Between Land and Water

Galiano Conservancy Association - Sustainability Scholars Project Summary

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Over the past five years, the Galiano Conservancy Association (GCA) has implemented extensive ecological restoration activities within the Chrystal Creek watershed on Galiano Island, restoring approximately five hectares of degraded wetland. These efforts have focused on recreating the hydrological and ecological dynamics of beaver-modified landscapes. The restoration project was originally conceived to counteract more than a century of degradation stemming from small-scale agriculture and logging, which had disrupted the natural hydrology, soil structure, and vegetation communities of the area. This report synthesizes the goals, context, methodologies, and preliminary outcomes of a collaborative research initiative that supported GCA's broader restoration program as a sustainability scholar.

The wetland restoration project's primary goals, outlined in a series of three applications to the EcoAction Community Funding Program of Environment and Climate Change Canada, included restoring natural hydrology and soil microtopography within a 12.5-hectare area of the Chrystal Creek watershed. Restoration activities aimed to re-establish a range of freshwater wetland types—both seasonal and permanent—while enhancing climate resilience and habitat conditions for sensitive species. Efforts were made to reinforce native vegetation, including western redcedar ecosystems that once dominated the area. A parallel objective was to remove old roads, refuse, and structural remnants, while retaining access routes to facilitate stewardship and research. Community involvement, particularly the engagement of youth, university students, and volunteers, formed a core element of the project through hands-on participation in restoration design and implementation. As part of the University of Victoria's Sustainability Scholars program, a multi-site research study was developed to contribute to the monitoring and adaptive management phase of this restoration program. A key aim was to investigate how active restoration techniques — particularly the replication of beaver pool — wetlands affect ecological outcomes such as biomass and biodiversity across wetland habitats. While restoration of wetlands, especially projects inspired by beaver habitat, is gaining traction in British Columbia, there remains a limited understanding of how such interventions influence carbon dynamics, vegetative structure, and species diversity in the long term. This study contributes to that knowledge gap by assessing a gradient of sites with varying histories of degradation and restoration. Four wetlands on Galiano Island were selected for this study, each representing a distinct stage of disturbance or recovery.

