



What Effect Does Climate Have on Wildlife

High School Grades

Lesson Summary

After students learn that climate change is affecting everything from newts to polar bears, they research habitat requirements for a local species and consider how climate change would affect it. They also consider whether changes in their own region are caused by climate change or by other human-caused factors.

Prior Knowledge & Skills

- Summarizing and categorizing information
- Research skills

AAAS Science Benchmarks

The Nature of Technology

Issues in Technology

The Living Environment

Diversity of Life

Interdependence of Life

NSES Science Standards

Life Science

Interdependence of Organisms

Science in Personal and Social Perspectives

Environmental Quality

Natural and Human Induced Hazards

Teaching Time: 1 - 3 hours

Materials

- Paper
- Pen
- Straight pins
- Scissors for cutting out icons or markers
- Classroom map of the world
- Student Handout

Advanced Planning

Preparation Time: ~10 minutes

1. Review the instructions
2. Gather the necessary supplies.

Recommended Reading: (attached)

- High School Backgrounders: #1, 8, 9



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What Effect Does Climate Have on Wildlife?



In a Nutshell:

After students learn that climate change is affecting everything from newts to polar bears, they research habitat requirements for a local species and consider how climate change would affect it. They also consider whether changes in their own region are caused by climate change or by other human-caused factors.



Goal:

To help students understand the international scope of climate change impacts, while at the same time encouraging them to think critically about the issue, identifying other variables that may be causing changes near their communities.



Background Learning:

Teachers should be familiar with the basic science of climate change and its anticipated impacts as reviewed in:

- High School Backgrounder #8: [Impacts on Northern Wildlife](#)
- High School Backgrounder #9: [Impacts on Fish and Fowl](#)

Teachers should read “Warming risks extinction for million plants, animals: study” at http://www.cbc.ca/stories/2004/01/07/climate_spp040107 (see More Information section).

Teachers should read “A Change of Season” in the January/February 2003 issue of *Up Here* (see More Information section).

Grade Level: 8–12

Subjects: Social Studies, Sciences, Northern Studies, Geography, English Language Arts

Enrichment: Science, Northern Studies

Time: 1–3 hours

Setting: Classroom

Materials: Paper, pen, straight pins, scissors for cutting out icons or markers, classroom map of the world

Skills: Reading comprehension, summarizing and categorizing information, research, writing

Key Vocabulary: Range extension, krill, zooplankton

High School Students should be familiar with the basic science of climate change and its anticipated impacts as reviewed in:

- High School Backgrounder #8: [Impacts on Northern Wildlife](#)
- High School Backgrounder #9: [Impacts on Fish and Fowl](#)

High School Students should read “A Change of Season” in the January/February 2003 issue of *Up Here* (see More Information section).

Learning Outcomes:

Click on the icon for your territory to review the learning outcomes that are addressed by this lesson:



Nunavut



NWT



Yukon



Introduction to Lesson Plan:

This lesson is designed: first to expose students to the possible effects of climate change -particularly on wildlife; then to encourage them to consider the possible impacts in their region; and finally, to consider what other factors might be contributing to changes in northern wildlife ranges.

The student handout, “What Effect Does Climate have on Wildlife?” and the CBC web article, “Warming risks extinction for million plants, animals: study” (see More Information) will introduce the concept that climate change is a global phenomenon. As an exercise in analyzing and making sense of a wide range of information, students will categorize the impacts of climate change described in the handout.

In Canada, many species appear to be extending their range northward. Through the readings and class discussions, students should become familiar with species whose ranges appear to be extending north. Secondly, they should consider both the impacts of these shifts and their likely causes.

Impacts will include things such as reductions or increases in food availability and increased or decreased competition for food and cover. For example, moose in the Yukon have been expanding their range onto the north Richardson Mountains. Local knowledge indicates that willows have also spread further north along the creeks toward the Beaufort Sea, suggesting that the shift in moose distribution may be in part related to climate change. There are other examples in the Backgrounders and in sources listed in More Information.

It is easy to say that climate change is the cause of these range extensions, but there may be other factors at play. Encourage students to think critically about cause and effect claims. The additional reading (see More Information section) will help them understand that it is often difficult to pin down cause and effect in the natural world. For example, northern range extensions may actually be a result of habitat modifications in some cases. Logging activities often encourage white-tailed deer to move into an area. White-tailed deer are a primary prey species for cougars. Could forest modifications therefore be the reason for increased cougar sightings in the north? Or is climate change the reason? Students should be encouraged to ask, “How can we know? What research needs to be done to answer these questions?”

