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Effects of Tree Removal at Langley Bog

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Background

Langley Bog is a globally rare ecosystem containing some of the only undisturbed, protected bog habitat in the British Columbia Fraser lowland (Figure 1). It has three blue-listed plant communities and can support over 30 red and blue-listed animal species. Historically Langley Bog was an open wetland devoid of trees. Peat removal began in Langley Bog in the 1960s which resulted in tree establishment. Trees negatively impact bog environments in several ways: first, they create shade, which is correlated to a decline in sun-loving bog-specific species. Second, leaf litter accumulates in the bog, which as it breaks down, inputs nutrients into the ecosystem. Bogs are defined by their low nutrient availability, which has allowed for the evolution of specialist traits in plants such as carnivory. By inputting nutrients, bog specialists are outcompeted by more generalist species. Finally, trees are correlated with a lower water table, which allows bog soils to dry out. When bog soils dry out, they begin to decompose, releasing stored carbon and transitioning bogs from carbon sinks to carbon emitters. A lower water table also negatively impacts Fraser Valley sandhill cranes, that nest in Langley Bog. Predators such as coyotes have greater access to cranes and crane nests when they do not have to traverse water. The aim of this project was to enhance bog habitat by removing trees from a 2,100 m² area in the center of the bog.



Figure 1. Location of Langley Bog

Methods

A crew from Diamondhead Tree Removal felled trees from a 2,100 m² area in the center of the bog (Figure 2) in December 2023. The trees were removed from the site May 27-31, 2024. They removed primarily lodgepole pine (*Pinus contorta*), western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*) and paper birch (*Betula papyrifera*). Because decomposing trees left in the bog would input nutrients into the low-nutrient system, the crew removed all felled material from the site. Metro Vancouver Regional Parks (MVRP) staff collected water table measurements passively using a HOBO U20L water level logger already installed in a piezometer within the treatment area. The logger has been collecting water levels every 30 minutes. Volunteers collected percent cover of vegetation visually along a transect run through the center of the site on July 29, 2021 and July 27, 2024. The transect ran parallel to the east-west road, starting at 49°11'57.4" N 122°36'39.4" W and ending at 49°11'59.7" N 122°36'32.6" W. At 10 m intervals we estimated percent cover before and after treatment in a 1 m² quadrat. Percent cover was visually estimated for moss, forb, and shrub cover. Cover of wetland-obligate species (Table 1) were compared.



Figure 2. Work area in Langley Bog and photos of pre-restoration conditions

Scientific Name	Common Name
<i>Carex interior</i>	Inland sedge
<i>Carex utriculata</i>	Common beaked sedge
<i>Drosera rotundifolia</i>	Round-leaved sundew
<i>Eriophorum virginicum</i>	Cotton grass

Scientific Name	Common Name
<i>Kalmia microphylla</i>	Bog laurel
<i>Oxycoccus macrocarpus</i>	Large cranberry
<i>Rhododendron groenlandicum</i>	Labrador tea
<i>Rhynchospora alba</i>	White beak sedge
<i>Sphagnum angustifolium</i>	Yellow-green peat moss
<i>Sphagnum capillifolium</i>	Small red peat moss
<i>Sphagnum fuscum</i>	Rusty bog moss
<i>Sphagnum magellenicum</i>	Magellan's bog moss
<i>Sphagnum palustre</i>	Blunt-leaf bog moss

Table 1. Wetland obligate species found along transect in Langley Bog.

Results and Discussion

Vegetation

From 2021 to 2024, percent cover of wetland obligate species increased from 45% to 58% (Figure 3). The largest change came from an increase in cover of white beak sedge (Figure 4). This is an unexpected outcome because species growing in nutrient-poor bogs grow slowly, and the restoration caused some disturbance. This can be seen by the decline in Sphagnum moss and Labrador tea over the monitoring period. The increase in white beak sedge, cranberry, and bog laurel, can partially be explained by these species' ability to grow via rhizomes. Rhizomes are underground root stems that allow the plant to reproduce asexually and quickly take advantage of new environmental conditions. It is also possible that this change represents slight variations in where the transect was laid, or natural changes in vegetation across the site since we did not conduct percent cover at a control location. We recommend ongoing vegetation surveys to capture the change in moss cover that will likely take several years to capture in cover data.