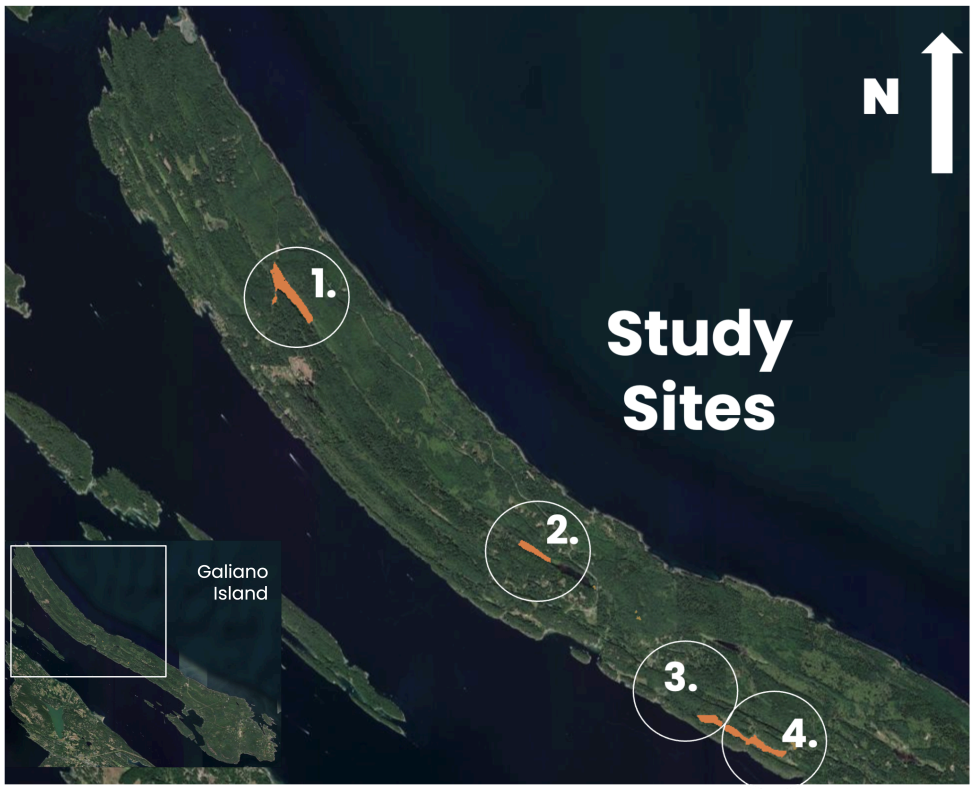
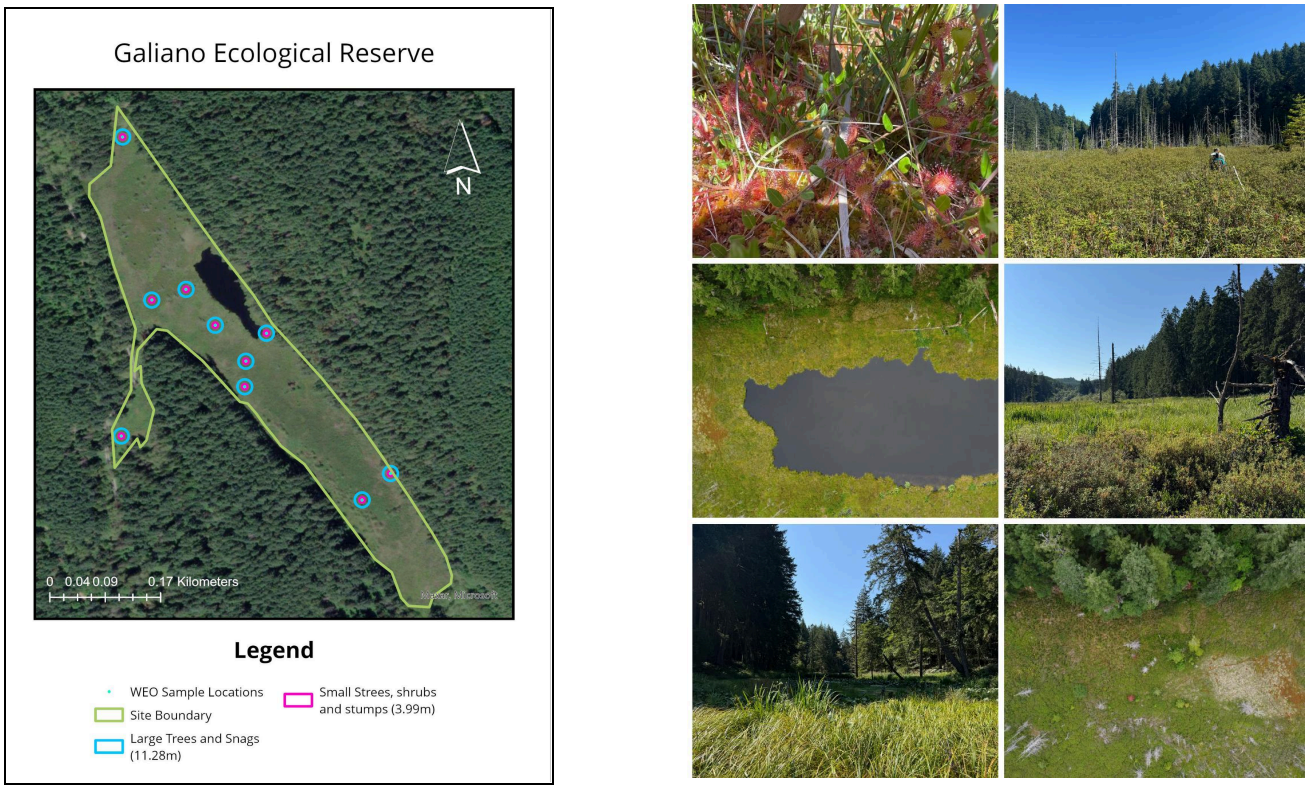


Figure 1. Galiano Island with an overview of site locations.

