pacing out the perimeter of the field (100m x 50m) to identify the site polygon and proceeded to complete a 5m x 5m assessment of the micro polygons. I recorded the latitude and longitude in each location and captured multiple photos. I utilized cellphone applications to identify the slope angle, aspect, and elevation. I referred to Swanston (date unknown) to accurately identify the meso-slope position. The drainage was assessed by digging a 1-2' hole and pouring water and observing the rate of dispersal. Soil collected from the pit was sampled using the worm test/cast retention. Further, layers of the soil were considered along with the amount of coarse fragment content present. I identified the Soil Nutrient and Moisture Regime (SNR & SMR) with observed data and criteria outlined by Green & Klinka (1994). The identified plant community site series tells us which plant communities would likely exist in the hayfield without previous ecological disturbance.

Again, referring to resources in the *Field Manual* (Hebda, 2022), I determined the terrain texture, surficial material, surface expression, and geomorphic processes. I also assessed for any remaining site modifiers and confirmed the structural stage. I did not adjust the SMR and site series to account for the drier than normal conditions as they are expected to increase in occurrence. Once I established the pertinent site series in each location, I returned to the aerial map from Google Earth of the macro polygon and created a TEM with Paint software. The TEM primarily intends to indicate the various plant communities or site series, the site series modifiers, and the plant communities' structural stage. I observed both Fd – Salal (DSfsw1) and FdBg – Oregon Grape (DGw1), with the latter occupying the lower more wet region of the hayfield. We planted different species of native trees according to their soil moisture needs, as outlined by the UTM zone CDFmm classification grid from the *Field Manual* (Hebda, 2022).

<u>Initial Stages of Implementation</u>

We commenced the "boots on the ground" portion of the restoration project by rallying together a handful of volunteers in week #2 of August '23. Volunteers assisted with various tasks, such as using the auger to dig holes, clear hayfield grasses with a weed whacker, transplant trees from the adjacent neighbour's property, and water saplings with a garden hose. Unfortunately, the summer heat waves overlapped with the window of time we were together and available to begin this process. We therefore monitored the physical needs of each volunteer and ensured adequate breaks were taken.

Figure 3: A family effort, beginning the work by digging holes (myself and Dad)



We initially transported approximately 75 *A. rubra* and 75 *A. macrophyllum* trees from the neighbour's land to the hayfield. Additional native trees were delivered from the landowner's second property site in Abbotsford, including more mature *Quercus garryana* (3) and *P. menziesii* (4). The trees were marked with either a planting flag or wooden stake for ease of identification, which proved effective throughout the initial watering phase.

Finally, we rented a tractor loader backhoe from Home Depot to remove the very well-established blackberry from the field-ravine perimeter along the eastern edge of the site. The subsequent debris was collected into a large burn pile and later ignited in the winter months. Again, the landowners were actively engaged throughout this invasive species removal process, including driving the tractor and managing the burn pile.

We then discussed and planned next steps for the fall and winter ’23. The landowners planted 10 additional 5-10ft tall *T. plicata* following a Christmas walk-through fundraiser event they hosted. As well, they added over 300 *P. menziesii* towards their Christmas tree farm business. We concentrated these trees in the recently cleared eastern region to create a buffer between the ravine and the hayfield. Although less relevant to the restoration project, adding extra *P. menziesii* Christmas trees ensures the landowners still receive a farm tax discount without an active hayfield.

Continuing Implementation Efforts

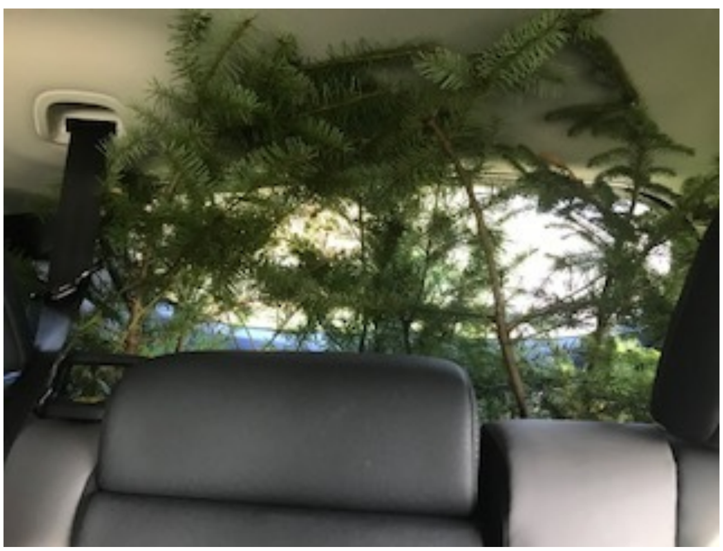
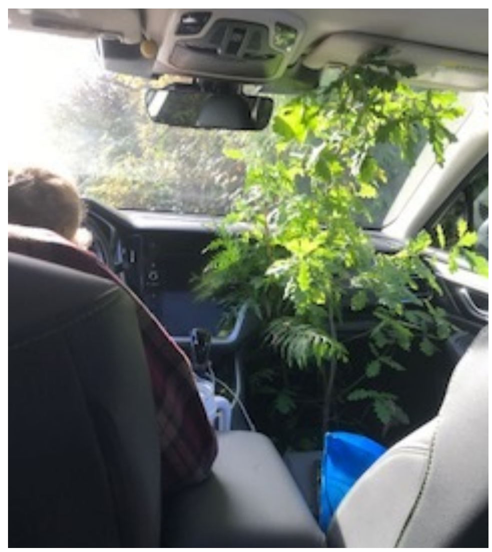
Returning to the site in fall ’24 involved carrying out an assessment of the survival rate from the sapling’s transplanted the year before. I walked throughout the hayfield tallying alive and dead trees. Many seemingly dead trees had miniature leaves growing at the base of the stem directly above the soil. Overall, 60% of the saplings (90/150) did not survive and were equally distributed between tree species. A combination of unideal planting conditions and being overcrowded by field grasses contributed to the saplings inability to establish.

Thankfully, the adjacent property had hundreds more saplings available for transplanting, which were more mature one year later and therefore more likely to survive. I used similar techniques from summer ’23 to transplant approximately 160 *A. rubra* and 50 *A. macrophyllum* throughout the month of September ’24. I either added extra saplings to the holes mulched previously or completely replaced the dead stems. As well, I used a spade shovel to dig new holes and increase the range of trees throughout the hayfield. I slightly adjusted the planting pattern, assuming saplings clustered together in groups may better withstand the field grasses.

And wherever necessary, I dug a wider diameter hole around the new saplings to displace the impeding field grasses. I also created an "edge" around the base of the '23 tree stems for the same reason. All the blackberry (~30) and *Rumex obtusifolius* (~20) present in the hayfield were removed by hand and shovel during this phase too.

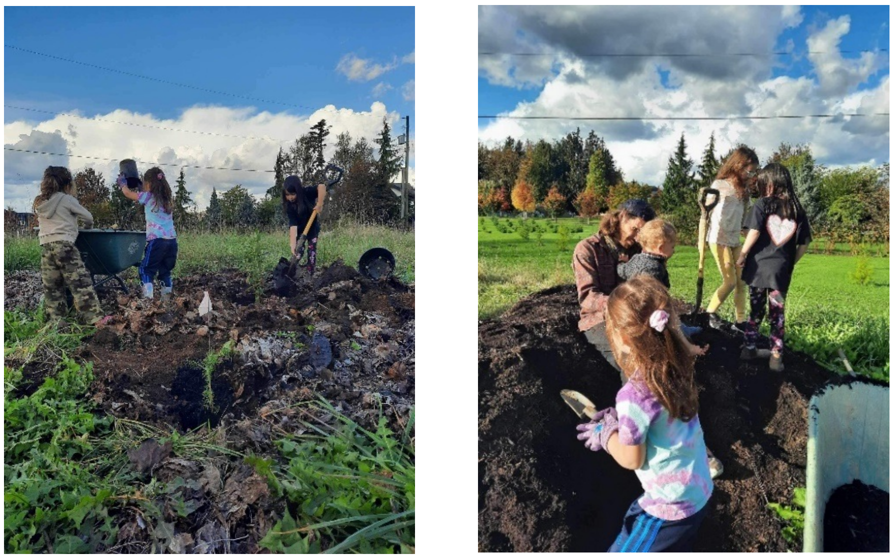
In October '24, we were fortunate to locate a private grower of native plants from Mission in support of our project. They contributed over 80 well-established native trees (5 *A. rubra,* 10 *A. macrophyllum, 4*0 *P. menziesii,* 1 *Q. garryana,* 10 *T. plicata,* & 10 *T. heterophylla*) towards our cause of "growing nature" for only $2/tree on average. We used our personal vehicle and the farm work truck to transport the native trees (almost directly across the Stó:lō River).

