

SCIENCE SPOTLIGHT



EXTREME WEATHER: FLOOD RESCUE!



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Canada





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Origin Story: WHAT IS FLOODING ?



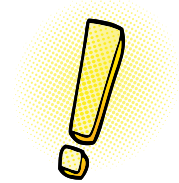
Floods account for 44 percent of all global natural disasters since 1970, with climate change largely responsible for this increase. Flooding occurs when floodwaters overflow and wash over land. The temperature increases over the last several decades are caused by human activities, through the increase in the concentration of greenhouse gases in the atmosphere. This creates more extreme and severe water-related hazards and weather-related events. Temperature can also alter the hydrological cycle. The hydrological cycle determines the direction and state of water in the atmosphere, the oceans, and the surface of the continent. Hydrological cycles are extremely sensitive to temperature fluctuations, and they affect the following:

1. Amount, frequency, and intensity of precipitation
2. Rate of melting of snow and ice and their characteristics
3. Amount of atmospheric water vapour
4. Evaporation rate of water from the Earth's surface
5. Water levels in the ocean and in soils and vegetation
6. Water volume and flow in rivers and lakes

Climate change has dramatically affected the global hydrological cycle, and floods are now the most frequent climate-related disaster worldwide. In Canada, floods are escalating financial, social, and environmental concerns. The risk of a catastrophic flood is beyond the financial capacity of Canadian society.

Protecting ourselves from flooding

COLLABORATION IS THE ANSWER



Flooding is a natural event that can be particularly devastating, as we saw in Quebec in 2017 and 2019. As climate change continues and the hydrological cycle intensifies, flooding will affect more households. However, there are solutions that can minimize the impacts of flooding and protect the population.

One solution lies in the intersectoral approach. The objective of this approach is to combine knowledge and expertise from different risk management specialists. For example, it offers solutions that benefit all who are affected, as well as the environment. This approach depends on cooperation between the natural, social, and political sciences, as well as engineering, health, education, psychology, communication, and management. Combining expertise in all these disciplines can lead to innovative, integrated approaches that promote community safety and sustainability. The collaboration offers an opportunity to access knowledge about risk factors and up-to-date information from any of these sectors.

Natural environments are also important to the overall solution. They can serve as valuable flood management resources, by lowering the risk of flooding or slowing the rise of floodwaters in a storm. For example, waterways need "freedom space" to evolve, which can reduce flooding. By respecting these spaces and avoiding human development, we can limit the impact of overflowing waterways. Vegetation along the waterways serves as a natural sponge and decelerates the water flow. Preserving and restoring these natural environments can protect us and enhance our collective resilience, while supporting local biodiversity. This is what we refer to as nature-based solutions.

COMMUNICATING RISKS: AN INNOVATIVE APPROACH

Communication and sharing information or mobilizing knowledge will encourage technological innovations and provide a better understanding of these complex events. Technology can identify and forecast hazards and establish strategies to better inform decision-makers and citizens.

PREVENTION: BEFORE, DURING AND AFTER

The cyclical approach to safety can be an alternative solution. Before the event, there are several measures that can improve water knowledge and continuous flood risk assessment in the catchment areas. Community awareness before an emergency is another way to better protect citizens. Even today, many Quebecers are unaware that their property is at risk of flooding. Knowledge transfer is essential to prepare citizens, particularly those who may be unaware of the risks. Preparation and intervention procedures must be in place during the emergency, while responders can provide medical and psychological assistance. Post-event recovery measures for victims should also be in place. Experts can

draw on this experience by evaluating which measures were successful and which measures need improvement. This will define and expand risk reduction measures, while improving flood risk protection in the area.

In conclusion, cooperation, communication, innovation, and prevention are tangible and feasible solutions for Quebec. This is key to limiting damage from future floods and developing more effective measures than were available in 2017 and 2019. While the floods may be devastating, these measures can mitigate their effects, especially for future generations.

TIME FOR GENACTION!

Try This at Home: VEGETATION TO THE RESCUE

If you want to understand how vegetation can be used to control water, you can try a simple experiment. Just pour a glass of water on a vegetated area and then observe the difference in absorption when you do the same thing on the sidewalk. You will see that the water travels more easily and quickly on artificial surfaces, while vegetation slows down and absorbs the water. Vegetation functions in the same way during a flood. This is why it is so important to preserve and revegetate our shorelines.

Climate Action: COLLABORATION

Communicating and gathering scientific data and knowledge is essential to risk prevention. It is always important to understand the environment around us and the associated risks. Municipalities and local watershed organizations have several websites that provide this information. Citizens can use these websites to access risk management programs that concern them, and they can easily share information on their own. Resiliency begins with awareness of flooding issues, as climate change is sometimes misunderstood by the public. Information sharing will increase awareness of this growing problem, while ensuring that we are informed about the associated risks so we can better anticipate the impact.

MEET OUR LOCAL SCIENCE HERO:

Philippe Gachon

Climate science researcher at the Université du Québec in Montreal

Philippe Gachon is a climate science researcher at the Université du Québec in Montreal. He is currently part of a research team focused on flood risk management. His expertise extends to regional climate modelling, extreme weather events, regional climate scenarios and the associated hydro-meteorological risks, and the implications of weather and climatic hazards on natural and human systems.



Philippe grew up in Ardèche, France, where his passion for climate studies began while watching summer thunderstorms. Today, his climatological studies teach us about the changing climate and the issues involved. His research focuses on avoiding past mistakes in risk management, promoting reduced consumption, and fostering a greater awareness of climate issues.



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.