Other factors that may lure species into new areas include new roads, cut lines or trails, all of which can provide travel corridors for animals. Extensive hunting or trapping of a particular species may cause changes in the abundance and distribution of other species. For example, if a prey species is reduced or eliminated in one area, predators may have to move into a new region to look for food. Or they may begin to prey on a species that they don't normally eat. Students are encouraged to think critically about these issues. It is important for students to realize that although range extensions will happen due to climate changes, there may be other factors that contribute to this.



Activity:

Part 1

1. Have students read the January 7, 2004, CBC web article “Warming risks extinction for million plants, animals: study” (see More Information) for a brief summary of recent computer modeling predictions.
2. Have students read the student handout “What Effect Does Climate have on Wildlife?” located in the student handout section.



3. Make a class list of all the species identified in the handout.
4. Have students make cutouts or some other kind of identifier for each species.
5. Hang a world map in your classroom and have students pin the species identifiers to the corresponding countries or regions.
6. As an exercise in analysis, ask the students to classify the impacts into four or five major groupings. For example, “reproductive changes,” “range expansion” and “range reduction” could be three of the headings. There are no “correct” groupings. Just help students find logical categories.
7. Establish a wall chart with the major grouping (such as “reproductive changes”) as column headings. Lead the class in categorizing specific impacts from the handout and listing them in the appropriate columns. For example, if the students had a column called “reproductive changes” they would likely list “painted turtles” in this column, since the handout says that warmer temperatures skew the sex ratios of painted turtles. The class can continue to add to this list later. Incidentally, the impacts may not appear to be negative. Some species will thrive under climate change.
8. Ask students to select one of the species or regions and have them do some research to see what other information they can find about habitat requirements and/or impacts of climate change. Ask them to summarize their findings in point form, and to cite references fully.

Part 2

1. Ask the students to read “Southern species head north,” Your Yukon, Column 129, available at <http://www.taiga.net/yourYukon/col129.html>, or one of the other articles listed in More Information that is pertinent to your region.
2. Ask students to select a local species and research its specific habitat requirements. Food, shelter, temperature requirements, predators, parasites, snow cover and migration corridors are examples of habitat features they should consider. In the Northwest Territories, <http://www.nwtwildlife.rwed.gov.nt.ca/NWTwildlife/nwtwildlife.htm> is a good source. Ask the students to write a brief paper (1 to 2 pages) listing the basic habitat requirements of the species. Assign students to read the results of at least two other students, so that they are familiar with the habitat requirements of at least three local species.
3. Now ask students to consider what would happen to the regional habitat under climate change. Examples of questions you can use to start the discussion are: Would the vegetation change? Would the fire regime change? How would that affect the species of plants? Would the sea/lake/river ice change?
4. Ask students to consider how these changes would impact the local species they researched. You will probably want to devise questions that are pertinent to your region. The following are examples of the types of questions you could pose:

- o Which species would thrive?





- Which would merely survive?
- Which would disappear from the region?
- Where would they go?
- If longer, warmer, drier summers led to more frequent and intense forest fires, what would happen?
- How would fire affect food and cover requirements?

Ask students to add their conclusions to the paper they wrote in 2.

5. Lead a class discussion about species that appear to be extending their range north. What might be the explanation for these changes? (If you need some ideas to get started, see <http://taiga.net/coop/indics/moose.html> for a brief, simple discussion of factors that could be behind the expansion of moose into the North Slope). With the class, generate a list of research questions that would help to fill in any information gaps. Find out if there is research going on near your community and ask the researcher to speak to your class about their research.



Handouts:

The handout that supports this lesson is attached at the end – [Student Handout: What Effect Does Climate Have on Wildlife?](#)



Student Web-Exchange:

Students can post a 200–600 word essay on their research on range extensions to the climate change north [student exchange](#). Click on the icon for information on how to post material.



Evaluation:

Through the reports students wrote in 4., evaluate each student's understanding of the habitat requirements for the species that they researched. Evaluate each student's understanding of how climate change may impact this species.



More Information:

Note: Asterisks mark the sources that are most relevant to the lesson plan topic.

*Arctic Borderlands Ecological Knowledge Co-op. Moose Population



Enrichment Ideas:

Science, Northern Studies

Impacts of Range extensions: Discuss the impacts on other species when a new species moves into a region.

Map the Range: Select a bird, fish or mammal and mark its range on a map. If climate change were to continue, indicate in another colour how this range might change. Discuss the implications.

Food Web: Select a bird, fish or mammal and create a visual diagram of what that species requires for food and habitat. Discuss what happens if a new species moves in or this species moves out.

About the Author:



Libby Gunn lived in the Northwest Territories for 14 years. She was curator at Fort Smith's Northern Life Museum and spent many years developing and delivering interpretive programs for Wood Buffalo National Park. She is a certified trainer with Interpretation Canada and is the author of *Thebacha Trails*, a natural history guide to the region around Fort Smith, NWT.

