

**Pebble Beach Reserve Forest Restoration Interpretive Trail Update:  
Maximizing Opportunities for Interpretive Learning with the Galiano Conservancy  
Association**

Courtney Cameron and Shania LaFreniere

School of Environmental Studies and Restoration of Natural Systems Program

University of Victoria

ES 471/ER 412: Advanced Principles and Practice in Ecological Restoration

Dr. Eric Higgs

July 12, 2021

### **Abstract**

The Galiano Conservancy Association (GCA), on Galiano Island, British Columbia, manages an approximately 0.5 kilometer Forest Restoration Interpretive Trail in the Pebble Beach Reserve. Meant to inform visitors about the importance of restoration with a brochure-led, self-guided interpretive tour through a young Douglas-fir plantation that was previously managed for forestry but has since undergone a variety of unique restoration techniques, the interpretive trail fits into the educational mission of the GCA. However, trail infrastructure has been neglected, and the brochure has not been updated since the trail was built approximately fifteen years ago. This report outlines details of the presently outmoded interpretive trail while highlighting its potential value and making specific recommendations for its revitalization. Goals for the trail update include making it trail inviting and easy to find, providing an enduring and engaging educational experience, and ensuring safety and accessibility.

### **Territorial Acknowledgement**

First and foremost, we would like to acknowledge our privilege of living, working, and playing on the unceded territories of the lək̓ʷəŋən speaking peoples and the W̱SÁNEĆ Nations. Further, this project we have undertaken is based on Galiano Island. This island has been central to the livelihoods of the Penelakut Nation, Tsawwassen, and Hwlitsum First Nations, as well as other Hul'qumi'num-speaking peoples and W̱SÁNEĆ Nations. We humbly acknowledge our privilege of being able to visit and learn on these traditional territories as uninvited settlers.

### **Introduction and Background**

The Pebble Beach Forest Restoration Interpretive Trail (hereafter referred to as the 'Trail'), built around 2005, lies within the Pebble Beach Reserve, or District Lot 63 (DL63), on Galiano Island, British Columbia. The 152-acre lot was acquired by the Galiano Conservancy Association (GCA) in 1998 (Galiano Conservancy Association [GCA], 2005) and is situated between parcels of forested Crown land. These areas comprise a portion of the Mid Galiano Island Protected Areas Network, and the Trail itself forms a connection between the Laughlin Lake trail and the Cable Bay trail (see Figure 1). Meandering approximately half a kilometre through a young coastal Douglas-fir (*Pseudotsuga menziesii*) plantation on previously logged land, the Trail was built to highlight the forest restoration activities that were carried out from 2001–2008. The brochure-led, self-guided interpretive tour has twelve stops, denoted by numbered wooden posts alongside the path. The free brochure (see Appendix A) is available at one end of the Trail and for each stop details the history of the area and various aspects of the restoration.

The restoration of DL63 aims to provide greater connectivity between the surrounding mature forest stands, and the Trail serves as an educational tool to broaden public awareness of the importance of conserving and restoring the diverse ecology of Galiano's forests. Galiano

Island is part of the Coastal Douglas-fir Biogeoclimatic Zone (CDF), an ecosystem ranked in British Columbia and globally as imperiled (Government of British Columbia, 2020). Since time immemorial, First Nations managed the understory of these mature Douglas-fir forests with regular, low-intensity fire for hunting and gathering. These gentle human pressures combined with natural disturbances such as wind helped create biodiversity by setting in motion successional processes. The resulting forest mosaic was characterized by large, old-growth fire-resistant Douglas-fir, western red cedar (*Thuja plicata*), and a diversity of understory plants and accompanying wildlife.

Since European arrival in the mid-1800s, logging on eastern Vancouver Island and the Gulf Islands has reduced older forests to only 2.6% of the landscape (Erickson, 2003). Developments in technology following World War II helped spur the advent of clearcutting; by the 1950s, MacMillan Bloedel, British Columbia's largest exporter of lumber products at the time, owned half the land area of Galiano Island and made a practice of clearcutting, broadcast burning, and replanting with homogenous plantations (GCA, 2005). About one-third of the forest on Galiano Island was clear cut in the second half of the 20<sup>th</sup> century (Erickson, 2003), including DL63—most recently cut in 1978—leading to habitat loss and landscape fragmentation.

The restoration goals for DL63 included thinning the canopy, scattering coarse woody debris (CWD), and erecting wildlife trees (Gaylor et al., 2002). The GCA used innovative techniques to pull down trees and move heavy logs without the use of power tools, assisted by a cable and pulley system. Tree-topping and girdling also helped thin the forest in order to encourage renewal and the return of biodiversity. The use of hand power meant no heavy or loud equipment was present to disturb the forest soil or atmosphere. As former GCA Conservation

Coordinator Keith Erickson noted, “restoration is about creating a relationship with the land” (personal communication, July 1, 2021).

Conservation and restoration have emerged as necessary actions to combat climate change, habitat fragmentation, and loss of biodiversity. Public education can draw support for restoration projects that benefit the local community and the planet more broadly; the GCA’s Pebble Beach Restoration Interpretive Trail serves as an educational experience that can generate interest and support from the public. As the forest changes over time, the Trail can continue to provide new insights and inspiration.

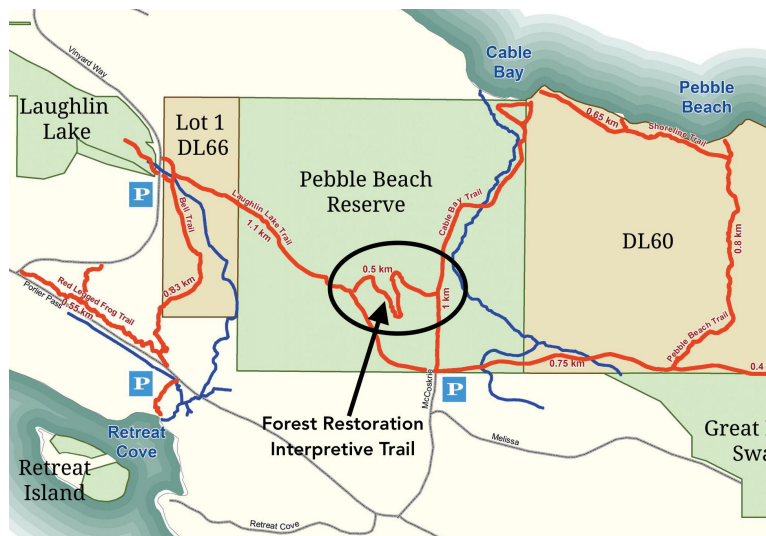


Figure 1. Map of Pebble Beach Forest Restoration Interpretive Trail. Adapted from <https://galianoconservancy.ca/wp-content/uploads/2019/06/Mid-Island-Protected-Areas-Network1.jpg>.