Site 1

The 10.5-hectare wetland, part of a 25-hectare reserve, lies in a depression between sedimentary rock ridges and drains via an intermittent stream to Trincomali Channel (BC Soil Map). Its very poorly drained Metchosin soils, combined with an annual precipitation of approximately 1,010 mm, sustain a rare Coastal Douglas-fir bog ecosystem characterized by Labrador tea, bog cranberry, sphagnum moss, sedges, and water-lily communities. The surrounding forests are dominated by Douglas-fir, arbutus, and salal, and support several rare plant species such as pointed rush and Chamisso's cottongrass (BC Parks). Beavers are present and influence local water levels, but overall hydrology has remained stable in recent years (Risa Smith, personal communication, 2025). As an Ecological Reserve, the site prohibits public access; however, occasional reports of unauthorized water siphoning during summer droughts highlight ongoing management considerations (Risa Smith, personal communication, 2025). As one of the least modified wetlands in the region, this site provides a baseline for understanding natural wetland structure and vegetation, serving as a reference against which restoration outcomes at other sites, such as Chrystal Creek, can be evaluated (Risa Smith, personal communication, 2025).

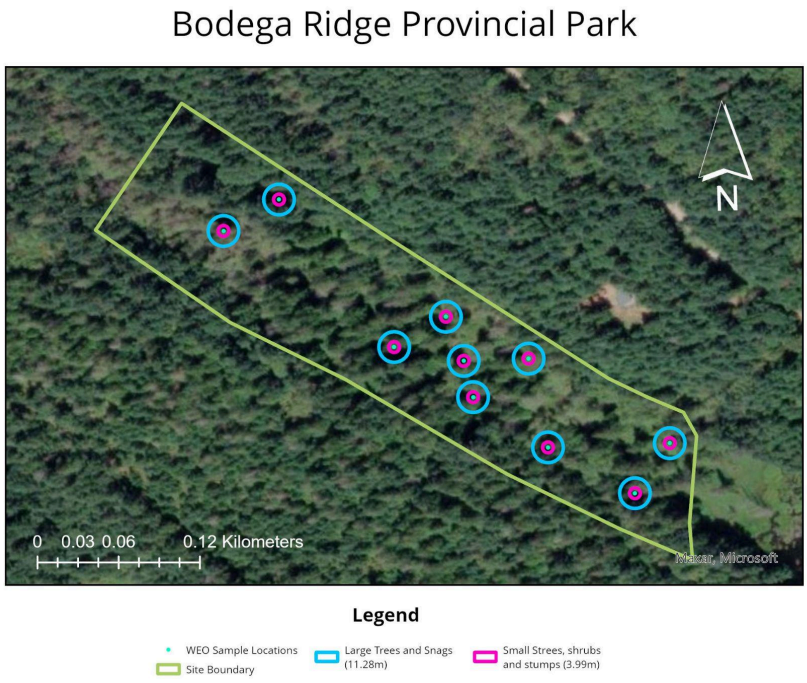


Figures 2 and 3: Galiano Ecological Reserve site map with sample locations, drone footage, and ground truthing.

Site 2

The second study site, located in Bodega Ridge Provincial Park, presents a marked contrast in both geomorphology and disturbance history. Once logged for forestry, the property was acquired from MacMillan Bloedel in 1995 and designated a provincial park in 2001 to protect underrepresented ecosystems in the Coastal Douglas-fir moist maritime (CDFmm) zone (Bodega Ridge, 2003). The park encompasses 190 hectares, including a 6.5-hectare valley wetland system situated between two ridges. Site soils are primarily Brigantine sandy loam and are imperfectly drained (BC Soil Survey Map). Craig Creek flows through the valley and has been dammed by beavers into a series of pools, several of which persist year-round. The wetland complex is characterized by swamp-dominated vegetation with patches of marsh, a forest canopy of western redcedar and Douglas-fir, and a diverse understory of salal, sword fern, and sedges. While the park contains an extensive trail network, the valley itself remains separated from current public access, though proposals for new trails could bring people closer to this system in the future (Chessi Miltner, personal communication, 2025). Despite the legacy of past forestry, the valley now supports a relatively intact wetland ecosystem, providing valuable contrast to less-modified