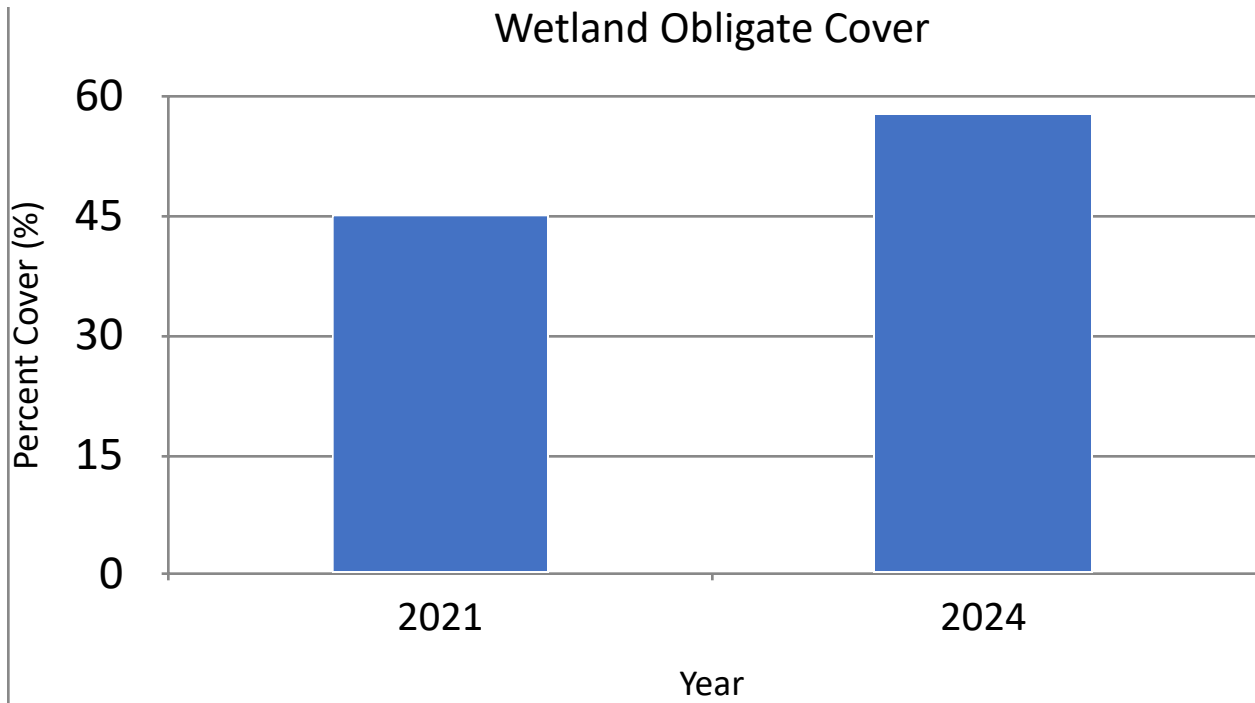


Figure 3. Change in percent cover of wetland obligate species at Langley Bog.

