

# SCIENCE SPOTLIGHT



**It is Ice to See You!**



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

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# It is Ice to See You How Seasonal Connections Are Affected by Climate Change

## Origin Story: What Is Climate Modeling?

Climatologists are scientists who study climate change. Climate modelers are climatologists who want to learn what could happen to the climate on Earth in the future. They use supercomputers to analyze data: information on temperature, humidity, precipitation and more. By using math, coding, physics, and an understanding of Earth's processes, they build working models of Earth in computer software. They then run simulations and experiments to see how climate will change and make projections based upon their gathered information.

Dr. Yukari Hori is one such climatologist from the University of Toronto who has been working with remote Northern Ontario communities. Community members requested help to better understand how a changing climate has been affecting a major lifeline for them in winter: ice roads.

## Winter Ice Roads: Where the Rubber Hits the Ice

For most of us, we may not give much thought to how our household goods, building supplies, vehicles, fuel, and other necessities come into our cities and towns. We do know that 'stuff' probably travelled by transport truck or rail. However, many northern, remote, Indigenous communities rely on seasonal corridors or ice roads to get their essential goods. Otherwise, these necessities would have to be flown in on planes or helicopters, as there is no railway or all-season road infrastructure. Due to the high cost of aviation fuel, airport maintenance fees, high costs of aircraft and their personnel, shipping costs can be up to twenty times more expensive than land. For example, the cost to send something by road could be one hundred dollars. To ship by air, the cost could be as much as two thousand dollars!

The construction and maintenance of winter road systems requires a colder climate. Climate factors such as surface air temperature, precipitation, snowfall, and wind all directly affect the winter road systems. These vast road connections will run over land, rivers, lakes, and bays. The ice that forms in lakes and rivers must be thick enough to hold vehicles that can weigh up to twenty tonnes, so ice thickness is a major factor to the reliability of the winter roads as well as when they can be opened and closed. Over the short life span of each seasonal winter road, it must be maintained and observed for accumulated snow, soft spots on the ice, and uneven ground and land-water transition points. Before and during the season, sections have to be repaired, levelled, or flattened, and observed for ice thickness.

In recent years, climatologists like Dr. Hori have been using climate modeling to assess the impacts of climate change on the longevity of winter roads in the next century. By using historical climate data from various weather stations in a particular area and analyzing it using computer and statistical software, scientists are able to simulate and analyze patterns and develop climate projections. A projection is similar to a prediction or where they determine what should happen under certain situations. They are using the modeling to project future ice road seasons and whether climate conditions would be favourable or not.

One example they looked at is in Ontario's Far North (OFN), from the western Canadian Shield to the Hudson Bay Lowlands, where warming trends have been seen in the past three decades, particularly during November. This time period is important as this is when lower seasonal temperatures would allow for the preparation of the winter roads where land portions can be readied and constructed while ice forms on the water sections. Some areas of OFN have modeled projections where climate conditions would be unfavourable for winter road construction by the middle of the 21st century, and in other areas, climate conditions would be unfavourable by the end of the century. As climate change continues to affect the preparation period, and so the maintenance and longevity of winter roads, then these communities will continue to struggle to maintain their way of life.

Winter roads in the northern regions of Canada are a crucial seasonal lifeline, to transport essential goods and services while also providing connections for social and cultural gatherings and meetings between communities. Following the modelling and projections, there is definite uncertainty regarding the possibility and durability of the winter roads.

Long-term planning, adaptation strategies and coordination of people and ideas are needed at community and government levels.

# TIME FOR GENACTION!

## Climate Action

There are many things you can do to work towards Climate Action. Participate in local activities that help the community such as spring clean-up, climate awareness campaigns, and Earth Day events. You can do things to help the environment by using less plastic, recycling when possible, conserving water, and using green methods of transport like riding your bike in the summer.

To develop a better understanding of northern ways of life and its hardships, it is important to form connections with Indigenous communities and learn their perspectives. Make the time and speak with Indigenous Elders, leaders, and youth. Many Indigenous people who live in larger urban centres may have connections to northern communities as well and may help you with your learning journey.



## Meet Our Local Science Hero: Dr. Yukari Hori



Ice Road Research  
Photo courtesy of Dr. Yukari Hori

### How did your interest in winter ice roads and climate change come about?

When I was a Ph.D. student at University of Toronto, one of my supervisors who used to live in Fort Albany told me that local people are concerned about the impacts of climate change on their winter roads. Later, I found many fly-in First Nations communities in Northern Ontario rely on the winter (ice) road networks. I believe that understanding impacts of climate change on winter (ice) roads is an important area of research that would help to adapt the changes or mitigate the risks for the northern communities.

### What is the best part of being a scientist?

I think we have an opportunity to discover new knowledge, and we have a chance to make a significant contribution to our society by our discoveries.

### If you could share one call to action with Canadian youth, what would you say?

I would like to share this old proverb: "Where there is a will, there is a way".

# 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.

