Environmental Science

2024

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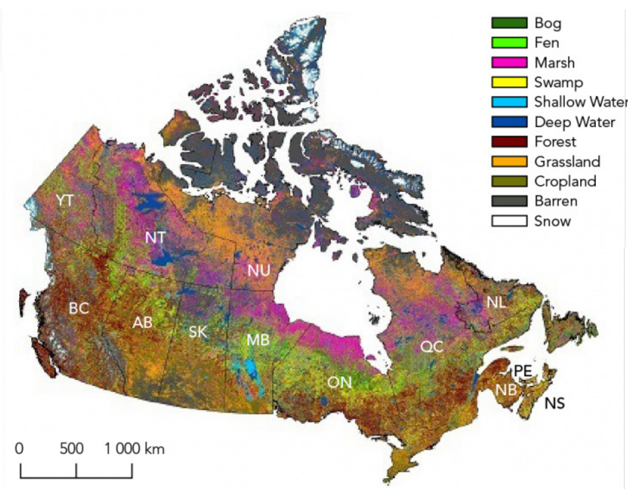
Introduction to Freshwater Wetlands

Wetlands

Wetlands are **habitats** that are either under water, or soaked with water part of the year. Freshwater wetlands include marshes, swamps, bogs and fens.

Geography

Canada has about 1.29 million km^2 of wetlands. This covers 13% of Canada's land. And this is about 25% of the wetlands in the world. 25% of Canada's wetlands are in the Boreal Shield. 21% are in the Hudson Plains. 18% are in the Boreal Plains.



First Canadian Wetland Inventory (CWI) Map Based on Canadian Wetland Classification System, 2019 (Source: Remote Sens. 2019, 11(7), 842; https://doi.org/10.3390/rs11070842).

> Did you know?
> Almost 80% of the Hudson Plains is wetland. The Hudson Plains curve around Hudson Bay and James Bay. They include land in eastern Manitoba, northern Ontario and western Quebec.

There were once many wetlands all over Canada. But over time, wetlands are becoming more rare. In southern Ontario, 68% of the original wetlands have been converted from their natural state. They are now used for things like agriculture and housing. In southwestern Manitoba, only about 25% of the original wetlands in the ‘Prairie Pothole’ region remain. The good news is that in the northern part of Canada, most of the wetlands are intact.

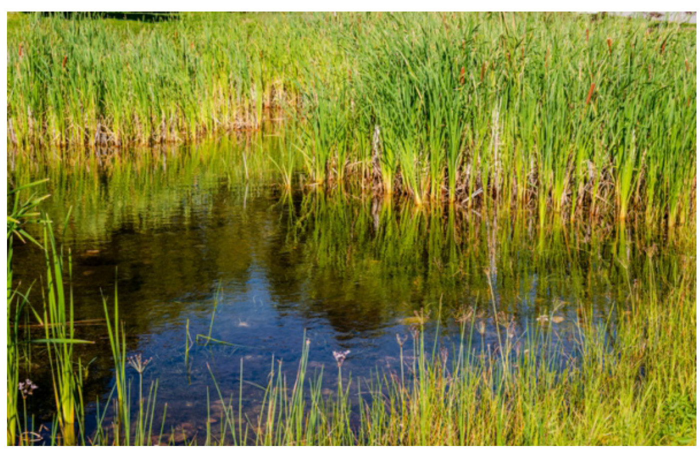
Chemistry

Just because an area is wet, doesn’t mean it’s a wetland. The amount of water in a wetland can change depending on **temperature** and **precipitation**. This means we need to look at other things to determine if an area is a wetland or not. One way is to examine the soil.

Wetlands have **hydric** soils. These are soils that formed in **saturated** conditions. Hydric soils are **anaerobic**. This means they contain very little **oxygen**.

The lack of oxygen means this soil has different colours and textures than **aerobic** soils. Aerobic soils have large amounts of a form of **iron (Fe)**. This makes it a yellow, orange or reddish colour. Anaerobic soils have a different form of iron. This gives them a grey colour.

Plants that grow in wetlands have special **adaptations**. These allow them to grow in low-oxygen conditions. **Cattails** and **bulrushes** have these adaptations. If you see cattails and bulrushes, this is a good indication that the area is a wetland.



Cattails and bulrushes in a wetland around a small pond (Source: Pito Fotos via iStockphoto).

Ecology

Wetlands are important to many animals. Some of these might be familiar to you.

Every drop of water contains microscopic phytoplankton and zooplankton. These are important parts of the food chain. **Phytoplankton** are microscopic **algae** that can create their own food. **Zooplankton** are microscopic animals that eat phytoplankton.

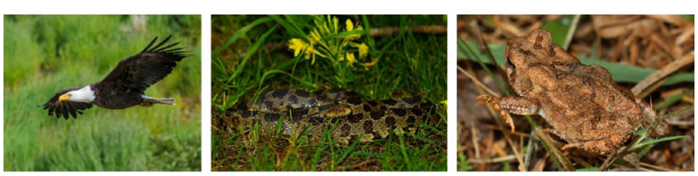
The surface of the water and the wetland bottom are covered with insect eggs, larvae, and nymphs. **Fish**, **amphibians**, and **reptiles** depend on the habitat provided by wetlands. Many bird and mammal species also use the water and the nearby shore. Let's look more closely at the different types of wetlands and some of the plants and animals found there.

Marshes

Marshes are permanently or regularly covered in standing or slow-moving water. Marshes are rich in **nutrients**.

They have many kinds of **emergent vegetation**. These are plants that grow up through the water. They include reeds, rushes, cattails and sedges. The roots of these plants are covered in water for most of the growing season. Marshes are the most **productive** type of wetlands. This means they produce more organic matter than other wetlands.

Marshes are home to many protected species. These include the Bald eagle, Sandhill crane, Eastern fox snake and Fowler's toad.



From left to right: Bald eagle, Eastern fox snake and Fowler's toad (Sources: David McGowen via iStockphoto, Peter Paplanus [CC-BY-SA] via Wikimedia Commons and Judy Gallagher via Wikimedia Commons).

Swamps

Unlike marshes, swamps have trees and shrubs. Swamps may be flooded seasonally, or for long periods of time. Like marshes, swamps are also nutrient-rich and productive.

Swamp plants include both coniferous, or cone-bearing trees and deciduous, or leaf-dropping trees. Swamps are most common in the southern part of Canada. Swamps are home to many protected species. These include the Eastern prairie fringed orchid, Loggerhead shrike, Red-shouldered hawk and Blanding's turtle.

From left to right: Loggerhead shrike, Eastern prairie fringed orchid and Blanding's turtle (Sources: Canon_Bob via iStockphoto, US Fish and Wildlife Service [public domain] via Wikimedia Commons and Wirepec via iStockphoto).

Bogs

Bogs are also called **peat bogs**. They are a kind of **peatland**. Peatlands are wetlands that contain peat. **Peat** is a build-up of partly-decayed plants. The top 30 to 50 cm of a peatland is made up of mosses and other living plants. Under that layer is the peat, which can be up to 10 metres deep!

> Did you know?
> In some parts of the world, dried peat is harvested as a source of fuel!

In a peatland, the peat acts like a giant sponge. This makes it hard for water to drain through it. Poor drainage and decaying plant material makes bogs very **acidic**. The water in bogs only comes from precipitation.

The high acidity and low oxygen in bogs makes it very difficult for plants to grow. This is why the biodiversity in peatlands is low.

The main kinds of vegetation in bogs are **sphagnum mosses**. Mosses are small, soft plants with small leaves. Mosses do not have roots. They absorb water through their leaves instead.

Shrubs like **heaths** can also be found in bogs. Heaths have adaptations for living in acidic soil. Other bog plants include cotton grass, cranberry, bog laurel, leatherleaf, blueberry and Labrador tea.

Left: Peat bog covered in sphagnum moss. Right: Scottish woman stacks peat slabs to dry as bricks to be used for fuel (Sources: Moorefam via iStockphoto and wanderluster via iStockphoto).

