Nuts’a’maat Forage Forest Scaled Monitoring 2025

Prepared By:

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Assisted by:

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Territorial Acknowledgement:

We acknowledge that we live and work within the shared, asserted, unceded and traditional territories of the Hul’qumi’num-speaking First Nations Peoples and those who hold traditional rights, responsibilities, and Indigenous rights and title in and around what is now known as Galiano Island.

Abstract

Prior to restoration, the Nuts'a'maat Forage Forest site at the Millard Learning Centre was degraded due to impacts from logging, deer browsing, and a high occurrence of introduced plants related to agricultural practices. The Galiano Conservancy Association (GCA) developed a restoration plan focused on the establishment of native food plants to restore the site in addition to enhancing ecological integrity and supporting cultural values and social engagement (Huggins, 2017). Following the initial preparation of the site, over 50 edible and medicinal native plant species were planted by groups and volunteers in the winter of 2018. Our goals included analyzing the efficacy of the restoration project between 2017-2025 through a review of the comprehensive monitoring framework designed by Hyeone Park (Park, 2016), and through an analysis of monitoring data and reports provided by GCA over this period. Park's monitoring framework was designed specifically to monitor the progress of GCA's food forests as well as for restoration values, utilizing the four principles for planning restoration outlined by Suding et al. (2015), which were applied in relation to 4 common goals identified in Park's research on food forestry, all of which was incorporated into one harmonized framework.

Initially our goal had been to provide a comparative analysis for the Nuts'a'maat Forage Forest and the Community Food Forest located a kilometre away at the Millard Learning Centre, but due to gaps in data and incompatible metrics our goal shifted to the collection of missing data for the Nuts'a'maat Forage Forest and the development of an achievable annual monitoring plan to support a comparative analysis of the food forests in the future. Our review revealed that Park's monitoring framework had only been partially implemented over the years, highlighting current gaps in data collection and the substantial time and resources required for full execution of this comprehensive plan. To enable practical and consistent annual monitoring while supporting future comparative analysis between the Nuts'a'maat Forage Forest and the Community Food Forest, we developed a scaled version of Park's framework. This adapted version retained key metrics from each of the framework's four guiding principles and corresponding measures. Due to time restrictions, our 2025 monitoring focused only on two key areas: *Ecological Integrity* and *Long-Term Sustainability*, but we believe it should be feasible to achieve monitoring for all key principles on an annual basis and support the future goal of comparative analysis between food forest sites.

Table of Contents

1. Introduction

This report is presented on behalf of the 2025 *Advanced Principles and Practices in Ecological Restoration* field school taught by Dr. Eric Higgs at the University of Victoria, and in partnership with the Galiano Conservancy Association (GCA). The authors position themselves as settlers living, learning, and working on the unceded and asserted traditional territories of the W̱SÁNEĆ, ləkʷəŋən, Penelakut, Hwlitsum, Lelum Sar Augh Ta Naogh, and other Coast Salish First Nations, as well as the ceded traditional territory of the Tsawwassen First Nation.

We acknowledge these lands not only as sites of ecological restoration but as living cultural landscapes shaped by millennia of stewardship, knowledge, and relational responsibility. In this spirit, we recognize that restoration work must be grounded in respect for Indigenous sovereignty and knowledge systems, and must involve sustained and reciprocal relationships with the communities whose territories we study and work within.

This report offers an assessment of the restoration trajectory and monitoring framework at the Nuts’a’maat Forage Forest, an eco-cultural restoration site at the Millard Learning Centre on Galiano Island. Through this report, we aim to support the GCA’s ongoing efforts to care for the land in collaboration with the Penelakut First Nation and the broader island community. Guided by ecological principles and an ethic of relational restoration, we evaluate the site’s alignment with restoration goals and provide recommendations to support long-term ecological and cultural resilience.

2. Goals & Objectives

This report has two primary goals: first, to contribute to the development of a foundation for future comparative analysis between the Nuts’a’maat Forage Forest and the Community Food Forest; and second, to support ongoing monitoring efforts by collecting site-specific vegetation data and evaluating the usability of the existing monitoring framework. Our work focused on field-based monitoring and data management, with a strong emphasis on creating accessible and repeatable systems for future student and community engagement.

Specifically, our objectives were:

1. To initiate the groundwork for future comparative analysis between the Nuts’a’maat Forage Forest and the Community Food Forest by collecting standardized vegetation data.

2. To conduct plant health and height monitoring in accordance with the Monitoring Framework developed by Hyeone Park for the Galiano Conservancy Association in 2016, and to evaluate the usability of this framework under current site conditions.
3. To upload baseline planting data to the GCA's ArcGIS system, documenting the original plantings from the initial restoration phase. This critical step fills a long-standing data gap, enabling more accurate and consistent future monitoring of species growth, survival, and spatial distribution.
4. To compile field data in a user-friendly, repeatable format that can be adopted by future students, interns, or volunteers, supporting knowledge continuity and easing the learning curve for new participants in monitoring work.

Through these objectives, we aim to strengthen the practical foundation for ongoing restoration monitoring, improve data accessibility, and help align site-level observations with broader ecological and community-based goals.

3. Background

3.1 History of the Nuts'a'maat Forage Forest

The Nuts'a'maat Forage Forest (NFF) is a half-hectare eco-cultural restoration site and native plant food forest located at the Millard Learning Centre on Galiano Island. Managed by the Galiano Conservancy Association (GCA) in partnership with members of the Penelakut First Nation, the Access to Media Education Society (AMES), and the wider Galiano community, the NFF is home to more than 50 species of native edible and medicinal plants. It serves as a living model of restoration that weaves together ecological healing, food sovereignty, and cultural revitalization.

The site lies within the W̱SÁNEĆ, ləkʷəŋən, Penelakut, Hwlitsum, Lelum Sar Augh Ta Naogh, and other Coast Salish First Nations, as well as the ceded traditional territory of the Tsawwassen First Nation, who have lived on and stewarded these lands since time immemorial. The project's name—*Nuts'a'maat*, meaning "working together with one heart and one mind"—reflects its foundation in collaboration, reciprocity, and relational restoration (GCA, 2024).

Prior to colonization and industrial disturbance, the area was part of a Western red cedar (*Thuja plicata*) forest ecosystem typical of Galiano's valley bottomlands, which historically supported wet forests and seasonal wetlands. However, decades of logging under previous private ownership reduced the site to a compacted clearcut by the early 2000s. By the time the GCA acquired the land in 2012, only a single old-growth Western red cedar—now known as the *Grandmother Cedar*—remained standing. The soil was degraded, invasive species such as English holly (*Ilex aquifolium*) and cutleaf blackberry (*Rubus laciniatus*) were becoming established, and regeneration of native species was absent (GCA, 2024)

Although the GCA originally planned to create a permaculture food forest elsewhere on the property, the strong presence of the Grandmother Cedar, the acidic soils, and the unique cultural value of the site inspired a shift toward a native plant forage forest grounded in traditional ecological knowledge. Early conceptual designs and site analyses were developed between 2015 and 2016 by UVic restoration students (Schiefelbein et al., 2015; Kucher et al., 2016), who assessed soil conditions, surveyed vegetation, and envisioned a forest that could be both ecologically regenerative and culturally meaningful.

At the same time, the GCA and the Access to Media Education Society (AMES) facilitated a series of meetings with Penelakut Elders and community members to gather guidance, traditional knowledge, and feedback on plant selection and site use (GCA, 2024). In 2017, UVic student Adam Huggins (now GCA's Restoration Coordinator) created a detailed restoration prescription that integrated these ecological and cultural insights. In that document, Huggins (2017) proposed a site layout for planting and management (Figure 1). Fieldwork began later that year with mechanical soil decompaction using the "rough and loose" method, the installation of deer exclusion fencing, and the removal of invasive species (GCA. 2024). In 2018, over 50 native edible and medicinal species were planted with the help of Penelakut and Galiano schoolchildren, Elders, artists, and volunteers. Early monitoring was carried out by Sonia Voicescu (2018), then a UVic co-op student and alumna of the Galiano field course.

