



# Restoration of a Young Coastal Douglas-fir Plantation

Galiano, the second largest of British Columbia's Southern Gulf Islands, is located within the Strait of Georgia between the urban centres of Vancouver and Victoria. Over half of the island was operated as a commercial tree farm until the late 1980s, and though the island today has a relatively intact forest landscape, much of this forest shows the history of industrial timber extraction.

**The Island's forests are ranked as imperiled, both provincially and globally.**

Galiano's position on the lee side of the Vancouver Island Mountain range combined with the moderating influence of the ocean lead to a mild and relatively dry climate. The Island's forests are characteristic of the Coastal Douglas-fir Biogeoclimatic Zone (CDF), an ecological classification that has recently been ranked as imperiled (a high risk of extinction) both provincially and globally. The CDF has the highest density of species of conservation concern in British Columbia. This conservation challenge is further intensified when considering the future impacts of climate change and has led to the CDF being identified as BC's highest priority for conservation.



**Climbing and topping creates gaps in the Douglas-fir plantation's uniform tree canopy.**

**Restoration includes the creation of large diameter wildlife trees using a hand-powered cable system.**



Over the past two decades the Galiano Conservancy Association has focused on addressing issues of biodiversity loss and environmental sustainability. These efforts include a unique project with a goal of helping to transform one of the island's degraded forest plantations into a healthy, resilient and connected forest ecosystem.

# Logging over the past century has transformed Galiano's forests...

Logging in its various forms and intensities has been a constant presence on Galiano Island for thousands of years. Florence James, an Elder from the Penelakut First Nation who was raised on Galiano Island, provided a glimpse of how our forests were cultivated and used for millennia: "The respect for trees is what my grandfather told us about as children, that the tree gives its body to assist us for travel [canoes]. So, a cedar tree was felled for a specific purpose and it was four to eight hundred years old. The tree was nurtured from a little sprig, limbed in a way that would prevent many knots. No single person would witness all this, as the plans were meant for future generations."



Coast Salish Canoe - James McCurdy, 1900  
(Museum of History and Industry, Seattle)

Not until the 20th century did the intensity of logging really begin to re-define the ecology of the island. Timber extraction in the early 1900s kicked things off with the use of the steam donkey, which increased the ability of early loggers to maneuver their fallen giants.

Efficiency was drastically increased after the two world wars with the development of the internal combustion engine in heavy machinery and the chainsaw. This increase in capacity to remove timber was showcased in the industrial clearcut – and by the 1980s, moonscape-like patches dominated the view of Galiano from the air.



By the turn of the new millennium one was hard pressed to find a patch of untouched old-growth forest on the island. The old trees managed for 1000s of years by our First Nations have been replaced by industrial plantations established within the past 50 years, scattered with patches of mature forest high-graded a century ago.



Courtesy of M. Reusseur Collection

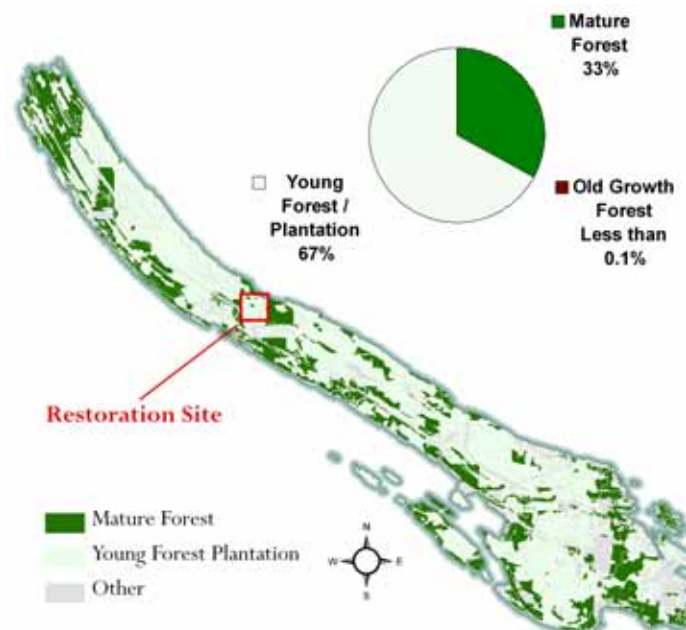
**Yarding trees with a steam donkey in an old-growth Douglas-fir stand.**