Figure 4: Transporting the native trees "across the river"

These trees increased the presence and abundance of more diverse native plant species throughout the field, and particularly in the underplanted south and southwest area of the hayfield. A double-wide vehicle path has been left unplanted along the south perimeter of the hayfield for the purpose of transporting *P. menziesii* Christmas trees from the east end of the property. Again, volunteers from the landowner's extended family network were involved in the planting process – including multiple children ranging in age from 1 to 9 years old!

Figure 5: All hands-on deck planting the native trees



It was also personally meaningful for my spouse and I to develop a spiral-shaped labyrinth with the potted native trees, as we planted one tree per season of our marriage. The spiral begins in the centre with the *Q. garryana,* planted on top of our son's placenta following his home birth at this property in summer '23. Our most recent progress in the restoration project has involved maintaining the field grass in the spiral-labyrinth, along with multiple walking paths which meander throughout the field. We use a weed whacker, riding mower, and push mower to carry out the maintenance of hayfield grasses. The walking trails are intended to provide access for the landowner's and their visitors to more easily engage and enjoy the budding forest. My spouse and I can also utilize the trails for recreation and business activities such as hosting forest bathing and outdoor yoga retreats.

<u>Timeline</u>

Date	*Hours*	*Description*
August ’23 week #1	20	Establish plan (budget) & acquire supplies Take initial photographs TEM site assessment including soil nutrient/moisture regime
August ’23 week #2	30	Dug holes with auger Initial transplanting with added mulch (3-4 volunteers) Approximately 150 trees (75 *Alnus rubra* & 75 *Acer macrophyllum*)
August ’23 week #3	20	Water trees daily – occasionally twice a day Plant flags / stakes to identify trees
August ’23 week #4	40	Water trees daily – occasionally twice a day Continue transplanting – 3 *Quercus garryana* & *4 Pseudotsuga menziesii* Remove blackberry from ravine-field perimeter using tractor
August ’23 week #5	10	Water trees daily – occasionally twice a day Establish next steps and plan for landowners to continue planting/maintenance in the fall ‘23
November ‘23	15	Landowner’s auger holes & plant 300 *P. menziesii* for the Christmas tree farm business
February ’24	5	Landowner’s plant 15 *Thuja plicata* Ignite burn pile of blackberry
September ’24 week #1	15	Assess survival rate from last year Transplant ~10 *Alnus rubra* & 20 *Acer macrophyllum* replacing dead trees
September ’24 week #2	10	Transplant ~30 *Acer macrophyllum*
September ’24 week #3	5	Remove blackberry from ravine-field perimeter using clippers
September ’24 week #4	5	Remove blackberry from surrounding power pole using shovel
October ’24 week #1	20	Transplant ~150 *Alnus rubra*

October ’24 week #2	20	Transport plants from native plant nursery Plant ~80 trees from native plant nursery (5 *A. rubra,* 10 A. *macrophyllum,* 40 *P. menziesii,* 1 *Q. garryana,* 10 *T. plicata,* 10 *T. heterophylla*)
October ’24 week #3	5	Cut field grass using weed whacker and riding mower to create a “spiral” labyrinth
October ’24 week #4	5	Create walking paths throughout the field using weed whacker and push mower
October ’24 week #5	25	Take photographs Complete rough draft of report
November ’24	10	Submit funding applications & final report
Total	260 hrs	

Supplies & Budget

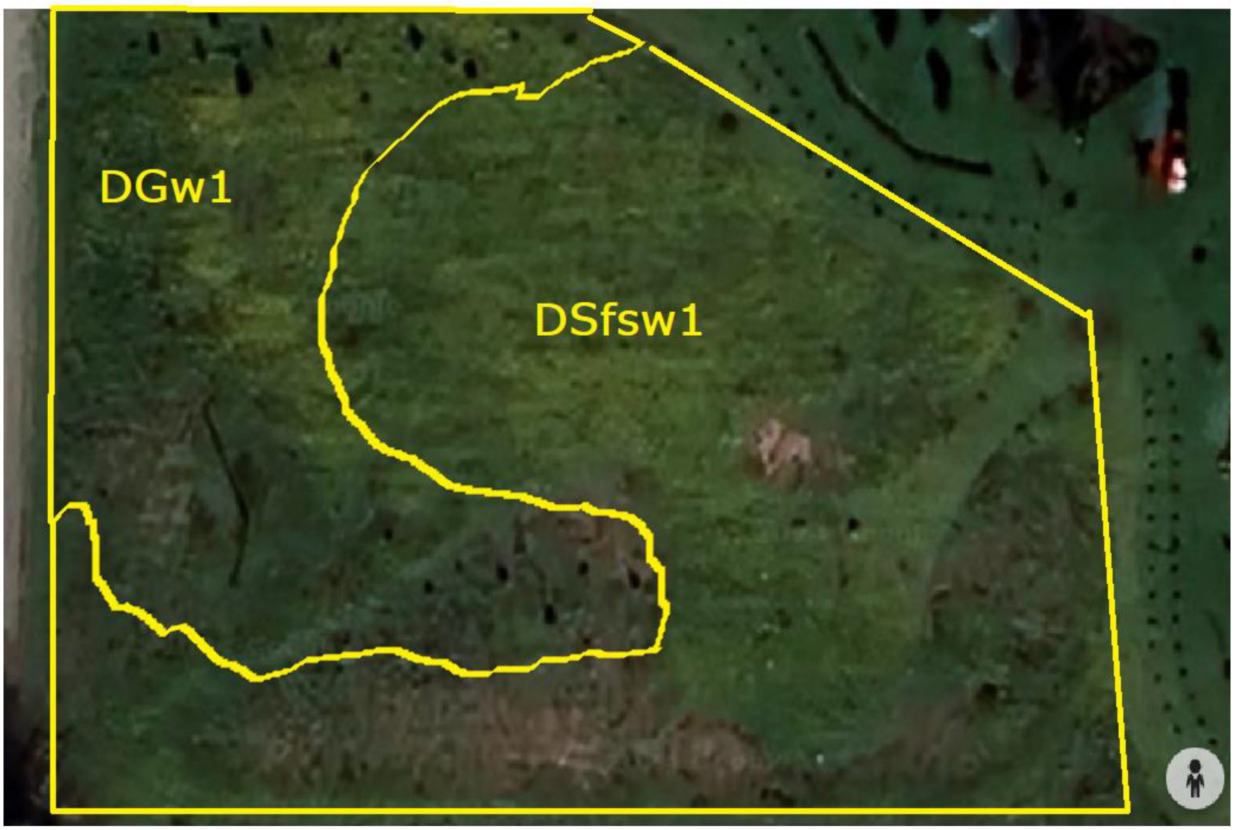
Item	*Cost*
Shovels	\$50 x 2
Earth auger	\$300
Mulch	\$150
Gas & diesel fuel	\$50
Planting flags	\$20 x 2
Tractor with bucket & backhoe rental (24hr)	\$500
Additional water hose	\$100
Native trees	\$2 x 80
Total	\$1,500

Results & Interpretation

Terrestrial Ecosystem Mapping

Data collected from the site survey can be found in Appendix A & B. See Appendix A for results from the Fd – Salal (DSfsw1) TEM polygon and Appendix B for the FdBg – Oregon Grape (DGw1) TEM polygon. The approximate area of the designated plant communities within the 2-acre hayfield site are outlined by the Google Earth map in Figure 5 below.