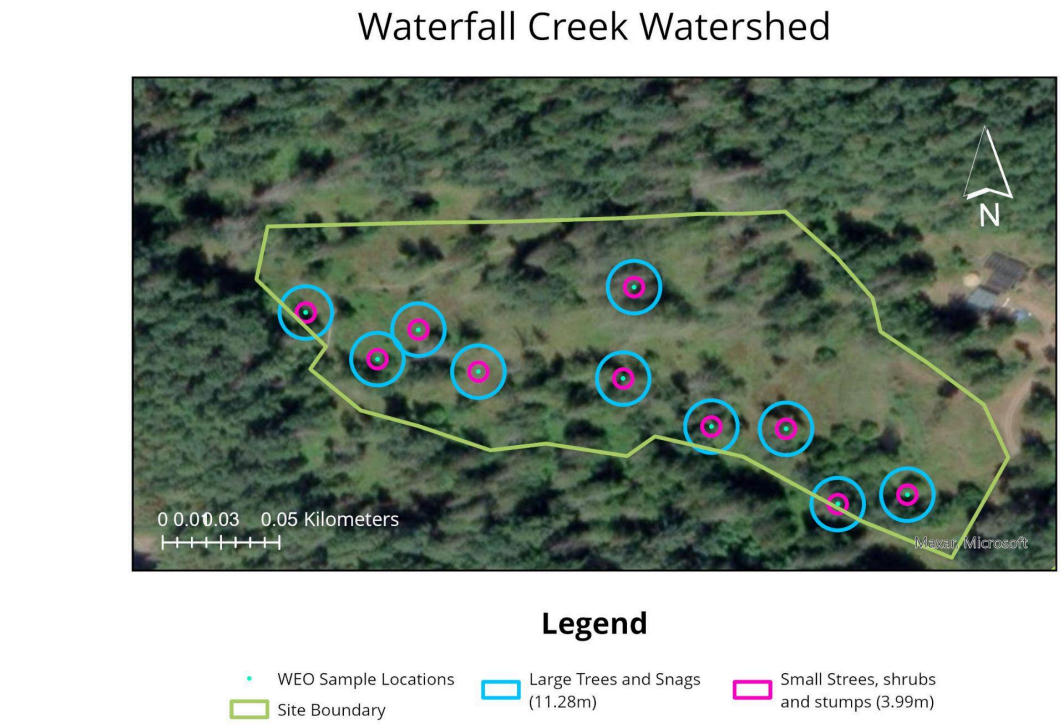
sites for understanding wetland structure and vegetation dynamics (Chessi Miltner, personal communication, 2025).



Figures 4 and 5: Bodega Ridge Provincial Park drone footage, ground truthing, and site map with sample locations.

Site 3

The third study site is located on the Millard Learning Centre property, owned and managed by the Galiano Conservancy Association since 2012. The Waterfall Creek site, the smallest of the four at 2.76 hectares, lies on well-drained Saturna sandy loam soils (BC Soil Survey Map). Historically cleared for pasture in the early 1900s, the site's hydrology was altered to reduce standing water. Today, it remains seasonally wet, with sections resembling marsh or swamp ecosystems, and supports remnants of Douglas-fir and redcedar forests with an understory of salal, sword fern, and sedges. The property includes a series of GCA-constructed trails, some with boardwalks and bridges, which primarily skirt the edges of the study sites to allow visitor engagement and staff access while minimizing impacts on the wetland habitats. Although historically modified, Waterfall Creek exhibits characteristics similar to those that would have existed in the Chrystal Creek watershed prior to restoration, providing context for understanding pre-restoration wetland conditions (Galiano Conservancy Association, personal communication, 2025).



Figures 6 and 7: Waterfall Creek site map with sample locations, drone footage, and ground truthing footage.

