

WETLANDS ON THE LANDSCAPE:

Wetland Classification

Wetlands are diverse, complex, highly interconnected systems. A whole landscape approach to ecosystem-based management in the western boreal forest requires understanding all parts of the landscape, including wetlands. Understanding what type of wetlands are present is the first step to conserving, managing, and restoring wetlands and their associated values. There is no single, legally recognized definition of the term 'wetland' that is used consistently across municipal, provincial, and federal jurisdictions in Canada. However, the Canadian Wetland Classification System¹ definition is widely used and the most applicable when working across multiple jurisdictions:

"... land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activity which are adapted to a wet environment..."



Canadian Wetland Classification

The Canadian Wetland Classification System is a standardized system that describes wetland characteristics and can be applied across all Canadian jurisdictions. Some provinces and territories have developed their own classification systems (e.g. the Alberta Wetland Classification System), but this is not consistent across the country. The Canadian Wetland Classification System divides wetlands into two categories: **Organic Wetlands** and **Mineral Wetlands**. Wetlands can be isolated or form intricate networks that stretch across the landscape. These connected systems, called wetland complexes, are especially prevalent in the western boreal forest.

ORGANIC WETLANDS

Organic wetlands are often referred to as peatlands or muskeg. Organic wetlands are peat-forming wetlands with peat layers **greater than 40cm**. This includes:

FEN

BOG

MINERAL WETLANDS

Mineral wetlands are wetlands that are non-peat forming and have peat layers **less than 40cm**, although some swamps occasionally have peat deposits greater than 40cm and are referred to as peat swamps. This includes:

SWAMP

MARSH

SHALLOW OPEN WATER



Organic Wetlands

Organic wetlands, often referred to as peatlands, are characterized by the presence of poorly decomposed organic soil deposits, called peat, that are typically greater than 40 centimeters in depth. These thick layers of organic soils often disguise the large amounts of water stored within the wetlands soils. Stable water tables and cooler temperatures in organic wetlands result in slow decomposition and the accumulation of carbon rich peat. Due to their thick layers of soils, organic wetlands can host plant communities such as shrubs and trees, which to the untrained eye can make them trickier to identify as wetlands. Vegetation in organic wetlands is often water-loving or has stunted growth, both of which are indicators of healthy wetland function.

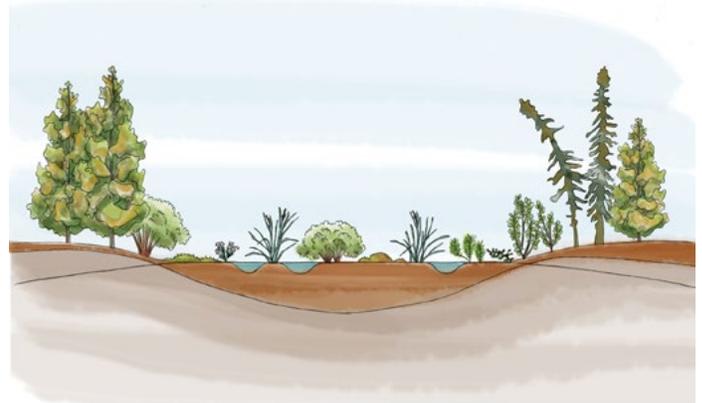
Bogs

- Isolated from groundwater and receive water through precipitation.
- Minimal water movement, rarely producing surface run-off. However, during wet periods bogs have the potential to move water and act as important water sources to adjacent wetlands and uplands.
- Nutrient poor due to their disconnected nature, resulting in highly acidic conditions and low, but unique, plant diversity.



Fens

- Receive water through a combination of precipitation, surface runoff, and groundwater sources.
- Gradual to moderate water movement, characterized by the presence of slow-moving or meandering channels. Able to move large amounts of water during wet periods and can act as important water sources to adjacent wetlands and uplands.
- Nutrient rich due to diverse water inputs, less acidic than bogs, with high plant diversity.



ORGANIC WETLANDS AND SOIL CARBON:

While only covering 3-5% of the earth's terrestrial surface, 30% of the earth's soil carbon pool is stored in organic wetlands (peatlands) globally.³ In North America, 85% of soil carbon is stored in peatlands, primarily in Canada, which contains one-third of the world's carbon-rich peatlands.^{4,5} Peatland soil carbon stocks exceed soil carbon in forest soils and agricultural soils combined. In the western boreal forest, approximately 60% of wetlands are peatlands, making these systems extremely important to conserve, manage, and restore.²