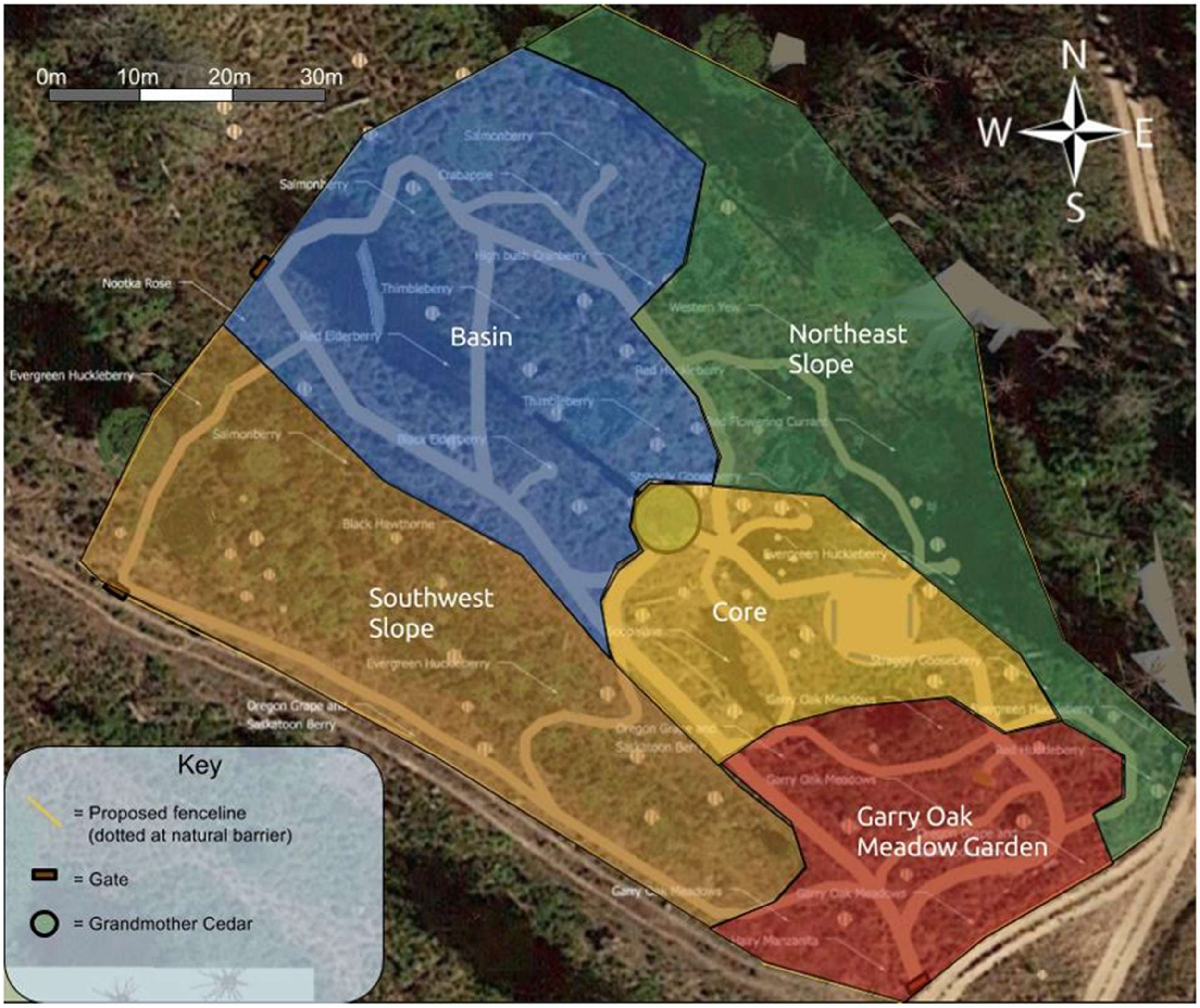

Figure 1. Proposed site layout for the Nuts'a'maat Forage Forest by Adam Huggins (2017), to aid in plant prescriptions appropriate to the microclimates in each of the zones.

A drier microclimate in the southeast corner of the site provided an opportunity to include a Garry oak (*Quercus garryana*) meadow component—an intentional decision that diverged from historical fidelity in favour of supporting an endangered endemic ecosystem and cultivating culturally important plants like camas (*Camassia spp*.) (Huggins, 2017). This choice reflected the project's broader focus on restoring human–land relationships and Indigenous foodways rather than strictly replicating pre-disturbance ecosystems.

The first community harvest took place in winter 2018, with larger seasonal harvests of plants like *yaala'* (cow parsnip), nodding onion, *q'uxmin* (biscuitroot), and *se'uq* (bracken fern) occurring in 2019. These were served at gatherings such as the Salish Sea Leadership Summit, bringing together Indigenous and non-Indigenous leaders in a spirit of sharing and renewal. That same year marked the launch of the GCA's Forest Garden Tea brand, made with harvested plants from the NFF, and ongoing public programs have since involved school groups in learning to grow, identify, and harvest native plants (GCA, 2024).

The NFF also features several artworks co-created by Penelakut and Galiano artists that reflect the collaborative nature of the project (GCA, 2024). These artistic elements reinforce the Forage Forest's identity not only as a restoration site but as a space of relationship, learning, and reconciliation.

Monitoring of the site is ongoing, using a framework developed by Hyeone Park in collaboration with the GCA. This framework guides ongoing assessments of plant health, survival, and community composition, while also encouraging broader evaluation of the site's cultural and educational value (Park, 2016). Engagement continues with Penelakut families and community members to shape the future of the NFF as both a living landscape and a shared vision of healing (GCA, 2024).

3.2 Principles of Restoration and Monitoring Framework

Restoration as a field has evolved significantly over the past few decades, shifting from a narrow focus on returning ecosystems to a presumed historical baseline toward more dynamic, context-sensitive approaches. As practitioners, it is crucial to apply guiding principles that support consistency across projects and provide a framework for long-term assessment. The International Union for Conservation of Nature (IUCN), a global leader in restoration policy and practice, outlines three principles for effective ecological restoration for protected areas: 1) re-establishment and maintenance of the values of a protected area, 2) maximization of beneficial outcomes while minimizing costs in time, resources and effort, and 3) collaboration with partners and stakeholders, promoting participation and enhancing visitor experience (Keenleyside *et al*., 2012). These principles helped inform a foundation for the four core principles proposed by Suding *et al*. (2015), which emphasize flexibility and a more integrated understanding of ecological and social dynamics. These principles state that comprehensive, holistic restoration:

1. increases ecological integrity,
2. is sustainable in the long term,
3. is informed by the past and future, and
4. benefits and engages society.

These principles provide a conceptual foundation for restoration projects that navigate diverse goals, including biodiversity recovery, food sovereignty, cultural reconnection, and adaptive resilience.

Hyeone Park, a Master's student in the School of Environmental Studies at the University of Victoria, applied these four principles in developing a Criteria and Indicators (C&I) monitoring framework for food forestry. Through content analysis of 63 sources and interviews with 16 experts in food forestry and ecological restoration, Park identified key goals, values, and measurable attributes that food forests must address to contribute meaningfully to restoration. Her generic framework comprises 14 criteria, 39 indicators, and 109 individual measures, all embedded within the four principles defined by Suding et al. (2015). This framework was designed to help food forestry projects evaluate not only ecological function but also social and cultural benefits over time.

As part of her graduate work, Park facilitated a workshop with the Galiano Conservancy Association (GCA) to adapt this generic framework for the Nuts'a'maat Forage Forest. The resulting site-specific monitoring system was designed to reflect the unique priorities of the GCA and its community collaborators, while remaining grounded in restoration science.

3.3 Previous Monitoring and Continuity

Monitoring efforts at the Nuts'a'maat Forage Forest began shortly after the first planting phase in 2017 and have continued in various forms since. In April 2018, Sonia Voicescu conducted the first comprehensive post-restoration monitoring of the site, providing a critical ecological baseline following the installation of native edible and medicinal plants. Voicescu found that species richness at the site had increased from 59 (pre-restoration, October 2016) to 102 species (April 2018). Herbaceous plants remained the dominant structural layer, covering approximately 75% of the site, while tree density was relatively low at 4 trees per hectare. This contrasted sharply with a stump density of 156 per hectare, underscoring the site's legacy as a heavily logged landscape.