Carnivorous plants also live in bogs. These include plants like sundews, butterworts and pitcher plants. Carnivorous plants are interesting. They get some of the nutrients they need by catching and digesting small insects and spiders. They can do this by catching them in sticky liquid, or by trapping them in their leaves.

From left to right: Round-leaved sundew (drosera rotundifolia), Common butterwort (Pinguicula vulgaris) and Northern pitcher plant (Sarracenia purpurea) (Sources: Michel VIARD via iStockphoto, Jörg Hempel [CC-BY-SA] via Wikimedia Commons and Westhoff via iStockphoto).

> Did you know?
> Peatlands cover over 1.1 million square kilometres, or about 12 percent of Canada.

Bogs provide habitat for both migratory bird species and permanent residents. These include palm warblers, Lincoln's sparrows, tree swallows and northern harriers.

Some large mammals also live in bogs. These include moose, White-tailed Deer, Wood bison and caribou. Small mammals like Bog lemmings, Southern bog lemmings and Arctic shrews prefer bogs to other types of habitats.

Fens

Fens are also a type of peatland. Unlike bogs, **fens** are fed by surface water and groundwater. This means the soil there is less acidic.

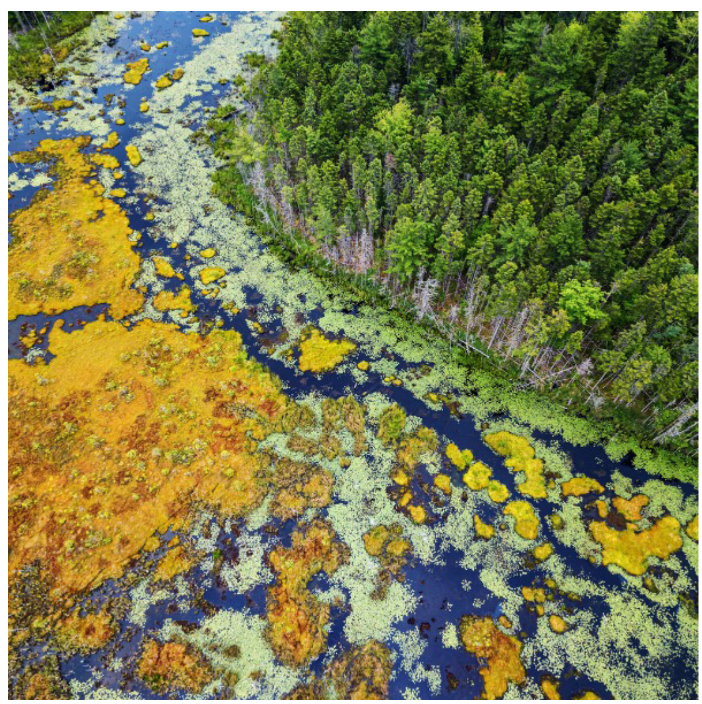
Fens are not as low in nutrients as bogs, so they are more productive.

The main kind of plant growing in fens are **sedges**. Trees like cedars, dwarf birches, black spruces, and tamarack can also grow here.

Left: Fen with sedges in the foreground and trees in the background. Right: Muskrat (Sources: Aaron Carlson [CC BY-SA 2.0] and Sebastián Saiter V. [CC BY-SA 4.0].

Fens are more common in the northern part of Canada. Birds found in fens include Virginia rails, yellow warblers and swamp sparrows. Mammals include water shrews, star-nosed moles and muskrats.

> Did you know?
> Peatlands are also called muskegs. This comes from the Cree word maskek and Ojibwe word mashkiig, meaning "grassy bog."



Aerial view of a wetland (shaunl, iStockphoto)

Introduction to Lakes & Ponds

The Earth is made up of many different **ecosystems**. The ecosystems on Earth can be divided into two groups. Ecosystems on land are called **terrestrial**. Ecosystems in water are called **aquatic**. The two main kinds of aquatic ecosystems are freshwater ecosystems and marine ecosystems.

Freshwater ecosystems can be further divided into lentic ecosystems and lotic ecosystems. This section of the handbook is about lentic ecosystems.

Lentic Ecosystems

Lentic ecosystems are in bodies of freshwater that do not flow. The word lentic comes from the Latin word ***lentus***. This means slow or motionless. Lentic ecosystems can be as small as a garden pond or as big as the Great Lakes.

> Did you know?
> The freshwater lake with the largest area in the world is Lake Michigan-Huron. Geologists define Lake Michigan and Lake Huron as one body of water. This is because they are linked by the Straits of Mackinac.

There is no technical difference between ponds and lakes. But scientists generally identify a **pond** as any water body with an area smaller than five hectares or 50 000 m^2. They identify a lake as a water body with an area larger than five hectares.

Geology

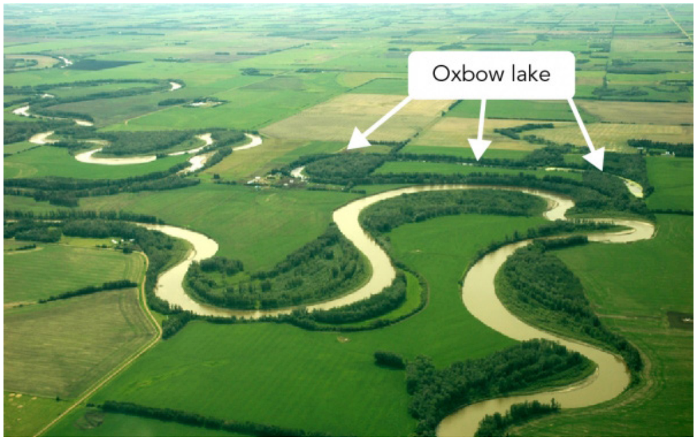
Lakes can be formed by a number of natural and artificial processes.

Huge sheets of ice called **glaciers** once covered almost all of Canada's land surface. As the glaciers moved they created valleys and depressions in Earth's surface. These filled with water when the ice melted.

This is how the Great Lakes, like Lake Michigan-Huron, were formed. Smaller lakes called **tarns** or **kettles** were also created this way. Many ponds and wetlands are also found on land that was once covered by glaciers.

In places where the land is low, meandering rivers often create **oxbow lakes**. This happens through a pattern of erosion and deposition. **Erosion** happens when rocks and soil are washed off the sides of rivers. **Deposition** happens when sediments like sand and silt build up in the river. These sediments can block the river. This causes a lake to form.

Satellite image of the Great Lakes on the left and garden pond on the right (Sources: SeaWiFS Project, NASA/Goddard Space Flight Center, and ORBIMAGE [public domain] via Wikimedia Commons and Cheva [public domain] via Wikimedia Commons).



Oxbow lake in northern Alberta (Source: Let's Talk Science using an image by wonganan via iStockphoto).

Humans create many smaller ponds and lakes. A **reservoir** is an artificial lake built to store water or to generate **hydroelectricity**. Its name comes from the French word réservoir. This means 'storehouse'.

One way to make a reservoir is to **dam** a river. To dam something means to stop the flow of water using a barrier. Another way to make a reservoir is to dig a big hole in the ground and fill it with water. This is called a **service reservoir.**

Farmers often build artificial ponds so animals have drinking water. People also build them as part of the landscaping around their homes.

Chemistry

The chemistry of a pond or lake depends on the land around it and the rock below it.

Lakes in **mountain valleys** are often low in **organic matter**. Organic matter comes from the breakdown of dead plants and animals. Lakes close to farms often have a lot of fertilizer and pesticides. **Fertilizers** are chemicals that help plants to grow. **Pesticides** are chemicals that kill weeds and insects that damage crops.

Lakes close to roads often have chemicals that come from things like motor oil and road salt. Cities can be a major contributor of chemicals to lakes. This is because **sewage treatment plants** release wastewater from homes and commercial or industrial buildings. Even though this wastewater has been treated, it can still contain harmful substances.

Fertilizers and sewage can upset the ecosystems of ponds and lakes. Fertilizers provide too much **nitrogen** and **phosphorus** to the **algae** living in ponds and lakes. This causes them to grow quickly and multiply. These algae then dominate the ecosystem, leaving little oxygen or sunlight for other species. This process is called **eutrophication**.

