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...in the classroom

Science 7

**Ecosystem Shift:
Ice**

Indigenous Knowledge Lesson Plan

Local and Traditional Knowledge in Watershed Governance
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Science 7

Ecosystem Shift: Ice

RATIONAL OF CURRICULUM CONNECTIONS

This lesson meets cross-curricular outcomes for Science 7 and Social Studies 7. Students will learn about Indigenous knowledge of freshwater ecosystems in the Mackenzie River Basin, which is within the circumpolar region, including how Indigenous peoples track changes over time related to seasonal ice freeze-up and melt.

SCIENCE 7

Unit A: Interactions and Ecosystems (Social and Environmental Emphasis)

Focusing Questions: How do human activities affect ecosystems? What methods can we use to observe and monitor changes in ecosystems, and assess the impacts of our actions?

- Investigate and describe relationships between humans and their environments, and identify related issues and scientific questions:
 - Students will describe examples of interaction and interdependence within an ecosystem (e.g., identify examples of dependency between species, and describe adaptations involved; identify changing relationships between humans and their environments, over time and in different cultures—as, for example, in Indigenous cultures)
 - Students will identify examples of human impacts on ecosystems, and investigate and analyze the link between these impacts and the human wants and needs that give rise to them (e.g., identify impacts of the use of plants and animals as sources of food, fibre and other materials; identify potential impacts of waste products on environments)

SOCIAL STUDIES 7

This lesson explicitly addresses Indigenous Knowledge, a key focus of the social studies curriculum (Junior Secondary Social Studies Curriculum, 1993, p. 10), in order to address key Social Studies 7 questions: What are the major changes facing the circumpolar world? What are the main environmental problems facing the circumpolar world? What impacts do physical geography and climate have on the human populations of the circumpolar world?

Major Understandings: Circumpolar regions are changing rapidly in areas of technology, economic activity, social structure and political organization.

Common Learning Experiences: Students will use maps and other resource materials to find data on the populations, economic resources, climates and physical features of the circumpolar world.

Knowledge: Students will demonstrate knowledge of the following:

- Physical and climatic characteristics of circumpolar regions
- How the environment of the circumpolar regions affects peoples: their lifestyles, occupations, leisure and economic activities

Attitudes: Students will be encouraged to develop:

- Respect for the rights, needs and concerns of others
- An appreciation for the consequences of people's interactions with their physical and social environments

Purpose

Students will learn the significant relationship between humans and the ecosystems of which they are part, including the consequences of human activities on the environment. This lesson shares important quotes from Elders, land users, and community members who have noticed shifts in the local ecosystem.

Teacher Resources:

- Rapid melting of ice roads in the north and impacts on communities:
- "Canada's ice roads are melting too soon": <https://www.atlasobscura.com/articles/canada-frozen-rivers-ice-roads>.
- Examples of changing ice patterns on transportation and access to supplies:
 - "Fuel tanker plunges through Deline, N.W.T., ice road": <https://www.cbc.ca/news/canada/north/truck-plunges-deline-ice-road-1.3477869>
 - "It's devastating": Barge cancellation taking a toll on Kugluktuk business, residents": <https://www.cbc.ca/news/canada/north/kugluktuk-supply-barge-cancellation-1.4872661>
- Mackenzie River Basin (location and introduction): <http://www.trackingchange.ca/river-basins/mackenzie/>
- This lesson is based on research from Tracking Change: Local and Traditional Knowledge in Watershed Governance: <http://www.trackingchange.ca/>.
- Protocol for inviting elders into NWT schools: https://www.ntassembly.ca/sites/assembly/files/13-06-3td_84-174.pdf

Materials Needed:

- Copies of "Tracking Change: Ice Freeze-up and Melt" handout
- Copies of Tracking Change worksheet
- Individual writing supplies (for individual responses) or large poster paper and felt pens (for group responses), according to preferences
- Optional: computer and projector to display Beyond Frozen

INTRODUCTION

The change in warmer winters and shifting seasons caused by human activities over the past couple of decades is becoming more noticeable. One key change is in the timing and predictability of ice freeze-up and melt. This lesson introduces students to the implications/consequences of human activities and how these changes have been noticed and recorded.