Additional ecological metrics recorded by Voicescu (2018) included an estimated coarse woody debris (CWD) volume of 14 m^3 for the site (28 m^3/ha) and exposed soil coverage of 18.1%, mainly due to planting bed preparation. Most native species belonged to the trees, woody perennials, and mosses structural layers, while invasive species were largely herbaceous. Voicescu also documented early indicators of public and community engagement, recording 257 visitors and 140 volunteers who had collectively contributed 1,060 hours to the project by that point.

In September 2018, UVic students Boyd and Spencer conducted further plant-level monitoring, focusing on the initial planting cohort. Their work included mapping the approximate locations of individuals and clusters of planted species (see Figure 2), and evaluating plant height and vigour using a standardized 0–5 rating scale. For each plant assessed, additional observations were recorded regarding biotic and abiotic conditions, such as competition from weedy species, shading, topographic context, and localized soil moisture.

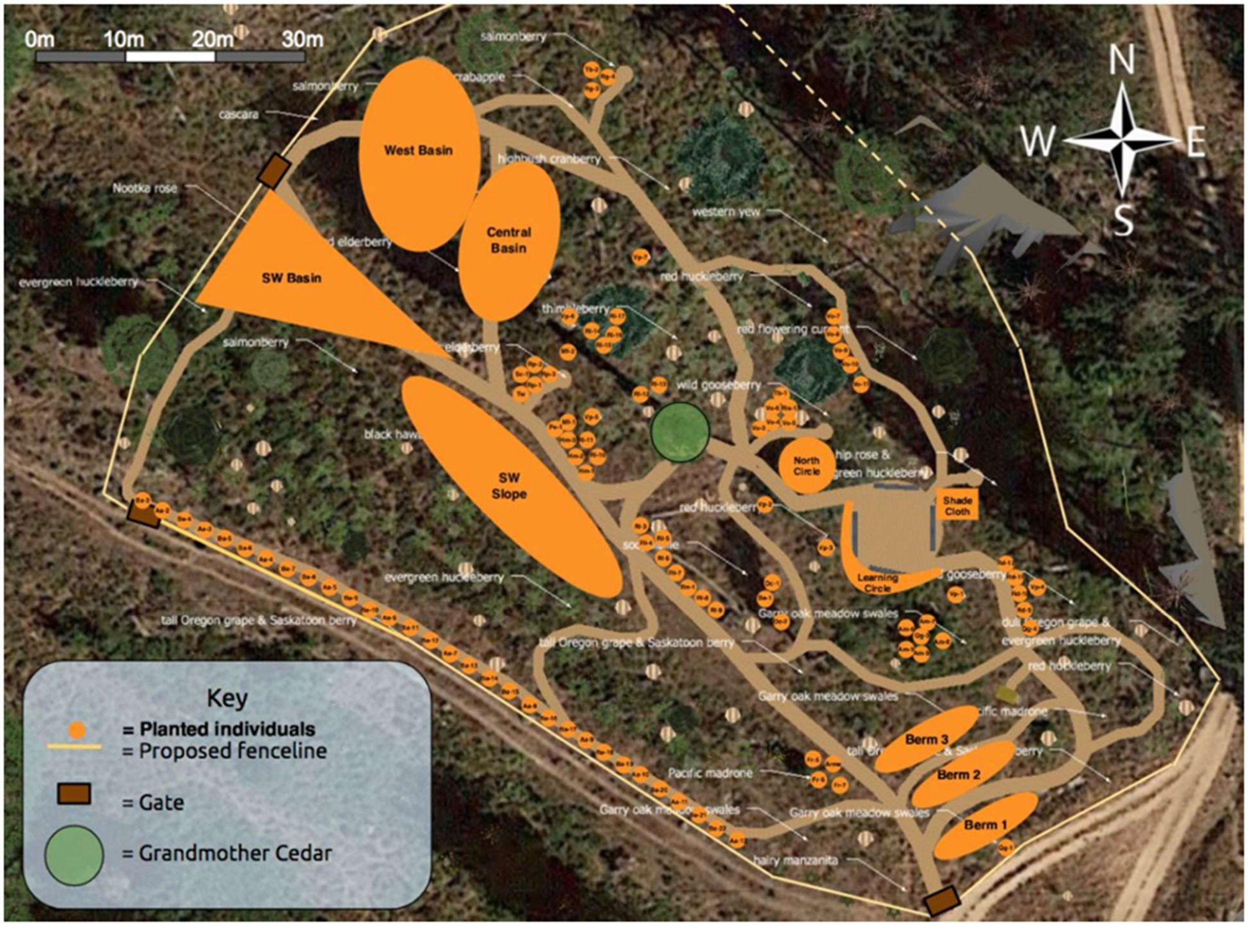

Figure 2. Site map created by Boyd and Spencer (2018) showing rough locations of individual and groups of plants that had been installed during restoration.

Of the 47 species included in the planting plan, 42 were observed during Boyd and Spencer's assessment. However, discrepancies were noted between the number of individuals planted (n = 269) and the number found during monitoring. In terms of vigour, 104 individuals were rated as moderately healthy (3), 76 as healthy (4), and 30 as thriving (5). A smaller number were in poor condition: 5 plants were dead (0), 22 were rated as very poor (1), and 32 as poor (2). Deer browsing and sun damage were cited as leading causes of low vigour, affecting 38 and 26 individuals, respectively. Boyd and Spencer also assessed vigour by site zone, providing spatial insights into plant performance. To ensure continuity with this earlier monitoring work, our 2025 team drew directly from Boyd and Spencer's map and vigour scale when conducting our own assessments. We used their health-rating system and added data to the GCA's ArcGIS database to ensure that the original 2018 plantings were finally georeferenced.

4. Methods

We incorporated data organization, field work, and result analysis to achieve our objectives. First, we compiled the existing monitoring framework, protocols, and datasets, drawing on both public and private sources, including GCA reports and papers. Next, we examined the significance, feasibility, and difficulty of the core measures, as well as their appropriate frequency for annual monitoring. From this assessment, we selected procedures that were both straightforward and meaningful, allowing for efficient data collection while still demonstrating valuable progress. To further streamline data management, we uploaded each plant's GPS coordinates to ArcGIS.

Under ecological integrity, we selected plant health and height as essential observations. This protocol is relatively simple while still comprehensive, making it replicable for any interested individuals. For the long-term sustainability principle, we included volunteer and intern numbers and hours to track community engagement. We also selected photo-points, as they provide an easy and effective way to document visual progress. These measurements are supported by the NPFF protocol document, which provides clear instructions and descriptions. Other core measures were left for GCA staff to determine as appropriate for annual, three-, five-, or ten-year monitoring cycles.

4.1 Fieldwork

For 2.5 days from July 10th, 2025, we collected the plant health, height, and GPS coordinates for the original planted plants. Due to time constraints and additional knowledge gaps to fill, we, a group of three and a GCA intern as a guide, took 56 plant measurements out of an approximate of 200. Considerable time was spent primarily on creating new datapoints on ArcGIS. This step will not have to be repeated, and future measurements can be directly updated on it making it more efficient and quicker. Conducting the field work procedure also gave us a better understanding of this condensed annual protocol's achievability.

GPS coordinates: We connected our phone to the Bluetooth GPS device with the NFF project opened on the FieldSurvey123 app. Then we identified the original plants by referring to Appendix A for plant IDs and Figure 2, a map of its location from the year 1 assessment document (Native Plant Forage Forest Year 1 Assessment, 2018). After creating a point for each plant on the map, we filled in the data of the plant's height, health and a picture.