She has also worked at Nahanni National Park, as a reporter for the Yukon News, and as a Wildlife Viewing Technician for Yukon Environment. She is currently a park warden at Wood Buffalo National Park.



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North Richardson Mountains.
<http://taiga.net/coop/indics/moose.html>

*CBC. "Warming risks extinction for million plants, animals: study."
http://www.cbc.ca/stories/2004/01/07/climate_spp040107

CBC. "Landlocked char suggest climate change."
http://www.cbc.ca/stories/2002/08/06/char_020806

*Environment Canada. "Southern species head north." Your Yukon, Column 129.
<http://www.taiga.net/yourYukon/col129.html>

Environment Canada. "Future forests could favour aspen," by Sarah Locke, Your Yukon, Column 349.
<http://www.taiga.net/yourYukon/col349.html>

*Environment Canada. "Red squirrels show evolution in the making," by Sarah Locke, Your Yukon, column 346.
<http://www.taiga.net/yourYukon/col346.html>

Environment Canada. "Trees plus temperature change is not a simple equation," by Claire Eamer, Your Yukon, column 338.
<http://www.taiga.net/yourYukon/col338.html>

*Environment Canada. "Pikas cannot beat the heat." Your Yukon, column 194.
<http://www.taiga.net/yourYukon/col194.html>

Environment Yukon.
<http://www.environment.yukon.gov.yk.ca/fishwild/info.shtml>

Gau Robert J. and Robert Mulders. "Cougars (Puma Concolor) in the Northwest Territories." Wildlife And Fisheries Division, Department Of Resources, Wildlife And Economic Development, Government of the Northwest Territories. Manuscript Report No. 140. Yellowknife: 2001.

Hiebert, H. Josef. "Inuits [sic] are sure world is getting warmer, no matter what scientists say." Ottawa Citizen, Nov. 16 2000.

*Natural Resources Canada. "The Atlas of Canada."
<http://atlas.gc.ca/site/english/maps/climatechange/potentialimpacts/index.html>

This site contains a number of resources.

Natural Resources Canada. "Taiga Plains Ecozone – Forest Health in Canada."

http://www.health.cfs.nrcan.gc.ca/TaigaPlains/index_e.html

NatureWatch – Frogwatch Yukon:

<http://www.naturewatch.ca/english/frogwatch/yt/intro.html>

Nunavut:

<http://www.naturewatch.ca/english/frogwatch/nu/steps.html>

Northwest Territories:

<http://www.naturewatch.ca/english/frogwatch/nt/steps.html>

*Nielsen, Ingrid. "A Change of Season." *Up Here*, Vol. 19, Number 1, January/February 2003, pp. 58-63.

Owens, Anne Marie. "15,000 caribou stop the traffic in Labrador." *National Post*, November 17, 2003.

*Struzik, Ed. "Grizzlies on Ice: What is Aklak doing in the kingdom of Nanook?" *Up Here*, Vol. 123, Number 6, November/December 2003, pp. 38-48.

Struzik, Ed. "An Edmonton scientist solves the cruel riddle of dying muskoxen and endangered Peary caribou," *Southam Newspapers*, Sept 21 1996. Cited in <http://www.yukon.alaska.com/history/bl-muskox.html>



Student Handout

What Effect Does Climate Have on Wildlife?

There are many examples of animal species already severely affected by climate change. Here are just a few:

Butterflies – In North America and Europe, over 35 species of butterflies have been expanding their ranges northward by up to 200 km. In the western U.S., Edith's Checker spot butterfly has not only shifted its range 92 km northward since the early 20th century, but has also shifted its range in elevation (approximately 124 m in elevation).

Foxes – In Canada, general warming is allowing red foxes to expand their range northward. Unfortunately for arctic foxes, red foxes are better suited to living in a warmer environment. Arctic foxes are retreating further north as their habitat shrinks.

Frogs, Toads & Salamanders – In Costa Rica and North America, frogs, toads and salamanders are disappearing due to climate change. With less winter precipitation, breeding pools aren't deep enough to protect eggs and tadpoles from damaging ultraviolet rays. Weakened by UV-B radiation, they become susceptible to fungal infection, dying at epidemic rates. With inadequate water, over 50% of western toads succumb to fungal infection.

Grizzlies and Pines – Nutritious whitebark pine seeds are a major food source for grizzly bears in western North America. The ability of a female grizzly to successfully bear young is linked to pine seed abundance – more seeds mean healthier bear families. Unfortunately, whitebark pine is vulnerable to the impacts of climate change. Warm temperatures allow pine blister rust – a deadly fungus – to thrive and spread, killing up to 90% of whitebark pine in a given area. Less trees, less seeds, less bears.

