Forest Restoration on Galiano Island

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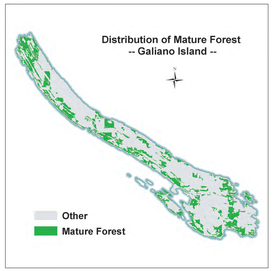
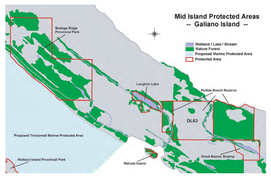
Introduction

Galiano Island is situated between the urban centres of Vancouver and Victoria. Its landscape reflects the regions intensive logging and settlement patterns over the past 150 years. Plantation forests, agricultural lands, roads and residential development have replaced Galiano's old forest's and fragmented what remains, leaving behind a patchwork of some the Province's most endangered natural ecosystems.

The Galiano Conservancy has embarked upon an innovative restoration project in an effort to improve the health of our island's forest ecosystems. The focus for restoration is a 26 year old coastal Douglas-fir plantation just over 60 hectares in size. The plantation is located on DL63 - a property owned by the Galiano Conservancy Association. DL63 forms part of the Pebble Beach Reserve protected area that is one component of a larger mid-island protected areas network. Restoration within the plantation will improve the capacity of the site to support biodiversity in the near and long term and will provide connectivity between adjacent protected mature forest stands.

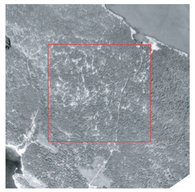




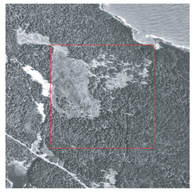
Galiano Forest Facts:

- Roughly 50% of Galiano's land base is recovering from being clearcut within the last fifty years.
- Roughly 25% of the island is comprised of mature forest that, although healthy, have dominant canopy species attributable to early 20th century high-grade logging operations.
- Less than half a dozen old-growth forest patches larger than one hectare in size remain.
- The remaining 25% of the landscape has been developed - compounding the impacts of forest harvesting with extensive fragmentation from roads and permanently cleared areas.
- Galiano's landscape is dominated by simplified, young Douglas-fir plantations surrounding small islands of mature forest.

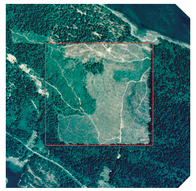
Logging History



1962 - District lot 63 shows signs of high grade logging where only the highest quality trees were removed from the site. Logging generally targeted the tallest, widest and straightest Douglas-fir trees.



1972 - This photo was taken five years after the first clearcut in District Lot 63. Approximately 25% of the lot was logged and then planted with Douglas-fir.



1980 - The remaining trees on DL63 were removed in 1978 in an intensive industrial clearcut operation. This photo tells the story of what was thought to be a progressive logging style at the time. The rows of Douglas-fir planted after the first clearcut in 1967 can clearly be seen in the top left corner of the lot. If the centre of the photo is exammined closely you can make out a number of long, light green linear piles called windrows. Windrows were created by bulldozers after the timber was harvested and contain all of the slash, stumps and top soil from the surrounding area. This was done to prepare the site for planting and to provide easier access for large machinery during future industrial scale logging. Attempts to burn the windrows failed .

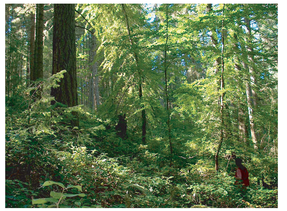
1998 - This photo shows the plantation on DL63 in a condition very similar to its present one. You can still make out the windrows near the centre of the photo. These areas were not suitable for planting and have grown thick with shrubs and deciduous trees. This diversity is presently being encroached upon by by the rows of Douglas-fir.

Current Stand Condition

The homogeneity of the Douglas-fir plantation canopy in DL63 is contrasted against the towering mature forest stand on the adjacent property.

Light in the understory is at a premium due canopy closure from the even-aged, single species plantation. Vegetation in the understory is sparse. Coarse woody debris and top soil were bulldozed into windrows after logging (right), leaving behind an impoverished and barren forest floor.

Reference Ecosystem



Nearby mature and old-growth forest patches provided a restoration target for our plantation on DL63. Data collected in these stands will provide a comparison for future monitoring and evaluation of restoration success.

Restoration Treatments

Unique hand powered treatments have been developed to thin the plantation stand, disperse any remaining coarse woody debris from windrows to the depleted forest floor, and erect wildlife trees. These treatments were designed to avoid further degradation to the soil ecosystem and to ensure minimum impact to natural vegetation and wildlife species in the plantation.

Dispersal of Coarse Woody Debris

Distributing Coarse Woody Debris from windrows to barren forest floor using our hand powered aerial cable yarding system.

Coarse woody debris provides habitat for forest creatures, ranging from fungi, bacteria, and invertebrate species, to amphibians to small and large mammals. The inherent moisture and nutrient properties of the wood will help to re-establish important ecological functions and site productivity.

