

WETLANDS ON THE LANDSCAPE:

Wetland Connectivity

The western boreal forest is a hydrological mosaic of lakes, streams, and wetlands interwoven within upland forests. Wetlands are an essential part of the boreal forest, **covering over 1 million km², or more than 35% of the land base.**¹ Within the boreal forest are over 200 million acres of freshwater resources, accounting for approximately 20% of the world's freshwater resources stored in lakes, reservoirs, soils, and groundwater.²

Functioning wetlands benefit upland forests by contributing to forest productivity and resiliency, mitigating the effects of upland harvest on water bodies, influencing wildfire behaviour and patterns, and mitigating the effects of climate change through carbon storage and sequestration. Sustainable forest management can support healthy wetland ecosystems, and healthy wetlands are crucial to sustaining productive upland forests. Due to the interconnectedness between wetlands and uplands, knowing how each system influences and interacts with the other is essential as industry activities may influence wetland hydrology with potentially far-reaching effects on connected wetlands and uplands. Understanding the primary factors influencing water movement can provide valuable information for a whole landscape approach to ecosystem-based management

Hydrological Connectivity between Wetlands and Uplands

Wetlands in the western boreal forest form highly interconnected systems with the ability to **transport significant amounts of water across the landscape.** Wetland hydrologic connectivity describes how wetlands facilitate the movement of surface and groundwater throughout the landscape. Wetlands can be hydrologically connected to other wetlands, creating **wetland complexes**, but can also be connected to uplands. Because of this connectivity, **wetlands act as important water sources during dry periods, and can buffer and slowly move large amounts of water during wet period, mitigating flood events.**³



Wetland hydrology influences uplands in three key ways:

- Discharging water to downstream ecosystems:** when the water table is high and the storage capacity of the wetland is full, wetlands will generate runoff with surplus water that will flow into downstream ecosystems, such as streams, lakes, or other open water wetlands.
- Groundwater recharge:** During dry periods (both seasonally and annually) wetlands will transmit water to uplands and other connected open water wetlands.
- Water storage:** During prolonged dry periods, wetlands will no longer transmit water, and will instead store water to maintain wetland processes.⁴