**Crew with spring-boards and crosscut saw admire their wedge cut.**



D.R. Kinsey, 1902 (US Forest Service)

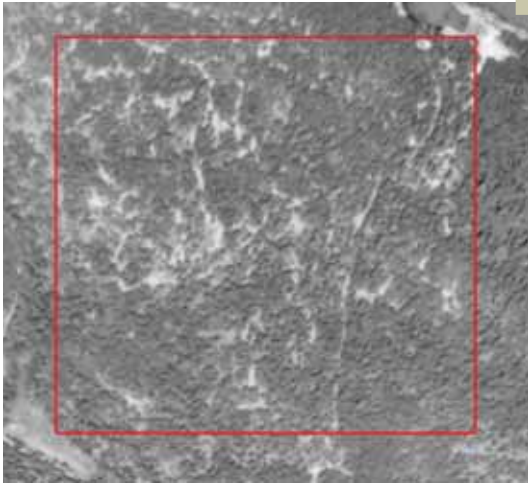
## Forest Distribution - 2002



**“The area is called Qwxwulwi’s, a place to live while resting, gathering provisions and medications, and waiting for good weather. Qwxwulwi’s is the word for the action of paddling...” Florence James, Penelakut Elder**

Qwxwulwi’s is the Penelakut name for the restoration site at the heart of the Galiano Conservancy’s forest restoration program. The site embodies the full spectrum of Galiano’s forestry history.

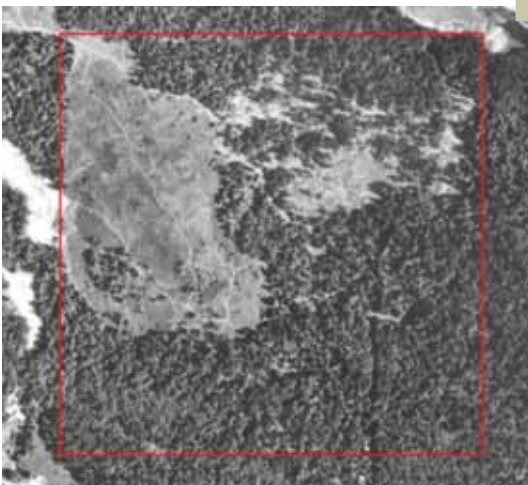
**1932**



A patchy mosaic of clearings is evidence of the high-grade logging conducted with crosscut saws and steam donkeys in the early 1900’s.

## **...creating monoculture plantations**

**1972**



The first clearcut, in 1968, removed all trees from about a third of the lot. The cut was followed by an intense slash burn that penetrated beneath the forest floor through the root systems of the stumps left behind.

**1980**



The remainder of the site was clearcut in 1978. The intensive industrial-scale treatment included the removal of every standing tree regardless of size or species followed by the bulldozing of top soil and slash into long linear piles called windrows. Although the site was set ablaze, the burn failed, leaving behind the windrows and their rotting organic material. This intensive and costly treatment of the cutblock was an attempt to simplify future access to the site for planting, thinning and harvesting.

The site was planted with uniform rows of genetically similar Douglas-fir seedlings selected for fast growth and size. Any other plants that naturally sprouted were quickly eliminated to ensure that the planted fir had no competition.