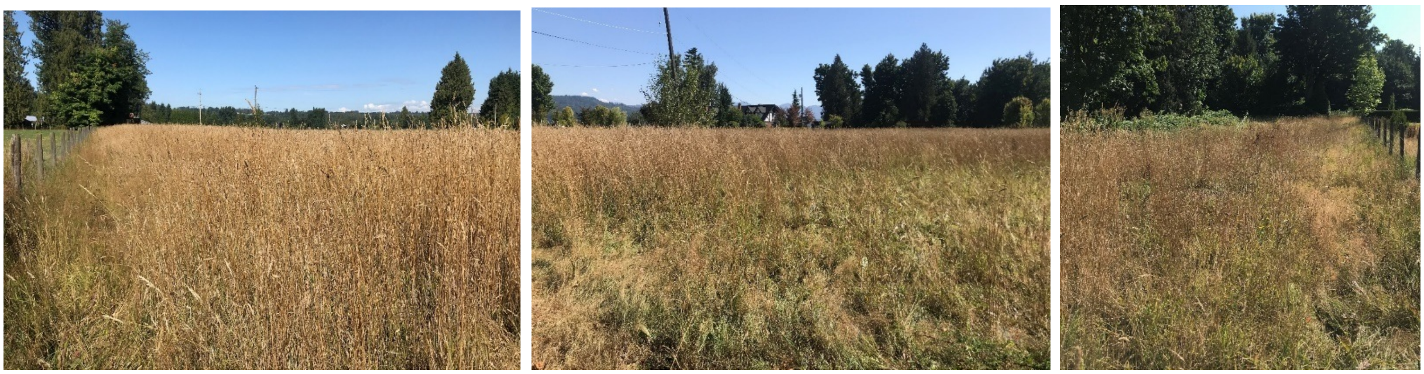
Figure 6: Google Earth / Paint illustration of TEM



As seen in the following figures, the native species cover was low while invasive agronomic species cover was high in both identified site series upon initial site assessment. There was some variance in the types of common species between the two regions, with *Ranunculus* *repens* being the most prevalent in both plant communities. It was encouraging to find *Kindbergia oregana,* a native moss throughout most of Fd – Salal (DSfsw1) polygon area.

Figure 7: Pre-restoration landscape images of the Fd – Salal (DSfsw1) polygon (August 2023)

a. South fence line of hayfield facing west – north – east



Major plant species present in this polygon following initial site assessment include: *Lysichitum americanum, Dactylis glomerata, Kindbergia oregana,* and *Ranunculus repens*.

Figure 8: Pre-restoration plant composition of the Fd – Salal (DSfsw1) polygon (August 2023)

a. *Lysichitum americanum* b. *Dactylis glomerata* c. *Kindbergia oregana*

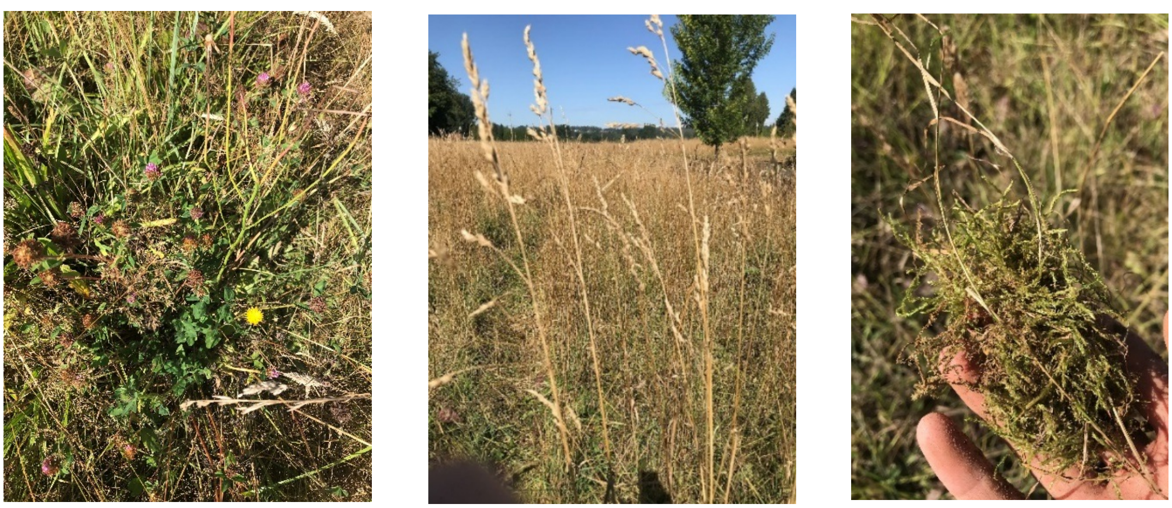
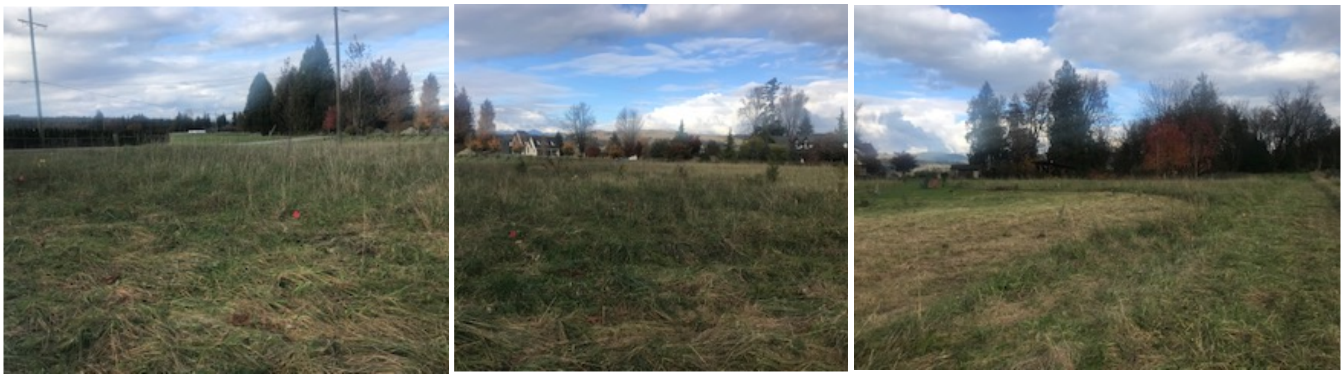


Figure 9: Post-restoration landscape images of the Fd – Salal (DSfsw1) polygon (October 2024)

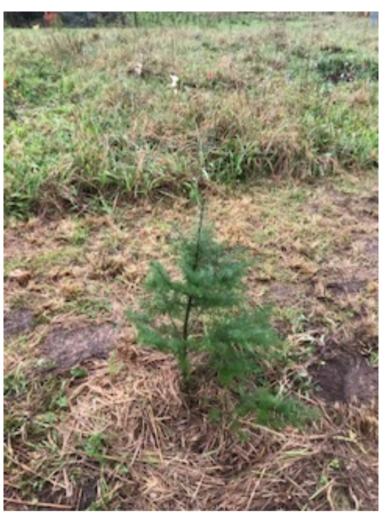
a. South fence line of hayfield facing west – north – east