Ecology

Lakes and ponds have different ecological communities. This depends on their size, location and chemical characteristics. An **ecological community** is a group of plants and animals living in the same area.

Small ponds tend to have many phytoplankton and zooplankton. **Phytoplankton** are microscopic, free-floating plants. **Zooplankton** are microscopic, free-floating animals. The zooplankton feed on the phytoplankton and on each other in a tiny microscopic part of the **food web**. Small **invertebrates** also live in lakes and ponds. These might include insects like beetles or flies, worms, leeches or **crustaceans** like shrimp or crayfish.

A collection of invertebrates from a pond in Ottawa as seen through a microscope (©2011 Chris Hassall. Used with permission).

> Did you know?
> Many insects, such as mayflies and dragonflies, can spend years as aquatic larvae.

The invertebrates and crustaceans feed on the phytoplankton and zooplankton, as well as other plants. In larger bodies of water, there might be enough plants and animals to provide food for larger animals. These could be **fish**, **amphibians** like frogs, toads, newts or salamanders, **reptiles** like turtles or snakes, and **birds**. Only the largest lakes contain the largest animals. There needs to be enough food for them!

Large lakes are important for large plants and animals. But ponds often have a wide variety of species for their size. This is because there are many ponds scattered across the landscape. These contain many different habitats that suit lots of different species.

Some ponds are **acidic**. They have low pH. Others are alkaline. They have high pH. Some are deep while others are shallow. Some are rich in nutrients while others have few nutrients.

Smaller ponds and lakes can also act as stepping stones. This means species that need fresh water can move through different habitats in the landscape. This is especially important as species move because of climate change.

Finally, some ponds are small and not connected. So if there is a problem in one pond, like pollution, the damage will be limited. It will be contained in that pond, or maybe nearby ponds. But in a lake where all of the water is connected, damage can spread and affect many plants and animals.

Temporary ponds form in different ways. Sometimes it's when snow melts or rain falls in the spring and fills a depression in the earth. Or it could be something that forms after a heavy rain. Temporary ponds only last for a short time before the water dries up. But they are still home to a number of animals!

Fish don't usually live in temporary ponds. This is because they can't survive if the ponds dry out. Also, they also can't transport themselves to new ponds. But many smaller animals, like tadpoles and aquatic insects, thrive here without fish to eat them.

Some animals that live in temporary ponds have specific characteristics. These characteristics allow them to survive occasional, sometimes unpredictable, times of **low precipitation**.

One of these is the **water flea Daphnia**, which has **adapted to droughts**. Others, like dragonflies, can easily move between water bodies. So, they can establish themselves in ponds when they become filled with water, and find a new habitat when they dry up.

So, whether they are tiny or vast, lentic bodies of water are all incredibly important to biodiversity on Earth!

Landscape with temporary pond (Source: membio via iStockphoto).

Introduction to Rivers & Streams

Earth is made up of many different **ecosystems**. The ecosystems on Earth can be divided into two groups. Ecosystems on land are called terrestrial. Ecosystems in water are called aquatic. The two main kinds of aquatic ecosystems are freshwater ecosystems and marine ecosystems.

Freshwater ecosystems can further be divided into lentic ecosystems and lotic ecosystems. This part of the handbook is about lotic ecosystems.

Lotic Ecosystems

Lotic ecosystems are found in flowing bodies of freshwater. The word Lotic comes from the Latin word lotus which means '*washed*'. Lotic ecosystems can be as small as tiny springs and as large as rivers several kilometres wide.

Whatever their size, lotic bodies of water have something in common. They all flow in one direction. Water always flows from the **headwaters**, which are the source of the river or stream, to the **downstream terminus**, where the river or stream ends.

Did you know?
Scientifically speaking, all running water is a stream. Even the mighty Mackenzie River is just a big stream. In fact, there's a saying to describe the words we use for different sized streams. "You can step over a brook, jump over a creek, wade across a stream, and swim across a river."

Physical Geography

Streams are natural **watercourses**. They flow over the surface of land in **channels**. They also drain areas of land. The location, size and speed of a river is determined by several things. These include the availability of water, the size of the channel and the slope of the land. This is why the term **'river'** includes all kinds of watercourses. These range from the tiniest **creeks** to Canada's Mackenzie River. The Mackenzie River is the 10th longest river in the world!

Rivers shape the landscape around them. How they do this depends on the volume of water and the speed of its flow.

Fast-flowing water can **erode** rock, soil and organic matter. In some cases, a river can carve deep **valleys** into the rock around it. This often happens near a river's headwaters.

Slow-moving water can **deposit** materials like silt and dead plants into a river. This usually happens **downstream**, near the **mouth** of the river. The mouth of a river is where it joins up with a lake or an ocean. Deposits at the mouth of a river may create a landform called a **delta**.


Left: Sprout Creek. Right: Floatplane on the Mackenzie River (Sources: Public domain image by Juliancolton via Wikimedia Commons and Public domain image by David Adamec via Wikimedia Commons).

Horton River Delta in the Northwest Territories (Let’s Talk Science using an image by NASA Earth Observatory).

Rain, melted snow and **groundwater** all affect how much water flows in a river. The flow of a river can change a lot from season to season and year to year. In Canada, river levels are highest in the spring. This is when flooding happens more often. This is because snow melts but the soil is still frozen. It can’t absorb the extra water. Heavy rains can also cause high water levels and **flooding** in smaller rivers and streams.

In Canada, low river levels and flows often happen in late summer. This is when **precipitation** is low. Summer is also when water evaporates more easily and plants use more water. River levels are often low in winter as well. This is because they are covered in ice and precipitation is in the form of snow, not rain.

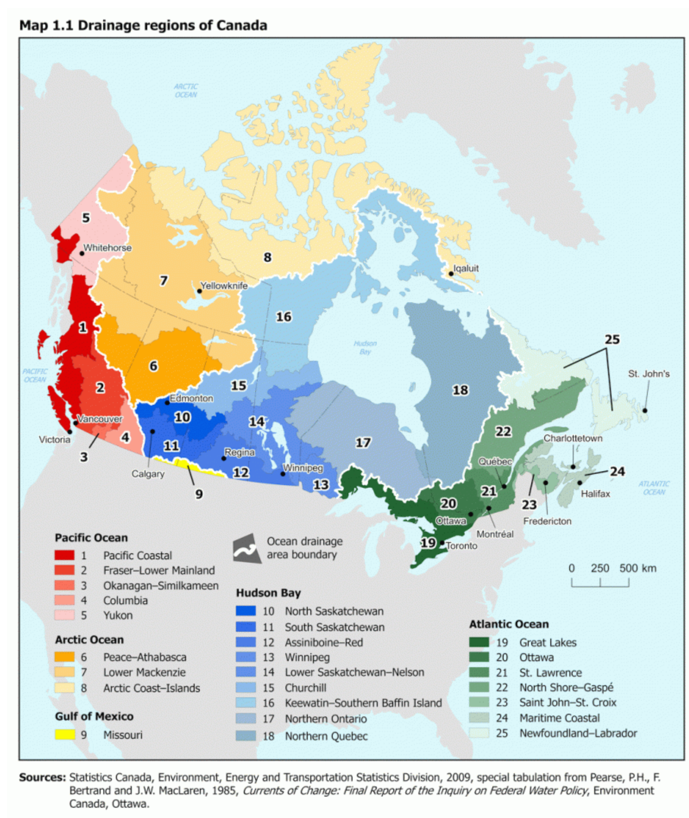
Drainage Patterns

The area of land that supplies water to a river is called a **watershed** or a **drainage basin**. This water may come from rain, melted snow and ice, or groundwater. One river's watershed is separated from the watersheds of neighbouring rivers by higher lands called **drainage divides** or **watershed divides**.

Small drainage basins supply water to streams. The drainage basins of several streams often combine to make up the drainage basin of a river. The drainage basins of several rivers combine to make up **regional watersheds**.

The drainage basin of the Saskatchewan River (Source: Karl Musser [CC-BY-SA] via Wikimedia Commons).

