

NATURAL DISTURBANCE:

Wetlands and Beavers

Beavers (*Castor spp.*) are **keystone species** and **ecosystem engineers** with significant impacts on wetlands, altering the ecosystem's function through tree cutting and dam construction.¹ Beavers play a transformative role in wetlands and wetland complexes, resulting in the creation of wetland habitats. Beavers can transform upland deciduous forests into wetlands in just a matter of years.² Beaver activities have wide-ranging effects, influencing organic wetland formation, hydrological dynamics, and wildfire resiliency at a landscape scale. **Beavers possess the remarkable capacity to construct, destroy, modify, and restore wetlands through damming streams.**²

While beaver activity can be beneficial for returning wetlands to the landscape and reducing fire risk, it can also cause challenges such as plugging culverts and affecting road performance or flooding merchantable forests. Understanding how beavers can naturally alter the landscape and how they can be used or directed to shape the landscape is important for ecosystem based management in the western boreal forest.



Beaver Activity: Creating Wetland Habitats

A common misconception is that open water is a prerequisite for beaver colonization.¹ Beavers can create ponds in organic wetlands by damming ground water and subsurface flows using disturbed vegetation.¹ This practice transforms landscapes by replacing deciduous stands and shrubs with herbaceous plants, essentially **reversing succession**.¹ The harvested vegetation is used to build dams, dens, and food caches.¹

Beaver ponds are temporary and follow a cycle of creation, abandonment, and eventual washout.¹ Once the food supply is depleted in an area, beavers will migrate and abandon their dams. The longevity of their impact differs between stream and organic wetland systems:

- In streams, the lack of maintenance to the dam often results in the dam washing away.
- In organic wetlands, the lasting impact of these dams is expected to be more significant because they cannot be easily washed away by surface flows.¹

Beavers are a natural disturbance with many benefits for ecosystem function; however, they can also cause significant challenges for land managers. Some of the wetland values created in beaver influenced landscapes may come at the expense of other values, with problems typically associated with tree cutting or flooding. For example, beavers routinely plug culverts leading to road performance and safety concerns, cause flooding of agricultural fields or merchantable timber stands, and can even interfere with septic systems.



Beaver Activity and Wetland Hydrology

Beaver dams exert a significant influence on wetland hydrology with the primary impact of a **heightened water table**, resulting in:

- Increased area and water storage,
- Expansion of the wetland's boundary, and
- Alteration of connectivity and flow.^{1,3}

Wetlands with beaver activity have more open water than those without any beaver activity.⁴ This is due to the diffusion of water flow by the dam, which causes greater water accumulation in the wetland. Changes in hydrologic connectivity can lead to the integration of wetlands with nearby streams. This transformation, can also divert water elsewhere on the landscape, enhancing subsurface hydrologic connectivity, regionally channeling water, and serving as a point for groundwater recharge.¹ **Beaver dams enhance the complexity of wetlands, fostering groundwater and surface water connectivity between smaller and larger wetlands in the landscape.³**

Beavers actively manage the water table to align with the crest of their dam, contributing to greater water table stability than anticipated in hydrologically dynamic wetlands like fens.¹ Consequently, fens affected by beaver activity maintain saturation throughout the growing season, deviating from the typical wetting and drying cycles.

Beaver effects on hydrology can be both positive and negative depending on the circumstances and the values that are considered. Flooding can have negative effects on areas where flooding is not desirable such as crops, residential areas, infrastructure, and harvest blocks.



BEAVER ACTIVITY AND CARBON

Beaver activity can significantly impact wetland carbon dynamics. Higher water tables created by beaver dams can alter vegetation composition, affecting the wetland's ability to sequester carbon. High water tables support increased carbon storage as they foster the thriving of peat-forming vegetation.

However, current climate predictions suggest a decline in water tables, resulting in drier conditions, which heightens the risk of ignition for this vegetation under dry circumstances.¹ Abandonment of dams may also result in a drop in water table, potentially drying out the wetland and increasing the risk of fire.