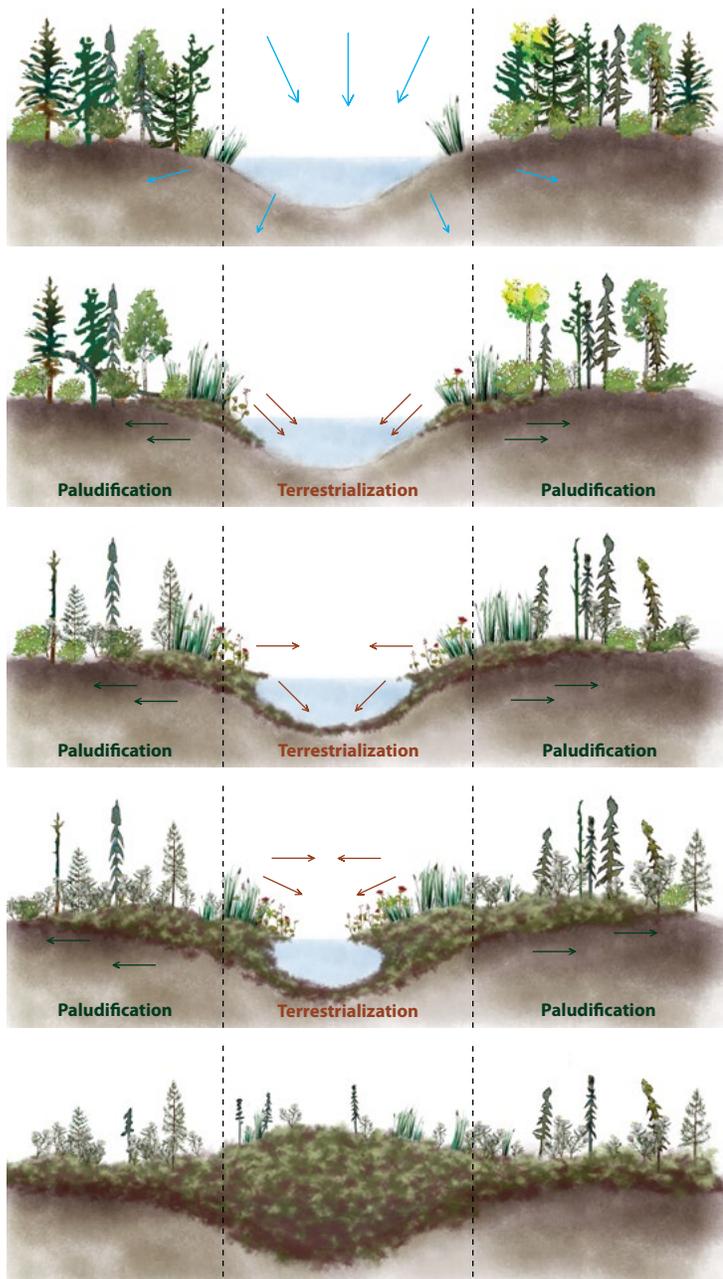
Organic Wetland Formation

Despite the relatively dry climatic conditions in the western boreal forest, up to **40% of the area is wetland**, predominantly organic wetlands. Organic wetland formation requires a **positive water balance** and a **stable water table** to establish *Sphagnum* mosses and enable peat accumulation, triggering one of two peatland formation processes:³

- **Terrestrialization:** The gradual filling of a shallow lake from the surface, with vegetation developing from the edges toward the middle.¹
- **Paludification:** Wetland vegetation blankets over terrestrial ecosystems and mineral soils, typically triggered by waterlogged soils due to natural or anthropogenic disturbance.⁴

Organic wetlands are successional ecosystems, meaning, that they transition from one form to another overtime through terrestrialization and paludification processes. As demonstrated in Figure 1, wetlands can transition from hydrologically connected, wet and open systems, such as fens, to hydrologically disconnected, dry, treed systems such as bogs.

Stages of Organic Wetland Formation



Water from rainfall, runoff, groundwater etc. is collected and retained in depressions. Mineral soils adjacent to these depressions become saturated.

Decaying organic matter begins to accumulate near the margins of the open water, and peat mosses begin forming in this area of high saturation. Less water-tolerant species such as white spruce (*Picea glauca*) begin to die back.

Because of the anoxic conditions in the water, organic matter continues to accumulate faster than it can decompose. As *Sphagnum* mosses spread, they further retain ground saturation and lower the pH, aiding in peat accumulation.

As the moss layer raises above the saturated ground layer, ericaceous shrubs as Labrador tea (*Rhododendron Groenlandicum*) and tamarack (*Picea glauca*) propagate in the hummocks, while water-loving plants form in the hollows.

Peat continues to accumulate over time, and may eventually form hydrologically disconnected or domed bogs. Trees growing in these areas are heavily stunted, and almost exclusively black spruce (*Picea mariana*).

Figure 1. Comparison of the terrestrialization and paludification processes of peatland formation.

