



SCIENCE SPOTLIGHT

THE WORLD BENEATH OUR FEET
LET'S GET TO THE **ROOT** OF IT!

This project was undertaken with the financial support of the Government of Canada.



Canada





The World beneath Our Feet

Let's Get to the ROOT of It!

Origin Story:

What Is the Boreal Forest?

The **boreal forest**, also known as **taiga**, is the largest biome in Canada and covers the whole island of Newfoundland. A **biome** is a type of natural environment with a particular climate. For example, the boreal forest is found below the Arctic and has many types of evergreen trees like spruce, fir, and larch. The boreal forest encompasses forests, lakes, rivers, wetlands, and open fields. It encircles the northern part of the globe covering most of Canada, Russia, and Northern European Countries.

Why Are Boreal Soils Special?

During the most recent ice age, soil was scraped from the land by glaciers, exposing bedrock. Due to this, soils in most of the boreal forest are young when compared to areas that were not glaciated. The **topsoil** (top layer of soil) builds up slowly because of the cold temperatures that limit decomposer activity. Some decomposers you may be familiar with include earthworms, carpenter bugs, fungi, and snails!

The thin layer of topsoil in the taiga allows water to run through the soil layers (**percolate**) quickly. This easily replenishes water reserves underground (**groundwater**) and reduces build up of water on the surface. The fast percolation rate of boreal soils (**podzols**) causes nutrients to wash out quickly. Because of this, podzols tend to be more acidic and lower in nutrients than soils from other biomes.

Plants found in the boreal zone have adapted to their acidic, low nutrient environment by relying on specialized traits such as carnivorous diets and shallow root systems. Have you ever heard of the pitcher plant? This provincial plant of Newfoundland and Labrador gains its nutrients by trapping and devouring insects!

THE BOREAL ZONE OF NORTH AMERICA



"Boreal Forest." Boreal Songbird Initiative. (2015). Accessed November 1, 2022, from <https://www.borealbirds.org/boreal-forest>

Soils and Climate Change

Many places can expect to see more precipitation (rain, snow, hail, etc.) with the oncoming of warmer temperatures as our climate changes. This can increase the risk of **flooding** (too much water at once), **erosion** (the movement of soils), and **drought** (not enough water for too long). This can destroy homes and make it hard to grow food.

Fortunately, the boreal forest is naturally resistant to these destructive impacts of climate change! As we know, water can easily move through boreal soils (podzols), which prevents the buildup of water on the surface while storing water underground. However, if the land is changed too much, it may not be able to withstand these impacts.





The Future of Soils: Why Do We Convert Land?

Land is often **converted** to grow food like meat, fruits, vegetables, and grains on farms; this is known as **agriculture**. More food is needed to support the growing population, but climate change is making it harder to grow food where we used to. To solve this issue, we may need to change land to support more agriculture. How will converted land react to the predicted climate change impacts? Dr. Daniel Altdorff, Dr. Lakshman Galegedara, and Dr. Adrian Unc tried to answer this question by testing different types of soil.

Boreal Soils vs. Converted Soils

Scientists Dr. Altdorf, Dr. Galegedara, and Dr. Unc, collected soil samples from different types of land in western Newfoundland. Some samples were unchanged soils that naturally exist in the boreal forest, and other samples were changed for agricultural development. They wanted to see how the soils would react to consequences of climate change like flooding, erosion and drought.

The scientists found that water moved through natural podzols faster and easier than through the soils converted for agriculture. The converted soils held more water in the top layers, which increased the build up of water on the surface and did not easily percolate to the bottom layers, where it would replenish groundwater reserves. This means that areas with converted soils are at risk of flooding and erosion when there is excess water, as well as drought during a dry spell because the soils have little water reserves. The scientists conclude that boreal soils converted for agriculture paired with the impacts of a changing climate will harm the surrounding environment.



Climate Action: **Reduce Waste!**

Only purchase what you can consume. This can help reduce waste AND food demand. Less demand for food means less need for agricultural development, and less converted soils! Start a compost to turn your organic leftovers into soil for your garden!

Get Involved!

Become a citizen scientist with WormWatch! Help scientists across Canada better understand soil ecology by sending them pictures of worms. Instructions on how to find worms, identify them and submit pictures can all be found on their website: www.naturewatch.ca/wormwatch/

Try This at Home: **Get Growing!**

Growing your own produce can reduce demand on the global food system! Don't have a backyard? Try indoor gardening. Some edible plants that grow well indoors include basil, parsley, and other herbs!



Climate Change

Past, Present, and Future

Earth is the only planet in the solar system known to support life. What makes our home so special? Earth has an atmosphere, a layer of gases between our planet and space. Some of these gases, like carbon dioxide, are called **greenhouse gases**. They are crucial parts of our atmosphere; they trap in the heat of the sun, similar to how heat is trapped in a greenhouse, or in a car on a hot day. This process, called the **greenhouse effect**, keeps Earth's temperature warm enough for living things to thrive.

The sun's rays hit our round, tilted planet unevenly. This uneven heating of Earth's surface leads to differences in temperature, which drives weather patterns. We call the patterns in temperature and weather over long periods of time **climate**. Different parts of the world have vastly different climates; it depends on how much heat they receive, as well as what landscape features are nearby. Water, mountains, ocean currents, and forests all impact our climate. In turn, living things around the world have adapted to the climate they live in.

Something, though, is changing. Over the past two hundred years, humans have been burning fossil fuels, such as coal and oil, to make energy to power our daily lives. Fossil fuels are made from decomposed plant matter and microscopic life millions of years old. This matter is full of carbon, and, burning it releases, or emits, billions of tonnes of **carbon dioxide** gas into the atmosphere every year. When too much carbon dioxide is emitted, the delicate balance of greenhouse gases maintaining

Earth's climate is upset. More and more heat is trapped, causing the planet to warm. Weather patterns change, water levels rise, storms get worse.

Climate has changed many times throughout Earth's history, from ice ages to periods much hotter than today. So why is this time any different? Scientists agree on two things. One, temperatures are rising faster than they ever have in documented climate history. Two, this climate change is driven by human activities, due primarily to greenhouse gas emissions. Climate change is already impacting people's ways of life all over the world. Powerful storms, droughts, forest fires, and floods are threatening people's access to food, water, and safe homes.

The most important step we can take to prevent serious climate change is to reduce greenhouse gas emissions. Incredibly brave and caring people around the world are finding new ways to reduce emissions and make our communities climate resilient every single day. And you can join them! These Science Spotlights are here to help us learn more about climate change and how you can take action.

Our Commitment to the Decolonization of Science

Institutions of GenAction initiative respect and affirm the inherent and Treaty Rights of all Indigenous Peoples across what we now know as Canada. We give thanks to the Indigenous Peoples who care for this land since time immemorial and pay respect to their traditions and ways of knowing. We acknowledge their many contributions to innovations in Science, Technology, Engineering, and Mathematics, past and present, and are committed to deepening engagement and collaborating with Indigenous Peoples as partners in order to advance truth and reconciliation and the decolonization of science.