These in turn join other regional watersheds to form **continental watersheds**. These are also known as **ocean watersheds**. Rivers in Canada are part of five continental watersheds. The rivers in each continental watershed flow into a different ocean, or another body of saltwater. Rivers in Canada flow into the Pacific Ocean, the Arctic Ocean, the Atlantic Ocean, Hudson Bay or Gulf of Mexico.



Drainage regions of Canada (Source: Statistics Canada).

> Did you know?
> The drainage divide between two continental watersheds is also called a continental divide. These are often marked by road signs. Have you ever seen one of these?

Measuring River Flow

In the spring you might hear an announcement like "Bear Creek is expected to crest later today at 6.3 metres." The 6.3 metres the announcer is referring to is called the **stream stage**.

Stream stage is the height of the water surface above an established mark which is considered to be zero. The zero level is often close to the stream bottom. The stream stage can be read off a tool called a **stream gauge**. It can also be recorded electronically by sensors placed in the stream. These send information about the stream stage to a data centre.

Stream stage is important because it can be used to calculate stream flow or **discharge**. Stream discharge is the **volume** of water flowing over a point in the stream, over a certain period of time. This is often measured in cubic metres per second (m^3/s).

Stream gauge (©2002 Derrick Beach, Fisheries and Oceans Canada. Used with permission.).

Discharge and water levels are important. Scientists can use them to manage water resources properly. Here are some of the ways scientists use this information.

- To reduce damage from floods. Scientists can map **floodplains**. Floodplains are areas near rivers which often flood. They can also create canals to move flood water away from areas they want to protect.
- To design and build structures near rivers. These include bridges, roads and culverts. A **culvert** is a tunnel that allows water to pass under a road.
- To plan and run environmental programs. This could be related to water quality, fisheries and wildlife habitats.
- To make sure that water resources in Canada are developed in a way that conserves and protects the environment.

Chemistry

Every river has some dissolved minerals. All water has minerals like **sodium**, **chloride**, **calcium**, **magnesium** and **potassium**. But how do they get into rivers?

Dust, volcanic gases and natural gases like carbon dioxide, oxygen and nitrogen can combine with water in rain. When toxic materials like **sulphur dioxide** and **lead** are in the air, they also become part of rain. When rain reaches the Earth's surface, it flows over and through the soil and rocks. This is called **surface runoff**.

Scientist measuring water quality (Source: damircudic via iStockphoto).

As surface runoff flows over land, it can dissolve and pick up materials. If the soil has a lot of limestone, the surface runoff will have a lot of calcium carbonate. This is because limestone is made of calcium carbonate. And calcium carbonate can dissolve in water.

In the Canadian Shield, there are large areas without much soil. These areas don't have many minerals that dissolve in water either. Because of this, the rivers and lakes in these areas have very low amounts of minerals.

Ecology

Many plants and animals live in or near rivers. Some species are only found in lotic habitats. Some insect species have developed **adaptations** so they can fight against high currents.

This is the case for blackflies. Blackfly larvae attach themselves to rocks on the river bed. Their mouthparts form a fan shape. They put this into the current to catch microscopic plants and animals to eat.

Black flies attacking a canoeist on the Dubawnt River, Nunavut (Source: NicolasPerrault [public domain] via Wikimedia Commons).

You may have seen salmon swim up rivers. This happens during their **spawning** season, when they need to lay their eggs. Salmon live most of their lives in the sea. But they always return to the river where they were born. So it's important to conserve rivers to make sure salmon survive. Sometimes, when a river is blocked by a dam, people build **fish ladders** to allow salmon to pass over it.

Scientists use many different kinds of organisms to measure the quality of water. These include invertebrates, algae, zooplankton, fish and aquatic macrophytes. Healthy streams have a varied, healthy population of these organisms. If there are not enough organisms, or not enough variety, scientists become concerned.

Benthic invertebrates are a group of bottom-dwelling aquatic animals that don't have backbones. They live all or most of their lives in the same body of water. And some of them can adapt to pollution. So, if scientists find that a stream only has invertebrates that have adapted to pollution, it could be unhealthy.

Aquatic macrophytes are large plants that grow in or near water. These include **cattails**, **bulrushes** and **pondweeds**. If scientists find there are not enough macrophytes in a stream, it could be a sign of low water quality. If there are too many macrophytes, it could be a sign of too many nutrients in the water.

Sampling benthic invertebrates (Image ©2002 Derrick Beach, Fisheries and Oceans Canada. Used with permission.).

Humans and Freshwater Ecosystems

Freshwater Ecosystems in Canada

Freshwater ecosystems play an important role in Canada.

Rivers, Lakes and Ponds

In the past, people used rivers and lakes for travel. They also used them to trade furs, harvest fish and transport logs. Rivers are still an important way to move things to international markets. They are also a source of hydroelectricity.

Des Chats Falls. Currier & Ives lithograph c.1900 (Source: United States Library of Congress's Prints and Photographs division under the digital ID pga.08656. Via Wikimedia Commons).

Lakes and ponds can also help to reduce **flooding** in towns and cities. A flood is when excess water covers land that is usually dry. Flooding can be a problem in places where there are a lot of roads and buildings. This is because water can't pass through these things. It goes over or around them instead.

Rivers and ponds can also bring wildlife into urban places that don't have many parks or green spaces. Scientists have proven that being close to nature can improve your well-being.

Deer Lake Park in the city of Burnaby, British Columbia (Source: Alex_533 via iStockphoto).

Plants living in bodies of water can collect carbon from the **atmosphere**. The term for this process is **carbon sequestration**. Plants take in carbon dioxide from the air. Then they use it to make the sugars they need for energy in a process called **photosynthesis**. When the plants die, they sink to the bottom of the water. This stores away the carbon they absorbed. Carbon sequestration is how ponds reduce **greenhouse gases** that contribute to climate change.

Many people use lakes and rivers for boating, swimming and fishing. Tourists come from around the world to enjoy them as well.

Wetlands

In the past, people often thought wetlands were useless land. People caused many direct impacts on wetlands. These include **dredging** wetlands to create harbours for ships and draining wetlands to build farms and cities.

Humans have also caused indirect impacts on wetlands. They have introduced **invasive species**. These are plants and animals that are not native to the area. Invasive species can outcompete native species for food and habitat. This sudden change can have a negative effect. It can harm other species in the food web and the wetland ecosystem.

Scientists now have a better understanding of wetlands. They know they are important water reserves. Most of the water we use every day comes from water stored underneath wetlands. They know wetlands also act as filters. They remove suspended particles, fertilizers and toxic pollutants from the water. They know that wetlands can act like giant sponges during floods, absorbing extra water. Finally, wetlands are a unique ecosystem. They supply food and **spawning** areas for many types of animals.

Freshwater Ecosystems and Water Quality

Water quality is the chemical content, physical characteristics and biological nature of water. It can include many measurements. Temperature is one. Concentration of substances, like dissolved oxygen or heavy metals, is another. And the number and kinds of microorganisms is another. Water quality can change for many reasons. Some changes are natural. Human activities cause others.

Water from rain and melted snow runs across the land towards lakes and rivers. The term for this water is **surface runoff**.

Surface runoff is a major source of water pollution. It can pick up many things along the way. Runoff in cities and towns picks up litter and organic matter from the streets. It can also pick up things like salt, sand, gasoline and motor oil and carry them into storm drains. And all these materials end up in aquatic ecosystems.

Litter and other debris at a street runoff drain (Source: carlosrojas20 via iStockphoto).

Surface runoff can also contain things like pesticides. People use these chemicals on lawns, gardens and golf courses to kill unwanted plants and animals. These chemicals are as harmful in water as they are on land.

Fertilizers have nutrients that plants need. These include **phosphates** and **nitrates**. But when fertilizers get into a body of water, they can cause algae there to grow quickly. When these algae die, **microorganisms** break them down. Microorganisms use oxygen to do this. This means there is less oxygen in the water. Low oxygen levels can cause fish and invertebrates to die. This term for this process is **eutrophication**.