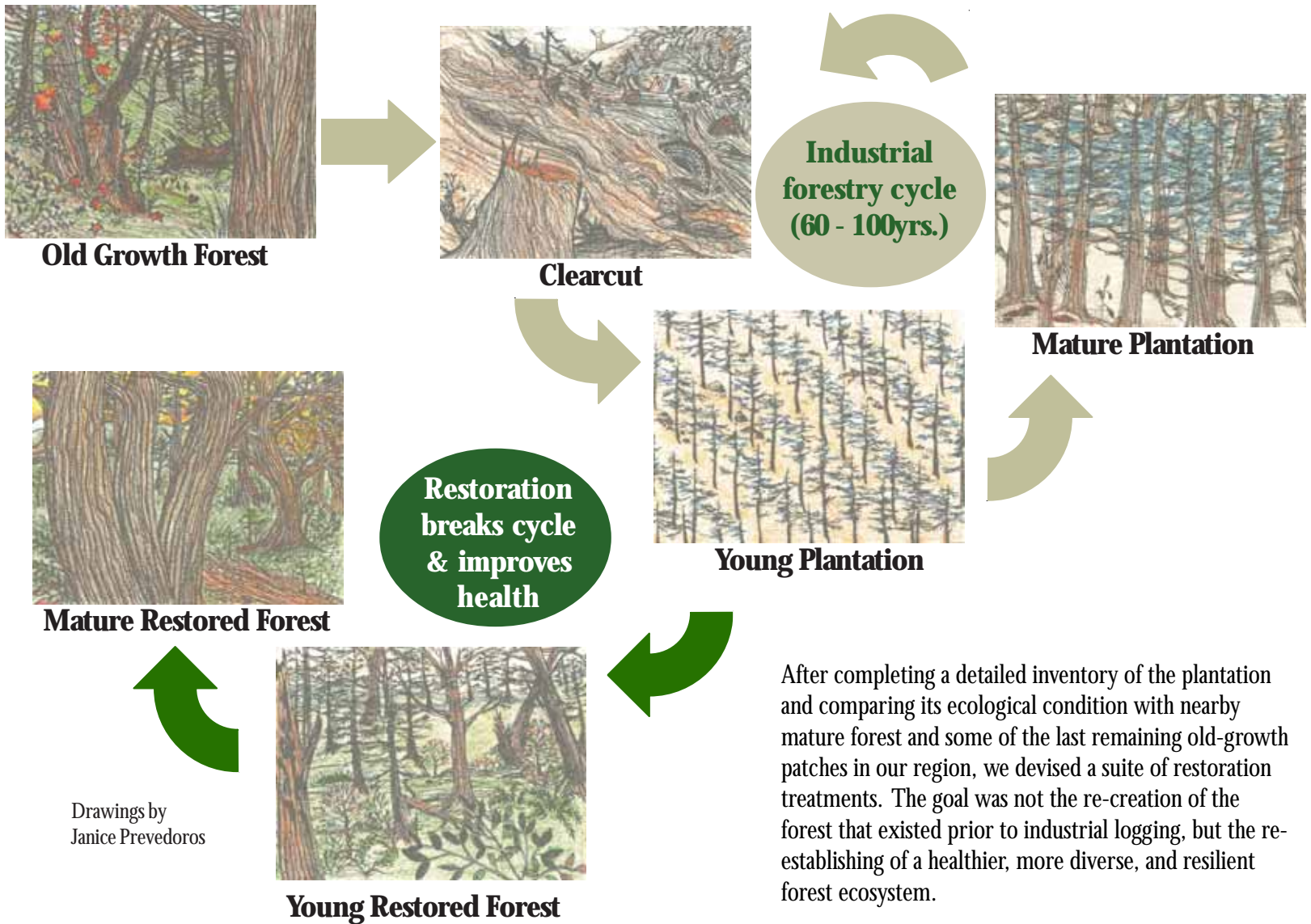


Rows of planted Douglas-fir

**The removal of all vegetation from the site, the devastation to the forest floor and the establishment of a uniform single-aged, single-species plantation have set the forest on a trajectory where biodiversity and ecosystem processes function on a minimal level.**

The industrial cycle was broken in 1998 when the Galiano Conservancy recognized the potential of the site to provide connectivity at the landscape scale and purchased the property for restoration. A forest restoration plan was prepared in 2002, and two years later restoration treatments were initiated to help shift the plantation’s successional trajectory towards a healthy mature forest.

# Transforming a monoculture of planted Douglas-fir into a healthy, diverse and resilient forest ecosystem...



## Dispersing slash diversifies the forest floor and creates habitat...

Using a 5-ton chain hoist for lift and a cable and pulley system for horizontal movement, rotting slash from windrows is dispersed across the barren forest floor. The organic material provides habitat for a variety of plants and wildlife, creates soil conditions conducive for the growth of mycorrhizal fungi and functions as a moisture sink during periods of summer drought. The unique, hand-powered, portable restoration system minimizes further damage to the site.



## Thinning treatments maximize diversity of vegetation and forest structure...

Culling plantation Douglas-fir trees creates gaps in the canopy allowing more light to reach the forest floor. This promotes growth of mosses, grasses, shrubs and other tree species. Any natural elements such as a red alder tree, a patch of salal or a small area of undisturbed soil around a stump that remain within the plantation are viewed as 'anchors' of diversity and provide a guide for choosing which plantation trees to keep and which to cull.