Newts – In Britain, earlier winter warming has thrown off the timing of amphibian reproduction. Newts have started breeding earlier, but frogs haven't. With a head start, the large, hungry newts feast on frog spawn, reducing frog numbers dramatically. Before climate change tipped the scales, frogs hatched first, thus avoiding being eaten by the newts.

Penguins – In four years of unprecedented warm winters Adelie and Chinstrap penguin populations on King George Island have declined by 40 and 35 percent, respectively. Sea ice cannot form on Antarctic seas warmed by climate change. The krill that typically feed on the algae are the primary food source of the penguins. As krill becomes scarce, penguins starve.

Polar Bears – In the last two decades, polar bears living in the western Hudson Bay area have undergone a change for the worse. The polar bear feeds primarily on ringed seals. Bears rely heavily on the predictable spring abundance of ringed seal pups to provide energy and nourishment for survival throughout the year – particularly for raising and nursing cubs. They need stable sea ice as a solid surface on which to hunt ringed seals. Anything that

affects the distribution and annual duration of sea ice has a profound effect on the health and well-being of polar bear populations. Since 1981, ice break-up on Hudson Bay has occurred earlier and earlier, forcing bears to come ashore in progressively poorer condition. Their hunting season cut short, they do not have enough time to regain their energy stores. Increased temperatures – caused by human-made greenhouse gas emissions – are responsible for melting the arctic ice out from under the bears' feet.

Reptiles – In many reptiles, temperature determines the sex of offspring. Increased global temperatures could seriously skew sex ratios. A shortage of either sex could undermine a species' ability to replace itself from generation to generation. In painted turtles, offspring sex ratio is correlated with mean July temperature. Even a modest temperature increase (2–4°C), could dramatically reduce the number of male turtles produced.

Salmon – Usually restricted by cold water temperatures, Pacific salmon species such as sockeye, pink salmon and coho salmon have been found far outside their normal ranges. A coho salmon was found almost 2000 km further into northern waters than usual. Temperature increases in the Arctic as a result of climate change have allowed these temperate-water salmon to expand their ranges.

Trout – Trout are a cold-water fish, thriving in spring- and glacier-fed water. Already struggling under the burden of pollution, erosion and diversion projects, trout are now – literally – in hot water. As climate change raises temperatures in North America, streams, rivers and lakes are becoming too warm for trout to survive. Brook, brown and rainbow trout will lose up to 76% of their habitat if greenhouse gases continue to build up and trap heat in the atmosphere .

Wolves, Moose and Trees – With increased winter snowfall in the North Atlantic region of North America, wolves are hunting in larger packs. Triple the numbers of moose are killed per day, compared to less snowy years when wolves hunt in smaller packs. With fewer moose feeding on their lower branches, fir trees quickly fill in the forest's understory.

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Impacts of Climate Change
High School Backgrounder 8

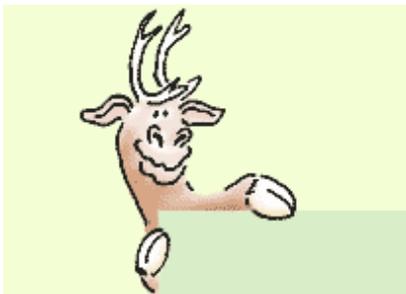
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Impacts on Northern Wildlife

We know that climate change means temperatures are getting warmer and we can likely expect more precipitation. As a result of climate change, permafrost is melting and sea ice is getting thinner.

Rivers and lakes are freezing later in the year, and melting earlier in the spring. These are a few ways that our northern world is starting to change as the climate changes.

So what will this mean for our wild friends like caribou, moose and even the pesky mosquitoes? What will happen as their home environment starts to change? This backgrounder describes how climate change might affect northern wildlife.



An Inuit legend about the origin of the caribou

Once upon a time there were no caribou on the earth. But then there was a man who wished for caribou, and he cut a great hole deep into the ground, and up through this hole came caribou, many caribou. The caribou came pouring out, till the earth was almost covered with them. And when the man thought there were caribou enough for mankind, he closed up the hole again. Thus the caribou came up on earth.

Told by Kibkarjuk and recorded by Knud Rasmussen in "1930 Observations on the Intellectual culture of the Caribou Eskimos." Report of the Fifth Thule Expedition, 1921-1924, vol. VII, no 2, Copenhagen, Gyldendalske Boghandel.

How Are The Caribou Dealing With Climate Change?

In all three of Canada's northern territories, there are large herds of barren ground caribou. These herds are

sometimes made up of 100,000 to 300,000 caribou!