### Defining the Trail’s Problems and Potential

Although the Interpretive Trail has significant educational potential respecting both the history of the land and the value of restoring forest ecosystems, a lack of continuous evaluation and maintenance by the GCA since the Trail’s conception has left the Trail degraded and underused. In order to increase the Trail’s use and value to the community, we set out to pinpoint areas of concern.

We walked the Trail several times in order to identify any salient issues or obstacles that would prevent use and appreciation of the Trail and the interpretive brochure. There were three core issues that we identified. First, the Trail was not easy to find or inviting; we found there to be a lack of clear and effective signage from the parking lot to the trailhead to encourage usership. Further, there were no available and accessible interpretive brochures for those interested in using the Interpretive Trail. Second, the educational experience of the Trail was hindered by the interpretive brochure and the Trail's infrastructure. We found the brochure (Appendix A) to have an overwhelming amount of text, be repetitious, and, in some cases, state information that was no longer accurate to the surroundings. Additionally, the numbered sign posts on the Trail were degraded themselves, often obscured with moss or not immediately visible from the Trail (see Figure 2). Third, we noted safety concerns along the Trail that would prevent full appreciation and accessibility of the Trail. These concerns included debris and downed trees across the Trail; dead, leaning trees across the Trail that had not yet fallen; large stones around and on the Trail; a rusted cable adjacent to the Trail; and stinging nettle (*Urtica dioica*) impeding on the Trail. Furthermore, the Trail was poorly delineated in some areas which has potential to confuse visitors.



*Figure 2.* A numbered sign post along the Trail obscured by moss. (June 24, 2021).

Addressing and remedying these aforementioned problems has immense potential benefits for a diverse group of stakeholders. Most evident is the potential benefit to the GCA; a core mission of GCA's is "environmental education and public awareness" (GCA, n.d. a, para. 3). Thus, the GCA has made interpretive trails an explicit component of their management plan, stating that they "provide key learning opportunities for both the public and for participants in [the GCA's] Learning Centre programs" (GCA, 2013, p. 30). Therefore, individuals of all generations who participate in the Learning Centre programs hosted by the GCA will have the chance to interact with the Interpretive Trail and learn about the area's local history, the GCA, the importance of conservation and restoration efforts, and the local flora and fauna that surrounds them.

Furthermore, regular visitors to the Pebble Beach Reserve from the local community of Galiano Island and the wider regional community (encompassing the Southern Gulf Islands, Vancouver Island, and the Greater Vancouver area) will benefit from an improved educational experience as they are provided with the chance to deepen their knowledge about the local environment and further anchor their sense of place. According to Amundsen (2015), the combination of "physical characteristics specific to a place and the subjective meaning attached

to it” (p. 258) is at the root of meaningful place attachment. An effective interpretive experience can strengthen these place-based ties. Those who do not visit regularly can begin to develop these place-based attachments as they learn more about the region they are visiting.

On a broader scale, the revitalization of the Trail has potential to set an example of how to effectively combine restoration efforts with an educational opportunity. While each restoration project is invariably contextual, interpretive trails can be modified to fit a variety of ecosystems, goals, and resource capabilities. A successful example of an interpretive trail experience has the potential to motivate other organizations and communities to invest in local interpretive experiences.

### **Methods**

In order to address the aforementioned problems and thus increase the Trail’s potential, we used the following three methods to help construct relevant and meaningful goals, objectives, and recommendations for updating the Pebble Beach Reserve Forest Restoration Interpretive Trail.

#### **1. Identify History of the District Lot 63 Restoration**

We reviewed the available literature on the restoration of DL63 as provided by the GCA. This included the current Trail brochure (Appendix A) and information available through the GCA website ([www.galianoconservancy.ca](http://www.galianoconservancy.ca)). Additional documents included the “Restoration of a Young Coastal Douglas-fir Plantation” (n.d. b) produced by the GCA and Gaylor, Scholz, and Erickson’s “Restoration Plan for District Lot 63 of the Pebble Beach Nature Reserve, Galiano Island” (2002). These resources were especially helpful in gaining a contextual understanding of the area's history, the restoration techniques used, and the intended purpose of the Trail at its conception.



## **2. Speak with Individuals Involved in the Trail's Creation and Invested in its Continuance**

We spoke to GCA restoration coordinator Adam Huggins about his knowledge of current Trail use and upkeep. We conversed with and received feedback from Galiano Island community members present at the ES471/ER412 Field Course project presentations on June 27, 2021. We also interviewed Keith Erickson, who was heavily involved with the restoration plan and implementation of DL63, as well as the Trail's creation. These conversations helped us solidify our understanding of the original goals for the Trail, and highlighted the value of sharing with the public the story of forest restoration and its importance for strengthening ecosystems.

## **3. Visit the Site to Inspect the Trail's Current Condition**

We walked the Trail on June 24 and 25, 2021 to make observations about the Trail's state. On our first visit (accompanied by Adam Huggins, Eric Higgs, and Nancy Shackelford), we stopped at the numbered posts, noting features visible at each site and how they related to the brochure text. We brainstormed which stops seemed engaging and which may no longer apply due to changes in the forest structure. We also noted potential matters of Trail upkeep. On our second visit, we walked the Trail in both directions, observing elements of the forest walk experience that may not necessarily be featured in the brochure but seemed of interest. We walked the trail at varying speeds to gain an understanding how a variety of Trail users would experience the trail. These walks of the Trail provided us with invaluable observations as they allowed us to experience the trail from the perspective of a Trail user.

## **Goals, Objectives, and Recommendations**

The overarching aspirational goal of revitalizing the Pebble Beach Reserve Forest Restoration Interpretive Trail is ultimately to inspire curiosity, engage the community, and bring public

awareness to the importance of conserving and restoring Galiano Island's diverse forest ecosystems. In order to align with this overarching goal, and guided by the identified problems with the Trail, the project is broken down into three goals that have corresponding objectives and recommendations to ensure their achievement.

### **Goal 1: Make the Trail Inviting and Easy to Find**

The first goal in revitalizing the Trail is to create an easily accessible trail that visitors and passers-by will feel invited to use.

#### ***Objectives***

- **1.1** Update the parking lot trail map directory (see Appendix B).
- **1.2** Make brochures accessible and inviting to Trail users.
- **1.3** Install directional signage at both entry points to the Trail.