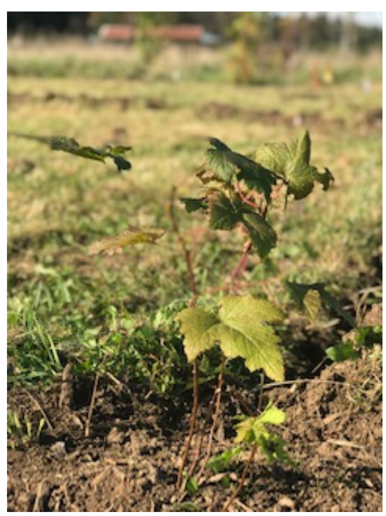


Major plant species present in this polygon following the succession restoration efforts include: *Pseudotsuga menziesii*, *Acer macrophyllum, Quercus garryana,* and *Alnus rubra.*

Figure 10: Post-restoration plant composition of the Fd – Salal (DSfsw1) polygon (October 2024)

a. *Pseudotsuga menziesii* b. *Acer macrophyllum* c. *Quercus garryana*





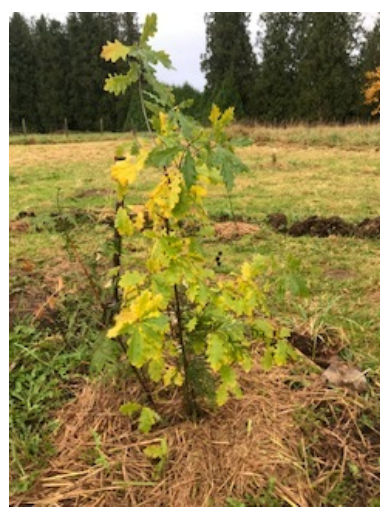
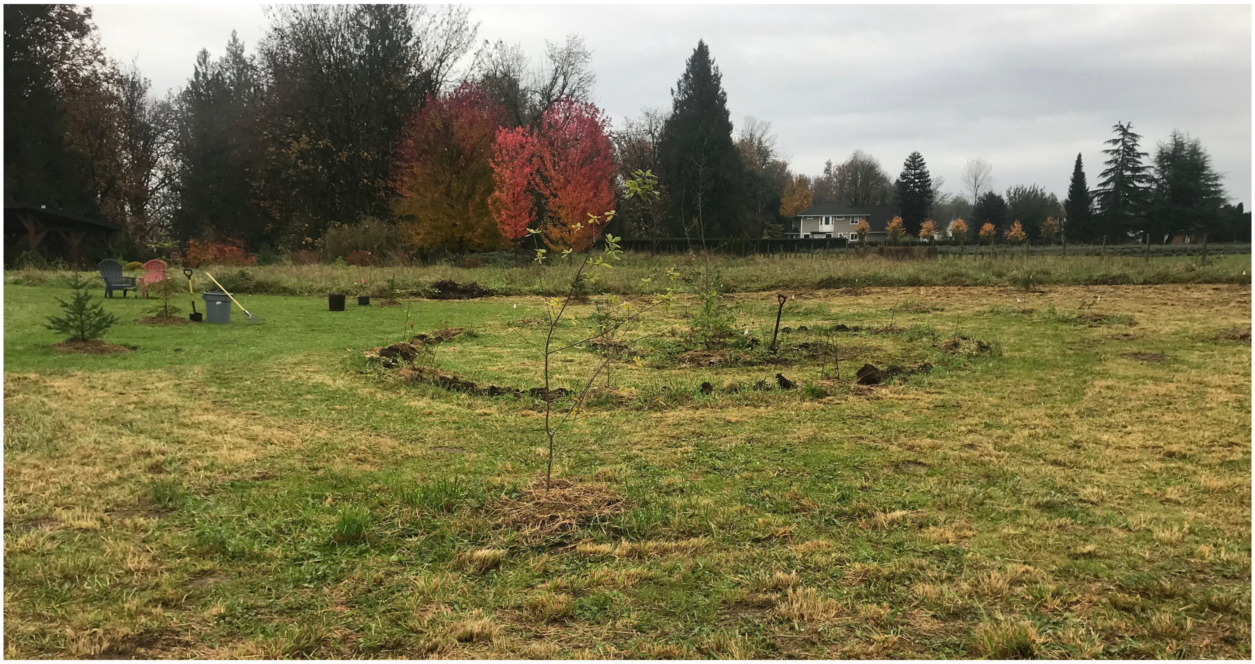


Figure 11: The “spiral” labyrinth in the DSfsw1 polygon (October 2024)

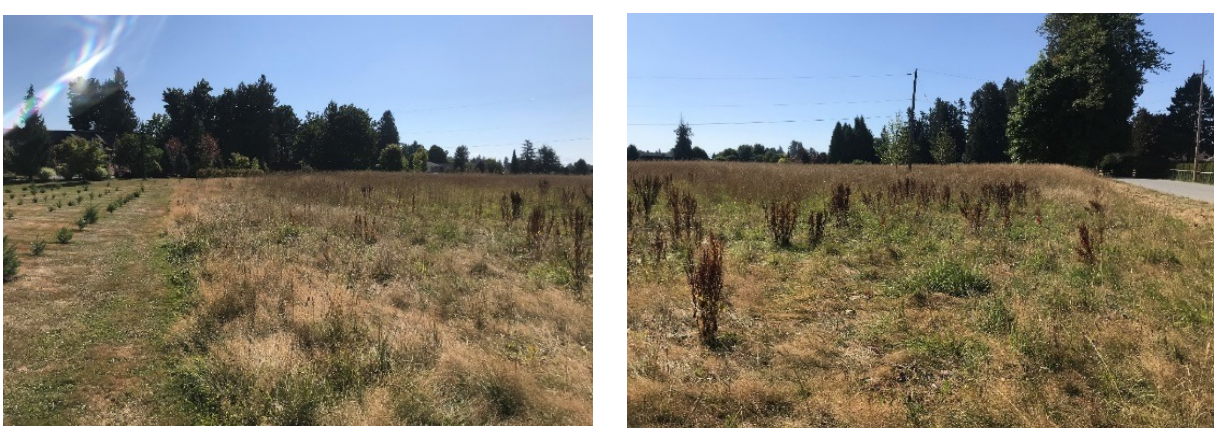


Although we did not have time in fall ’24, we intended to purchase and plant native flower bulbs, such as Great camas (*Camassia leichtlinii*) in-between the saplings.

The second, and slightly smaller polygon on the TEM is DGw1 and includes the lower-level depression, or basin region.

Figure 12: Pre-restoration landscape images of the FdBg – Oregon Grape (DGw1) polygon (August 2023)

a. Northwest corner of hayfield facing east – south



Major plant species present in this polygon following initial site assessment include: *Setaria viridis, Ranunculus repens*, and *Rumex obtusifolius.*

Figure 13: Pre-restoration plant composition of the FdBg – Oregon Grape (DGw1) polygon (August 2023)

a. *Setaria viridis* b. *Ranunculus repens* c. *Rumex obtusifolius*

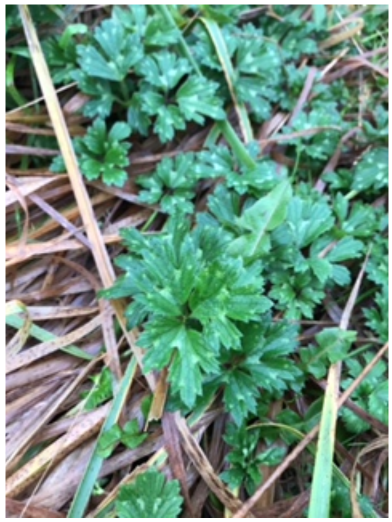
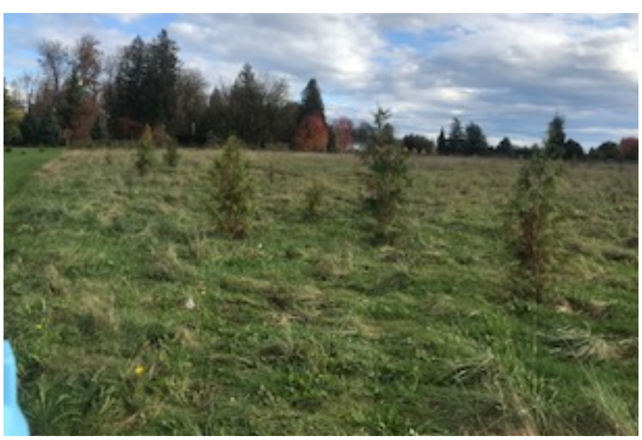
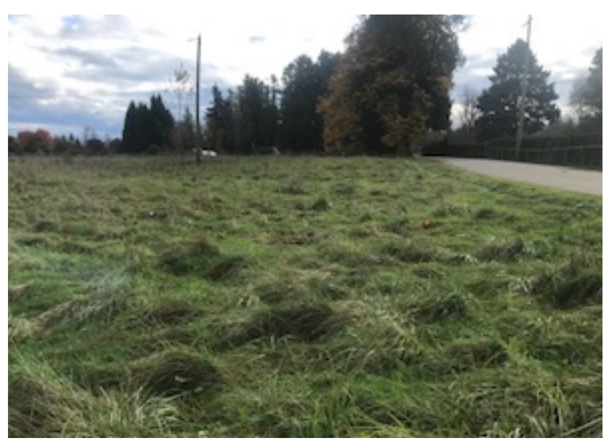