Diversifying Canopy and Understory Conditions

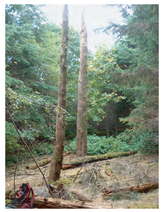
Carfully planned thinning of planted Douglas-fir trees is helping to transform the canopy and understory condition from a simplified monoculture plantation into a diverse and healthy forest. Thinning treatments are designed to promote tree species diverstiy, create gaps where understory vegetation flourishes and to increase structural diversity through the addition of small diameter snags and woody debris. We use three methods for thinning - pulling trees over with a hand powered chain hoist and cable system, topping trees, and girdling trees.

Pulling over trees mimics a natural wind disturbance, leaving an exposed root wad and a pit instead of a stump.

Topping these planted Douglas-fir opens up the canopy and allows light to reach the forest floor immediately. Topping also creates small diameter snags, suitable for foraging by species such as the Pileated woodpecker.

Creating Wildlife Trees

Large diameter snags provide a variety of habitat conditions such as sloughing bark used by bats for roosting, limbs or broken tops used for perching by birds of prey and wood volume adequate for the creation of large cavities by the Pileated woodpecker. Large cavities in turn provide nesting sites for owls, Northern Flickers, Wood ducks, squirrels and other birds and mammals.



Two recently created wildlife trees.

Raising a wildlife tree using the mechanical advantage of a 5 ton chain hoist.

Girdled trees will die over several years allowing the ecosystem to gradually respond to the increase in light penetration.

Planting native to Galiano vegetation after thinning helps to diversify and speed up understory growth. The plants are raised in our restoration nursery.

Monitoring

Monitoring Goals:

1. To show clearly and credibly that the restoration treatments were effective.
2. To indicate what and when adaptive response and subsequent restoration treatment entries are required.
3. To be effective and achievable over the long term within a range of potential economic constraints.

To best achieve these monitoring goals our strategy incorporates a variety of monitoring techniques that ride a sliding scale spanning the rigorous scientific to anecdotal observation. To meet our monitoring needs we have devised four main techniques to gather data; detailed stand mapping, 20X20m permanent biodiversity monitoring plots, permanent repeat photography points and an anecdotal observation trail. The data from these techniques rely on comparative analysis of before and after treatment conditions, of contemporary comparisons between the treatment area and untreated control area, and of relative comparisons between the treatment area and reference ecosystem mature forest stands.

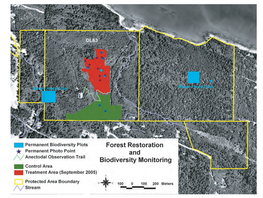


Photo Monitoring

Permanent photo monitoring points have been set up within treatment and control sites. Photography will be repeated on an annual, or semi-annual, basis providing an outstanding visual diary of the stands response to restoration treatments.

The photos below show how the understory responds to thinning treatments

The photos below show how the dispersal of woody debris has tranformed the formerly barren forest floor.

90% of large diameter snags are showing signs of Pileated woodpecker use after being erected.

Permanent Biodiversity Monitoring Plots

Permanent plots were established in treatment, control, and reference mature forest sites. Tree canopy information was collected in accordance with Ecological Monitoring and Assessment Network (**EMAN**) protocols, recording tree locations, diameters, heights and health. Data related to site, soils, vegetation and coarse woody debris was collected using the BC Ministry of Forests Field Manual for Describing Terrestrial Ecosystems. Data collection in permanent plots will be repeated on a five year interval.

Drawing on the work of Spies and Franklin (1991), permanent plot data will be used to monitor key indicators of forest structure as the stand moves along its successional path towards a mature forest. The following indicators, which differentiate between young, mature and old-growth forest stands will be specifically monitored:

Overstory structure Tree density
Mean dbh / Total basal area / Broadleaf basal area / Shade tolerant species basal area / Standard deviation of dbh

Understory Structure Herb cover
Graminoid cover / Density of shade tolerant saplings / Sub-canopy tree sapling density / Deciduous shrub cover

Debris
Combined depth F and H litter layers / Woody debris and Snag volume

Anecdotal Observation Trail

We have built a restoration interpretive trail that passes through our control area and an area where we have applied the full range of our treatments. We are asking for the public to record any observations made while walking the trail and submit them to be included in an anecdotal journal record. To provide continuity to this information we are working on a partnership with our local naturalist group who have volunteered to walk the route seasonally, making simple observations and taking pictures of features such as snags, cwd, understory vegetation, and planted seedlings at pre-defined stations. This anecdotal information will be sorted and stored in a database.

Detailed Stand Mapping

Detailed ground-based mapping of an initial five hectare treatment area and a one hectare control area will provide insight into attributes and patterns within the canopy and on the forest floor that are indiscernible from air photos. The mapping provides a comprehensive baseline picture of the initial resoration area. This information will be used to monitor stand compostion, gap and patch dynamics as well as the elimination of windrows as a visible feature in the stand. Details of treatments (eg. number of girdled, pulled and topped trees) have also been mapped providing a simple account of our progress as well as potentially helping to explain any variations of ecological response encountered through future monitoring of the site. We would like to repeat this detailed stand mapping on a 10 year cycle. **The figure below shows mapped features and the level of detail.**

Map 1 is displayed at a 1 : 2,000 scale and shows general stand composition along with patches of vegetation and areas affected by root disease.

The insert map, displayed at a 1 : 500 scale shows the distribution of individual naturally regenerated trees and large diameter stumps.

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