#### ***Recommendations***

- **Objective 1.1**
  - Update the trail directory map to label the Trail on the map ("Interpretive Trail" or similar) as is done with the other trails on the map. This will make the Trail visible to visitors at a quick glance.
  - Denote the Trail's path on the map with a solid black line, the same as how the other trails are indicated, rather than a black dotted line. This will make the Trail more clearly delineated to visitors looking for a trail to walk.
  - Provide a short (2-4 sentence) introductory statement about the Trail on the text-section right-hand side of the trail directory to entice visitors. This statement should be clearly titled with the same title as appears on the trail map in order to show a clear connection between the Trail's location and the Trail's purpose.

- **Objective 1.2**

- Ensure the brochure holder installed on the parking lot directory is placed next to the short introductory statement (as discussed in Objective 1.1) in order to clarify the brochure's purpose.
- Place brochure holders at both of the entry points of the trail. Attach these brochure holders to the directional trailhead signage (see Objective 1.3).
- Ensure the three aforementioned brochure holders are regularly stocked full. Regular maintenance will be necessary to ensure brochures are kept stocked. Brochure usage will vary seasonally, so stocking brochures more frequently (e.g. weekly) during the busier summer months will be required.
- Ensure the brochure holders are installed at an appropriate height for access of both adults and older children. A recommended height is between 1 and 1.5 meters.
- Offer laminated brochures with erasable markers to educational groups using the trail with the GCA Learning Centre in order to re-use brochures and limit waste.

- **Objective 1.3**

- Place a directional-shaped, wooden trail marker at each of the Trail's two entry points that are laser-etched or painted on both sides with the Trail's name ("Forest Restoration Interpretive Trail" or similar).
- Point the directional signs toward the Trail's start point and perpendicular to the main trails (the Cable Bay Trail and the Laughlin Lake Trail) to ensure their visibility to passers-by.

## **Goal 2: Provide an Enduring Educational Experience for Visitors to the Pebble Beach Forest Restoration Trail**

In order to create an experience that broadly captures the range of visitor types, it is imperative that the materials guiding a user along the Trail be engaging and kept up-to-date. Trail users may have varying degrees of environmental awareness; some may not have familiarity with restoration as a concept, while others may already have a good understanding of the area and its history. Offering a mixture of ways for people to engage with the story of forest restoration will appeal to a diverse populace.

### ***Objectives***

- **2.1** Produce an engaging and aesthetically pleasing brochure.
- **2.2** Minimize and upgrade numbered sign posts.
- **2.3** Develop and maintain an online presence for the Trail.

### ***Recommendations***

- **Objective 2.1**
  - Revise the stop-specific brochure text blocks to be relevant to the surroundings while being not specific to one location or point-of-interest (see Appendix C for a suggested brochure revision). This will allow for long-term relevance as the forest changes through time and allow information from the brochure to be witnessed throughout the Trail.
  - Ensure the brochure text is engaging and concise for people of all ages and knowledge-levels.

- Add a QR code linked to the GCA website on the brochure to allow visitors to easily connect directly with the GCA and access more information about the region.
  - Use art within the brochure to support the text and enhance understanding. Label drawings of specific flora and fauna with common and Latin names.
  - Use a well-spaced, readable font for text-blocks.
  - Provide interactive opportunities on the brochure with prompts that urge visitors to interact with their surroundings, and with spaces to draw and write about their experiences (see Appendix C2).
  - Use the brochure to prompt trail users to engage with an iNaturalist project created specifically for the trail (accessible at <https://www.inaturalist.org/projects/pebble-beach-reserve-forest-restoration-interpretive-trail>). This will encourage interactive species identification and serve as a citizen science catalogue of species for the GCA's research.
- **Objective 2.2**
    - Reduce the number of interpretive stops from twelve to six in order to keep the information concise and engaging.
    - Relocate posts to relatively evenly-distanced sites along the Trail corresponding to the new brochure text.
    - Place posts in visible locations at consistent distances just off the path. We recommend 1.5 meters from the Trail's edge. Current posts can be reused, provided they are in good condition (i.e. not rotted or otherwise damaged).

- Replace the numeric stop system with picture-denoted stops (see Appendix C2 for suggested images of recognizable forest biota that correspond to related text-blocks). Affix small (roughly 3x3 inches), durable, and easy-to-maintain aluminum printed pictures to post tops. Simple pictures atop the posts in lieu of numbers invite bidirectional Trail usage and allow future updates to easily include more or fewer stops without the need to re-number the entire span.
- **Objective 2.3**
  - Update and maintain the current available webpage (<https://galianoconservancy.ca/pebble-beach-reserve/>) with more information relevant to the Interpretive Trail, including a downloadable map, photos of the original restoration work, a more detailed history regarding restoration methods, a link to the iNaturalist project (see Objective 2.1), and any future plans for restoration in District Lot 63.
  - Link the aforementioned webpage to the brochure using a QR code (as discussed in Objective 2.1).
  - Maintain the iNaturalist project webpage “Pebble Beach Forest Restoration Interpretive Trail” (see Objective 2.1).

### **Goal 3: Ensure the Trail is Safe and Accessible**

#### ***Objectives***

- **3.1** Remove debris and potential hazards from the Trail and directly adjacent area.
- **3.2** Clearly delineate the Trail.
- **3.3** Create a plan for regular maintenance and safety checks of the Trail.

### ***Recommendations***

- **Objective 3.1**

- Remove debris from the Trail to ensure a cleared path of approximately 1 meter across where feasible. Debris includes large branches, woody debris, and stones that may impede walkability of the trail.
- Remove trees that have fallen across the Trail to allow for a 1 meter passage where feasible.
- Assess and remove hazardous trees that may fall across or adjacent to (within 5 meters of) the Trail.
- Remove the rusted cable adjacent to the path and any other human-made hazards.
- Remove hazardous flora, specifically stinging nettle (*Urtica dioica*), from the trail, up to 1 meter across.

- **Objective 3.2**

- Delineate the trail by removing debris (as discussed in Objective 3.1).
- Create a 1-meter wide trail with woody debris along areas that have grown over with grass, specifically the Trail's entry point off of the Laughlin Lake trail.

- **Objective 3.3**

- Create a regular maintenance and safety-check schedule for the Trail. This schedule should be coordinated to accommodate the seasonal variability of visitors. Thus, the routine Trail checks should be scheduled bi-yearly, in the spring (between March and May) and autumn (between October and December).

- Schedule maintenance and safety-checks of the Trail prior to planned Interpretive tours with the GCA Learning Centre when possible.

### **Future Considerations**

We believe that our goals, objectives, and recommendations align with the GCA values. We note, however, that time constraint was a limitation for us. With only two days to visit and survey the Trail, we realize that future opportunities may exist that we are unable to fully explore in this paper.

### **Trail Rerouting**

One notable possibility is a rerouting of the Trail, which has potential to increase educational richness and usage of the trail. Although a specific trail rerouting prescription has fallen outside the scope of this report, it has become clear that a reroute to incorporate some of the adjacent mature, undisturbed forest would be beneficial as it creates a tangible comparison with the young, recovering forest. In our conversations with community members, this seemed like a desirable option. In addition to educational value, a reroute has potential to increase foot traffic.