Key questions for student inquiry:

- How are patterns of ice freeze-up and melt changing in the Mackenzie River Basin? How does human activity contribute to this change? How does this change impact people who rely on the river?

LESSON PLAN PROPER

- **Location:** In classroom
- **Length of activity:** 90 minutes / 2 class periods
- **Activating Strategies:**
 - *Introduction.* Briefly introduce how the world's changing climate means that our warm seasons are getting longer, and our rivers do not freeze and melt in the same ways they have in the past. This has significant impacts on the lives of people who live in northern regions. After all, humans are part of their ecosystems - shaping and being shaped by the environment around them. People who rely on the ice have a strong awareness of these changes and impacts. They also find ways to adapt to the changing land. Listening to people who know and understand the land can help us understand these changes and the adaptations and actions that are required.
 - *Individual Brainstorm.* Ask students how the river/water body near them is used. Ask students to share their own experiences on the river throughout different seasons (e.g. What do you do on the river when it's free flowing? When it's just starting to freeze? What about when spring breakup starts?).
- **Learning Experiences:**
 - *Class Activity.* Introduction to an ecosystem shift resulting from climate change - ice freeze-up and melt.

- Display and read selections from *Beyond Frozen* that focus on ice freeze-up and melt, such as the story of Allen Gordon of Kuujjuaq, Nunavik (<https://projects.thestar.com/climate-change-canada/nunavut/>). This article focuses on lands of Inuit peoples, but there are some commonalities with communities in the Mackenzie River Basin. Discuss:
 - What does the article say is the cause of ice freeze-up and melt in Canada's North? Who is responsible? How do these changes impact the lives of the Inuit (consider: food, culture, safety, etc.)? How are Inuit people responding?
 - As a class, share stories and make predictions about how life is impacted by changes to ice in your community.
- *Individual or Group Activity.* Indigenous knowledge of ecosystem shift in the Mackenzie River Basin.
 - Introduce the handout, "Tracking Change: Ice Freeze-up and Melt," which provides excerpts from Indigenous knowledge holders about an ecosystem shift event (i.e about the timing and predictability of ice freeze-up and melt).
 - Have the students read the provided excerpts and respond to the questions. They may work individually or in groups, using poster paper to present their responses.
 - Option: have each student select an excerpt and write a more in-depth response:
 - Choose one of the excerpts and generate a series of interview questions to ask the speaker. Think: what more do you want to learn about the ice itself? What is important to ask in order to more fully understand the links between ice and human life?
 - Discuss student responses together as a class.

CONCLUSION/REFLECTION

- *Individual or Group Reflection.* Discuss:
 - What did you notice about the excerpts? Was there anything you were surprised by? Anything you disagreed with? Anything you wanted to learn more about? If you wanted to learn more, who in your own community could you ask about this topic?
 - These excerpts were gathered as part of a research project to understand local people's knowledge of changes to the ice. What do we know from these people that we might not know otherwise? What do you think is the value of research that listens to people in this way?
- *Class Discussion for Moving Forward.* Based on the group discussion, ask students to brainstorm ways community members can respond to the changing ecosystem (e.g. share observations about freeze up and thaw on Facebook)

groups; present/write to local or national governments to advocate for safety measures; present to the United Nations Conference of Parties (COP) to motivate action on climate change; learn from Elders how to identify dangerous ice; adapt harvesting patterns to changing ice).

- **Extension:** Many communities rely on ice roads or barges to deliver food, supplies, and fuel. Have students consider the ways that unpredictable ice freeze up and thaw could affect a community's ability to receive shipments. What challenges does unpredictable ice/melt pose to communities accessing the supplies they need? What alternatives are there to ice roads/barge transport? Have students conduct additional research to find real-world examples of this issue and what is being done (or not being done) about it (e.g. barge not able to make it to Paulatuk, fuel truck going through Deline ice road).
- **Extension:** invite an Elder, harvester, or other land user to speak to the class about ice freeze-up and melt. The class could meet in the classroom or outside near a waterway. In advance of the visit, have students generate questions for the guest, building on this activity but in reference to their home community. For details on how to guide your class through an interview with an Elder or community member, see the lesson plan on co-management.