Plant health: The plant health vigour scaling from 0 to 5 is a qualitative measure developed by Boyd and Spencer (2018) and is defined as the following (Galiano Conservancy Association, 2014):

0 – dead; no new growth, no buds

1 – very poor; significant dieback and poor condition/colour of leaves

2 – poor; dieback on branches, obvious discolouration, new growth is poor

3 – moderate; some dieback on branches, possible discolouration, new growth

4 – healthy; plant looks generally healthy with some new growth

5 – very healthy; no dieback, robust new growth, no discolouration (fruits and/or flowers)

Plant height: We used a stick ruler to measure most shrub heights in centimeters and a clinometer for taller shrubs and trees. For the clinometer, we measured 10m away and looked through the eyepiece to the tree base for the number on the right. This is the angle to the tree base, and we repeated the same for the angle to the tree crown. We calculated the height later using the formula shown below

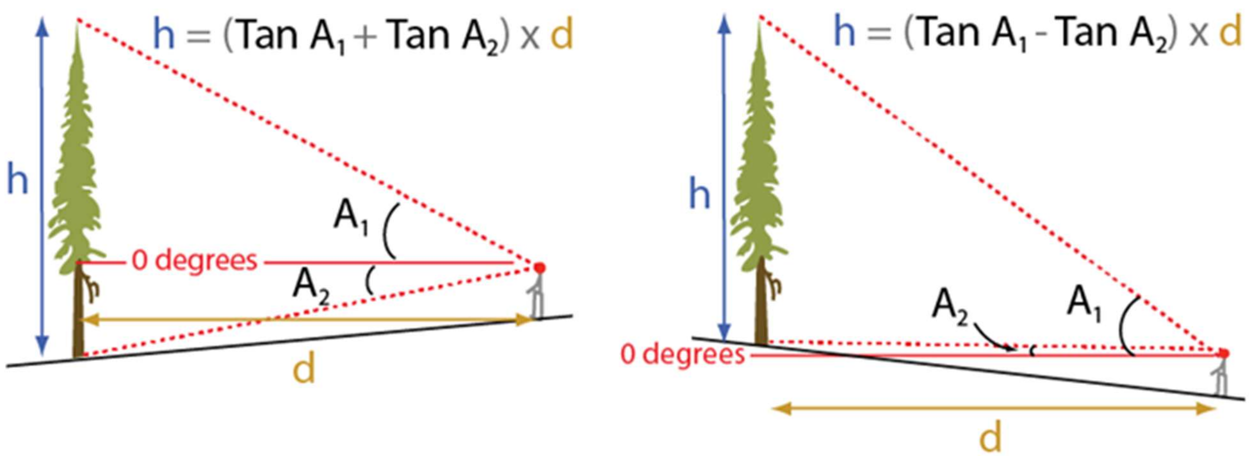

Figure 3: Formula for tree height using clinometer for both angle measurement. Image from https://bigtrees.forestry.ubc.ca/measuring-trees/height-measurements/

Photo-points: We found 3 photo-points with 2 azimuths each used annually. For 2025 we captured photos for the two azimuths of Photo Point 2 using a 2020 iPhone SE (2nd generation) with a 12MP Wide camera. It is recommended to use the same camera for photo-point monitoring, but time limitations prevented us from meeting this requirement. The photos taken in 2018 used a Canon PowerShot ELPH 125 with a 28-224mm F3.2-6.9 8x zoom lens - again a different camera from the one originally used in 2017 (Voicescu, 2018). Despite this, the photos still clearly show a progression of plant growth and succession.

Table 1: Details on each photo-point for replication.

	Northing	Easting	Longitude	Latitude	Azimuth 1 (°)	Azimuth 2 (°)	Lens height (m)	Distance to board (m)
Photo-point 1	5419615	465679	-123.46856	48.92851	325	37	1.4	10
Photo-point 2	5419623	465706	-123.4682	48.92859	240	334	1.4	10
Photo-point 3	5419691	465678	-123.46859	48.9292	174	222	1.49	No board. Centre Azimuth 1 at base of arbutus and Azimuth 2 at base of cedar seedling on top of stump

4.2 Data analysis

We made an excel sheet to enter the measurements for the completed plants with its ID to calculate the average and create graphs. To compare the progress between 2018 and 2025 for average tree height, shrub height and plant height, we created bar charts for both years to show the difference. The average formula used was the sum of all measurements divided by the number of plants. For volunteers and interns' hours and numbers, we took the average and made graphs for all the years between 2018 and 2025.

5. Findings

5.1 Organization

The following documents and datasets informed the protocols and methodology we applied in this project. From the NFF Year 1 Assessment (Boyd & Spencer, 2018), we drew on the five ecological sub-zones identified in the NPFF Restoration Plan (Huggins, 2017), the plant health scale (0–5) adapted from 2014 GCA references, and the appendix listing plant IDs and locations of both individual and grouped plants. The NFF Monitoring Report (Voicescu, 2018) provided photo-point information.

In the GCA's NFF Monitoring Protocol Ecological Integrity database, six regions were recorded, which followed the same zoning scheme as earlier documents, except that the basin was divided into upper and lower sections. The NPFF Ecological Database included multiple layers (a, b, c, d, and g) that corresponded to different plant types such as trees and grasses. Finally, the NFF Monitoring Protocol Database contained multi-year data and summaries of monitoring reports.

While these resources provided a comprehensive and well-organized foundation, we noted a key limitation: plant IDs were not incorporated into the monitoring protocol database, even though they were available in other datasets and would have been valuable for our analysis.

5.2 Data

We compiled monitoring data collected by the GCA from 2018 through 2025 and surveyed 56 plants to evaluate changes in vegetation growth and plant health (ecological integrity), volunteer participation (long-term sustainability), intern participation (social benefits), and photo-point monitoring (ecological integrity) in accordance with Park's (2016) monitoring framework.

Plant Height and Health:

Table 2: Average tree and shrub height in centimetres, and average health of the 56 plants surveyed in 2025 compared to 2018

Data \ Year	2018	2025
Avg Tree Height	104.88	556.71
Avg Shrub Height	56.05	149.23
Avg Health	3.20	4.00

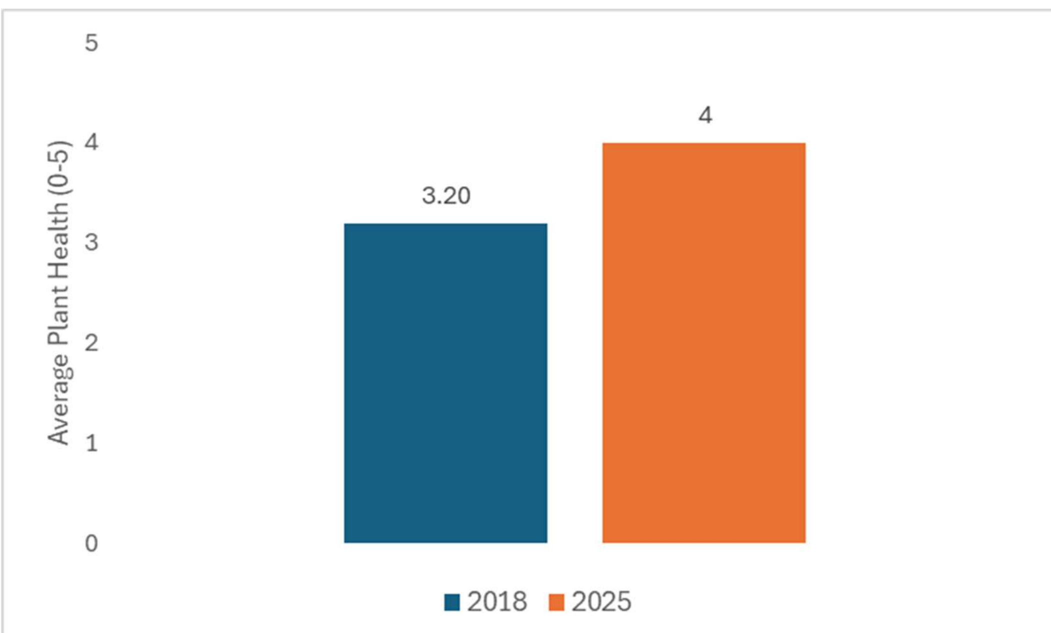

Figure 4: Overall plant health in 2018 and 2025 on a 1-5 scale.