Applying fertilizer pellets on a lawn (Source: BanksPhotos via iStockphoto).

Laundry detergents often contain phosphates. These make detergents work better, but they can get washed into aquatic ecosystems. This also causes eutrophication. Farming, mining and industrial activities also affect water quality.

Farming

Runoff from farmland can contain pesticides, fertilizers and animal waste. It can also have small rock particles. These are from the **erosion** of soil in farm fields. Animal waste can contain **fecal coliforms**. This is a group of bacteria and other harmful microorganisms.

Mining

There are four main ways mining affects water quality.

1. **Acid Mine Drainage.** This happens when water and oxygen react with rocks that contain **sulphide**-bearing minerals. This produces **sulphuric acid**. Surface runoff moves this acidic water from mines into rivers and lakes. This can change the **acidity**, or **pH**, of the water.

2. **Heavy Metal Pollution**. This happens when mined rock containing metals comes into contact with water. These metals could include arsenic, cobalt, copper, cadmium, lead, silver and zinc. Surface runoff can carry these metals into bodies of water.
3. **Processing Chemicals Pollution**. This happens when the chemicals used to separate minerals from ore in the mine, spill or leak into nearby bodies of water. These chemicals can be toxic to people and wildlife.

Aerial view of the mining industry near Sechelt Inlet, British Columbia. Note the colour of the water in the water by the mine versus the water in the river (Source: edb3_16 via iStockphoto).

4. **Erosion and Deposition**. Mining can cause the erosion of large amounts of rock and soil. These eroded materials can clog rivers and streams and harm vegetation, habitats and organisms.

Industrial Activities

Industrial waste is waste made by manufacturing and other industries. It includes things like garbage, scrap metal, gravel, grass clippings and chemicals. Industrial waste can be solid or liquid. Liquid waste like cleaning fluids, paints, dyes and solvents contributes to water pollution. Sometimes this waste is pumped into lakes and rivers. Sometimes it leaks out of storage containers. Industrial waste can harm aquatic ecosystems. It can make water unusable, now or in the future.

Conservation

Many living things depend on freshwater ecosystems. Many people recognize the value of lakes, rivers and wetlands. Governments are writing laws and regulations to protect freshwater ecosystems. People are also making efforts to restore and preserve these ecosystems.

Conservation includes **rehabilitating** or **restoring** areas to health. Rehabilitation can include re-establishing natural water levels. It can also include controlling invasive species and removing contaminated sediments. It also includes purchasing or securing land with important habitats.

Here are some things you may be able to do to keep these ecosystems healthy. These steps will help improve water quality and the environment.

- Don't rinse bits of food down the drain. **Compost** them instead.
- Don't flush garbage down the toilet. Put it in the garbage can.
- Use cleaning products that are low in phosphorus. These can cause less eutrophication.
- Don't use chemical herbicides or pesticides. Pick weeds by hand.
- Don't pour paints or chemicals down the drain. Bring them to a liquid waste collection centre.
- If you're out on a boat, don't throw garbage overboard. Keep it until you get to shore and dispose of it properly.

Many organizations are working to conserve Canada's aquatic ecosystems. One way you could help is through a local shoreline clean up. Or you could contact local environmental groups for other ideas.

Peat Bogs and the Ring of Fire

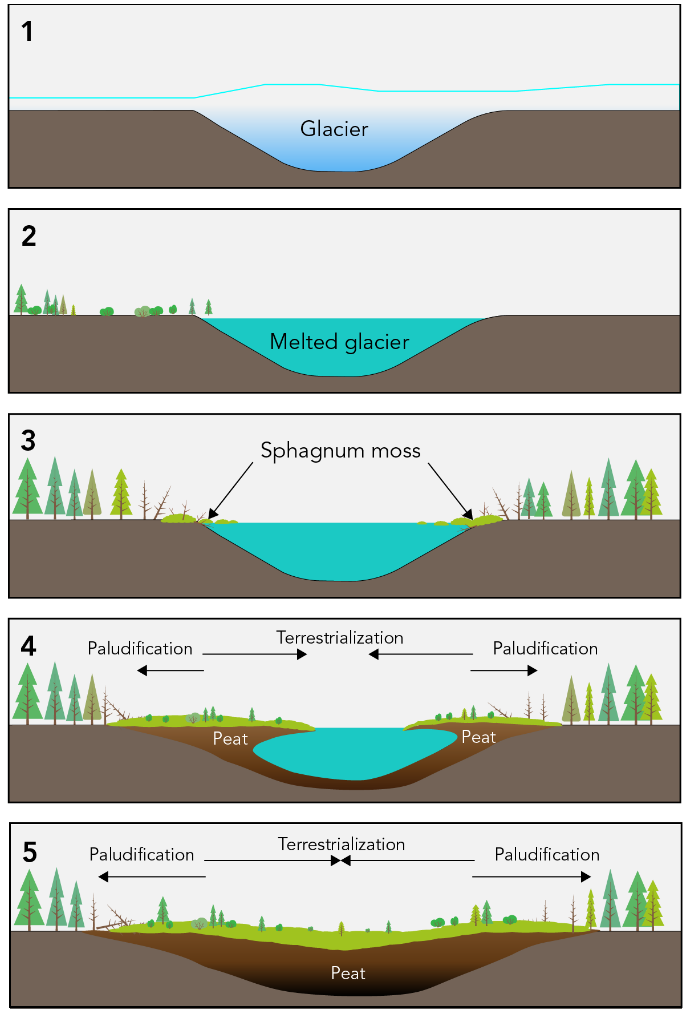
Think of an **ecosystem** you know. Did you think of peat bogs? Probably not! This ecosystem may not be the first one you think of, but it is incredibly important for many reasons. It is also at risk. Peat bogs are rapidly changing due to climate change and human activities. This change is already impacting the plants, animals and people who depend on peat bogs. By learning about this ecosystem, we can all help protect it.

Peat bog at the Lac de la Tourbière, La Mauricie National Park, Québec (Source: Cephas [CC BY-SA 3.0] via Wikimedia Commons).

What are peat bogs?

Peat bogs are a type of **freshwater wetland**. They form in places where water pools and does not drain. This includes old river valleys, coastal areas and the depressions in land caused by the retreat of **glaciers**.

Peat bogs form when plants grow, then die around the body of water. As the plants die, decaying plant matter accumulates over thousands of years. This increase in organic plant matter over time is called **paludification**. New plants move in to grow on the organic matter. These slowly fill in the lake.This process is called **terrestrialization**.



Steps in the formation of a peat bog (©2023 Let's Talk Science).

Peat bogs are different from other wetlands because they are very **acidic**. This is caused by two factors. One is the breakdown of the organic matter, which produces organic acids.
The second is poor drainage. This prevents less acidic water from moving through the bog and raising its **pH**.

Bogs are found all over the world. Generally they are found in cooler, northern areas. In Canada, there are major bogs in different regions across the country. In Northern Ontario, there is an extensive network of peat bogs in the Hudson Bay lowlands. In Quebec, there is a system of peat bogs in the St. Lawrence Valley. Bogs are also common in Alberta's **boreal** region. These are just a few of the many bogs across Canada.

Did you know?
Bog snorkelling is a competitive sport! Snorkelers must swim back to back 55 metre lengths in a water-filled trench that has been cut through a peat bog. They must do this using only the power of their flippers! Whoever completes the lengths the fastest wins the title of bog snorkeller champion!

Bogs are full of life! The most widespread plant in bogs is **sphagnum**. This is a type of **moss**. There are over 380 known **species** of sphagnum.

People often call sphagnum moss **peat moss**. But these two names do not mean the same thing. Living sphagnum moss grows on the surface of the bog. Below this layer is dead and decaying sphagnum moss. This layer is called peat moss. If you walk on peat moss it feels squishy and wet.

Sphagnum moss in northern Ontario (Source: Ryan Hodnett [CC BY-SA 4.0] via Wikimedia Commons).

Peat is different from peat moss and sphagnum. **Peat** is a brown soil-like material. It is made of partly decayed moss and other plants. Plants decay slowly in peat bogs because they are always under water and never exposed to air. Scientists call this type of environment **anaerobic**.