Figure 14: Post-restoration landscape images of the FdBg – Oregon Grape (DGw1) polygon (October 2024)

a. Northwest corner of hayfield facing east – south

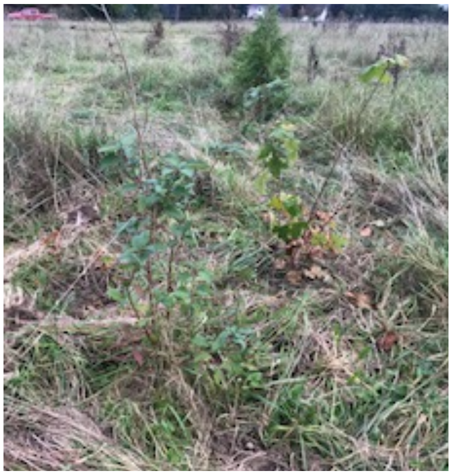


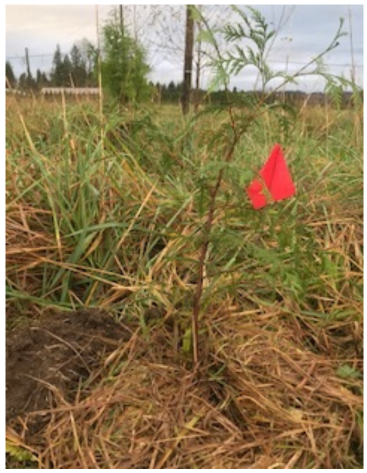


Major plant species present in this polygon following the succession restoration efforts include: *Alnus rubra, Acer macrophyllum, Thuja plicata,* and *Tsuga heterophylla.*

Figure 15: Post restoration plant composition of the FdBg – Oregon Grape (DGw1) polygon (October 2024)

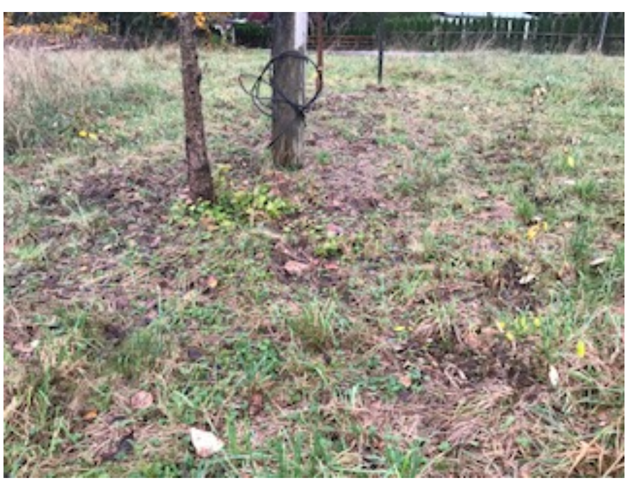
a. *Alnus rubra* b. *Thuja plicata* c. *Tsuga heterophylla*

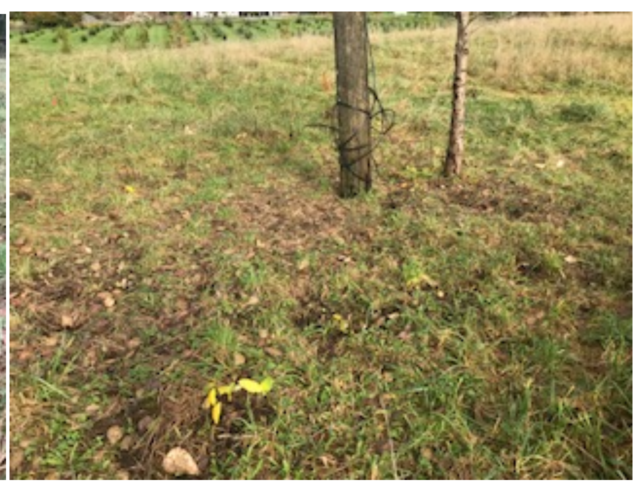




A concentration of blackberry located around the base of the power poles in the FdBg – Oregon Grape (DGw1) site series was replaced by approximately 20 *A. rubra* saplings.

Figure 16: Replaced blackberry with *Alnus rubra s*urrounding power pole

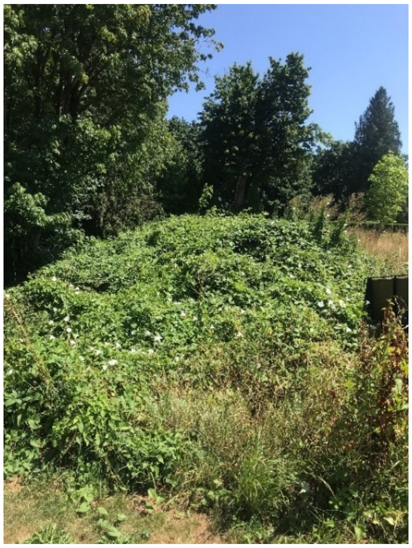




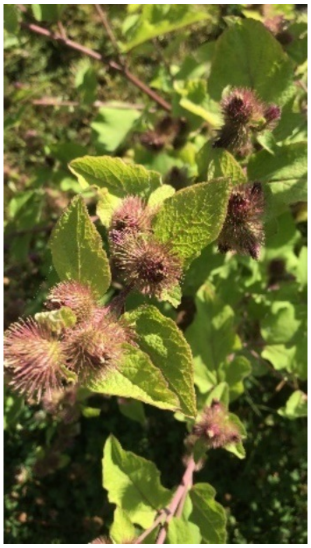
Finally, I briefly assessed the plant communities along the ravine edge perimeter of the field despite its exclusion from the primary restoration site, as invasive species from this area would likely populate the rest of the field if left unaddressed. Major plant species present in this region following initial site assessment include: blackberry*, Arctium minus*, and *Setaria viridis*.