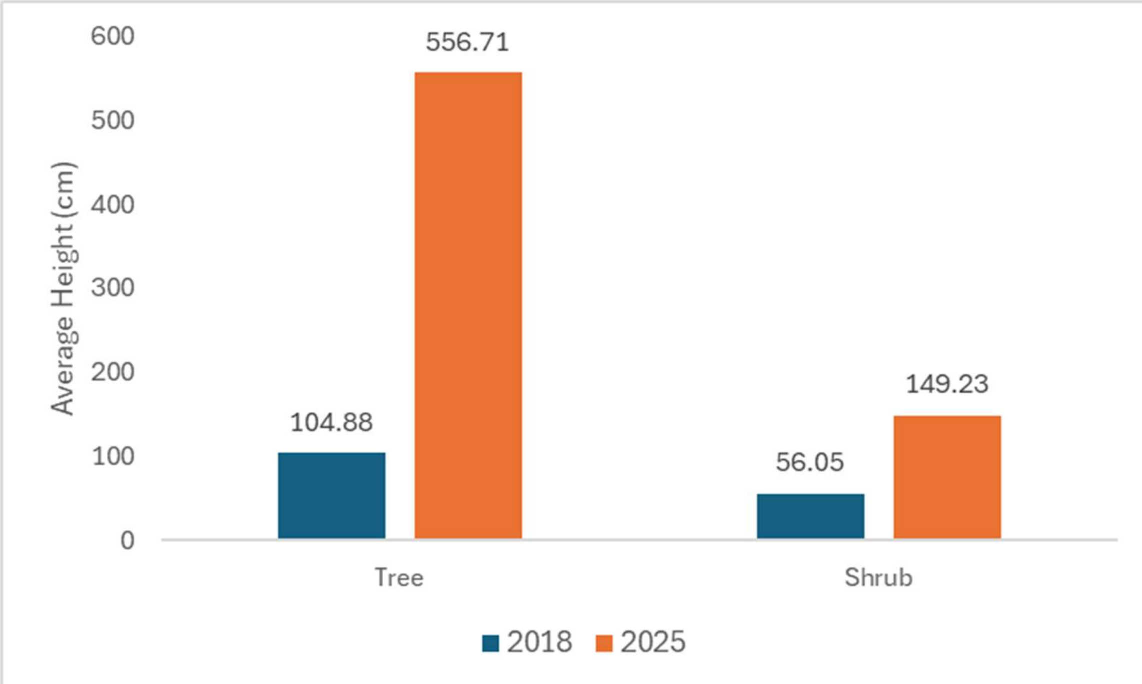

Figure 5: The average plant height of trees and shrubs in the NFF in 2018 and 2025.

Volunteer Participation:

Table 3: The number and hours of volunteers from involved in Land Management projects from 2018 to 2025. Data is missing for 2021. Data for 2025 is to-date.

Year	2018	2019	2020	2021	2022	2023	2024	2025
Volunteers	194	117	43		23	26	6	63
Volunteer Hours	1202.5	226	51		47	10	25	150

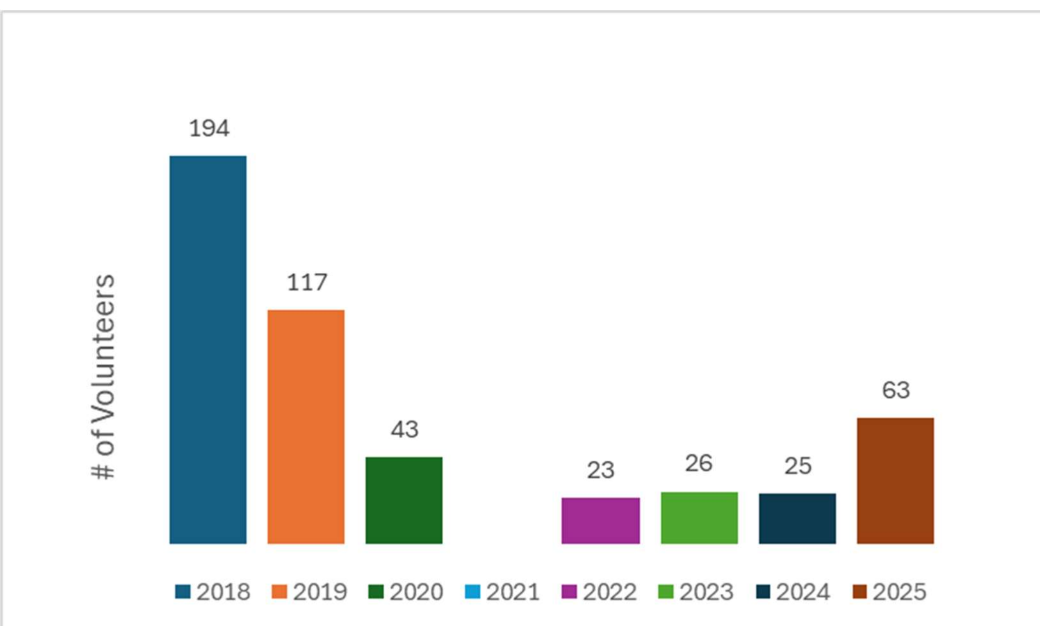

Figure 6: The number of volunteers involved in the NFF from years 2018 to 2025 with data unavailable for 2021.

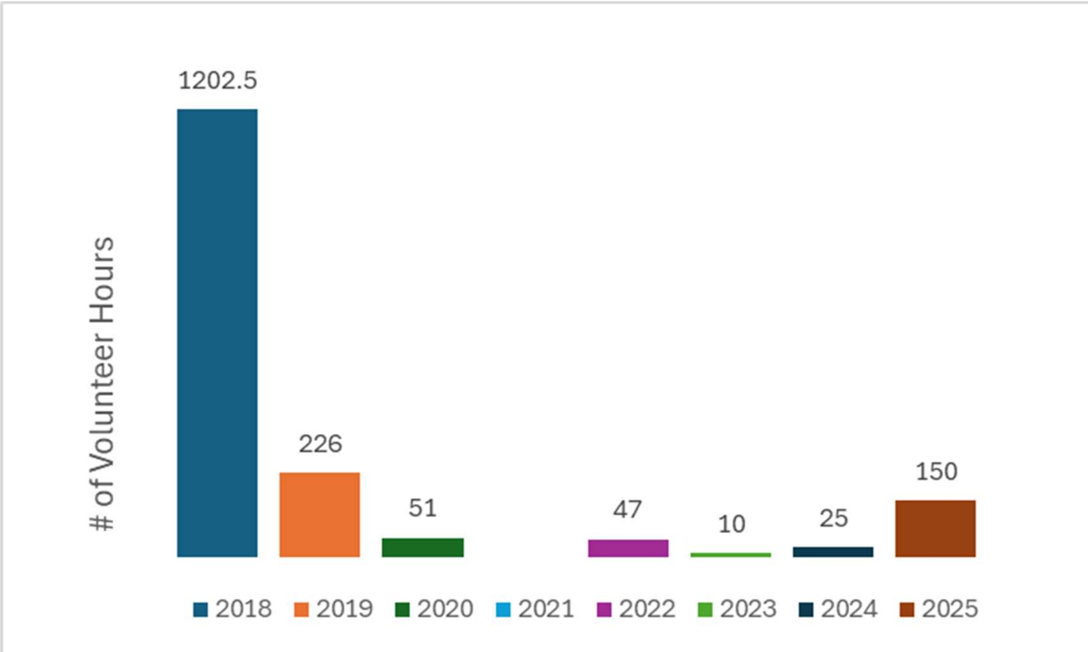

Figure 7: The hours of volunteers participation in the NFF from years 2018 to 2025 with data unavailable for 2021. The trends in number of volunteers and logged hours are aligned, and show significant year-to-year changes. Participation peaked in 2018, with a substantial decrease in the hours and numbers of volunteers in the following years. There has been a gradual increase in engagement in 2025, and despite the data for this year still being collected, there is a notable increase.