Peat (Source: Public domain image via Wikimedia Commons).

Did you know?
Histosol is the term for a type of soil that is mainly made of peat.

As well as sphagnum, bogs have other plants, like **sedges** and **heather**. Some trees can grow in bogs as long as their roots are not wet all the time. These include **bog willow**, **black spruce**, **tamarack**, and **grey** and **white birch**.

Purple heather flowers in bloom (Source: Eimar Kranendonk / 500px via Getty Images).

Did you know?
Lots of the berries people eat grow in bogs. These include cranberries, blueberries, and huckleberries.

Insects, including **spiders**, **moths**, **butterflies**, **beetles**, and **bees**, thrive in bogs. They eat a variety of things, including plants, fungi, pollen, and insects. Both reptiles and amphibians live in bogs. These include **snakes**, **salamanders**, **frogs**, and **toads**. Their diets range from tadpoles, small fish, and insects to various other small creatures.

The **Northwestern Salamander** is commonly found along Canada's western coastline. These **amphibians** can grow to 26 cm. That's big for a salamander! In some wetlands, fish eat salamanders. But fish cannot live in bogs. This makes them ideal habitats for salamanders. Bogs provide a habitat for a variety of mammals, like **beavers**, **deer**, and **moles**. They are also a habitat for birds, like **sparrows**, **warblers** and **rails**. Have you ever been near water and heard a honking sound that reminded you of a pterodactyl? It's quite possible you were hearing a Blue Heron! These birds often use bogs as both a feeding and nesting area.

Northwestern Salamander (Source: andrewnydam [CC BY 4.0] via Wikimedia Commons).

> Did you know?
> Bogs are sometimes called muskegs. The word muskeg comes from the Cree word “maskek” and the Ojibwe word “mashkiig”, meaning “grassy bog”.

Peat Bogs and Ecology

Bogs play a crucial ecological role by storing and filtering water. The moss-covered surface soaks up water like a sponge. The dense sphagnum moss, along with various other water-absorbing plants, acts like a natural filter. They trap **sediment** and absorb pollutants. Also, the acidic conditions in bogs help break down organic matter, further purifying the water. These processes contribute to the health of the surrounding environment. Bogs also help prevent flooding and absorb excess runoff during rainy seasons.

Peat Bogs and Climate Change

Carbon dioxide is one of the main **greenhouse gases** involved in **climate change**. Bogs are **carbon sinks**. This means they store large amounts of carbon through a process called **carbon sequestration**. This is when carbon is removed from the air and stored in some way. In bogs, carbon is stored in the peat. As plants slowly form peat, the carbon they have stored is absorbed within the peat.

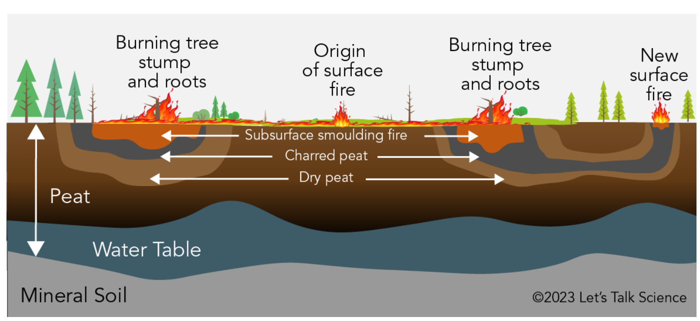
Permafrost peat bogs store a large amount of carbon beneath an “active” layer. This layer thaws and refreezes each year. But the frozen peat below keeps carbon locked away. In summer, the active layer prevents the heat from reaching the frozen layer below. In winter, it allows cold to reach the peat. Permafrost is like a kitchen freezer that keeps food from spoiling. It protects frozen organic material from fully decaying.

As the climate warms, peat bogs are affected. Intricate relationships between peat, vegetation, water are a delicate balance that keeps them working properly. As the Earth gets warmer, these relationships are changing. Previously frozen landscapes like permafrost peat bogs are thawing. As they thaw, carbon is released into the environment.

Thawing permafrost (Source: Boris Radosavljevic [CC BY 2.0] via Wikimedia Commons).

Climate change is also affecting weather patterns. These impact peat bogs. Lower levels of precipitation can cause bogs to dry out. When bogs are dry, they can easily catch on fire. Fires in dry peat bogs can spread quickly, burning large areas.

Surface fires in peat bogs can even become underground fires. These are particularly harmful because they can move underground and appear in new locations. Sometimes they reappear far from the original fire. Underground peat fires are s**elf-extinguishing**. This means they cannot be put out by humans.They must burn out on their own. This can take a long time and cause a lot of damage to bog ecosystems.



Surface and underground peat fires (©2023 Let’s Talk Science).

On the other hand, wet peat bogs are good at slowing the spread of fires. They can even stop them completely. If fires do happen in wet peat bogs, they are usually small and easy to put out.

Human Impacts on Peat Bogs

Humans have other impacts on peat bogs. In Canada and other places around the world, peat from peat bogs is commercially harvested. Peat can be used as soil in gardens and potted plants. It can also be burned for fuel.

Seedlings growing in peat (Source: OlgaSoloveva via Getty Images).

When peat is harvested, carbon is released into the atmosphere. Harvesting peat can also have a negative impact on animal habitats. As we learned above, peat bogs are essential to the survival of many plants, birds, reptiles, insects and small mammals.

Harvesting peat in Europe (Source: Kenneth Allen via Wikimedia Commons).

The Ring of Fire

500 km northeast of Thunder Bay, Ontario are the **Hudson Bay Lowlands**. This is the second largest peatland in the world. Within this region is a 5 000 square kilometre, crescent-shaped area called the **Ring of Fire**.

Ring of Fire within the Hudson Bay Lowlands (Source: Let's Talk Science based on an image by Cephas [CC BY-SA 3.0] via Wikimedia Commons).

In 2007, mining companies found deposits of valuable minerals in the Ring of Fire. These included chromite, which is used in making stainless steel and **nickel**. Nickel is used to make **batteries** for **electric cars**. Since then, governments and mining companies have been working to access these minerals, with little success.

One reason is the remoteness of the location. People can only get to the Ring of Fire using **ice roads** in the winter and aircraft in the summer. There are no permanent roads in the region and no power lines for electricity. These things would have to be built for mining to happen.

Another reason is that the peat bogs there are an **environmentally sensitive area**. The bogs are home to **endangered** animals like **caribou** and **wolverines**, as well as many types of migratory birds. Mining this area could have serious impacts on the bogs, affecting their delicate ecosystem.

The third reason is that the Ring of Fire is located on the traditional territory of 33 different First Nation communities. Marten Falls First Nation and Webequie First Nation are leading environmental assessments for their proposed

Peat bog near Hudson Bay (Source: Thorsten Milse / robertharding via Getty Images).

all-season road projects. But not all communities and conservationists agree that this area should be mined or developed. Of the many First Nations in the region, only the two communities named above formally support mining projects.

The people who live in the area have deep connections with the land. The bogs have provided generations of their people with food and a place to live. Elders of Mushkegowuk Cree First Nation call it the "**breathing lands**" because they consider bogs to be the lungs of the Earth.

Deciding whether or not to mine in the area is difficult. On one hand, building roads and mining could create new jobs for the people living there. The leaders of Marten Falls First Nation and Webequie First Nation think this could help keep young people in their communities by providing more opportunities. New roads could also help provide these remote communities with better access to food, clean water and other necessities. In addition, the minerals that could be mined are important to moving away from vehicles with combustion engines to those that are electric.

On the other hand, creating roads will not only destroy peat bogs, but any other habitat in its path. This will impact wildlife and release carbon into the atmosphere. Waste from mines could also pollute local water systems if it is not disposed of correctly. In addition to the environmental cost, there is also an economic cost. In 2023, the Government of Ontario pledged $1 billion to support infrastructure in the Ring of Fire area. That is not a small sum of money!

Finally, the money generated through mining may not be shared equally between local communities and mining companies.