With these considerations in mind, rerouting the Trail to be parallel to the Cable Bay trail, with the trailhead located in the parking lot and an exit point further down the Cable Bay trail, seems like an advantageous option to bolster both these goals. That being said, a precise plan for rerouting the Trail will require an intensive look at the forest topography and ecology, in combination with the landscape of restoration efforts, to determine the best route options available. A reroute will also incur the added costs of trail making, moving interpretive posts, updating the parking lot map directory, and updating the Trail brochure.

### **Continued Forest Restoration**



We also recommend that further restoration treatments be performed within DL63. As the Trail and brochure were designed to showcase the GCA's unique restoration techniques, ongoing restoration efforts would support the Trail's benefit to the public through both social and ecological means. Hohendorf's (2018) study of the effectiveness of forest restoration treatments on DL63 concluded that continued restoration, especially thinning to create larger canopy gaps, could increase biodiversity and improve structural diversity in the forest. The original Restoration Plan for DL63 recommends monitoring with the goal to provide feedback on ecological responses to restoration treatments; outlined long-term monitoring plans indicate that further thinning may become necessary (Gaylor et al., 2002). Hohendorf notes that canopy gaps created by the GCA were small and closed relatively quickly. We concur, as we noted on our Trail walks, that many of the canopy gaps pointed out in the brochure no longer exist.

Beyond additional thinning, future restoration plans could include creating deer exclosures and monitoring biodiversity and forest structure through bird surveys. The official Restoration Plan (Gaylor et al., 2002) mentions extreme black-tailed deer (*Odocoileus hemionus*) grazing pressure on Galiano Island but does not include restoration prescriptions to address the problem. We noted browsed vegetation during our Trail walks, but in the absence of data, deer browsing trends particular to DL63 cannot be determined. Creating deer exclosure study areas within the forest may provide data to drive future restoration goals. Bird point counts or censuses within DL63 could also contribute to a better understanding of forest structure and functionality. Martin et al. (2011) studied deer browsing on the Gulf Islands, finding that songbird richness and diversity were reduced where deer had over browsed the understory thus diminishing bird nesting habitat. Regular monitoring of bird populations could also add information about how snags are being used, and whether more snags might be required for

improved bird species richness. The Restoration Plan supports monitoring wildlife tree usage, suggesting visual inspection of the erected snags (Gaylor et al., 2002). Future restoration activities will necessarily help further the goal of rejuvenating the Interpretive Trail by perpetuating visible evidence of restoration and forest recovery.

### **Community Engagement**

The Trail could also provide future opportunities to engage community members, such as coordinating with local schools to designate volunteer stewards who could assist with Trail maintenance. Additionally, the iNaturalist project that we set up (<https://www.inaturalist.org/projects/pebble-beach-reserve-forest-restoration-interpretive-trail>) can be used for activities with the local community to engage with the flora and fauna on the Trail, including bioblitz events, guided bird walks, ecology walks, or mushroom-themed walks.

### **Costs**

The Pebble Beach Reserve Forest Restoration Trail update recommendations that we have provided offer several opportunities of varying costs that fulfill a core GCA value of providing enriching educational opportunities. Because much of the Trail infrastructure already exists, costs specific to our recommendations will likely stem from the following:

- Payroll
  - Designing and installing improved signage.
  - Installing brochure holders.
  - Regularly stocking brochures.
  - Revising the brochure.
  - Moving and removing interpretive sign posts.
  - Installing new post tops.

- Updating and maintaining online resources.
- The initial and ongoing trail maintenance (i.e. trail clearing) and safety checks.
- New signage and materials
  - Aluminum post tops (6 suggested).
  - Two wooden directional signs at trail entrances.
  - A new trail directory sign in the parking lot.
  - New brochure holders.
  - Paper (7”x11”) and ink to print brochures.
  - Laminating brochures.

### **Acknowledgements**

We would like to acknowledge the tremendous support and resources provided to us by the Galiano Conservancy Association and the assistance provided by their Restoration Coordinator Adam Huggins. Additionally, we would like to thank Keith Erickson and all of the other dedicated community members who gave us invaluable insight into this project. Lastly, we would like to thank Dr. Eric Higgs and Alina Fisher for their guidance and support.

### References

- Amundsen, H. (2015). Place attachment as a driver of adaptation in coastal communities in Northern Norway. *Local Environment*, 20(3), 257–276.  
<http://doi.org/10.1080/13549839.2013.838751>
- Erickson, K. (2003). Making connections: Forest restoration on Galiano Island. *Georgia Basin/Puget Sound Research Conference*.  
[https://galianoconservancy.ca/wp-content/uploads/2016/11/6a\\_erick.pdf](https://galianoconservancy.ca/wp-content/uploads/2016/11/6a_erick.pdf)
- Galiano Conservancy Association. (n.d. a). *Mission, constitution, and by-laws*.  
<https://galianoconservancy.ca/about/our-mission/>
- Galiano Conservancy Association. (n.d. b). Restoration of a young Douglas-fir plantation.  
[https://galianoconservancy.ca/wp-content/uploads/2016/11/forest\\_restoration\\_report.pdf](https://galianoconservancy.ca/wp-content/uploads/2016/11/forest_restoration_report.pdf)
- Galiano Conservancy Association. (2005). *Forest restoration interpretive trail* [Brochure].
- Galiano Conservancy Association. (2013). Galiano Learning Centre management plan.  
[https://galianoconservancy.ca/wp-content/uploads/2016/11/Galiano\\_Learning\\_Centre\\_anagement\\_Plan\\_-\\_February\\_15th\\_2013skm.pdf](https://galianoconservancy.ca/wp-content/uploads/2016/11/Galiano_Learning_Centre_anagement_Plan_-_February_15th_2013skm.pdf)
- Gaylor, N., Scholz, O., & Erickson, K. (2002). Restoration plan for District Lot 63 of the Pebble Beach Nature Reserve, Galiano Island. *Terrestrial Ecosystem Restoration Program Forest Investment Account*.  
<https://www.for.gov.bc.ca/hfd/library/fia/html/FIA2002MR003.htm>
- Government of British Columbia. (2020). *BC species and ecosystem explorer* [Database].  
Retrieved July 10, 2021 from <https://a100.gov.bc.ca/pub/eswp/>
- Hohendorf, Q. V. (2018). *Monitoring forest restoration effectiveness on Galiano Island, British Columbia: conventional and new methods* [Doctoral Dissertation, University of Victoria].