Beaver Activity and Vegetation

The presence of higher water tables due to beaver activity can lead to a shift in the vegetation community, which can have long-lasting impacts on wetland functions including hydrology and carbon storage and sequestration. The increase in water tables, contributes to increases in soil moisture and nutrient availability, notably nitrogen and phosphorus essential for plant growth.^{2,5}

Beaver dams may also modify stream sediment dynamics, reducing flow speeds and leading to sediment accumulation behind dams and on pond beds.² Sediment accumulation can facilitate the emergence of new riparian landforms.^{2,6,7} Over time, plant communities are replaced based on their ability to tolerate varying hydric conditions.^{2,8,9}

Beaver ponding has two main effects on vegetation:

- 1. A shift to terrestrial vegetation that is unique to beaver-influenced wetlands:** Because vegetation in wetlands is highly sensitive to water fluctuations, shifts in vegetation are unique to each system. Vegetation that does not thrive in wet soils will die off.¹
- 2. A shift from terrestrial to aquatic vegetation:** Mosses, shrubs, and other terrestrial plants die off and aquatic plants start to dominate.¹

Beavers' foraging behavior primarily focuses on the leaves and bark of deciduous trees and shrubs, often leaving much of the woody biomass they cut unconsumed. This practice serves important roles in forest health and diversity and the tree cutting can also stimulate vigorous sprouting and early growth in affected plants, ultimately influencing the ecosystem structure and dynamics.²

Beaver influenced changes to vegetation are not always desirable. Beavers can remove trees and other desired vegetation, particularly impacting rural and urban natural habitats where trees may be limited. As well, beaver influenced flooding can cause unwanted shifts in vegetation when crops or merchantable timber are affected. Taking a whole landscape approach to ecosystem based management requires considering the positive effects on some ecosystem values alongside the negative effects on others. In recent years, there has been an increasing understanding of the value that beaver bring to the boreal landscape.



Credit: Charles Erdman/Trout Unlimited

BEAVER ACTIVITY AND WILDFIRE RESILIENCE

Beaver dams are renowned for their ability to promote groundwater recharge and sustain green vegetation during droughts. Additionally, areas with beaver activity exhibit enhanced ecological resilience, but also provide fire-resistant riparian corridors.¹⁰ When fires burn through an area, these beaver-influenced areas remain verdant, offering temporary refuge to the diverse wildlife that inhabits them.¹⁰ Beavers could be an effective tool to explore as part of ecosystem based management and there is a growing body of research looking into their role in wildfire and carbon management.

Resources:

- [Working with Beavers](#)
- [Beaver Beneficial Managements Practices Interactive Decision Tree](#)
- [How Beavers Build Fire Resistant Landscapes](#)
- Karran (2018). *The Engineering of Peatland Form and Function by Beaver*. University of Saskatchewan, Saskatoon, Canada.
- Fairfax, E., & Whittle, A. (2021). Smokey the Beaver: Beaver-Dammed Riparian Corridors Stay Green During Wildfire Throughout the Western USA. *The Bulletin of the Ecological Society of America*, 102(1). <https://doi.org/10.1002/bes2.1795>
- Westbrook, C. J. (2020). Beaver as agents of plant disturbance. In *Plant Disturbance Ecology: The Process and the Response*. <https://doi.org/10.1016/B978-0-12-818813-2.00014-9>

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9. Donkor, N. T., & Fryxell, J. M. (2000). Lowland boreal forests characterization in Algonquin Provincial Park relative to beaver (*Castor canadensis*) foraging and edaphic factors. *Plant Ecology*, 148(1). <https://doi.org/10.1023/A:1009860512339>

10. Fairfax, E., & Whittle, A. (2021). Smokey the Beaver: Beaver-Dammed Riparian Corridors Stay Green During Wildfire Throughout the Western USA. *The Bulletin of the Ecological Society of America*, 102(1). <https://doi.org/10.1002/bes2.1795>

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