Site 4

The fourth and final study site, Chrystal Creek, is a 12.5-hectare wetland restoration project designed to re-establish hydrological function in an area historically altered by agriculture, logging, and drainage ditching (Galiano Conservancy Association, 2020). Guided by Tom Biebighauser's approach to wetland restoration (Biebighauser, 2011), and implemented by his former apprentice Robin Annschild, the GCA excavated depressions and used a core trench to reconnect the site to the water table and disrupt legacy drainage structures, creating a mosaic of shallow, groundwater-fed and surface-water wetlands of varying shapes and sizes. The site comprises Brigantine and Tolmie soils, characterized by imperfect to poor drainage, and receives a mean annual precipitation of 978 mm (BC Soil Map). To protect plantings and support vegetation establishment, deer-exclusion fencing was installed. An access road runs along the east side of the southern section, bisecting it into two distinct areas, and continues along the west side of the upper section. Trails border both the west and east edges of the southern section, providing staff access while minimizing impacts on wetland habitats. Chrystal Creek is located immediately adjacent to the Waterfall Creek site, separated primarily by the access road. The site is being monitored to assess the effectiveness of restoration interventions and to provide insight into how wetlands in the region respond to human-led restoration efforts (Galiano Conservancy Association, personal communication, 2025).

Figure 8: Chrystal Creek Watershed drone footage and ground truthing footage.

The four study sites represent a continuum of wetland condition and management intensity within the Coastal Douglas-fir biogeoclimatic zone. The Galiano Ecological Reserve serves as a reference site, maintaining near-natural hydrology and vegetation structure with minimal anthropogenic disturbance. Bodega Ridge Provincial Park exhibits similar ecological function but within a larger valley wetland shaped by beaver activity, with only light recreational pressure. In contrast, Waterfall Creek reflects a legacy of agricultural drainage and partial forest recovery, resulting in a seasonally wet system with altered hydroperiods. Chrystal Creek represents an experimental restoration context, where hydrological processes have been actively re-established through excavation and ditch remediation, creating a variety of groundwater- and surface-fed wetlands now showing early signs of successional stabilization. Together, these sites

span a gradient from reference to restoration, providing a robust framework for assessing wetland function under varying disturbance histories.