Figure 17: Pre-restoration plant composition along ravine – field perimeter (August 2023)

a. *Rubus armenicus*

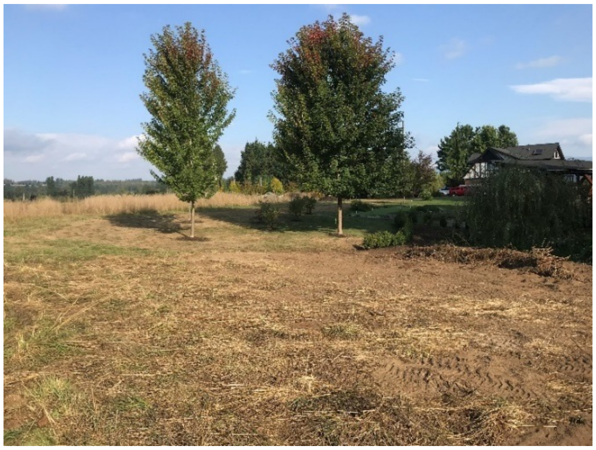


b. *Arctium minus*



c. *Setaria viridis*

Figure 18: Post-removal of blackberry with tractor landscape images (August 2023)



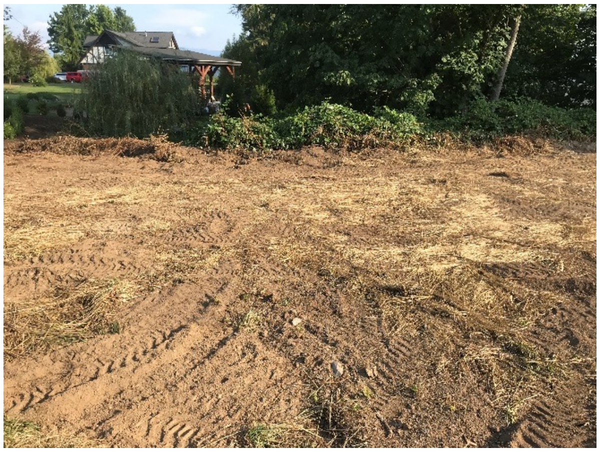
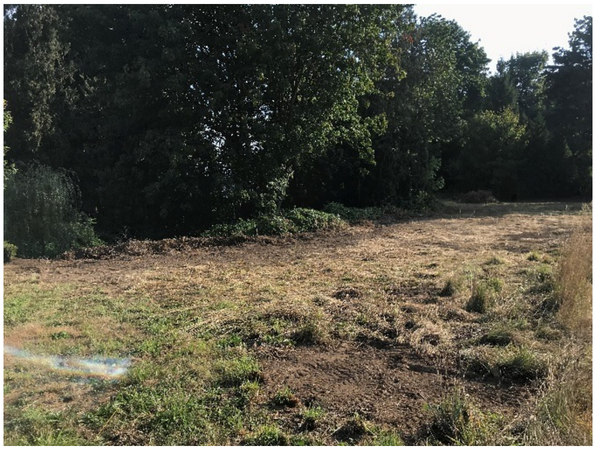


Figure 19: Invasive species burn pile located at the southeastern edge of field



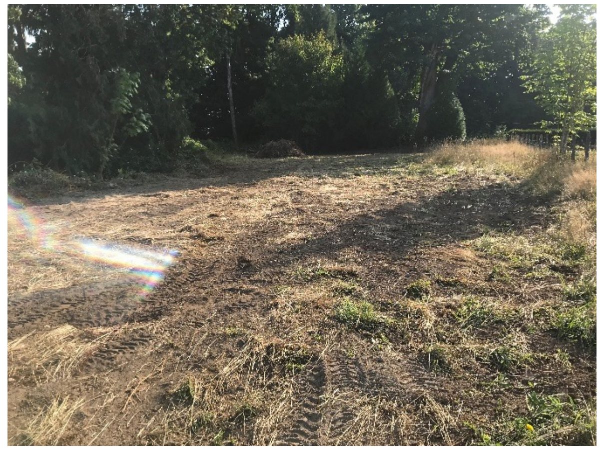
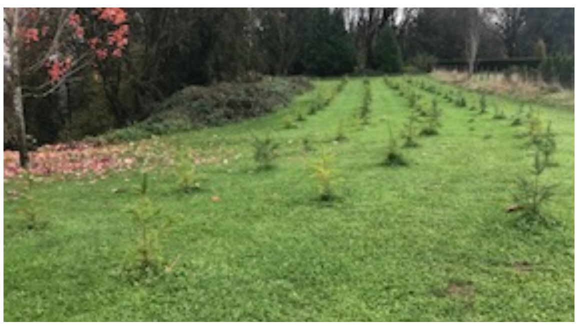


Figure 20: Four rows of *Pseudotsuga menziesii* added to the cleared southeast area of hayfield



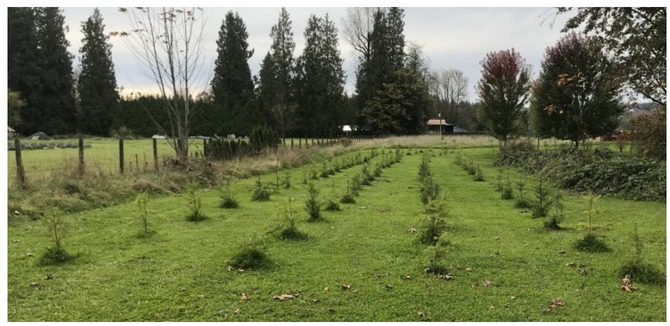
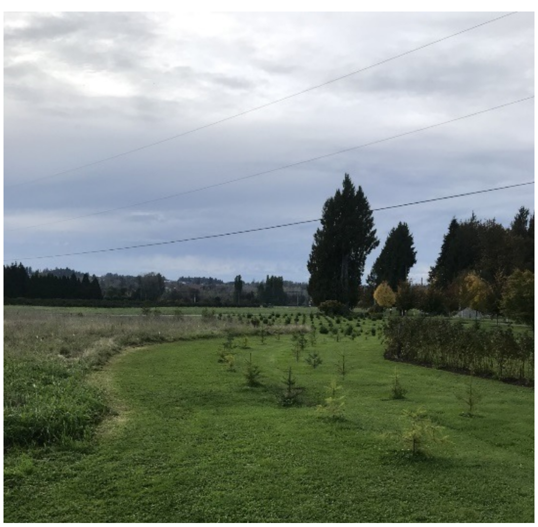
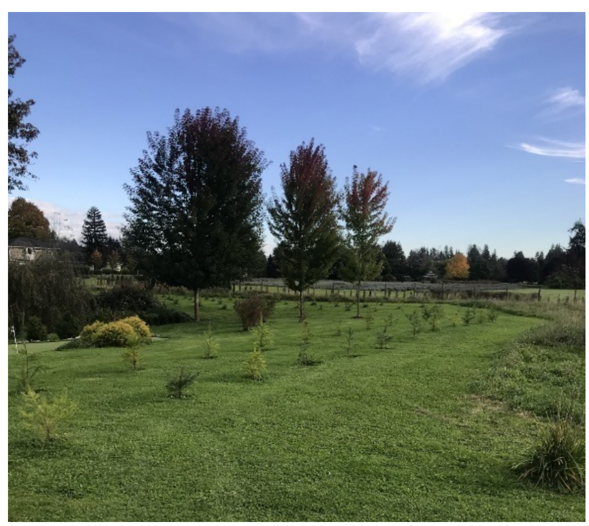


Figure 21: Two rows of *Pseudotsuga menziesii* added along outside edges of hayfield





Discussion & Recommendations

Project Goals

The first objective (1.1) for the hayfield-to-forest restoration project was achieved by conducting a complete TEM and using this data to inform the direction of successful forest development. Both objectives 1.2 and 1.3 were accomplished simultaneously throughout both summer ’23 and fall ’24. Although the return of the blackberry along the ravine edge has been significant, it is regularly maintained with lawn management (and clippers as required). Additionally, the landowners may eventually extend the hedge row along the perimeter of the ravine to restrict the invasion of blackberry. Ongoing efforts to contain blackberry underneath the power poles will most likely also be necessary. The early successional tree species will naturally deter further growth of invasive species as they become more established (Buchman, 2007). At the time of writing (November ’24), there are approximately 400 young native trees growing in the primary hayfield restoration site. There are also hundreds of *P. menziesii* Christmas trees which can be utilized towards the forest ecosystem restoration in the future. Lastly, awareness of native ecosystems and restoration strategies was enhanced among the local landowners through direct involvement in the restoration activities (objective 2.1).

Theoretical Considerations for Meeting Project Objectives

Guiding our efforts to obtain the project goals, Buchman (2007) recommends the following considerations when restoring abandoned farmland.

Climate variation	Areas of the field do not significantly vary in terms of sun and wind exposure. Relatively similar elevation.