Caribou herds travel great distances, season to season, from their wintering grounds to their calving grounds, and back again. Caribou travel to different areas because different places provide particular conditions that allow them to survive the season. If climate change affects the travelling conditions, it will affect the caribou.



For example, the calving grounds for the Porcupine Caribou Herd are located on the Arctic plain in northern Alaska. The Gwich'in people who are strongly connected to the Porcupine Herd believe the calving area in northern Alaska is sacred ground. Like clockwork, the Porcupine Caribou herd heads to this area in Alaska every spring from their wintering grounds in north and central Yukon, eastern Alaska or northwestern NWT.

However, as climate change warms things up and possibly causes more snow to fall, the snow may become deeper and heavier than normal. Have you tried walking through deep, wet snow? It's much harder than walking through dry, fluffy snow, isn't it?



So when the snow gets heavy and wet, it might be too difficult for some of the caribou to get to the Arctic plain in the spring. Caribou that can't make it all the way to the Arctic plain will have their babies away from their traditional calving grounds. These cows and calves will not have all the benefits of their normal calving grounds – the nutrient rich food and safety from wolves and bears. So fewer newborn caribou will survive.

Other northern herds like the Beverly Caribou Herd also travel great distances every year, sometimes as far as 2,000 kilometres one-way. The Beverly herd spends time in northern Saskatchewan, NWT and Nunavut. The Qamanirjuaq Caribou Herd also travels far and wide, from Nunavut and NWT down into northern Saskatchewan and Manitoba. These caribou herds need to travel great distances to find the different types of summer and winter habitats that they need to survive. Travelling through heavy, wet snow would make these journeys much harder.

Earlier break-up and thinner ice

Travel for the caribou is also getting harder because warmer temperatures in the spring are causing rivers and lakes to break-up earlier.

Inuit Elders in the Bathurst Inlet area in Nunavut have reported how warmer weather in the 1990s affected the Bathurst Caribou Herd. (A research project called the "Tuktu and Nogak Project" collected Inuit observations on this herd). The elders believed that the Bathurst caribou shifted their migration routes to avoid rivers full of rushing water and chunks of ice. The elders also noted that more caribou were drowning as the caribou fell through ice that was thinner than usual.





It's not just the caribou whose travel plans are interrupted

In 2000-2001, Vuntut Gwitchin residents of Old Crow, Yukon reported that, "We had only about two cold spells before Christmas. Because of the snow depth, it left the lakes and river with a lot of overflow, open water and hard to travel. There were a lot of problems with wet snow." *Arctic Borderland Ecological Knowledge Co-op, Report Series Number 2001-2.*

Digging for food



The heavier and deeper snow that is expected to result from climate change may also make it harder for the caribou to dig through to get to their food (mostly lichen) that is buried under the snow. Another problem is that as temperatures warm with climate change, there will likely be more cycles of thawing and freezing of snow during the winter. This will create ice that the caribou will have to dig – and walk – through.

Depending on the snow conditions, caribou may have to spend more time digging for food than actually eating it. What do you think might happen to the caribou if they have to spend so much energy travelling and digging in the snow?

More bugs to avoid

As climate change causes temperatures to increase, mosquitoes and parasites will be able to survive farther north and higher up the mountains – in places where it used to be too cold for them to live. Caribou hate mosquitoes and will go out of their way to seek windy areas because the wind keeps the mosquitoes away. If there are more of these little pests around, the caribou will likely spend even more energy trying to get away from them. If the caribou spend more time avoiding mosquitoes, and less time eating, their health will be affected.

Some good news! Plants grow sooner

Climate change may also have some benefits for the caribou. People have noticed that the snow is melting earlier in the spring than it used to. This means that vegetation can start growing earlier in the year.

Elders in Nunavut have noticed that the Bathurst caribou have changed their migration in order to move to areas that are greener and lush earlier in the year.

Scientists in Alaska have looked at satellite images of the calving grounds of the Porcupine Caribou Herd that were taken between 1983 and 1996. These images clearly showed that things had started to get greener earlier in the spring as the years passed. Studies have shown that more calves are surviving in this herd and researchers believe it is likely because the nutrient-rich food is available earlier in the year. The new growth in the plants provides the energy the new caribou moms need to produce their milk.

Although more calves in the Porcupine Caribou Herd are surviving, more of the caribou cows are dying. Starting in 1989, the herd started to decrease in size. Since that same time, the weather has also been getting warmer. During this time period, the temperature has been above zero about twice as often as it used to be. This has made travelling



conditions much harder for the caribou and it is likely why more cows are dying.

If caribou are affected, so are many communities



Communities in the range of all of these caribou herds depend on the migrating caribou for food. Caribou have been central to the culture and life of many northern aboriginal people for thousands of years.