Intern hours:

Table 4: The number of interns and hours logged in Land Management, including work in the NFF, from 2022 to 2024.

Year	2022	2023	2024
Number of Interns	21	4	6
Intern Hours	154	81	314

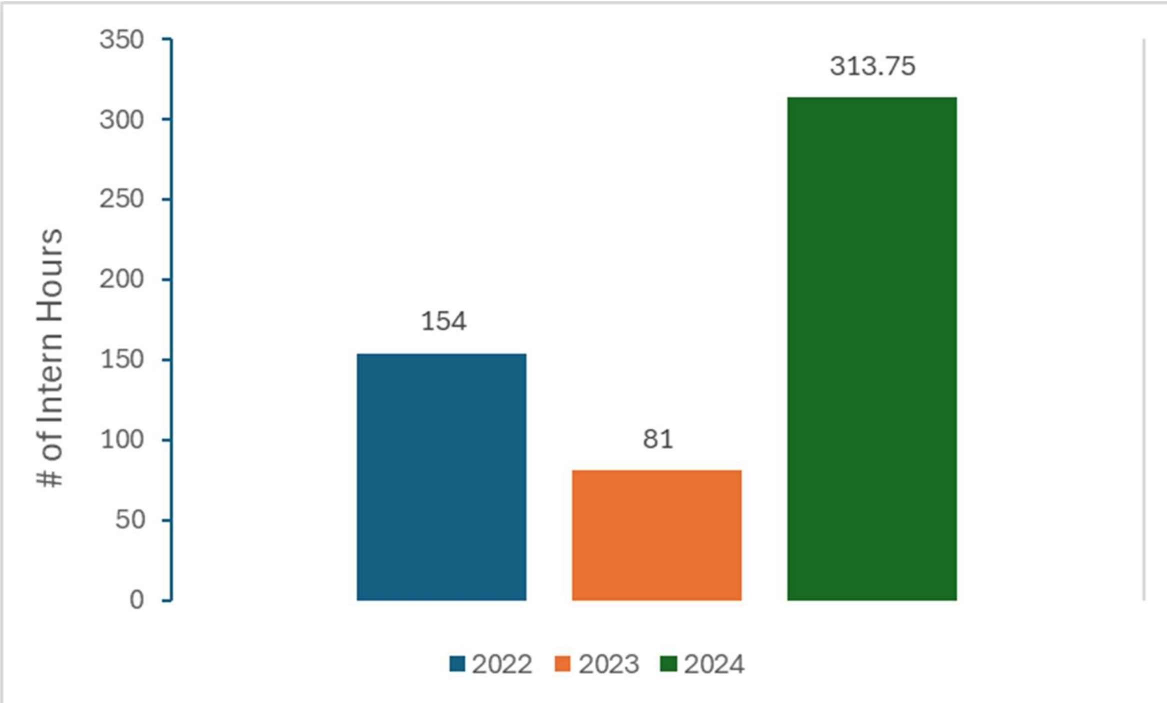

Figure 9: The number of intern hours per year from 2022 to 2024 involved in Land Managament. The data for years 2018-2021 was unavailable. In 2022 there were 21 interns working in the NFF, however from this dataset 2024 had the greatest number of intern hours with 6 interns working in the NFF.

Photo Points:

Figure 10. Photo Point 2 - Azimuth 1

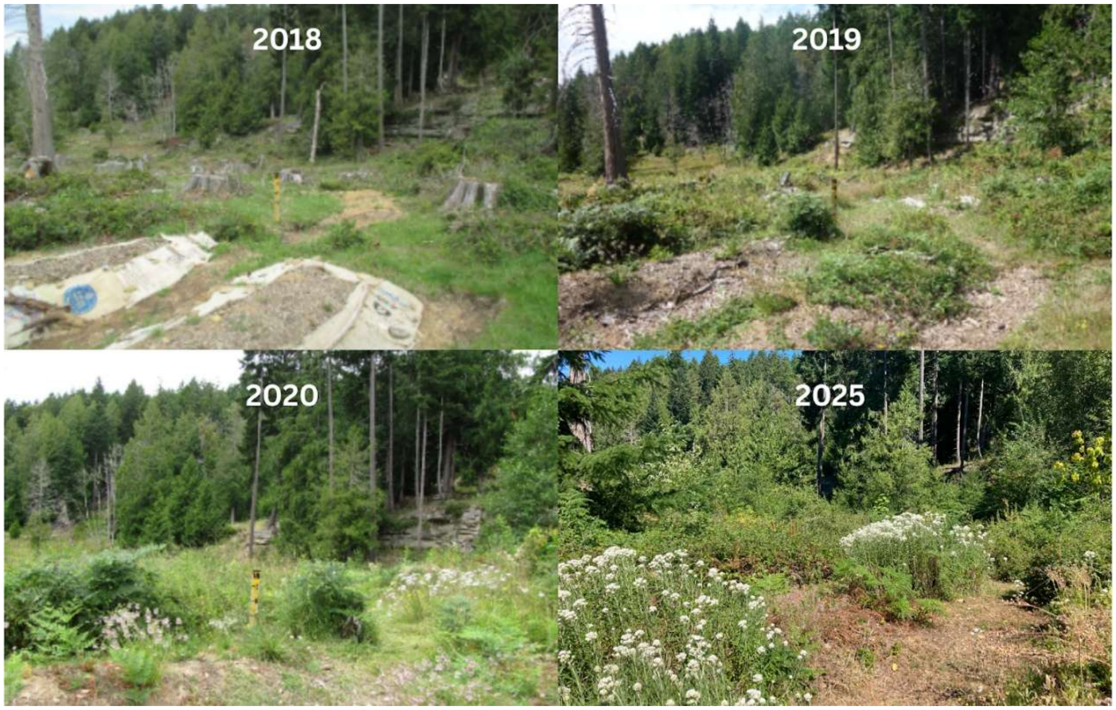

Figure 11. Photo Point 2 - Azimuth 2. Due to time constraints, we only took 2 pictures from photo-point 2 to demonstrate differences in vegetative growth from 2018 to 2025. Vegetative cover includes the plants that were initially installed during the 2018 restoration of the site, as well as plants that have naturally grown into the space. Over the years we can see an evident increase of the plant height. There is an apparent increase in density, however a formal measurement of vegetative cover is warranted.

6. Discussion

6.1 Ecological Integrity

Monitoring for ecological integrity provides valuable information on ecosystem health and helps to identify key changes and threats that may occur over time, which in turn can be used to inform adaptive management approaches. Terrestrial Ecosystem Mapping (TEM) completed in 2017 by GCA's Restoration Coordinator - Adam Huggins, delineated 6 ecological site series within the Nuts'a'maat Forage Forest site (Huggins, 2017). The majority of plant data we collected in 2025 was limited to the area classified as *RK - CwFd - Kindebergia* - a drier, well drained site with high sun exposure. At the time of TEM mapping in 2017, this polygon was dominated by graminoids with some areas of shrubs and herbs, which was highly impacted by logging, grazing, and agriculture. This site series has a gentle to moderate slope with an average of 5 degrees, directing the flow of drainage in a northwesterly direction. As the slope levels at the northwestern border of the site the water table nears the surface, reflective of the moisture adapted vegetation observed in low lying areas as represented by the site series *RC = Cw - Skunk Cabbage* and *RF = CwBg - Foamflower.* In contrast, drought tolerant vegetation is also reflective of drier uplands such as *RK - CwFd - Kindebergia* observed to the southeast, and on the steep 20°- 30° parallel ridges that border the site to northeast and southwest represented by site series DG = *FdBg - Oregon grape* and *DO = Fd - Oniongrass*. This topography acts as an effective water catchment (Huggins, 2017). Although the drier upland sites would be more difficult to establish restoration plantings as compared to lower lying areas with more moisture availability, our findings showed an overall increase in plant health and growth, outlining the overall success of restoration plantings when using the 5-point scale for plant health (Boyd & Spencer, 2018) and height increase measures to determine ecological integrity. Our data analysis shows that between 2018 and 2025 there was a 5.31 x increase in average tree height, a 2.66 x increase in average shrub height, and a 1.25 x increase in average plant health.