**Topping** creates a small-diameter wildlife tree while opening the canopy and allowing more light to reach the forest floor.



**Girdling** is the most efficient technique for thinning. The cambium is removed in a band around the entire circumference of the tree with a specialized chisel, cutting off the transport of nutrients to the roots.



**Pulling trees over** mimics natural windthrow creating a pit and mound feature on the previously scraped and flattened forest floor. A 5-ton chain hoist in series with a number of chains, pulleys and cables easily brings the trees down by hand.

## Creating large diameter wildlife trees provides an essential component of a functioning ecosystem...



Using a modification of the cable system, large, intact pieces of slash are stood up as wildlife trees creating forest structure that would otherwise take centuries to form.



**Planting native Galiano stock** reestablishes understory cover and enhances genetic and species diversity...

**BEFORE**



## Just 5 years after restoration treatments...



The plantation has responded to restoration treatments with an increase in species richness and biomass. The moss layer was the first to respond to the increase in light resulting from thinning treatments. The grasses and herbs followed quickly, along with a flourish of shoots branching off of red alder stems. Salal, oceanspray and other shrubby species have been slower to respond; however, patches of these species are beginning to emerge and are expected to expand throughout the stand over the next 5 years. Structurally, the restored areas of the plantation resemble a more natural condition with a mosaic or patchy distribution of dominant Douglas-fir trees, a revitalized sub-canopy of broadleaf trees and conifer saplings, wildlife trees of varying diameter throughout the site, and coarse woody debris across the forest floor. This newly created structural complexity equates to greater habitat diversity and availability, adding to the sites potential for supporting biodiversity.

## Healthy Forest - H

“The restoration work being done by the Galiano Conservancy is not only enhancing vegetation and wildlife habitats; it is also supporting a natural soil system by means of a nutrient cycling system.”

(Koele, Nina. 2005. Archipelago. Galiano Conservancy)

A study of available soil nutrients found that the minerals in the restoration site were more abundant than in the adjacent mature forest stand than in the study suggests that the restoration work is creating a healthy soil system that is a natural mature forest system.



# AFTER



## Forest - Healthy Soil...

work being performed by Conservancy Association is not vegetation regeneration and is also supporting the forest by means of an active stem."

(Galiano Conservancy..)

nutrients found that levels of key soil nutrients at a site were more similar to those in an old-growth forest than in the untreated plantation. This restoration work increases microbial activity in the soil system that more closely resembles a natural forest system.

**The 'pit and mound' effect created by pulling trees over creates diverse micro-sites for vegetation growth. The 'pit' exposes mineral soil and tends to hold moisture, while the raised mound is rich with organic material and often more acidic.**



**Heart-rot fungi have established in recently topped trees, creating conditions suitable for insect invasion, soon followed by the Pileated Woodpecker.**



# Education and research are vital components of the restoration program...

Data from the monitoring program on this site indicates that ecological restoration has clearly increased the structural, compositional and functional diversity of the Douglas-fir plantation. Now, in light of the ever-increasing significance of climate change, the Galiano Conservancy is studying the impact of restoration treatments on carbon sequestration in the forest. Preliminary studies looking only at the vegetation have indicated that treatments are carbon neutral in the short-term but will likely increase carbon sequestration over the long-term. Researchers have also begun to examine the effects of restoration treatments on carbon sequestration in the soils.

**Current research is assessing whether restoration treatments are increasing carbon sequestration on the site.**

While restoration treatments at this site are benefiting the local ecology, it is the educational component of the project that reaches beyond Galiano's shoreline. Site tours and opportunities for in-depth study are offered to students and professionals from around the world. Forest restoration theory and techniques are also the focus of an ongoing youth educational program. The program incorporates hands-on restoration activities that provide students with a positive connection to the natural world. The Conservancy is now piloting programs that engage students in restoration projects in their home communities after visiting our site on Galiano.



**Students pull down a plantation Douglas-fir.**

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***For more information or to inquire about tours and educational programs contact:***

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**Restoration crew with a newly created wildlife tree.**

**www.galianoconservancy.ca**