If the caribou change their migration routes or decrease in numbers, this will have a serious impact on people in many northern communities. For example, caribou meat is a healthy – and inexpensive – source of food. If hunting caribou becomes too difficult, this will affect the health of northern people who currently eat a lot of caribou. It will also change a long tradition of how people live on the land.

Meandering Moose?

Moose usually live in the boreal forest, eating willows and other shrubs. Moose are not usually considered an “arctic” species because they prefer the cover of forests and brush to the open tundra.

However, lately, people are seeing moose more and more along the North Slope and Arctic coast in the northern Yukon. Moose have also been seen traveling out to the Beaufort Sea in the summer. This is not where you would expect to find moose!

Moose were counted in the Northern Richardson Mountains (along the border of the Yukon and NWT) and the nearby coastal plain in March 1989 and again in March 2000. Over this time period, moose numbers in this area increased by 67%!

There might be more moose in this area because their usual predators – wolves – continue to focus on eating caribou and the other animals that the wolves are used to. These northern wolves may not have added moose to their menu – yet! So, without anyone eating moose for dinner, the moose population can increase. That would change if local wolves added moose to their menu plans!

However, moose could also be increasing in numbers in part because of climate change. Elders in Aklavik, NWT have reported that there are more willows – which the moose eat – than there used to be on the Yukon’s North Slope. The increase in willows is partly caused by warmer temperatures caused by climate change. As the willows move north with warmer temperatures, the moose may also be following their food north.

Other Northward Bound Animals

Other animal species are also moving farther north, possibly because of the warming climate. In some areas of the Yukon and NWT, whitetail deer, coyotes and cougars are already being observed farther north than usual.

One reason these animals might be moving north is because the plants that some of them eat are also moving north as the weather gets warmer (see [Background 6](#)). And when the animals that eat the plants – the herbivores like moose and deer – move north, then the animals that eat the herbivores – predators such as cougars and coyotes – will also follow their food north!

Climate Change And The Little Critters

Did you ever wonder where all the small animals like ground squirrels and mice live in the winter? Many make their winter homes under a blanket of snow.

The small mammals can breathe under the snow because air can travel through dry and fluffy snow. But if the weather is warm and the snow becomes layered with ice, then the carbon dioxide that the animals breathe out (and the carbon dioxide the soil slowly releases) could start to suffocate these little



creatures. If this happens the small mammals would have to travel to the top of the snow to get some fresh air. Above snow, the predators or freezing temperatures can get them.

But Arctic ground squirrels could also benefit if we get deeper snow – without the icy layers. Studies in the Yukon have shown that when the snow is deeper in the winter, ground squirrels successfully raise more babies.



This Should Bug You!

Insects that hang out in southern Canada will also start moving north as the weather warms. And the northern pests that already live here will likely be able to move further up the mountains and into more northerly (areas where it used to be too cold for them to survive). So warmer weather will mean a buggier north!

New parasites will also likely travel north. Some of these might travel in on the backs of other species that are heading north: animals like the whitetail deer. And species of parasites that already survive in the north can be expected to increase in number as the climate gets warmer. Parasites live off of many types of wildlife and can seriously affect the health of animals like caribou and moose. So getting more parasites could harm our wildlife.

Insects and parasites can also affect plants and trees. Around Kluane National Park in western Yukon, spruce bark beetles have killed large areas of mature white spruce forest. A number of mild winters and springs provided good breeding conditions for the beetles and allowed them to survive the winters and multiply rapidly. Over 200,000 hectares of forest were affected by these beetles between 1994 and 1999.



Traveling back to Whitehorse from Vancouver one year and I came upon a bull moose lying on the road... It was full of bugs. Later I saw the moose walk around it had no hair on it. It was eaten up. Where do the bugs come from?... It isn't only the moose that has it, its caribou, sheep and lynx too.

Johnny Smith, Elder's Panel during climate change workshop at the Council of Yukon First Nations, February 2003.

So, Is It Good Or Bad News?

As you can see, climate change will cause both some positive and some negative impacts. Moose might like having more food to munch on but might not be so keen about having more parasites to deal with. Caribou will have more trouble traveling in the snow, but earlier springs will mean good food arrives earlier too!

Northern people and other researchers are still trying to figure out exactly just what will change, how quickly the changes will occur, and how easily plants and animals will be able to adapt.

To understand how a changing climate is changing the land on which the wildlife discussed in this backgrounder rely, read [Backgrounder 6](#). To read more about climate change impacts on other animals, like polar bears, seals, walrus and other ocean-based animals, check out [Backgrounder 10](#). For information on fish and birds, see [Backgrounder 9](#).



