
# SCIENCE TO THE RESCUE!

# SAVING OUR FORESTS

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

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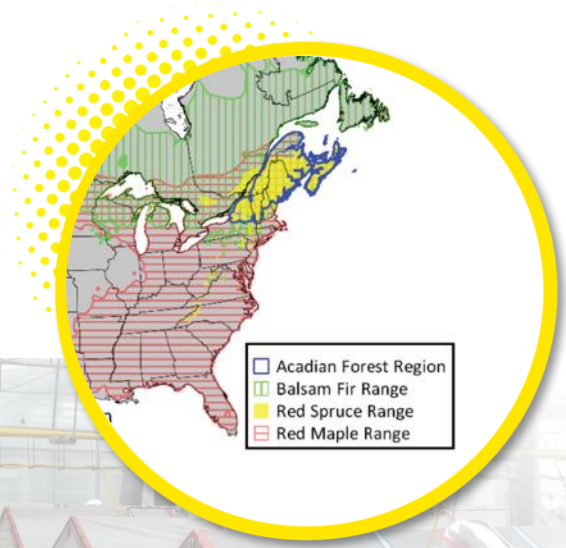
# Saving our Forests

## Origin Story:
### OUR CLIMATE FUTURE

How can climate scientists predict the future of climate change? Of course, we cannot predict the future, but we can think about different scenarios that might happen. Climate scientists use information about the current environment to help predict our climate future. The different scenarios are based on how much greenhouse gas continues to be emitted. These scenarios are called Representative Concentration Pathways or RCP for short.

If we do nothing about our greenhouse gas emissions, then we are on the "business-as-usual" pathway. Climate scientists call this the RCP 8.5 scenario. Under the RCP 8.5 scenario, the carbon dioxide levels continue to rise, and the average annual temperature will increase by seven degrees Celsius by the year 2100. RCP 8.5 is considered the worst-case scenario and is unlikely to happen, but it is still a possibility since we do not fully understand how human activities affect the environment. Therefore, it is important to study RCP 8.5 so we can understand what will happen if we do not take action.




## Climate Change Experiment:
### THE ACADIAN FOREST REGION

What will happen to our trees if we continue emitting greenhouse gasses "business-as-usual"? This is the question that Dr. Anthony Taylor and his colleagues wanted to answer. They conducted an experiment which showed that on our current pathway, in a few decades it will be too warm for the trees that live in the Acadian Forest Region.

The experiments used the seedlings of three tree species that live in the Acadian Forest Region: balsam fir, red maple, and red spruce. New Brunswick is at the southern range for balsam fir trees, the northern range for red maple, and in the middle of the range for red spruce.

To mimic the effects of climate change on the "business-as-usual" pathway, Dr. Taylor and his colleagues had to build a closed environment in which to grow their tree seedlings. They built mini greenhouses, called phytotrons. Inside these phytotrons the team controlled the temperature, the level of carbon dioxide in the air, and the soil moisture to match the predictions of the RCP 8.5 scenario. To understand the impact of each effect individually, the team exposed the seedlings to the temperature, level of carbon dioxide, and soil moisture separately as well as in each possible combination.

Dr. Taylor and his team made four hypotheses, or predictions:

1. Warmer temperatures will make the trees grow more
2. Drier soil will make the trees grow less, and this will be worsened by higher temperatures
3. More carbon dioxide will make the trees grow more
4. The red maple seedlings will survive better than the balsam fir and red spruce

What they found is that the three variables: temperature, carbon dioxide level, and soil moisture - all interact with each other. The data supports all four hypotheses, but looking at them individually does not tell the full story. For example, although warmer temperatures encourage the trees to grow more, it also causes more evaporation in the soil, and drier soil makes the trees grow less. Similarly, more carbon dioxide can help trees grow, but in the case of balsam fir and red spruce, this effect stopped when the temperature got too high.

The conclusion of the experiment is that if we continue "business-as-usual" and do nothing to help fight climate change, many of the trees in New Brunswick will not survive. Having the results of a controlled experiment means that researchers tried to control as many variables as possible. Scientists can use this information to choose different trees to plant, help build better computer models, and encourage policy-makers to make the best decisions to save the trees in the Acadian Forest Region.

This Science Spotlight was written based on Vaughn, William R., Anthony R. Taylor, David A. MacLean, Loic D'Orangeville, and Michael B. Lavigne. 2021 "Climate change experiment suggests divergent responses of tree seedling in eastern North America's Acadian Forest Region over the 21st century." *Canadian Journal of Forest Research*, 51, no. 12, 1888-1902. https://doi.org/10.1139/cjfr-2021-0047

# Time for GENACTION!

## Try This at Home:

### SEEDLING EXPERIMENT

Using materials at home, you can control the soil moisture just like Dr. Taylor and his team did in their experiment to mimic the RCP 8.5 scenario.

Materials:
- Two bean seeds
- Soil
- Two clear cups
- A marker
- A ruler

Start by growing your own seedlings. Fill the cups halfway with soil and plant one bean seed in each cup. Keep the soil moist until the seedlings sprout. If you stick your finger in the soil up to your first knuckle, it should feel damp. Once you have two seedlings that measure at least two centimetres tall, you can begin your experiment.

1. Measure the height of each seedling and write it down.
2. Label one seedling as your control and one as your climate change seedling. Place your seedlings next to each other so they are in the same environment.
3. Continue to water your control seedling so that the soil feels moist up to your first knuckle. Do NOT water the climate change seedling.

After one week, collect your results. Measure the height of each seedling. Which seedling grew taller?

### MEET OUR LOCAL SCIENCE HEROES:

Dr. Anthony Taylor is an Associate Professor of Forest Management at the University of New Brunswick in Fredericton, NB. His research focuses on the effects of climate change on our forests.

Rob Vaughn is a biologist at the Canada Forest Service, and is currently pursuing his PhD under the supervision of Dr. Taylor.

## Climate Action:

### CARBON EMISSIONS

The RCP 8.5 scenario is the "business-as-usual" scenario - but this does not have to be our future if we take action!

An important factor is deforestation. Trees help absorb carbon dioxide from the atmosphere. You can help fight deforestation by:
- Visiting your local library to learn more about trees
- Join or start a community group at your school
- Go outside and learn which trees grow in your neighbourhood

"BEING AWARE OF YOUR OWN GREENHOUSE GAS FOOTPRINT IS CRITICAL...

...REDUCING DEFORESTATION GLOBALLY WOULD BE ANOTHER MAJOR PART OF THE EQUATION"
-Dr. Anthony Taylor

# 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.