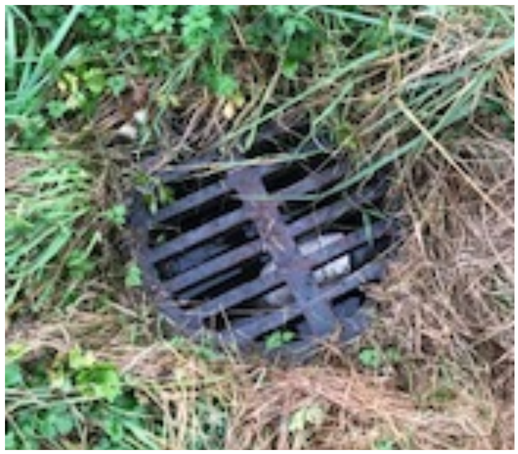
Post-abandonment disturbance	The field has been used as a depository of herbaceous material, including leaves and lawn clippings. This organic material can support the planting of saplings. However, it can also be a source of invasive species seed / propagules and therefore needs to be closely regulated, if continue.
Invasive plant species	Need for ongoing removal of invasive species (particularly blackberry) to prevent “inhibition” succession pathway (details below).
Seed predation	Remove various non-native grass roots immediately surrounding transplants to prevent overcrowding and improve chances of survival.
Soil nutrient status (SNR)	Complete TEM: informs location & type of native species to plant. Supplement soil with mulch blend as necessary.
Soil type and condition (SMR)	Complete TEM: informs location & type of native species to plant.
Distance from forest margin	The southeast perimeter of the hayfield is next to a mature forest in the ravine and requires the most intense ongoing invasive species management. As well, the southwest corner of the field has adjacent mature trees.
Size of field	The 2-acre hayfield has two major plant communities. Small enough to establish active walking trails.
Plowed vs. left fallow after abandonment	Left fallow – makes the soil hard to dig in the summertime and in need of an auger for planting.
Last crop sown prior to abandonment	Hay grasses – tend to overcrowd the saplings but can be used more effectively for limiting moisture evaporation when removed and placed around the base of the transplants.

As a system, the hayfield was clearly heading towards an invaded stable state, otherwise known as the “inhibition” pathway of succession for abandoned farmland (Buchman, 2007). According to the related “basins of attraction” concept, invasive species from the ravine would eventually occupy the entire hayfield system if permitted (Buchman, 2007). The site therefore required active intervention to direct succession towards a desirable forest state.

<u>Additional Considerations & Recommendations</u>

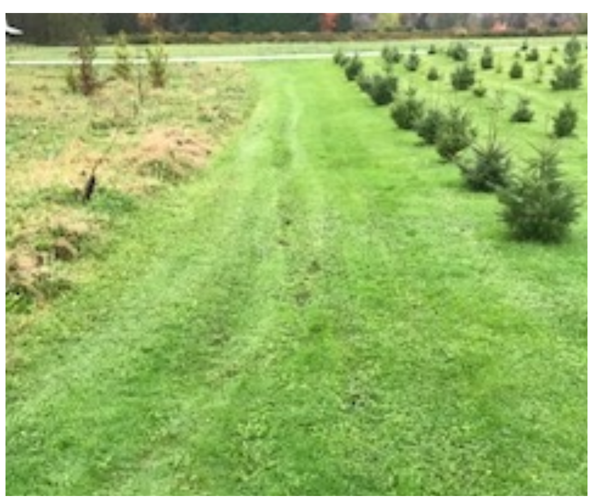
Areas for ongoing discussion pertain to the drain located in the northwest region of the hayfield. Drainage prevents moisture retention in the soil which can prevent a full return from the intended plant community, especially in the DGw1 polygon.

Figure 22: Drain located in northwest region of field



Related, it may be beneficial to relocate the neighbouring row of *P. menziesii* Christmas trees to drier regions of the property, if not including them into the forest. Utilizing more reliably available moisture in this wetter area of the property can advance the DGw1 plant community's initial and later successional stages.

Figure 23: Wettest area of the field/lawn currently designated for *P. menziesii* Christmas trees

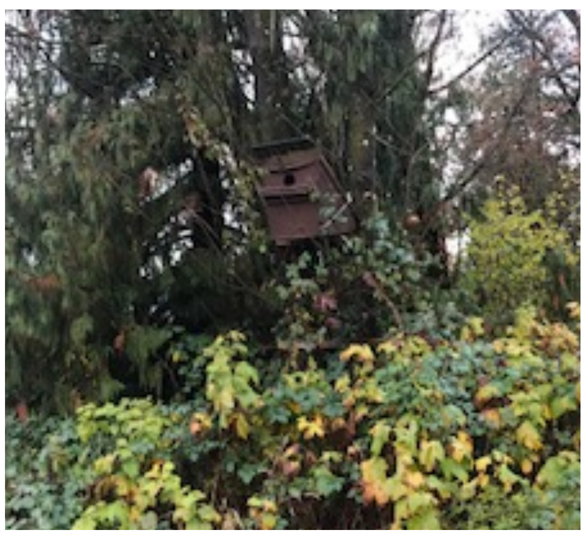


<u>Highlights: As Above, So Below</u>

The spiral-labyrinth is a bio-mimicry design based on the energy patterns observed throughout the universe. In this way, the hayfield restoration site intends to provide a microcosm of the macrocosm. It is, after all, interconnected with driving ecological systems including the biosphere, hydrosphere, atmosphere, and geosphere.

As previously mentioned, habitat refugia and connectivity are examples of important ecological functions returned to the local ecosystem by restoration. The Barn Owl (*Tyto alba*) is a currently threatened species in British Columbia which could potentially benefit from this restored environment. Given their limited presence in the area, we built and installed a south facing *T. Alba* house along the ravine-field perimeter on the eastern edge of the property.

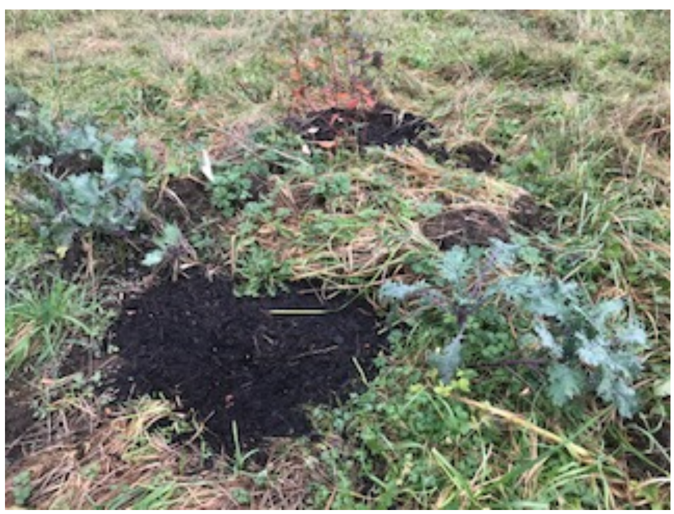
Figure 24: Designed and built *Tyto alba* tree house with recycled material



Another non-human world connection from this project was created with two neighbourhood cats who frequent the hayfield in search of rodents. Although not closely observed, I noticed a general decline in rodent activity both within the residence of the landowners and throughout their well-manicured lawn. It appears the increased presence of rodent predators is addressing a longstanding issue the landowners faced in effective indoor pest management. This provides an example of reciprocity, where caring for the local ecosystems can positively benefit human needs. More information about the importance of "backyard" conservation can be found in the Newyork Times Bestseller, *Nature's Best Hope: A New Approach to Conservation That Starts in Your Yard* by Douglas W. Tallamy.