<https://dspace.library.uvic.ca//handle/1828/10133>

Martin, T. G., Arcese, P., & Scheerder, N. (2011). Browsing down our natural heritage: Deer impacts on vegetation structure and songbird populations across an island archipelago. *Biological Conservation*, *144*(1), 459–469.

### Appendix A

**Restoring the Forest**

A deer is on the forest edge to the west and though some beaver cutting, and though some beaver had been selectively logged early in the late 19th century, the forest remains a rare example of a mature forest. Douglas-fir ecosystem. The unique structure of the forest, with the habitats and spaces within the plants, snags, and fungi, organisms, large and small, and all of their relationships - all that makes the healthy forest ecosystem - restoration efforts for the plantations.

The aim of restoration on the Douglas-fir ecosystem is to create a forest with more diverse species and spaces. A diverse forest not only supports more interesting variety of plants and animals but also is more able to adapt to environmental changes.

To restore diversity in the plantation, we had to open up spaces in the artificially dense canopy. We simulated the natural process of wind blow-down by pulling down dead or dying trees. Other trees were topped or girdled to simulate natural die-back from pest and disease. To provide biological diversity, we had to remove some woody debris through the forest. We demand windrows and dispersed old stumps and logs across the forest floor.



**Restoring the Forest**

About a third of District 60 was clear-cut in 1967 or earlier and the Galiano Island forest is a second clear-cut in 1978 to make room for what was managed by MacMillan-Bloedel. A fire logging bulldozer scraped the unmerchantable logs, stumps, and soil into long piles or windrows. To further clear the site, the contractors tried to burn the windrows, though the burn was only partially successful. In 1980, the clear-cut was replanted with rows of homogeneous Douglas-fir seedlings grown from seed stock collected away from the plantation. The wind gaps remain one of the out by the vigorous growth and dense canopy of the forest. The wind gaps persist within the stand.

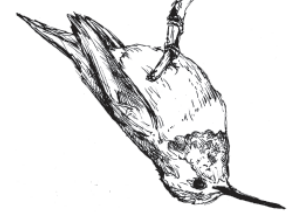
The Galiano Conservancy Association purchased District 60 in 1996 as part of a vision of a managed and protected area for recreation and community values. In 2001, with vision of healthy forest in mind, we started to restore the composition of the plantation.



**A Brief History of Quuxwiltwis (the Cable Bay/Pebble Beach Area)**

The working old-growth western red cedar and Douglas-fir forest that once defined these lands provided a special and natural sustenance to the forest ecosystem for resources essential to local community life and trading. For example, the regular they set kept the understory open and productive for gathering and hunting. Occasionally first people would feel a giant tree's ally-nurtured seed for construction of a dugout canoe or a multitude of uses the species provided. Our pre-contact forest far from unimpaired and reflected the combined forces of an ecological abundance and the influence of human activity.

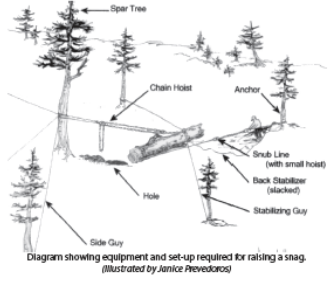
More recently European pioneers approached from the sea, with axes and cross-cut saws in hand, looking for the easiest access, they would seek likely large gaps in the forests, leaving pods of water at floor. After World War II, with technological advances in power saws and heavy equipment with a goal of maximum resource extraction at minimum cost, plantations were established in minimum of 1000-hectare blocks to single species tree farms.



Throughout the restoration process we looked for naturally-seeded trees and shrubs that had managed to get a foothold in the plantation and thinned around them, giving them a fighting chance for survival. All of these treatments are working with nature to shift the ecosystem from the stark plantation of crop trees towards a biologically rich forest of open spaces and dense clusters, of sunny glades and shadows, and of multiple habitats for a wide variety of plants and animals, from the largest trees to the smallest microorganisms.



Rather than use heavy machinery for the restoration, which would only compound the damage to the recovering forest soil we are doing this work by hand. For the heavy work, we have rigged a small version of a "skylvine" logging system powered by a hand-operated 5-ton chain hoist. With cables strung between trees, we can lift and move stumps and logs, re-erect downed logs as snags, and pull down 25-year-old plantation trees, all without the noise and intrusion of heavy motorized equipment.



**We'd Like to Hear from You.** We welcome your comments, thoughts and observations. Your encounters with birds, bees, flowers, and trees will contribute to the store of information that helps us track changes to the forest.

**Come back and watch the forest respond to the restoration treatments.**

For more information please contact the Galiano Conservancy Association: [galiano\\_conservancy@gulfislands.com](http://galiano_conservancy@gulfislands.com) [www.galianoconservancy.ca](http://www.galianoconservancy.ca) ph/fax: 539-2424 RR#1 Galiano Island, BC V0N 1P0 October 26th, 2005

**Line Drawings by Shauna Anderson  
Cartoons by Annette Shaw**

**Funding for this brochure and the interpretive trail provided by:**  
Mountain Equipment Coop

**Funding for our restoration treatments is provided by:**  
EcoAction, Tides Foundation, VanCity, Home Depot Foundation, Science Horizons, Summer Career Placement, CCHREL Work Source

**WHY RESTORE A FOREST?**  
**COME TAKE A WALK!**

**Forest Restoration Interpretive Trail**

The Galiano Conservancy Association set up this interpretive trail to contrast a mature forest ecosystem and one that has been industrially logged. The trail takes you through Conservancy lands that were once a commercial forest "plantation" and shows the efforts the Conservancy is making to restore this land to a fully functioning forest ecosystem that is so much more than just trees.

The interpretive trail starts about 350 meters up the old logging road to the northwest what is now the path to Laughlin Lake. The entire loop through the plantation forest and back to the parking lot is a distance of 1.2 kilometers and is an easy stroll of about 45 minutes.

Appendix A1. The outside pages of the original brochure.

**1 Waste Not**  
This open area was originally a "landing", where harvested logs were piled and loaded onto trucks. The intense traffic of heavy equipment destroyed natural vegetation and compacted the soil. When the machinery left, exotic shrubs and grasses easily invaded, led by Scotch broom (*Coronilla varia*), Himalayan blackberry (*Rubus discolor*) and sweet vernal grass (*Anthoxanthum odoratum*). To restore the site, we cleared the exotic shrubs by hand and brought in four truck loads of woody debris, salvaged from local island burn piles. An excavator loosened the soil and then "planted" and arranged the stumps and standing dead trees you see before you. When the machine work was finished, we planted native herbs, shrubs and trees around the site to speed up recovery.