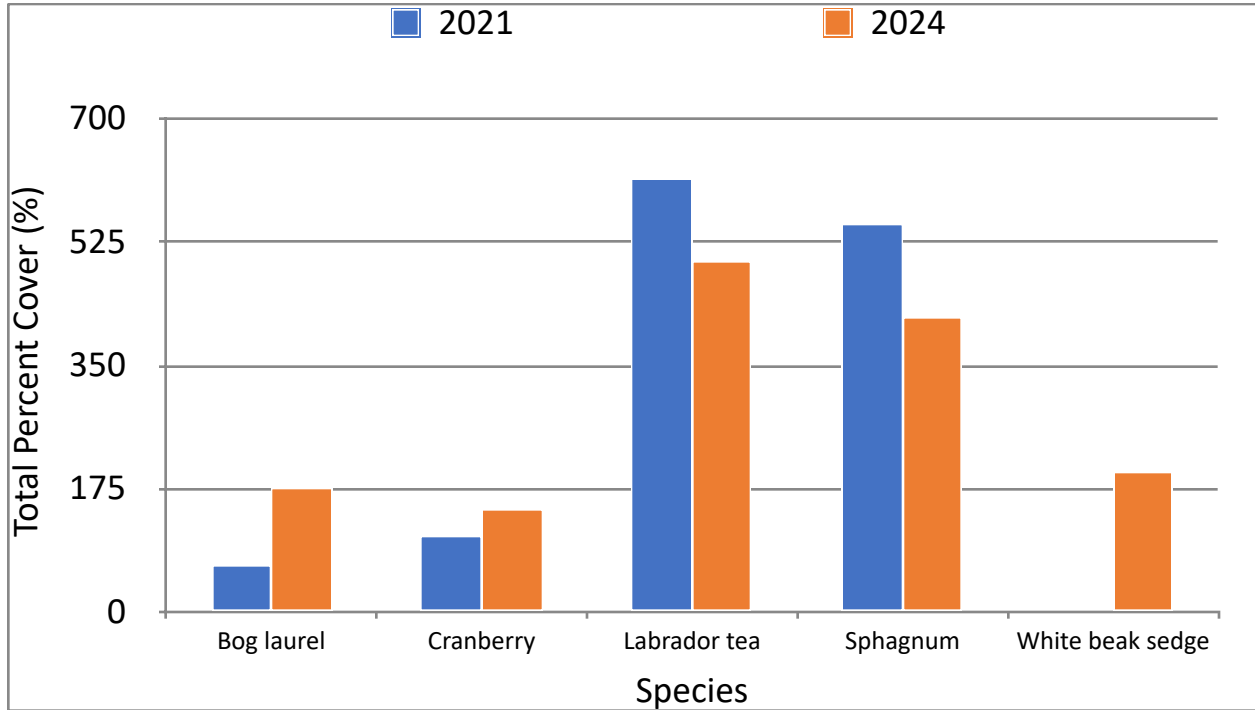


Figure 4. Change in species percent cover at Langley Bog.

Water Level

There was no significant changes in average water level depth between pre and post-restoration conditions (Figure 5). However both the restoration site and the control site (Figure 6) show a significant drop in water level in 2023 that is correlated with the high average temperatures and low average precipitation in Langley in 2023 (Figure 7). This same drop is not seen at the restoration site in 2024, after treatment. It is possible that the tree removal in the restoration area bolstered the site against a water level drop in 2024 as compared to the control. It is also possible the higher average precipitation in 2024 resulted in a higher water table.