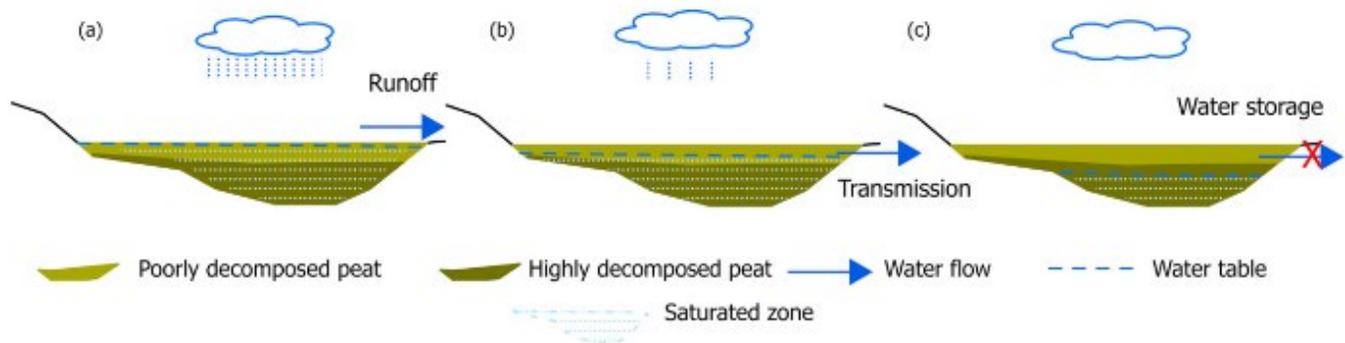


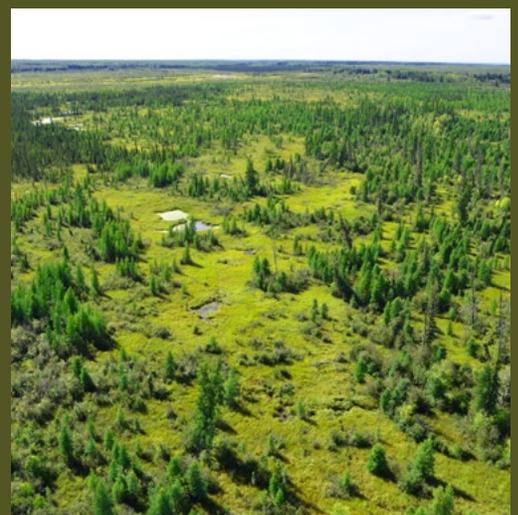
Figure 1. Model showing wetland function of an organic wetland system with respect to water table and peat decomposition degree, from Volik et al. (2023).

Upland forests and open water bodies act as sinks, **while vegetated wetlands with little or no standing water act as sources** that can contribute to increased forest productivity in upland habitats that may otherwise face water deficits.³ This relationship can increase upland forest productivity, influencing vegetation cover, growth, and yield.³

Different wetland classes (*Factsheet #3*) play different roles in water distribution. For example, fens, marshes, and shallow open waters can have surface inflow and outflow points which contribute water to wetland complexes, influencing water distribution on the landscape.⁶ Some fens and bogs also move groundwater through their soil profile instead of surface inflow and outflow points.⁶ Therefore, understanding **wetland classification** is critical for understanding the potential hydrologic connectivity of a specific wetland and for effective wetland management.

HYDROLOGICAL HOTSPOTS

Water table fluctuations can vary across a single wetland or wetland complex, resulting in different parts of the wetland or complex contributing in different ways to landscape hydrological dynamics. Central and deeper areas in a wetland are typically less hydrologically dynamic than the edges and transition zones. This stability is important in maintaining wetland function during dry periods. Areas that experience more dynamic water table fluctuations are considered hydrological hot spots, as hydrological and biogeochemical processes are heightened in these areas.⁴ Hotspots are typically the wetland's edges or transition zones, and are often classified as swamps. Despite being important hydrological and biogeochemical hotspots, swamps are the least understood of the five wetland classes.⁷



Forests regulate adjacent ecosystems' micro climatic and hydrologic conditions, including light, wind, temperature, and moisture conditions.⁸ Given the landscape mosaic of upland forests and wetlands prevalent across the western boreal forest, upland forest disturbance can affect adjacent or nearby wetland ecosystems.

Wetlands can also play an important role in mitigating the effects of upland forest disturbance. Wetlands are resilient ecosystems that have the ability to adapt to both disturbance and climate related stressors.⁹ For example, as documented in the Forest Watershed and Riparian Disturbance Project in west-central Alberta, intact wetlands can mitigate the effects of forest harvest on water yield and quality by reducing runoff and contributing positively to recovery.¹⁰ However, this mitigating role and resiliency may be dependent on climatic conditions and wetland abundance.

Wetland loss can affect wetland upland forest water quantity and quality in several ways:

- Reduce overall storage capacity of wetlands at a landscape scale, which can result in greater flow events, increased soil erosion, and flooding during wet periods.
- Diminish the ability of wetlands to support upland forests during dry periods.
- Reduce water quality as nutrients, such as nitrogen, phosphorous and dissolved organic carbon, that are typically filtered and stored by wetlands are now mobilized into the watershed.²

A wetland's potential to mitigate the effects of climate change (e.g., flooding, drought, fire) on adjacent upland systems is itself dependent on climatic conditions. This includes both short-term climate variation and long-term climate change (*Factsheet #7*). During wet or dry periods, there may be a limit to the mitigation potential of wetlands. For example, during dry periods, wetlands will only release water to surrounding forests to a certain extent to preserve the wetland's functions.⁴

The important relationships between wetlands and uplands can be impacted by both climate and land use changes. Understanding the connections and the effects of anthropogenic disturbances (*Section Two*) and natural disturbances (*Section Three*) on these connections is needed for a whole landscape approach to ecosystem based management. Activities that take place in upland forests can impact wetlands and vice versa.



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