**2 Diversity and Complexity**  
Unlike other areas of the plantation, this slope was not scraped clean after clear-cut logging. As a result, the forest floor remained somewhat intact, thick and spongy. Many of the natural trees that were growing as seedlings and saplings survived during logging and now contribute to the variety of trees that surround you. The mix of species includes red alder (*Alnus rubra*), western red cedar (*Thuja plicata*) and Douglas-fir (*Pseudotsuga menziesii*). Note the variety of tree size and shape and the presence of dead trees, important especially to woodpeckers and cavity-nesting animals. There is diversity in the plant life here, with gaps among the trees and lots of dead wood rotting on the forest floor where herbs, ferns, shrubs and tree seedlings grow. Such complexity in this stand results in more biodiversity here than elsewhere in the plantation.

**3 The Alder Advantage**  
The dense stand of deciduous trees before you is red alder (*Alnus rubra*). In this long narrow strip, alders have in-seeded from trees like the large specimen at stop 4 and are successfully competing with the planted Douglas-firs. The higher soil moisture and nutrient levels on this cool northeast aspect favour the alder. Alder is a pioneer species quick to colonize exposed mineral soil, fast-growing but short-lived to only 60-80 years. The alder's ability to fix nitrogen in its roots allows it to grow in soils with low nitrogen making it available to nourish not only the alder but also the surrounding vegetation. Over time, shade-tolerant western red cedar, western hemlock and ground fir, as well as the occasional Douglas-fir, will eventually replace this pioneering alder stand, creating a mixed-species, conifer-dominated forest. Were this stand still being managed for industrial forestry, silviculturists would try to suppress the alder to ensure the rapid dominance of Douglas-fir rather than wait for natural succession and the rebuilding of soil nutrients.

**4 Windrowing**  
You are standing on a windrow of old logs, stumps, soil and vegetation that were pushed here by bulldozers after the forest was clear-cut. In industrial forestry, windrowing is often used to "clean up" the site, making it easier to plant new trees. Windrowing is also a precaution against the spread of laminated root rot fungus. Windrowing scours the forest of all its valuable woody debris and toppil, leaving the forest floor outside the windrows ecologically impoverished.

**5 A Glimpse back in Time**  
This blackened Douglas-fir stump is all that remains of the old-growth forest that had evolved over thousands of years on this land. Try to imagine this tree when living, rising majestically to a canopy three times the height of the trees you see around you. Now imagine you one to five car-lengths apart how you are getting a feel for what the primordial forest once looked like. By mapping stumps such as this one, we can estimate the density of trees in the old-growth stands. This research gives us a target for our restoration thinning in this plantation stand.

**6 Let it Rot**  
All of the wood on the forest floor around you was moved here as part of our restoration treatment. In forest ecology, this "coarse woody debris" (CWD) offers crucial habitat for small animals and plants and contributes to soil structure and nutrient cycling. Imagine the forest floor for food when suddenly a Banded Owl swoops through the trees. Without a hiding place in CWD, you would be dinner. In fact, if not for the presence of CWD, you might not venture out here in the first place. As well as shelter, CWD provides a growing medium for plants, fungi, Jaime mollusks, bacteria and many creatures. As wood decomposes, it builds and enriches soil. Trees are nourished by their ancestral kin, a foundation in the beautiful cycle of forest life.

**7 Row upon Row**  
You are looking across the rows of even-aged, evenly-spaced Douglas-fir trees that characterize plantation forestry on the land. The dense canopy of the trees has excluded most of the other species of trees, and shrubs will drop out of the stand over the next 5-10 years as they fall in their struggle for light with the ascending ferns. Sometimes referred to as "biological deserts", stands such as this need restoration treatments to restore diversity inherent in healthy forests.

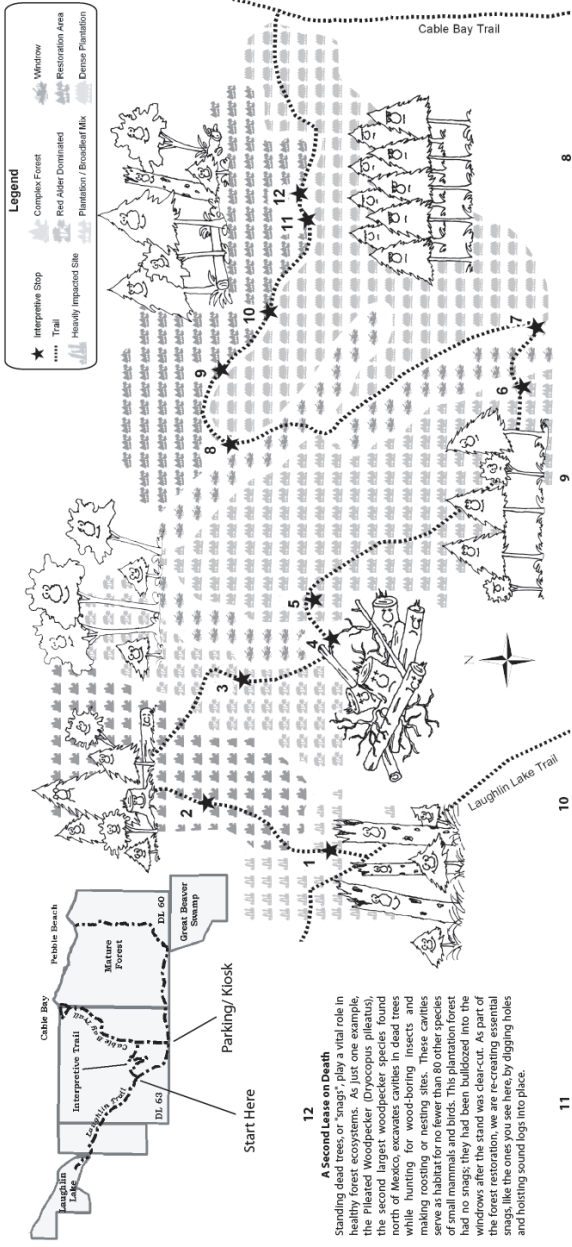
**8 Let there be Light**  
The upslope side of the trail was treated for restoration in late 2004-early 2005. Coarse woody debris was dispersed from nearby windrows, and trees not marked for saving were girdled, topped or pulled over. Girdling adds wildlife habitat and structure to the forest floor. The removal of trees has opened up the forest floor to more light onto the forest floor. Topping or pulling over trees not only brings woody material onto the forest floor but also opens up the canopy for increased light penetration and releases surrounding trees from impending starvation under the bows of the Douglas-fir canopy. Compare the light-filled treated area with the untreated plantation down slope behind you.

**9 When a Tree Falls in the Forest**  
Blow-down of trees during wind storms is an important natural disturbance in forest ecosystems. Fallen trees leave gaps in the forest canopy that make room for new seedlings to grow. The process of blow-down as part of the restoration treatment, we pulled over the downed trees you see here.