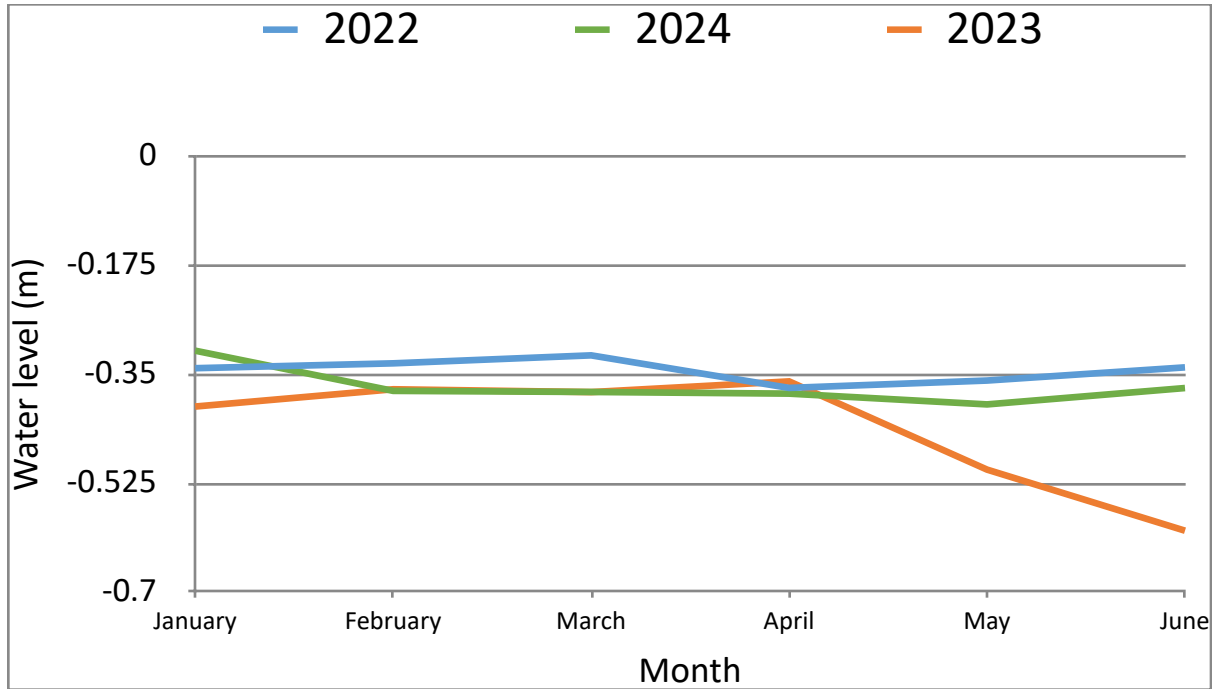


Figure 5. Average water level depth at restoration area in Langley Bog

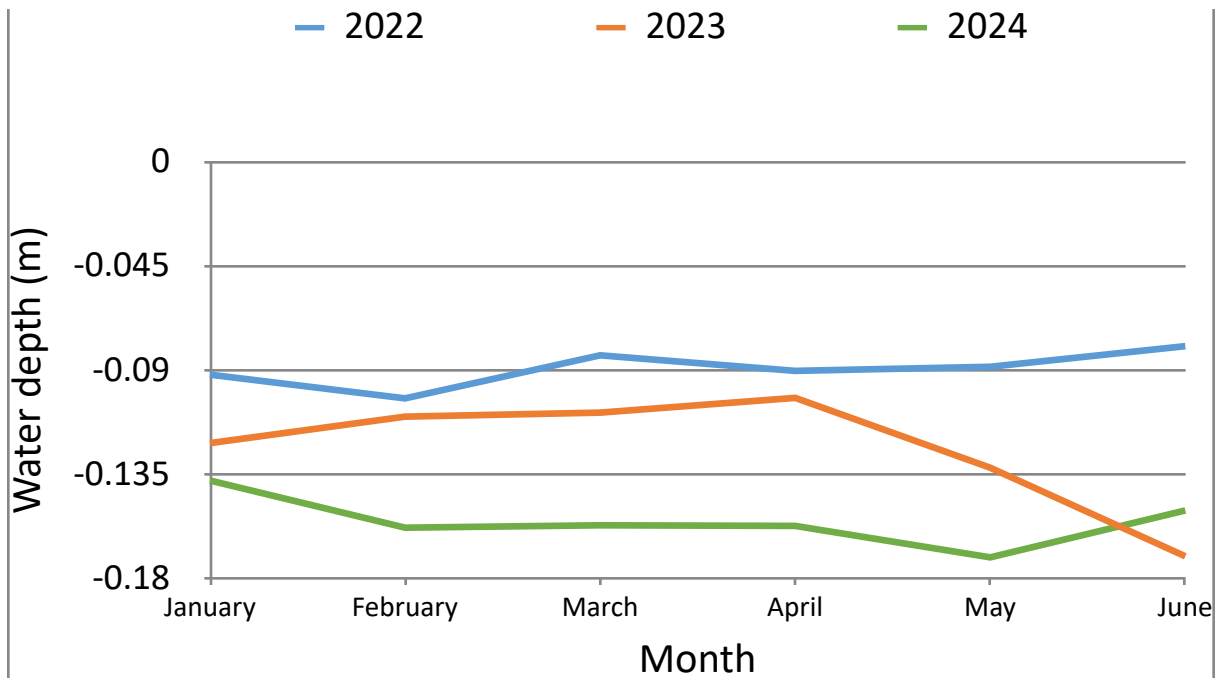