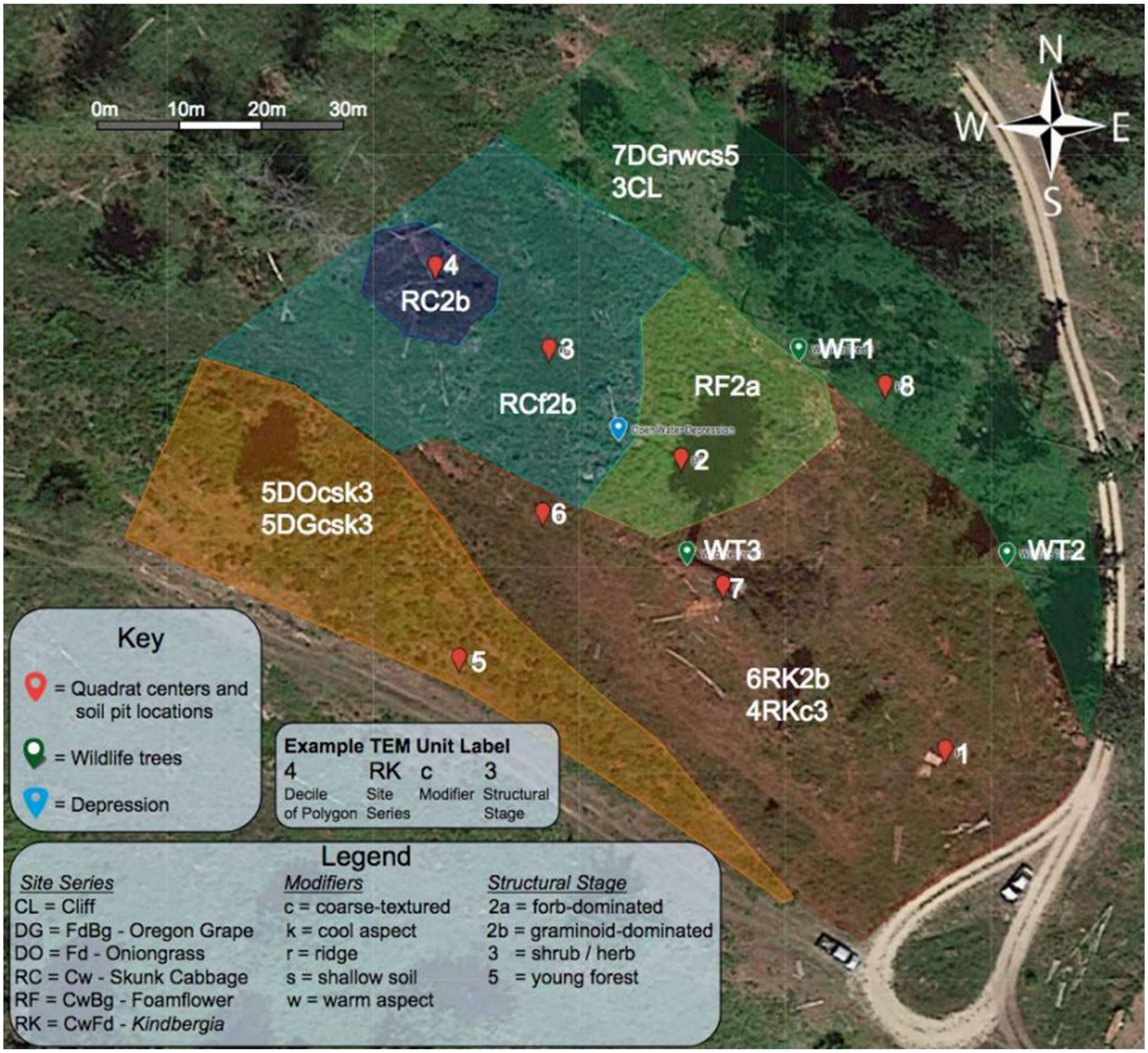

Figure 12. TEM for the Nuts’a’maat Forage Forest site (Huggins, 2017) including site series polygons, quadrat centers, and wildlife trees.

While our focus was on the collection and analysis of data for the Nuts’a’maat Forage Forest, we also visited GCA’s Food Forest with Cedana Bourne - GCA’s Sustainable Food Systems Coordinator. During this visit we discovered that some plantings in the Food Forest were subject to pruning and that there was no record of which plants had been pruned or how much this had reduced plant heights. This brought awareness to a limitation when using plant height as a measure for Ecological Integrity in future comparative analyses between the two food forests. However, the use of the 5-point scale to measure plant health remains a viable measure of Ecological Integrity for both food forests.

During our mapping of the Nuts’a’maat Forage Forest, we collected missing data on the locations of the original 2018 restoration plantings which we then uploaded to GCA’s ArcGIS plant location database. Although these plantings had been mapped approximately, most GPS locations for plantings had not been collected. During our GPS mapping of locations we discovered many inconsistencies in the approximate locations mapped, which could create difficulties in determining the locations of the remaining unmapped specimens. Due to the time that had lapsed since the original date of planting, we faced some difficulty in determining which plants were original plantings from those which had self-propagated - this was most obvious when attempting to map a well-established patch of thimbleberries (*Rubus parviflorus*). In such cases we selected the most mature plants present to represent the original plantings, although this creates uncertainties around accuracy. Additionally, there were several instances where we were unable to locate specific plantings, once again leading to uncertainty around the accuracy of the planting locations provided, or whether these plantings may not have survived. These limitations emphasize the importance of collecting location data at the time of planting to support efficient and accurate monitoring into the future.

6.2 Social Benefits

Currently, there is no system in place for monitoring the number of visitors accessing either of the food forests, but we believe this could be an achievable measure to monitor annually for the principle of Social Benefits. This could be achieved by keeping a visitor registration log at the entrance to each site, or possibly by using a more modern approach such as providing a readily scannable QR code linked to a tracking system capable of logging visitation rates.

In addition to visitor data, records of internships also provide an indication of the site’s social value through opportunities for training and employment. While records from 2018–2021 were unavailable, the available dataset shows that in 2022, 21 interns were employed at the Nuts’a’maat Forage Forest (NFF). From 2022 to 2024, interns collectively contributed 549 hours, with the highest number of hours recorded in 2024 from 6 interns. However, it is important to note that these hours were logged under a general project code encompassing all land management work at the GCA, meaning they may not fully represent the hours dedicated exclusively to the NFF. It appears that more employee hours are attributed to the Food Forest, so this may be an additional measure to factor when considering long term sustainability. Logging hours and number of interns under a project code that is specific to the NFF may provide a more accurate measure of its economic benefits.

6.3 Informed by Past and Future

For this principle, no data were collected or compiled as part of our monitoring framework. However, we recommend that the GCA integrate climate and weather monitoring into future assessments of restoration progress. The GCA already has a weather monitoring station adjacent to the Millard Learning Centre that records temperature, humidity, wind speed and direction, barometric pressure, and local weather conditions. These data could provide valuable insights into how local climate patterns influence ecological processes and restoration outcomes over time. In addition, historical weather data for Galiano Island are available through Environment and Climate Change Canada, with five on-island weather stations containing records dating back to 1970. Together, these resources could be used to track long-term climate trends, compare past and present conditions, and anticipate future shifts that may shape restoration planning and success. For example, changes in precipitation and temperature could directly affect the growth and productivity of food plants in the Nuts'a'maat Forage Forest. Monitoring these conditions would provide the GCA with a stronger basis for adapting restoration strategies to ensure long-term resilience.

