PEATLANDS: A WAY TO BEAT THE HEAT

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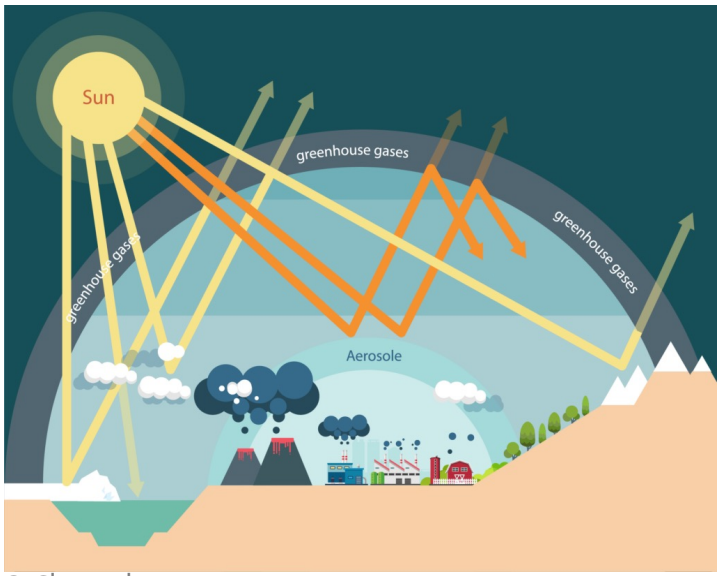
Peatlands:
A Way to Beat the Heat!

Origin Story:
WHAT IS THE GREENHOUSE EFFECT?

There are many different gases that make up our atmosphere. Some of these gases are called **greenhouse gases**. They help control the climate on Earth by acting like a blanket that keeps our planet warm. This is called **the greenhouse effect**, because like a greenhouse, the sun's energy passes through the atmosphere and is trapped as heat when the energy reflects off the Earth's surface. Some of the greenhouse gases in our atmosphere include carbon dioxide, methane, and nitrous oxide. Ozone, a different kind of the gas high up in our atmosphere, protects us from ultraviolet (UV) radiation from the sun. This UV radiation is why we use sunscreen to protect our skin! Without ozone, we would be even less protected.

We need gases in our atmosphere, but having a lot of greenhouse gases like carbon dioxide and methane can trap too much heat, and increase temperatures on Earth. This is something that causes our climate to change. Carbon dioxide comes from the burning of fossil fuels like coal, oil, and natural gas. Methane is even more harmful than carbon dioxide, and also comes from natural gas.



Collecting Data:
TAKING EARTH'S TEMPERATURE

Our planet is not just heating up. In some places on Earth, the temperature is increasing, and in other places, the temperature is decreasing. So how do we know if a certain place is heating up or cooling down? Scientists measure and track the temperature of individual ecosystems. When doing this, there are multiple factors they need to keep in mind.

One of these factors is called **albedo**. When sunlight hits the Earth's surface—our land and oceans—some of it is absorbed and turned into heat, while the rest of it is reflected back into space. The amount of light that is reflected is referred to as albedo. The places that reflect the most light, and therefore have the highest albedo, are usually our snow-covered surfaces and glaciers. This is because light best reflects off of light coloured, smooth, and shiny surfaces. On the other hand, light is best absorbed by dark surfaces, such as the ocean. We take albedo into consideration when measuring a place's temperature since not all the light is kept and turned into heat. Since our glaciers are melting, Earth is losing its surfaces that best reflect light, and is left with its darker surfaces that absorb light, therefore increasing our temperatures.

Another factor that affects our temperature calculations is what we covered earlier—the heat trapped by greenhouse gases in our atmosphere. Some of the light reflected off of Earth passes through the atmosphere into space, but not all of it. When it is trapped by the greenhouse gases in our atmosphere, it heats up the Earth, driving global warming.

When we consider the energy lost because of albedo and the energy kept because of greenhouse gases, we are left with the temperature of our location! If a place is *losing more* energy than keeping it, the location has a cooling effect. If a place is *keeping more* energy than losing it, then the location has a warming effect!

Making Change:
RECYCLING OLD FARMS!