Figure 6. Average water level depth at control area in Langley Bog

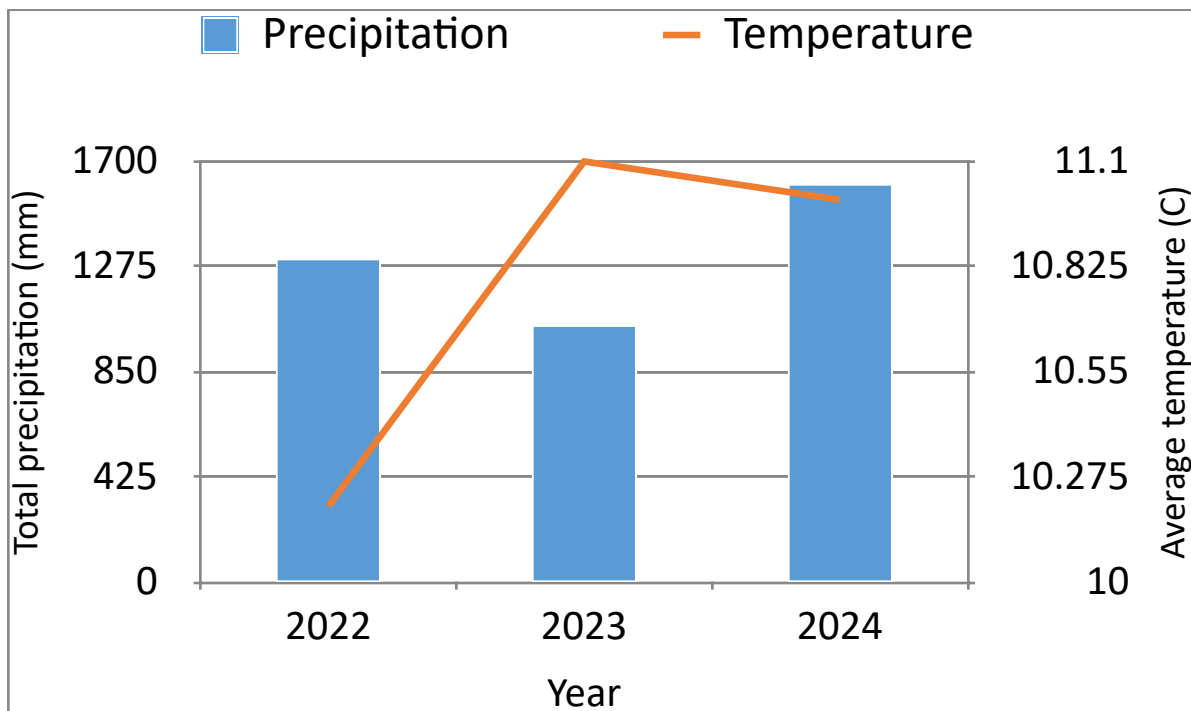


Figure 7. Total average precipitation and temperature in Langley, BC