6.4 Long-Term Sustainability

Volunteer hours have been well documented by GCA and this information provides a useful measure for the long-term sustainability of the Nuts'a'maat Forage Forest and the Community Food Forest by demonstrating community involvement and commitment to these projects over time. It is also important to note that the ratio of volunteer numbers to hours differs each year, suggesting varying patterns of engagement. For instance, some years may involve fewer volunteers contributing more hours each, while others reflect broader participation with fewer hours per person. These differences require separate interpretation depending on whether the focus is on increasing total hours, the number of volunteers, or both. Participation peaked in 2018, likely due to the intensive help and teamwork required during the initial establishment phase of the project. In the following years, a substantial decline is observed, which can be partly attributed to the impacts of the COVID-19 pandemic that limited safe opportunities for participation in 2020. Declines observed in volunteer hours may also be correlated to the scale of the projects and involvement of volunteers required at different times. Volunteer data may be best interpreted in contrast to the activities occurring at GCA at the time - in other words a decline in these metrics could naturally fluctuate in relation to the scale of projects or resources available at the time, but should not necessarily be viewed as a dereliction.

It is worth noting that, similar to the intern hours, volunteer hours are logged under a broad Land Management project code. While there are notes indicating when volunteers were engaged in the NFF, some of these notes are vague and do not name specific locations for the work done. This makes it difficult to determine precisely how many of those hours were dedicated to the Nuts'a'maat Forage Forest. Future monitoring could benefit from a more refined tracking system to better assess the sustainability of volunteer engagement in the food forests.

7. Conclusion and Recommendations

The data collected during our 2025 monitoring provides valuable insight into the continued positive performance of the Nuts'a'maat Forage Forest restoration project. Our work this year also supports the long-term goal of aligning monitoring efforts with the Community Food Forest, offering a simplified and scalable version of Park's (2016) C&I framework. By tracking plant health and height, volunteer and intern hours, visitor numbers, and weather data, we've built on an approach that is achievable by students, volunteers, and community members alike, which helps to ensure consistent annual monitoring over time.

Though some challenges remain—such as incomplete GPS data, limitations in height monitoring due to pruning, and gaps in visitor and weather records—we believe this scaled monitoring program is still viable and can be implemented in future years. By grounding our indicators in the four principles of ecological restoration (Suding et al., 2015), this framework provides a meaningful way to track ecological change, social engagement, and long-term resilience. As noted by Huggins (2017), annual consistency is key if these sites are to be compared effectively. With further refinement, this could be one of the first documented comparative studies between food forest projects in North America, and a valuable case study for similar initiatives elsewhere.

To support continued monitoring and build toward future comparative analysis, we recommend the following:

- **Align metrics between the two food forest sites**.
  Focus on measures that are already being collected consistently or are realistic to monitor annually. The plant health score using the five-point scale works well for both forests and can continue to be used for assessing Ecological Integrity. However, using plant height as a comparable metric is more complicated due to regular pruning in the Community Food Forest. If this metric is to be used, pruning events should be documented clearly, and pre- and post-pruning height should be recorded.

- **Complete the remaining 2025 data collection**.
  To ensure robust analysis, any missing plant data (height, health, photos) from this year should be collected. This also includes volunteer hours and visitor numbers—key indicators of Social Benefits and Engagement—and any climate or weather data available for 2025.

- **Establish a visitor tracking system.**
  Currently, there is no system in place for tracking how many people visit either food forest site. Implementing a low-tech visitor logbook or a QR code linked to an online form at the entrance of each forest would allow for simple, consistent data collection. This supports evaluation of social engagement and ensures this principle remains visible in future monitoring.

- **Integrate weather and climate data.**
  Adding climate records from the Millard Learning Centre's weather station or Environment Canada can help contextualize ecological change. This aligns with the principle of being informed by history and future and supports more adaptive decision-making in the face of ongoing environmental change.

- **Improve data collection at the time of planting.**
  For future restoration efforts, we recommend collecting GPS coordinates and soil profile photos during initial plantings. This would support long-term monitoring by helping to locate specific individuals and understand soil conditions over time. This step could also help determine which plants are original and which have self-established naturally.

Together, these recommendations aim to strengthen monitoring continuity at the Nuts'a'maat Forage Forest and support future comparisons with the Community Food Forest. With more consistent and scalable indicators in place, this framework can continue to be carried forward by future students, interns, and volunteers—contributing to both ecological knowledge and community-based restoration practice.

8. References

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9. Appendix

Plant	Tree vs Shrub	Plant ID	2018 Health (0-5)	2025 Health (0-5)	2018 Height (cm)	2025 Height (cm)
Amelanchier alnifolia	Shrub	Aa-14		5		134
Artemisia suksdorfii	Shrub	ArS-1		5		169
Berberis nervosa	Shrub	Bn-4	3	5		56
Berberis nervosa	Shrub	Bn-6	4	5		55
Berberis nervosa	Shrub	Bn-3	5	3		39
Berberis nervosa	Shrub	Bn-5	5	5		50
Crataegus douglasii	Tree	Cd-2	3	5	145	744.5963
Crataegus douglasii	Tree	Cd-1	4	5	140	1827.114
Crataegus douglasii	Tree	Cd-3	4	5	190	1099.847
Holodiscus discolor	Shrub	Hd-1		5		292
Oemleria cerasiformis	Shrub	Oc-2	3	4	53	185
Oemleria cerasiformis	Shrub	Oc-1	3	4	72	272
Prunus emarginata	Shrub	Pe-2	1	5	50	320
Quercus garryana	Tree	Qg-4	2	4	59	154
Quercus garryana	Tree	Qg-1	3	4	32	188
Quercus garryana	Tree	Qg-3	5	4	47	122

Quercus garryana	Tree	Qg-5		4		227
Rhamnus purshiana	Tree	Rhu-2	4	5	170	514.8344
Ribes divaricatum	Shrub	Rd-5	2	2	34	77
Ribes divaricatum	Shrub	Rd-1	2	3	51	167
Ribes divaricatum	Shrub	Rd-9	2	4	53	168
Ribes divaricatum	Shrub	Rd-11	3	3	31	159
Ribes divaricatum	Shrub	Rd-3	3	2	48	127
Ribes divaricatum	Shrub	Rd-4	3	3	62	63
Ribes divaricatum	Shrub	Rd-10	4	3	30	132
Ribes divaricatum	Shrub	Rd-12	4	4	42	182
Ribes divaricatum	Shrub	Rd-2	4	2	59	128
Ribes sanguineum	Shrub	Ris-1	3	5	74	180
Rosa gymnocarpa	Shrub	Rg-2	4	2	56	95
Rosa nutkana	Shrub	Rn-9	3	5	83	155
Rosa nutkana	Shrub	Rn-8	4	5	63	174
Rubus leucodermis	Shrub	Rl-18	5	3		160
Rubus parviflorus	Shrub	Rp-6	3	5	34	184

Rubus parviflorus	Shrub	Rp-10	3	3	40	80
Rubus parviflorus	Shrub	Rp-11	3		52	127
Rubus parviflorus	Shrub	Rp-7	3	4	66	179
Rubus parviflorus	Shrub	Rp-5	4	5	31	193
Rubus parviflorus	Shrub	Rp-13	4	5	45	155
Rubus parviflorus	Shrub	Rp-12	4	3	50	136
Sambucus racemosa	Shrub	Sr-1	1	4	104	367
Shepherdia canadensis	Shrub	Sc-5	3	4	58	133
Shepherdia canadensis	Shrub	Sc-3	3	3	105	123
Shepherdia canadensis	Shrub	Sc-4	4	4	95	184
Synphori carlos Albus	Shrub	Sa-1		5		162
Taxus brevifolia	Tree	Tb-1	3	4	56	133
Vaccinium ovatum	Shrub	Vo-11	1	4	50	121
Vaccinium ovatum	Shrub	Vo-7	1	4	54	123
Vaccinium ovatum	Shrub	Vo-6	2	5	75	123

Vaccinium ovatum	Shrub	Vo-8	3	4	50	165
Vaccinium ovatum	Shrub	Vo-5	3	5	57	171
Vaccinium ovatum	Shrub	Vo-10	4	4	73	152
Vaccinium parvifolium	Shrub	Vp-8	3	5	24	138
Vaccinium parvifolium	Shrub	Vp-2	3	3	47	100
Vaccinium parvifolium	Shrub	Vp-7	3	4	50	160
Vaccinium parvifolium	Shrub	Vp-1	3	4	64	109
Vaccinium parvifolium	Shrub	Vp-6	4	5	45	90