**10 Relief through Release**  
In the greater light and space of the thinned forest, other species can thrive, including the Abutrus (*Abutrus menziesii*) before you. Characterized by its shagging bark and smooth sinuous trunk, Abutrus berries resemble grape-like clusters of tiny, rosy red oranges. These fruits are devoured by many species of birds, which in turn disperse the seeds over great distances. Abutrus seeds readily germinate in disturbed soils, but the trees do best on warm south-facing slopes with plenty of light. Our thinning treatment is liberating naturally-seeded tree species in this stand from the oppression of the dense-growing plantation trees.

**11 Changing Spaces**  
In this area you can see the full spectrum of our restoration treatment techniques. We first pruned the lower branches. We then flogged the trees we wanted to save. Finally, we removed the trees we wanted to remove. Coarse woody debris from the nearby windrows, spreading it out across the forest floor. We pulled trees by pulling, girdling or topping, and planted native species seedlings into larger gaps. Although the area may look "messy" at first glance, the site offers much more habitat diversity and a healthier forest shape and structure than in the uniform plantation.

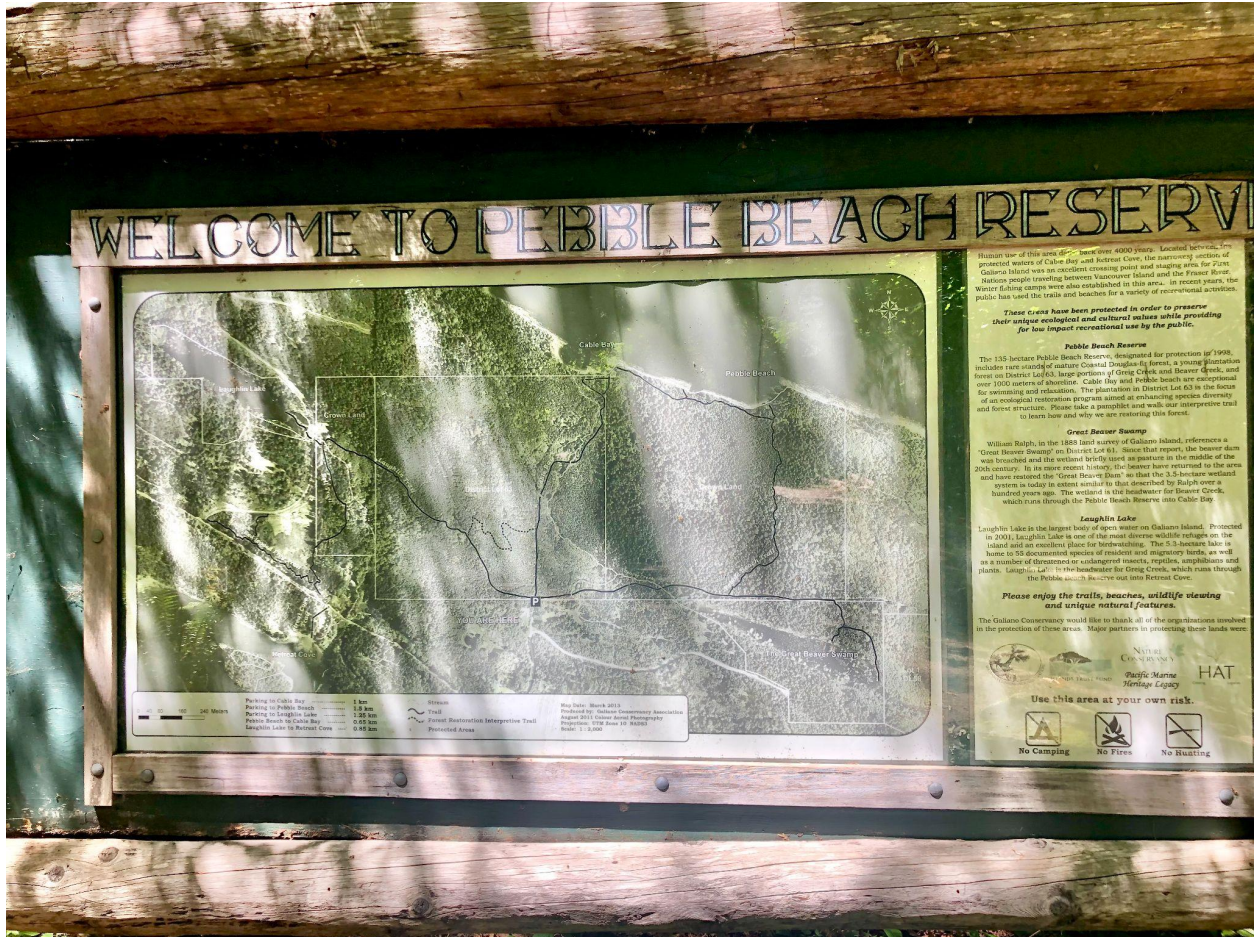
**12 A Second Lease on Death**  
Standing dead trees, or "snags", play a vital role in healthy forest ecosystems. As just one example, the Pileated Woodpecker (*Dryocopus pileatus*), a native of the north of Mexico excavates cavities in dead trees while hunting for wood-boring insects and making nesting sites. These cavities serve as habitat for no fewer than 80 other species of small mammals and birds. This plantation forest had no snags; they had been bulldozed into the windrows after the stand was clear-cut. As part of our restoration treatment, we placed the snags like the ones you see here, by digging holes and hoisting sound logs into place.



Appendix A2. The inside page of the original brochure.



Appendix B



Appendix B. The Pebble Beach Reserve trail directory map located in the parking lot.



### Appendix C

The aim of restoration on this site is to convert the Douglas-fir monoculture to a forest with more diverse species and spaces. A diverse forest not only supports a more interesting variety of plants and animals but also is more able to adapt to environmental changes.

In 2001, the GCA started to restore the compromised ecology of the plantations with biodiversity for generations to come. The hope to regain forest health, function, and the Douglas-fir monoculture to a forest with more diverse species and spaces. A diverse forest not only supports a more interesting variety of plants and animals but also is more able to adapt to environmental changes.

*Odocoileus hemionus columbianus*  
Columbian black-tailed deer



In 1980, the cleared land was densely planted with rows of homogeneous Douglas-fir seedlings grown from seed stock not native to Galiano. The dense and uniform Douglas-firs vigorously grew into a thick canopy that shaded out the forest floor. Native flora and fauna could no longer thrive in this changed forest ecosystem.



#### A Homogenous Forest

#### Restoring the Forest



To restore diversity in the plantation, spaces were created in the dense canopy. This allows sunlight to penetrate the forest floor, giving the understory a chance to regenerate. Trees were pulled down with a hand-pulley system to simulate the natural process of wind blow-down. Others were thinned, topped or girdled simulating natural death from pest and disease. To create wildlife trees with crevices and holes for nesting birds and other organisms, several larger diameter logs were raised upright. These are called snags.