Certain types of ecosystems can actually help keep our planet cool because of their composition! Peatlands are usually found in the Boreal Forest biome. Peatlands are very waterlogged ecosystems and can also be referred to as a "bog" or a "mire." Peatlands are special because after they have reached a certain age, they take carbon dioxide out of the atmosphere really well. When peatlands are formed, they do the opposite, and produce a lot of greenhouse gas— methane and nitrous oxide. However, once it grows enough plants, or vegetation, it takes more greenhouse gases out of the atmosphere than it produces. Because of this, it creates a cooling effect!

Local Research:
NEWFOUNDLAND AND LABRADOR FARMING

In Western Newfoundland, researchers Mei Wang, Jianghua Wu, Peter M. Lafleur, and Junwei Luan studied peatland in an area called Robinson's Pasture. Previously, the land was a bog that had been drained for agriculture. After ten years of farming, the pasture was abandoned for twenty-five years. While it was abandoned, something curious happened. It transformed back into peatland!

A number of measurements were taken over two years to calculate how much greenhouse gases were being produced and absorbed. Some factors that affected their measurements were wind speed and direction, humidity, soil moisture and temperature, and rainfall.

Researchers measured the temperature the same way we have learned: they considered the energy lost because of albedo, and the energy kept because of greenhouse gases in the atmosphere while making their calculations. They were left with the temperature of the peatland. The researchers found that the peatland had a cooling effect. This is because during periods where the land was covered in snow, it had a much higher albedo. During the growing season, it absorbed more greenhouse gases out of the atmosphere than what it was producing. Therefore, energy was both reflected and able to pass through the atmosphere instead of being trapped and absorbed as heat! An area that acts this way is called a carbon sink, because it essentially drains carbon out of the atmosphere.

This research proved that if certain agricultural land is abandoned, it has the potential of becoming a peatland, and a carbon sink. This is a really important finding! This means we may be able to utilise old farmland to cool down places on our planet and fight climate change. It turns out, we can recycle more than just our paper and plastic!

MEET OUR LOCAL SCIENCE HERO
Dr. Jianghua Wu

Peatland research area, Robinson's Pasture
Photo courtesy of Dr. Jianghua Wu

TRY THIS AT HOME!

As we learned from the research on Robinson's Pasture, vegetation has the potential to absorb greenhouse gases and reflect energy to create a cooling effect. Trees contain a lot of carbon from the carbon dioxide they remove from the atmosphere. Did you know that you can measure how much carbon is in a tree? Try this fun activity in your backyard or community!

1. Pick a tree and identify its species with the help of your science teacher, parent, or the internet.
2. Measure the tree's height in metres. You can do this by estimating with a tape measure or by comparing the tree to the height of your house.
3. Measure the circumference of the tree trunk from 4.5 feet off the ground. Divide the circumference by pi (3.14) to get the diameter of the tree.
4. The National Forestry Inventory, created by Environment Canada, has a Carbon Biomass calculator. You can find this calculator at: https://nfi.nfis.org/en/biomass_calc.
5. Enter your region, tree type, and measurements into the calculator to determine the mass of the tree.
6. Lastly, multiply the total mass of the tree by 0.47 to discover approximately how many kilograms of carbon are stored in the tree!

CLIMATE ACTION

We all contribute to carbon emissions by consuming energy every day in our electronics. Did you know that your household appliances still use electricity even when they are not in use? This adds up to be a considerable waste of energy. Try to find electronics that are not being used around your home and unplug them to reduce your home's carbon footprint!

DID YOU KNOW

44% of Newfoundland is covered by Boreal forests and Boreal forests in Southern Labrador form the Eastern flank in the Canadian Boreal Shield Zone.

This Science Spotlight was written based on Mei Wang et al. "Investigation of the climatological impacts of agricultural management and abandonment on a boreal bog in western Newfoundland, Canada." Science of the Total Environment 711, (2020): 1-10.

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.

Climate Change: Past, Present, and Future is based on...Delmotte, Masson, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, et al. 2021. "Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change." Intergovernmental Panel on Climate Change. Cambridge University Press. In Press.