INDIGENOUS LANGUAGES - WORD BANK

Indigenous knowledge of the land is interwoven with language. The following are key terms in northern languages that are directly related to this lesson. Following the NWT's whole-school approach to language learning, we recommend bringing these terms into the science classroom, according to the language(s) spoken in your community. In this way, it is possible to provide students with a holistic understanding of the land, language, and culture in ways that support their own identities.

To use any of the Northern Indigenous languages fluently means that the speaker observes and interacts with their environment. They are relational languages. The connection between the speaker, their actions and the environment speaks to a worldview where relationships are important - relationships with self, others, the land and one's spirituality - Our Languages, 2020, p. 5

We encourage collaboration with language teachers where available to support student learning. A few ideas to bring northern languages into science classrooms include:

- Creating classroom displays that highlight terms from this list using diagrams, photographs, artwork, and/or definitions.
- As a teacher, using these words in conjunction with or in place of English words throughout the lesson (and others) where possible.
- Encouraging students to incorporate these terms into written and oral components of this lesson (and others).
- Discussing with students how the precision of some of these words is linked with Indigenous knowledge of the land.

- Incorporating terms into a game/activity/lab assignment to make language learning fun.

Source: https://www.ece.gov.nt.ca/sites/ece/files/resources/our_languages_curriculum_2020_low_res.pdf

TRADITIONAL WORDS					
English	<u>Tsaat'ine</u> <u>tthadeh</u> / Dene (Beaver or xe'ghont'e)	<u>Sahtúq̄t'ine</u> / Dene (Slavey or Kaguntu)	<u>Nēhiyawēwin</u> / Cree	<u>Dinji</u> <u>Zhu'</u> <u>Ginjik</u> / <u>Gwich'in</u>	<u>Inuvialuktun</u> / Inuvialuit
Ice	E'teni	Te'	miskwamiy	Łuu	Siku
Dark ice (dangerous ice)	E'teni dendi t'essi (mbe wo'nde'jii)	Te dendi t'essi	kakwes- paneyih-tākosi mask- wamiy	Łuu	Illagauyaq
Spring Breakup	Nda'udidli e'tene de'ele	Ttuittedi	machisee- kwahk	Łuu tijih	Upinraksaq
Water on the ice	E'teni k'e tu	Te'ke tumbe't- sande' ih ndat- sedetsi'	nīpiy katah- kohcihk mask- wamiy	Łuu kak chuu	Misaliraq
Ice that remains after breakup	Nda'udidli e'tene da'ghe' óhli	Te de'eh	maskwamiy kaiyat kakisisee- kwahk	Teevee tuu	Sikuliagaa
Ice broken up by bad weather	Tthene edu uujō t'ah e'teni ya'iton	Dzene nezūile t'a te' de'eh	maskwamiy pīkopayiw oschi kamā- yikisikak	Łuu khadi- naanaih	Sikuliagaa
Opaque Ice (solid ice)	E'teni k'edze'	Te ndatse'	maskwamiy isōhkatīn	Tan	Tuglu

Solid Ice above the tides	E'teni k'edze ta'decho'ii diieh	Te ndatse'-ta'ke	maskwamiy isôhkatî ispimihk ihtakî-wêciwanihk	Tan	Siku
Water on top of the ice	E'teni ke' tu	Te ke'tu	nîpiy katah-kohcihk maskwamiy	Łuu kak chuu	Misaliraq
Ice floe	E'teni da'xe'ohli	Tuitledi	maskwamiy pemicô, mâcistan	Łuu alah	Sikuliqi-yuaq
Steep ice hanging at low tide	E'teni yueh tu eduli	Te yue tu nedue'	maskwamiy tapah-takocin kîwêcwan	Łuu nijee alah	Imailar-ningaa
Free of floating ice	E'teni da'ghe' ôhli xoolah	Te' tadheh	pimâpakiw maskwamiy	Łuu kwâh	Siku puktayuaq
Sound of ice breaking up in spring	E'teni ya'itu'ii adii	Te tadetų'	kasekwahk pêhtâwihk maskwamiy epîkopayt	Tan dhatràih	Siku puktayuaq