Dismantled windrows and old stumps provided woody debris, which was distributed over the forest floor. This helps maintain the nutrient cycle through the natural rotting process.

All of these treatments work with nature to shift the ecosystem from a uniform tree plantation towards a diverse and biologically rich forest that fosters habitats for a wide variety of plants and animals, from the largest trees to the smallest microorganisms.



About a third of this forest ecosystem in District Lot 65, now known as the Pebble Beach Reserve, was clear-cut in 1967. A second clear-cut in 1978 took most of what was left. After logging, bulldozers then scraped the logs, stumps, and soil that was left behind into long piles known as windrows.



In the mid-1900s, a combination of technological advances and an increase in international market pressure allowed industrial logging to begin in earnest in British Columbia. Large swaths of forest were rapidly clear-cut, leaving no trees behind.

*Polystichum munitum*  
Western sword fern



In the 1850s, European colonizers arrived and fundamentally changed the landscape. As Indigenous peoples were forcibly removed from their land by colonial powers, many of the forests that had been stewarded since time immemorial were logged, leaving only springboard-notched stumps behind.

#### Logging the Land

#### Thank-you for participating!

Restoration is never a finished process. Come back again soon to see what has changed!



Red-breasted sapsucker, *Sphyrapicus ruber*

Scan this QR code to learn more information about the restoration of the Pebble Beach Reserve, or visit [www.galianoconservancy.ca](http://www.galianoconservancy.ca)



Galiano Conservancy ASSOCIATION

Get in touch with us! [www.galianoconservancy.ca](http://www.galianoconservancy.ca)  
Phone: (250) 539-2424  
10825 Porlier Pass Road, Galiano Island, B.C.

Line drawings by Shauna Anderson  
Cartoons by Annette Shaw

These forests were homelands and traditional territories that reflect the combined forces of ecological abundance and cultural care since time immemorial.



*Salal, Gaultheria shallon*

These peoples intentionally nurtured and managed this forest ecosystem to be a place of abundance. For example, regrowth, low-intensity fires were set to keep the understory open and productive for gathering and hunting. Occasionally, giant western red cedars would be felled and made into dugout canoes, or its bark stripped to make baskets, accessories, and clothing.

The towering old-growth western red cedar and Douglas-fir forests that once defined this land on Galiano Island were central to every aspect of life for the Penelut, Tsawwassen, and Hwiltsum First Nations, as well as other Hul'qum'num-speaking peoples and WSANEC Nations.

#### A Brief History of Q'waxwul'wis (now known as the Cable Bay/Pebble Beach Area)



#### Pebble Beach Forest Restoration Interpretive Trail

Come walk the interpretive trail to discover how forest restoration can help an ecologically degraded area become a healthy forest ecosystem. As biodiversity returns, we invite you to notice new things each time you visit: singing birds, cool fungi, new understory plants, thick mosses, and ever-growing trees!

There are six stops along the trail. Open up the brochure to follow the forest's journey and learn how the Galiano Conservancy Association is helping to restore this valuable landscape.

**Interactive Challenge!**

Look down!  
Can you draw or name 3 understory plants you see?



Listen!  
Can you draw or name one animal you can hear?



Look up!  
Can you draw or name 2 trees you see?



A regenerating forest floor invites all sorts of new species! Decaying logs and stumps provide nutrients and new homes for other species, such as salamanders and mosses. These are called "nurse stumps" or "nurse logs" as they help to "nurse" other species into health! Critters also use these nurse logs and stumps to live in and munch on (imagine being able to eat your house). These new species can then help the forest get right back on track. In fact, slugs are like the messengers of the forest floor—they help clean-up pollutants and spread nutrients around.

Can you find a nurse log or stump? What about a slug?



Pacific banana slug, *Ariolimax columbianus*

After an area is cleared or disturbed, the process of **ecological succession** begins, with changes in the composition and structure of species over time as plants grow and alter the conditions around them. For example, **red alder trees**, early to colonize disturbed areas, change the soil nutrients by pulling nitrogen from the air to enrich the soil. This soil nourishes other surrounding vegetation. As alders grow, they also provide more shade. Eventually, shade-tolerant trees like cedar and hemlock will replace alders, creating conifer-dominated forest. This dynamic process generates biodiversity, but it takes a long time!

Can you find the deciduous alder trees around you? Look for smooth bark and oval-shaped leaves, or no leaves if you are visiting in the winter!



A healthy forest begins with healthy soil. Scattering coarse woody debris from windrows and old stumps across the forest floor allows for nature to do the heavy lifting of restoration. Microorganisms and natural nutrient cycling will slowly break down this debris and bring life back into the soil. The uneven ground also creates all sorts of habitats for a variety of critters to thrive. Fungi are a great indicator of this process in action as they thrive on decaying woods and healthy soils!

Can you find any mushrooms around you?



Thinning out the dense canopy cover was a major component of restoring this forest. This process included **finning** (removing tree branches) and **topping** (removing tree tops). **Girdling**, the technique of removing a strip of bark around the base of a tree, was also used, allowing the tree to die standing up. In combination, these techniques mimic the natural processes of a healthy forest. Who knew killing trees could help the environment!

Can you see any dead trees around you?

Decaying and dead wildlife trees are a crucial component of a forest landscape. These upright snags provide homes for many creatures from insects to birds and small mammals. Woodpeckers—including the almost prehistoric-looking Pileated Woodpecker—excavate holes, which are then used by other creatures. Restoration of this forest included adding large-diameter dead trees: they were set upright and "planted" in the ground. As birds come to nest, another layer of biodiversity returns! **Have you seen or heard any birds today?** Check out the wildlife trees - you might get lucky!



American red squirrel, *Tamiasciurus hudsonicus*



Pileated woodpecker, *Dryocopus pileatus*



Biggest maple, *Acer macrophyllum*

**Look around!** You may notice differences between the young plantation forest you are in and the older forests toward the coast: larger trees, more plant variety, earthy scents, and a different "feel" with complexity and layers. Forest restoration treatments on the young forest plantation aim to invite more of this complexity which will help provide forest connectivity and reduce landscape fragmentation on Galiano Island. A mature forest is valuable for storing carbon, and for supporting life and biodiversity—but also take a moment to appreciate its sheer wonderousness!

**Show us what you find!**

Be part of a worldwide citizen science initiative! Upload photos of plants and creatures you found along your journey onto the app Naturalist, or use the website [www.naturalist.org](http://www.naturalist.org). Photos taken here will become part of our ongoing project "Pebble Beach Forest Restoration Interpretive Trail." Take a look at all the species other people have found, too!