Did you know?
As of 2022, there were 26 000 mining claims in the Ring of Fire Region.

How can we protect peat bogs?

There are many ways we can take care of peat bogs! Learning about their importance, especially when it comes to climate change, is a great start. Every action we take to help reduce carbon emissions is worthwhile.

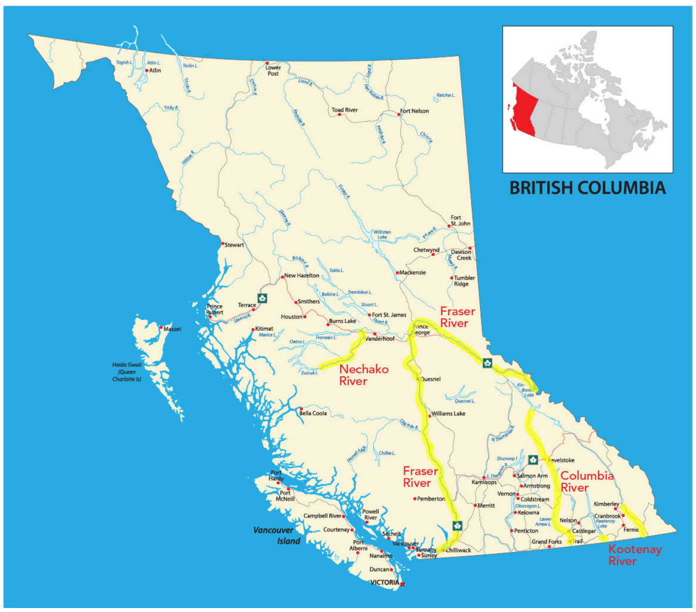
If you are lucky enough to visit or live near a peat bog, be respectful of the habitat. Avoid disrupting the homes of animals and plants, and always clean up after yourself. Teaching others about bogs is another good way to raise awareness and highlight their importance!

Boardwalk trail through Sifton Bog in London, Ontario (Source: The Cosmonaut [CC BY-SA 2.5] via Wikimedia Commons).

Conserving British Columbia's White Sturgeon

Introduction

The province of British Columbia (BC), Canada, is full of beautiful and important rivers. These include the Kootenay River, the Columbia River, the Fraser River and the Nechako River. They are home to many different plants and animals. One of these is a prehistoric-looking fish called the **White Sturgeon** (*Acipenser transmontanus*).



Map of British Columbia with the Nechako, Columbia, Fraser and Kootenay rivers highlighted in yellow (Let's Talk Science using an image by Rainer Lesniewski via Getty Images).

There are five species of sturgeon in Canada. White and Green Sturgeon live in the ocean and rivers near the Pacific coast. Lake Sturgeon live in lakes and rivers east of the Rocky Mountains. Atlantic and Shortnose sturgeon live in the ocean and rivers near the Atlantic coast.

White Sturgeon: Living Fossils

Sturgeon are an ancient group of fish. They **evolved** around 200 million years ago. Today's sturgeons do not look that different from their ancient relatives.

White Sturgeon get their name from the white colouring along their sides and belly. They have long, narrow bodies and pointy snouts. There are four barbels that look like whiskers on the underside of their snouts. These help the fish detect food. Sturgeons feed on many things, like fish, lamprey, crayfish, clams, insects and worms.

You might be surprised to learn that sturgeons do not have teeth. Like sharks, sturgeons have skeletons made from **cartilage**. They only have small amounts of bone in their pelvis, skull and jaws. Instead of scales, sturgeons have bony plates that cover their bodies. These are called **scutes**.

Young White Sturgeon (Source: BC Hydro. Used with permission).

White Sturgeon grow very slowly. Scientists estimate they live up to 100 years! They can also grow very large. The largest freshwater fish in North America is the White Sturgeon. One very large sturgeon was caught on the Fraser River in 2012. BC. It was almost four metres long and weighed about 500 kilograms (1,100 lbs).

White Sturgeon **spawn** many times during their lives. They begin to reproduce between 15 and 30 years of age.Then they only spawn every two to six years. Over their lives, mature female sturgeon can produce between 700 000 and four million eggs. But very few of these eggs survive.

The Decline of the White Sturgeon

White Sturgeon have long been important to Indigenous people living along rivers in BC. They sustainably harvested the fish for meat and eggs, which they ate fresh or dried and smoked.

In 1806, the explorers Lewis and Clark wrote about their visit to a fishing camp along the Columbia River. There, the Kathlamet people had harvested many large sturgeon. Europeans found sturgeon meat and eggs delicious. By the end of the 1800s sturgeon were being commercially harvested in BC. The harvest of sturgeon in the Fraser River peaked at 517 tonnes in 1897.

Postcard “Sturgeon on the Columbia River, Oregon” 1899 (Source: Public domain image via Wikimedia Commons).

Over the past 100 years, populations of White Sturgeon have declined steeply. Biologists are still doing research to understand why this is happening. But human activities like pollution, hydroelectric dams and fishing are part of the problem.

As of 2023, the White Sturgeon populations in the Upper Kootenay River and the Upper Columbia River are listed as Endangered under Schedule 1 of the Species at Risk Act.

The Future of White Sturgeon in British Columbia

Several organizations in BC are working to conserve White Sturgeon populations.

Fraser River Sturgeon Conservation Society

For over 20 years, The Fraser River Sturgeon Conservation Society has been working to conserve the White Sturgeon population. They also educate the public about them. They work with First Nations, governments and other partners to speed up the recovery of the population throughout the river’s ecosystem. Their vision is for the population to be strong, healthy and naturally sustaining for future generations.

Their volunteers track and assess population trends and publish reports. They also educate the public through school programs. They even have an “Adopt a Sturgeon” program.

Measuring a sturgeon (Source: Public domain by the US Geological Survey).

Nechako White Sturgeon Recovery Initiative

Sturgeon in the Nechako River are also getting a helping hand. The provincial government studied White Sturgeon populations here in the late 1990s. These showed that the population was dropping rapidly. Soon after, groups of people along the river came together to create the Nechako White Sturgeon Recovery Initiative (NWSRI).

The long-term goal of the NWSRI is to return the Nechako White Sturgeon population to a self-sustaining level. They are currently running a breeding and release program. This helps maintain and rebuild the population. Like the Fraser River Sturgeon Conservation Society, the NWSRI offers school programs and writes reports. Students can also tour their Conservation Centre to see their **hatchery**.

BC Hydro

BC Hydro generates and delivers electricity to 95% of people in BC. It generates most of this using **hydropower**. Most hydroelectric power plants are in rivers, and they can impact fish populations. BC Hydro works to minimize these impacts in several ways.

Water Use Plans

Water use plans have been developed for most of BC Hydro's hydroelectric facilities. These were done through collaboration with government agencies, First Nations, local citizens and other groups. Some of these people formed the **Upper Columbia White Sturgeon Initiative**.

Members of the initiative have been monitoring sturgeon under the Water Use Plan. They are learning about habitat use, movements, spawning and how sturgeon mature. In 2001, a conservation program was started to prevent **extirpation**. This is the extinction of a population in a local area. Their goal was to make sure there are enough fish of every age in the population. They're continuing to study how river conditions affect where and when the sturgeon spawn. They're also using genetic techniques to look at tissue samples from fish born at certain sites. They do this to estimate the number of wild adult fish in each area. This will help them continue to improve the program.

At Reservoirs

The slower moving water in **reservoirs** above dams is often low in **nutrients** used by plants. Scientists call water like this **oligotrophic**. Microscopic aquatic plants called **phytoplankton** cannot survive in oligotrophic water. This impacts the entire food chain, including sturgeon. To minimize this, BC Hydro uses fertilization programs to add nutrients to reservoirs.

At Dams

Dams can alter the habitat of fish by blocking the natural flow of water. For sturgeon, this can keep them swimming **upstream** to reach their spawning grounds. Fish can also be drawn into water intakes as they travel **downstream**.

BC Hydro uses different ways to help fish safely bypass dams. For example, they have built **fish ladders** and **screens** at some dams. These provide a corridor where fish can swim safely upstream.