Keywords: river, ice, melt, climate change

Themes: traditional knowledge, community, livelihood, climate change, ecosystem shift

Student Handout: Ice Freeze-Up and Melt

In the following excerpts, Indigenous people from various communities in the Mackenzie River Basin share their deep knowledge of the ice. This knowledge has been developed through long-term experience and observations living, harvesting, and travelling over the ice, throughout people's entire lives and also across generations. Because this knowledge is developed over time, it expresses large patterns in change, not just small changes from day-to-day or year-to-year. Such deep knowledge of the land and water is sometimes referred to as "Indigenous knowledge" or "local and traditional knowledge."

Ice used to be three to four feet thick," explained one participant while another added that now you are lucky to see two feet of ice. One described ice up to six feet thick at break-up in the past comparing it to much thinner ice now and "a different kind of ice – slushy, not thick, solid, and clear. - participant from the Dehcho area, p. 34, 2016-2017 Report

A participant explained that the warming is happening from both directions, not just from the top of the ice but also from underneath. "Scary," he said, "you can't tell what the land is doing underneath." He explained that he is constantly hearing of people falling through the ice and that people need to travel very carefully now, constantly 'being on guard.' "It's hard to follow your grandfather's trails," he said. - participant from the Dehcho area, p. 34, 2016-2017 Report

In the winter time it's different too, because you see the ice pile up on the Mackenzie. Like last year on the Mackenzie...you could actually take a skidoo right from here and right to Rabbit Skin and drive along the shoreline, just nice and flat. But this year the ice is just piled up like humongous, like mountains along the way, so it's pretty hard to follow the shoreline nowadays. - Dehcho K'ehodi Program participant, p. 34, 2016-2017 Report

LKDFN members remember the ice being 6-8 feet thick in places; currently it doesn't get much more than 3-4 feet in most places. - participant from the Lutsel K'e Dene First Nation p. 58, 2016-2017 Report

You gotta test the ice wherever you go, with weather changing so fast, climate change, it's a lot warmer now this time of year, ice is thinner than it used to be, dangerous for travel you know. - Lutsel K'e Dene First Nation, p. 59, 2016-2017 Report

The river break-up is happening sooner now. Ice doesn't pile up on the shores anymore because it isn't thick. It doesn't scour the bank. There are no more flood. - Smith's Landing First Nation, p. 59, 2016-2017

One participant spoke about how people used to ice fish in September, whereas now people have to wait until November. Another participant spoke about how there used to be ice on the lakes on June 20th, but now they can't even go out on lakes on May 20th. – participant from the Gwich'in area, p. 15, 2017-2018 Report

You have to really watch where you're going. You have to check the ice before you cross the lake. But it's not as thick as before so you really need to watch. (source?) – no source mentioned, Sahtu/Deline area, p. 29, 2017-2018 Report

It's really dangerous to go out in the winter time because it's not freezing as much anymore.... The ground where the people want to go can't freeze anymore. Even right now its -33 [but] there's some places they can't go right now because it's not freezing. – Dehcho K'ehodi Program participant, p. 34, 2016-2017 Report

... reduced ice thickness in certain areas can make it less safe to travel to some places. This change has been observed in the last 5-10 years – 2016 FJMC Report



Picture of Ice Floe

Photo Credit: Michael & Christa Ritchert

5. How has this change impacted daily life in this community?

6. In what ways does this community adapt to this ecosystem change?

7. What could this community do to ensure they can continue to have healthy livelihoods in the future?

8. If you could speak with one of these people, what would you ask them in order to learn more?