Key Points

- ★ Barren ground caribou in northern Canada travel great distances every year. However, travelling conditions for the caribou are becoming harder with climate change because the snow is getting deeper and heavier. Ice on lakes and rivers is also thinner and breaking up earlier in the year which is dangerous for the caribou.
- ★ Climate change also means there will be more insects to harass caribou. On the good side, plants that caribou eat are growing earlier in the spring.
- ★ Moose and other animals like coyotes, white-tailed deer and cougars are being seen farther north.
- ★ Smaller mammals may find it difficult to live under the snow if climate change makes the snow icier than usual.
- ★ Insects and parasites are expected to increase in numbers with warmer weather.



Want to Know More?

Here are some websites to help you find out more about the impacts of climate change on northern wildlife:

- **Being Caribou Homepage:** <http://www.beingcaribou.com/> – Two Canadians follow the Porcupine Caribou from Old Crow. Follow them on their journey.
- **Defenders of Wildlife:** <http://www.defenders.org/wildlife/arctic/oildevelopment.html> – Links oil development in the north with increased global warming, and increased problems for Arctic wildlife.
- **Greenpeace Archives:** <http://archive.greenpeace.org/climate/arctic09/reports/seaice3.html> – A comprehensive scientific article on what's happening to Arctic ice, and its effects on Arctic wildlife.
- **Greenpeace USA (Climate Chaos):** <http://www.greenpeaceusa.org/climate/speciestext.htm> – Good overview of the effects of climate change on wildlife. Click on the bottom links to read more about caribou and salmon.
- **Taiga Net: Caribou:** <http://www.taiga.net/top/caribou.html> – A page of great caribou links, including a slide show and a population model.
- **West Kitikmeot Slave Study:** http://www.wkss.nt.ca/HTML/o8_ProjectsReports/o8_index.htm – Click on the two Caribou topics to read about what traditional elders say about the caribou and changing habitat.

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Impacts of Climate Change
High School Backgrounder 9

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Impacts on Fish and Fowl

All creatures, great and small, are impacted by climate change. This backgrounder highlights how the changing climate is impacting some creatures that live in water – fish, and some that live on it – ducks.

Fried Fish Anyone?

Some fish live in the salty water of our oceans and some hang out in the freshwater of our lakes and rivers. For example, trout only live in fresh water but salmon live mostly in the ocean, until they travel into fresh water to spawn. Different species can survive in each type of water.

Different species also live in different temperatures of water. For example, some species, like Arctic Char, are better adapted to living in cold water than other fish are.

However, it is cold-water fish like the Arctic Char that might have the hardest time with climate change. This is because as the climate warms, the waters the fish live in will warm also. Cold-water fish will need to find colder waters or adapt to the warmer waters. If the char and other cold-water species move on to colder waters somewhere else, how do you think this might affect the people and animals that usually eat them?



A warmer climate also poses problems for salmon as they move upriver to spawn. Salmon stop eating and rely on stored fat when they enter fresh water for the swim upstream. Salmon are cold-blooded – their metabolism is tied to the temperature of the surrounding water. If the water is too warm, salmon use up their energy stores and are unable to reach their spawning grounds. Warmer waters also increase the risk of bacterial and fungal infections in salmon.

Excerpted from "Salmon in Hot Water", a poster by Natural Resources Canada

Fish that survive in warmer water may actually benefit from climate change. For every 1°C increase in water temperatures, warmer water fish species are expected to move up to 150 kilometres north into waters that are too cold for them right now.

There are a few other ways that climate change might affect fish:

- Some parasites that live on fish may survive and reproduce faster in warmer water. In 1999, Chinook salmon in the Yukon River were found to be carrying a parasite (*Ichthyophonus hoferi*) that had never been seen in northern wild salmon before. More parasites could threaten the health of some fish.
- Warmer weather will cause more water to evaporate. More evaporation could lower water levels in lakes and rivers. If this happens, salmon may not have enough water in the rivers and creeks to get to where they need to go to spawn. Streams and creeks that get their water from melting glaciers shouldn't have a problem with water levels because glaciers will melt even more with climate change and keep the streams full...unless of course the glacier completely melts! If this happens, then there may be no more water for these streams.
- Warmer water in spawning streams could also affect the hatching of fish-eggs because there is less oxygen in warm water.
- Warming temperatures are causing permafrost to melt. This melting permafrost is already causing more landslides and erosion along riverbanks (see [Backgrounder 6](#)). This causes more dirt – also called sediment – to fall into the water. This dirt can cover up the gravel areas in which some fish need to spawn. More sediment in the rivers can also make it more difficult for fish to breathe.