BC Hydro crew monitoring the Cheakamus River near the Daisy Lake Dam (Source: BC Hydro. Used with permission).

Downstream of dams, they also help fish by placing gravel in river beds. This helps keep fish from getting stranded. They also add fallen logs and branches to improve fish habitat.

BC Hydro is also a partner in the Fish and Wildlife Compensation Program (FWCP). This is a partnership between BC Hydro, the BC government, Fisheries and Oceans Canada, First Nations and public stakeholders. The goal of the program is to conserve and enhance fish and wildlife impacted by the construction of BC Hydro dams.

Near Power Lines

Sometimes BC Hydro clears plants and trees near power lines to prevent fires and damage. If this is done near rivers and streams, fish can lose shade and protection from **predators**. Teams at BC Hydro look carefully at the habitat before deciding how to clear vegetation. Their goal is to reduce disruptions to fish and their spawning, resting and hiding areas.

How You Can Help

No matter where you live, you can help fish populations. One way is by not throwing litter or dumping chemicals into rivers and streams. Another is by helping during shoreline clean-ups and other fish-friendly activities. The fish will thank you!

Let's Talk Science would like to thank BC Hydro and BC Hydro's Power Smart for Schools program for their assistance in the development of this part of the handbook.

How can you design the least "expensive" water filter?

Consider using the Design & Build Process with this challenge.

This activity will help build skills related to the Generate Ideas, Plan, Create, and Test & Evaluate phases of this process. It also highlights the iteration required during this process.

Materials:

Note: Use the dollar values below when calculating the "cost" of your device.

Tools (no charge)

- Scissors
- Recycled bottle (i.e., plastic water bottle) for collecting the filtered water

Dirty Water Solution (no charge)

- 500 mL recycled plastic bottle with lid
- Measuring cup
- Water (approximately 400 mL)
- Sand (approximately 15 mL)
- Dirt/soil (approximately 15 mL)

Filter Materials

- Recycled plastic water bottle ($1)
- 1 coffee filter ($1)
- 1 paper towel ($1)
- 10 cotton balls ($0.25 each)
- 50 mL clean gravel ($5)
- 15 cm x 15 cm nylon stocking ($5)
- 1 old sock ($5)

What to do!

Have you ever wondered how water treatment plants remove solid particles from water? They use filters. Your challenge is to design and build a filter using materials you might find around the house.

Tips and Hints

Before testing, make up some "dirty water" by putting the water, sand and dirt into the 500 ML plastic bottle. Close the lid and shake well.

1. **Generate Ideas** – Think about what materials you think would let water pass through but not let solids pass through.
2. **Plan** – Create drawings for what you want your design to look like. Think about the costs of the materials before deciding the quantity and types of materials you will use.
3. **Create** – Build a prototype. This is a working model that you will be able to test. Use the empty plastic bottle for collecting the "clean" water.
4. **Test** - When you are satisfied with your prototype, it is time to test it. Pour the dirty water through the filter and catch the clean water in the empty bottle.
5. **Evaluate** - If the water still looks dirty, try again. Think about the types of materials you used, the order of the materials and their quantity. Continue to refine your device until the water looks clear.

****Note: do not drink your filtered water even if it appears clean!!***

Given the materials you used, what would be the cost of your device?

What's happening?

Solid particles mixed in water can be removed using a filter. A **filter** is a device with small holes or spaces. Water can pass through the spaces. But particles larger than the spaces will get caught in the filter, removing them from the water.

Filters come in different shapes and sizes. They are also made of different materials, as you've seen in this activity. Did you notice the materials that got the water the cleanest also took the most time? That's because, the smaller the spaces, the longer it will take for the water to travel through them. Think of sand and gravel. Sand particles can get very close together and leave only small spaces between them. Gravel is much larger, and the pieces can't get as close together. This leaves larger spaces between the particles. The larger the spaces, the faster the flow of water.

Because materials with small spaces trap more solids, they can get clogged over time. This is why filters need to be cleaned.

The filters that you've made in this activity can remove larger particles from water. They cannot remove small particles like **bacteria**. That's why **water treatment** has many steps. The first step involves doing what you just did - filtering out the larger particles! This is usually done with a screen. Other steps remove smaller particles using screens with smaller holes, and chemicals that make particles clump up and sink to the bottom. The final step involves treating the water with chemicals that kill **microorganisms**.

Why does it matter?

In the past, people often thought wetlands were useless land. Scientists now have a better understanding of wetlands. They know they are important water reserves and water filters. They can remove particles, fertilizers and toxic pollutants from the water. Wetlands can also act like giant sponges during floods. They help absorb excess water and keep our homes from flooding.

Large areas of Canada's natural wetlands, especially in populated areas, have been cleared to make room for agriculture and housing. This is why it is important to protect the ones that remain. This is especially important in populated areas where they can help prevent damage from floods.

Investigate further!

- Can you make a 'cheaper' filter that works as well as a more 'expensive' one?
- What other materials can you use in your filter to make even cleaner water?
- Where else can you find water filters?

Julie Koloff

Wetland Specialist
Jacobs

I was born in Windsor, Ontario. I now live in Calgary, Alberta. I obtained a BSc. Biological Sciences and a M.Sc. Biological Sciences at the University of Windsor, Ontario.

What I do at work

As a Wetland Specialist at Jacobs, I make decisions about possible impacts a project could have on wetlands. My goal is to identify ways any impacts can be reduced. I do field surveys to collect information about wetlands such as type and boundary. I access the wetland on foot, by helicopter, or by ATV's. The information I collect includes the types of plants present and the soil conditions. I also note the water conditions in the area. I create maps of wetland areas as well. I do this using satellite imagery and identify the boundaries of the wetland.

I use my mapped wetlands and field survey results to identify how a proposed project could affect the area. I also help our clients complete regulatory permits related to doing construction in wetlands. I collect specific data using standardized methods. This is very important because it helps me make decisions using data. My background in STEM helps me with this part of my job. I also mentor a team of wetland specialists. It's great to work as part of a team because we all bring different strengths and skills to the job.

My career path

I had no idea I would end up in this career. I always loved nature and wildlife but in school I preferred social science classes. In university, I started out with an Undeclared Major because I did not know what I wanted to study. Even though I really enjoyed the courses I was doing, I realized I did not want a career in any social science. I shifted gears and started to do a degree in biology. I got a part-time job in the Dean of Science office. I also worked in an avian sound analysis lab for a professor. I ended up taking a field course in Costa Rica with that professor. When I graduated, I was offered a summer job as a field technician there as well. This led me to enroll in a MSc. in biology. In this program, I did research on a tropical bird in Costa Rica. I got a lot of field skills from these experiences that I apply to my current job.After I graduated, I took another field job in Northern Alberta studying birds in wetlands. I applied to my current company (Jacobs) outlining all my skills to see if I would be a good fit. The wetland team called me and I was offered a job. Even though I had a steep learning curve, it has been the best decision I could have made! I still get to watch birds while I work in wetlands and my wildlife knowledge has been an asset.

I am motivated by

Working with biologists of all different skillsets, is very exciting. The people I work with have skills and knowledge in such areas as vegetation, reclamation, wildlife, fish, soil, as well as wetlands. I learn something new everyday and get to share my skillset with others. The work I do at Jacobs changes all the time so I don't get bored! There are always new challenges to meet or questions to answer. Travelling across Canada to do field surveys and working in remote locations with helicopters is a very cool part of my job. I am passionate about the environment. Being able to positively effect change keeps me motivated.

How I affect peoples' Lives

Wetland conservation is a global issue and very important. Wetlands have many benefits and help in preventing floods and filter water. These areas also provide important habitat for wildlife. As a result, it is very important that we protect wetlands and reduce possible impacts to them. Helping companies make responsible environmental decisions is very rewarding. People and wildlife benefit greatly when wetlands are conserved.

My advice to others

Get experience doing fieldwork in the summers to learn skills in biological surveys such as fish sampling, bird or vegetation identification. Your career does not have to follow a direct path. If you are open to learning, say 'yes' to all opportunities, you never know where it will take you!

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