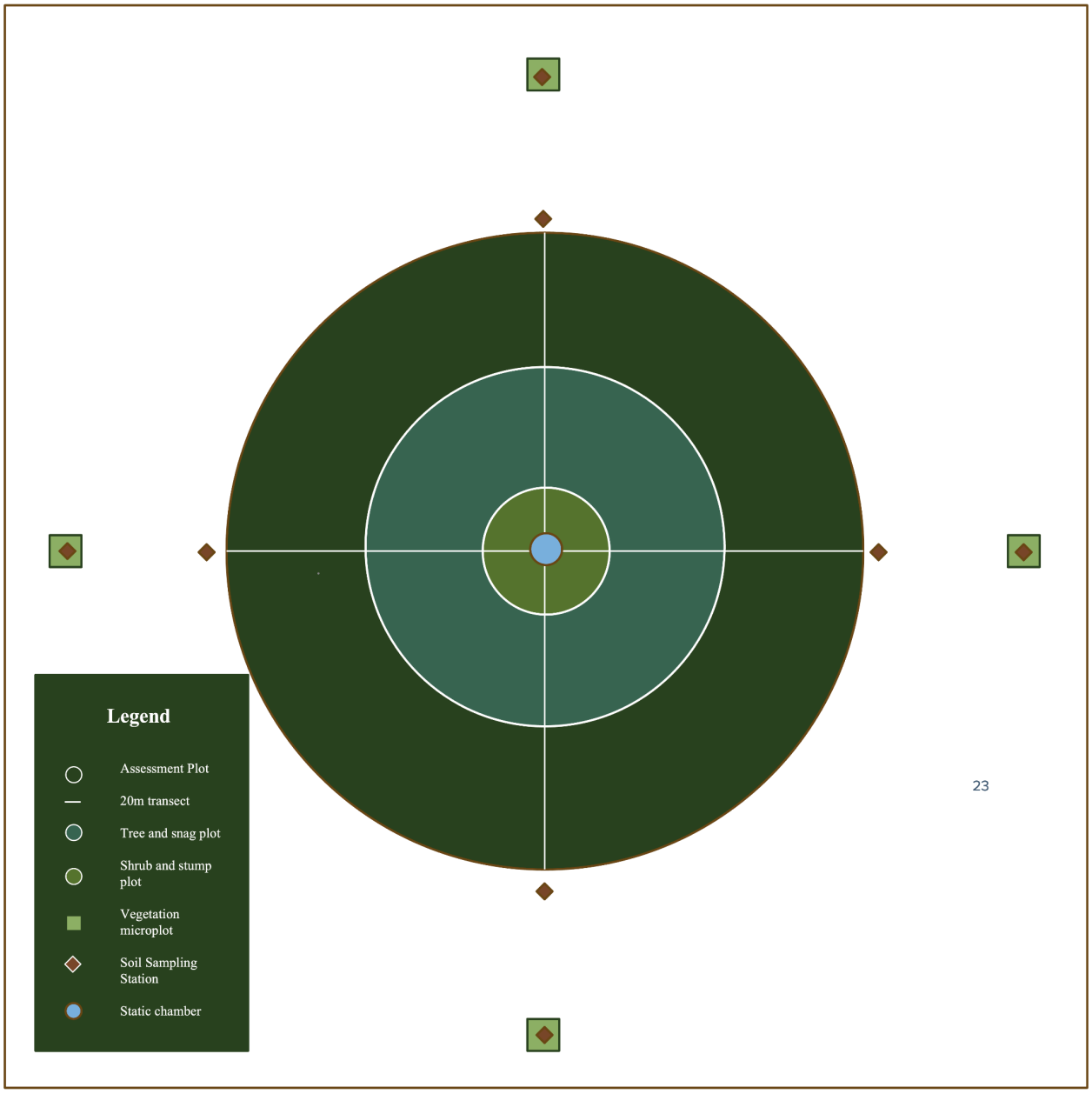


Figure 9. Original sample location design.

To assess ecological outcomes across these sites, a standardized sampling methodology was employed. Each site was stratified into two wetland types: marsh (emergent non-woody vegetation) and swamp (emergent woody vegetation). Five random sample points were selected within each type, totaling ten plots per site and forty plots overall. This stratified random design helped to mitigate bias while ensuring diverse community types were represented, regardless of

site heterogeneity. Above-ground biomass was estimated through a combination of remote sensing and ground surveys. RGB drone imagery was captured at peak growing season using a DJI Mini 2 flown at 120 meters with a 90-degree vantage point. These images are currently

being georeferenced and stitched into site mosaics, from which NDVI (Normalized Difference Vegetation Index) will be calculated using the standard formula (NIR – Red) / (NIR + Red), as recommended by the USGS. To validate these remotely sensed estimates, in situ biomass data were collected following Natural Resources Canada (2011) protocols. Each main assessment plot, centered on a randomly selected point, included two 20-meter perpendicular transects, a 3.99-meter radius plot for small trees and shrubs, an 11.28-meter radius plot for large trees and snags, and four 1m × 1m vegetation microplots placed along diagonal transects. Soil sampling and greenhouse gas flux monitoring, originally included in the research design, were ultimately excluded from the summer data collection plans due to resource constraints. Nevertheless, a detailed standard operating procedure for both methods was delivered to GCA for future use. Biodiversity surveys were successfully conducted during peak growing season between late June and early July. These surveys incorporated methods described by Stolgren et al. (2007) with principles of Wittacker's nested design (1960), modified to align with the existing biomass protocol and improve field efficiency. Within each sample location plot, species presence and abundance were recorded across ground vegetation, shrubs, and canopy layers. Bryophytes and lichens were included in these surveys, allowing for a fuller assessment of ecosystem diversity (Dengler, 2009). Data were cleaned and organized to facilitate statistical analysis of species richness and community composition across restoration stages.

This data will contribute to valuable insight into how human-led restoration—such as site decompaction and native planting—compares with passive, beaver-driven restoration. These findings will support the Galiano Conservancy Association in continuing this research to refine its restoration priorities and allocate resources more effectively. Over the course of the project, data were collected from 40 stratified sample locations across four wetlands, and biodiversity and above-ground biomass data were cleaned and prepared for statistical analysis. Although soil and GHG sampling could not be completed, foundational methods were developed and passed on to the GCA for future implementation. Together, these efforts not only advance academic understanding of wetland restoration in British Columbia but also provide practical tools to guide community-based conservation in the region.

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