“At the mouth of Prince River [in Nunavut] there used to be a lot of fish and you used to be able to get char. There’s been a lot less fish because there’s not as much water anymore. And we used to be able to get a lot of fish all the time at Qikiqtaujaq and all the other places where you can get fish. The fish were more plentiful and they used to be bigger. Now you hardly get char anymore at Prince River or any of these fishing places because the water level has gone down.”

L. Arngaa’naaq, Baker Lake. Quoted in “These Things are Really Happening: Inuit Perspectives on the Evidence and Impacts of Climate Change in Nunavut” by Shari Fox. The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change, edited by Igor Krupnik and Dyanna Jolly, 2002.

Lucky - Or Unlucky - Ducks?

Climate change seems to create both winners and losers in the world of birds. Climate change is allowing some bird species to expand their range further north. On the other hand, climate change is making it harder for other birds to survive in places they usually hang out.

As regions of the Arctic warm, some birds that used to be rare in the far north are now being seen more often. For example, an increase in both Shoveler and Ring-necked ducks has been recorded in the Old Crow Flats in northern Yukon over the past 20 years. Ring-necked ducks had never even been seen in this area before 1983.

The presence of new duck species farther north is likely a sign that the habitat has become more suitable for warmer weather ducks. It is also possible that destruction of habitat in areas farther south has caused ducks to move north in search of suitable habitat. As temperatures continue to increase, summers will be longer than they used to be, so more vegetation will be around for more weeks of the year. This means more food for young birds so that more will survive and be ready for the long flight south in the fall.



Longer summers also mean there is more time to nest and raise babies before the ducks have to fly south again. Perhaps it's not surprising that more duck species would move north to take advantage of this warming trend.

In the Eastern Arctic, temperatures are currently cooler than they used to be. This is part of natural variations that happen in the Arctic's climate. These shorter-term cooling periods are also having an impact on local birds. For example, some researchers believe that snow geese that used to nest in areas like southwest Baffin Island or Southampton Island are spending more time farther south because it is currently too cold in their old stomping grounds.

So these snow geese are setting up their nests and

having their babies in the western Hudson Bay coastal flats north of Churchill, Manitoba. Because there are so many more birds spending time in this part of Hudson Bay, the plants in the area are becoming overgrazed. The fragile arctic ecosystem in the area is having a hard time supporting all the birds that are flocking to it!

In the area around Sanikiluaq (an island of Nunavut that is found in the eastern part of Hudson Bay), recent cooling trends have also meant there is more ice on the water. People on this island have noticed that the Eider ducks, which depend on open water for food and warmth, have been suffering.

This cooling trend in the eastern Arctic will change. Like most of the world, over time this region should experience an increase in the average temperature because of climate change.

What About The Other Critters?

To learn more about other animals that live in or by the waters of the ocean, check out [Backgrounder 10](#). You can also read more about the animals that live on the land in [Backgrounder 8](#).



Strange birds

"There were some strange birds that have never been seen before. A flock of I don't know what kind of birds, they'd never been seen before. They captured a turkey vulture this fall, I don't know what it's doing here!"

Participant from Fort MacPherson, NWT at the 7th Annual Gathering of the Arctic Borderlands Ecological Knowledge Co-op (2002).

Key Points

- ★ As climate change warms northern waters, warm water species will benefit and likely expand their range north. However, cold-water species might have a harder time surviving.
- ★ Warmer temperatures should lead to more evaporation from lakes and rivers. This could have a negative impact on fish that need enough water to travel to their spawning areas.
- ★ In the Eastern Arctic, weather has been cooling and some birds, like snow geese, are nesting further south than they used to. However, this region is also likely to begin to warm in the coming decades.
- ★ Warmer weather in parts of the Arctic is resulting in new duck species being seen in the North.



Want to Know More?

Check out these websites for more about what's happening to fish and fowl in the Arctic:

- **Arctic Borderlands Ecological Knowledge Co-op:** <http://www.taiga.net/coop/indics/ocduck.html> – Information about changing duck populations the Old Crow flats.
- **CBC News:** http://www.cbc.ca/stories/2002/08/06/char_020806 – This article – “Landlocked Char Suggest Climate Change” – explains what's happening to the char and why.
- **Community Adaptation and Sustainable Livelihoods:** <http://www.iisd.org/casl/projects/inuitobs.htm> – Don't miss the video, Sila Alangotok: Inuit Observations on Climate Change. You can view a short version at this site, or get information on buying it.
- **Taiga Net (Climate Change and Fish Habitat):** <http://www.taiga.net/reports/dfo1.html> – A discussion of the possible effects of climate change on northern aquatic habitats in the Upper Yukon River Basin.
- **Book:** Krupnik, Igor and Jolly, Dyanna (eds). 2002. *The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change*. Fairbanks, Alaska: Arctic Research Consortium of the United States.