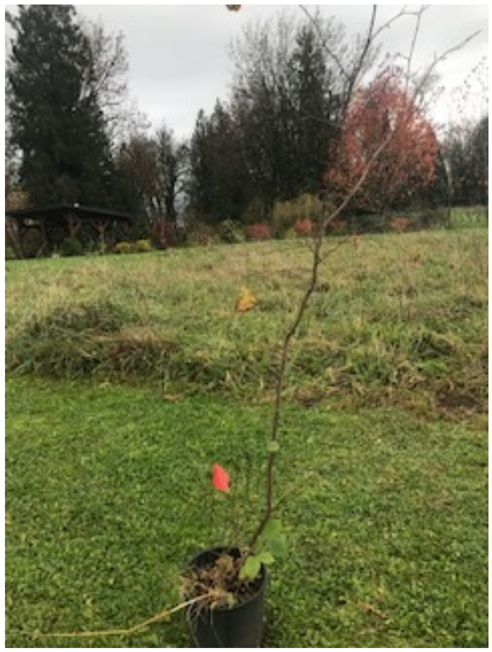
A host of other ecosystems services may become more apparent throughout the ongoing stages of succession. If desired, there is currently space to develop a "food forest," currently comprised of fruits and vegetables such as kale, blueberries, apples, pears, and linden berries. This could be further established to warrant "farm status" and decrease dependence on the *P. menziesii* Christmas tree farm.

Figure 25: Basic introduction of food production into the northeast region of hayfield



Related, a 7ft tall Hazelnut tree was included with the native plants from Mission and could possibly support the "food forest." The landowners may wish to reintegrate a Hazelnut tree onto their property in honour of their family's intergenerational agricultural roots. Currently, this tree remains unplanted for the landowner's discretion since neighbours with a hazelnut tree farm warned against cross-contamination from other tree species.

Figure 26: A Hazelnut tree to possibly be included into "food forest"



Long-term Engagement Activities (Objective 2.2)

Ongoing engagement will be determined in part by securing funding sources (as we currently await confirmation). If resources allow, we can begin planting the shrub layer in spring '25 with a primary focus on the area underneath the power pole lines. Sourcing shrubs may also be done locally on-site, as there is an abundance of Salal (*Gaultheria shallon*) in the adjacent garden beds. Other shrubs to plant in accord with the site series results include: Pacific dogwood (*Cornus nuttallii*), dull Oregon grape (*Mahonia nervosa*), Ocean spray (*Holodiscus discolor*), Western sword fern (*Polystichum munitum*), and Vanilla leaf (*Achlys triphylla*). These shrub species will most likely need to be sourced from native plant nurseries, or possibly the landowners second property in Abbotsford. Lastly, an abundance of *T. plicata* juvenile shoots found throughout garden beds bordering the forest can be transplanted into pots until mature enough for the hayfield (if desired to be relocated).

Besides further planting, there will be continuous opportunities for blackberry removal along the site perimeter (if not within the hayfield) using clippers and shovels to dislodge the root bulbs. Disposal of blackberry and other invasive species debris in the designated burn pile seems to be an effective strategy. Finally, there is an ongoing need to suppress the field grasses and other invasive species throughout the spiral labyrinth and walking trails with a push mower, riding mower, and weed whacker. This could include management of the tall grasses immediately surrounding the saplings during the growing season as well.

5 Year Future Timeline

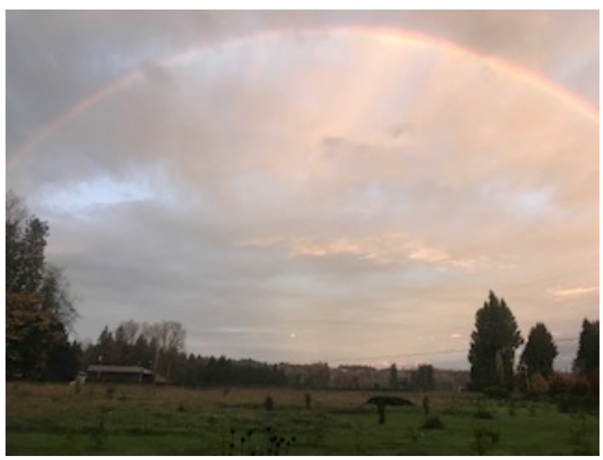
Date	*Hours*	*Description*
Winter ‘24	10	Follow up with required materials for funding sources
Spring ‘25	50	Mow/trim hay grasses with focus on the spiral labyrinth and walking paths Purchase and plant native flower bulbs in labyrinth and shrubs underneath power pole line Transplant *G. shallon* into area underneath power pole line and *T. plicata* into small pots to grow larger
Summer ‘25	15	Mow/trim hay grasses with focus on the spiral labyrinth and walking paths Edge around trees to create space from hay grass Water as necessary
Fall ‘25	5	Mow/trim hay grasses with focus on the spiral labyrinth and walking paths Take additional photos Remove/repair planting stakes as necessary
Spring ‘26	50	Mow/trim hay grasses with focus on the spiral labyrinth and walking paths Purchase and plant shrubs throughout the field

Summer '26	15	Mow/trim hay grasses with focus on the spiral labyrinth and walking paths Edge around trees to create space from hay grass Water as necessary
Fall '26	5	Mow/trim hay grasses with focus on the spiral labyrinth and walking paths Take additional photos Remove/repair planting stakes as necessary
2027	-	Continue management plan Plant *T. plicata* from small pots into hayfield Take additional photos
2028	-	Continue management plan Transition away from *P. menziesii* Christmas tree farm towards "food forest" Take additional photos
2029	-	Continue management plan Incorporate *P. menziesii* Christmas trees into hayfield restoration project Take additional photos

Conclusion

In closing, the Mount Lehman Hayfield to Forest Restoration has span over the course of multiple years and generations of people involved including kids, aunts/uncles, parents, and grandparents. Thank you everyone, and especially the landowners for dynamism in reimagining your backyard! Such inclusion is appropriate considering the longstanding intergenerational connections to this place, among not only the current caretaker's family of European ancestry but also stewardship by the Matsqui First Nation. I felt personally reminded of the many ancestors connected to this place when a striking rainbow presented itself above the hayfield.

Figure 27: Rainbow over the hayfield



In closing, this restoration project demonstrates the achievement of outlined objectives on a relatively low budget by utilizing local resources. The final report has primarily outlined relevant methods and results, including data collected through a site survey and illustrated with terrestrial ecosystem mapping (TEM). The provided recommendations are intended to inform ongoing restoration activities at not only the present site, but also other nearby abandoned farmland (objective 2.3). For instance, there is a hayfield comparable in size located between Mt. Lehman and Bradner currently undergoing early stages of succession.

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Appendix

A)

Location of DSfsw1 polygon: 49 7’41” N / 122’2” W

Elevation: 60m

Slope aspect: NA

Meso-slope: Level

Drainage: Very poor drain (v)

Mineral Soil texture: Clayey (SiC)

Organic Soil texture: Mesic (u)

Humus form: Moder

Surface organic horizon thickness: 0-40cm

Root restricting later: No root restriction (N)

Coarse Fragment Content: <20%

Terrain texture: Humic (h)

Surficial material: Organic (O)

Surface expression: Plain (p)

Geomorph process: Slow mass (F)

SMR: MD - 4

SNR: M

Site Series: Fd - Salal

Site modifier: fine soil (f), shallow soil (20-100cm) (s), warm aspect (w)

Structural stage: 1

B)

Location of DGw1 polygon: 49 7'42" N / 122'4" W

Elevation: 60m

Slope aspect: 230 @ 4 slope angle

Meso-slope: Depression

Drainage: Rapid drain (r)

Mineral Soil texture: Silty (SiL)

Organic Soil texture: Humic (h)

Humus form: Mull

Surface organic horizon thickness: 0-40cm

Root restricting later: No root restriction (N)

Coarse Fragment Content: <20%

Terrain texture: Humic (h)

Surficial material: Organic (O)

Surface expression: Gentle slope (j)

Geomorph process: Slow mass (F)

SMR: MD - 3

SNR: R/VR

Site Series: FdBg – Oregon Grape

Site modifier: warm aspect (w)

Structural stage: 1