Mineral Wetlands

Mineral wetlands typically have shallow organic soil deposits that are less than 40 centimeters, and underlain by mineral sand, silt, and clay. Water table fluctuations, warmer temperatures, or vegetation properties lead to higher decomposition rates, allowing vegetation litter to become incorporated into the mineral soil horizon or forming a highly decomposed, thin layer of organic soil.^{1,4} These wetlands support water loving and aquatic vegetation, and when trees and shrubs are present, they experience more vigorous growth than in organic wetlands due to more dynamic water tables throughout growing season. Mineral wetlands that have surface water present year-round differ from ponds and lakes in that their average depth throughout a growing season is 2 meters or less. In the western boreal forest, it is often that you find these systems along the edges of lakes and ponds, and even in transition areas between upland forests and organic wetlands.

Swamp

- Receive water through a combination of precipitation, surface runoff, and groundwater sources.
- Water movement can vary depending on swamp type and landscape position. They are commonly recognized as shoreline/riparian areas of rivers and lakes, experiencing dynamic water levels over the season.
- Highly diverse wetlands that are sometimes referred to as lowland forests, forested wetlands, and shrub swamps.
- Occasionally, have deeper organic soil deposits that are greater than 40 centimeters.



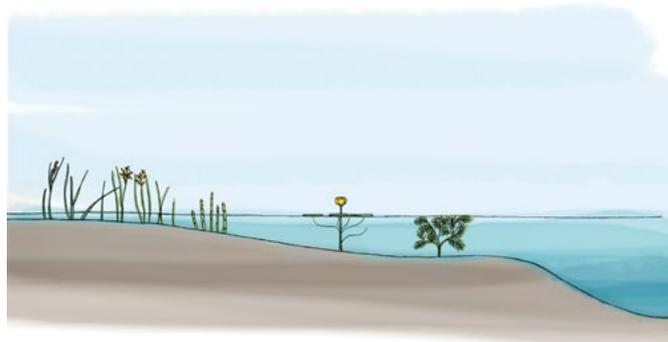
Marsh

- Receive water through a combination of precipitation, streams, and groundwater sources.
- Water levels in marshes fluctuate seasonally and are often transition zones between open water and shorelines.
- Dry out periodically, exposing soils to oxygen and resulting in a nutrient rich soil substrate.
- Supports the germination of water tolerant emergent plants (e.g., sedges, grasses, rushes, reeds, and cattail).



Shallow Open Water

- Receive water through a combination of precipitation, streams, and groundwater sources.
- Generally permanently flooded but water levels may fluctuate seasonally, resulting in exposed mudflats.
- Water depth is less than 2 meters with pond-lily or submerged aquatic vegetation.



Resources

Classification Systems:

- [National Wetlands Working Group 1997](#)
- [Wetland Classification of the Boreal Plains \(Enhanced Wetland Classification\)](#)
- [Alberta Wetland Classification System](#)

Field Guides:

- [Alberta Wetland Classification Field Guide](#)
- [Wetlands of British Columbia: A Guide to Identification](#)
- [Wetland Plants of British Columbia: Field Guide to Indicator Species for Wetland Classification](#)
- [Manitoba Prairie Wetland Classification Guide](#)
- [Field Guide to the Ecosites of Saskatchewan's provincial forests. Saskatchewan Ministry of Environment, Forest Service. Prince Albert, Saskatchewan. 343 pp](#)

Trainings:

- [Aquality Environmental Consulting - Alberta Wetlands: From Classification to Policy](#)
- [Tannas Conservation Services Ltd. Wetland Course](#)
- [Ducks Unlimited Canada - Wetlands 101: Boreal Wetland Classification and Identification](#)
- [University of Alberta - Wetland Delineation, Classification and Assessment](#)
- [University of British Columbia - Fundamentals of Wetland Delineation and Assessment](#)



1. National Wetlands Working Group. (1997). The Canadian Wetland Classification System, second edition. Wetland Research Centre, University of Waterloo, Waterloo, Ontario. <https://nawcc.wetlandnetwork.ca/Wetland%20Classification%201997.pdf>

2. Fissore, C., Giardina, C. P., Swanston, C. W. & King, G. (2009). Variable Temperature Sensitivity of Soil Organic Carbon in North American Forests. *Global Change Biology*, 15(9). https://www.researchgate.net/publication/44929892_Variable_Temperature_Sensitivity_of_Soil_Organic_Carbon_in_North_American_Forests (Zoltai and Martikainen, 1996)

3. Webster, K. L., Beall, F. D., Creed, I. F., & Kreuzweiser, D. P. (2015). Impacts and prognosis of natural resource development on water and wetlands in Canada's boreal zone. In *Environmental Reviews* (Vol. 23, Issue 1, pp. 78–131). National Research Council of Canada. <https://doi.org/10.1139/er-2014-0063>

4. Lavoie, M., Paré, D., Fenton, N., Groot, A., & Taylor, K. (2005). *Paludification and management of forested peatlands in Canada: A literature review*. In *Environmental Reviews* (Vol. 13, Issue 2, pp. 21–50). <https://doi.org/10.1139/a05-006>