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...in the classroom

Science 8:
Human Impacts

Indigenous Knowledge Lesson Plan

Local and Traditional Knowledge in Watershed Governance
www.trackingchange.ca

Science 8: Human Impacts

SCIENCE 8: FRESHWATER AND SALTWATER SYSTEMS (SOCIAL AND ENVIRONMENTAL EMPHASIS)

Focusing Questions: How do water, land and climate interact? What are the characteristics of freshwater and saltwater systems, and how do they affect living things, including humans?

Analyze human impacts on aquatic systems; and identify the roles of science and technology in addressing related questions, problems and issues.

- Analyze human water uses, and identify the nature and scope of impacts resulting from different uses;
- Identify current practices and technologies that affect water quality, evaluate environmental costs and benefits, and identify and evaluate alternatives;
- Illustrate the role of scientific research in monitoring environments and supporting development of appropriate environmental technologies;
- Provide examples of problems that cannot be solved using scientific and technological knowledge alone.

Purpose

Students will learn how to analyze the different factors affecting marine and freshwater environments, the human impacts on the environment, and how to address these issues. This lesson shares some excerpts and quotes from the tracking change reports for the purpose of researching the different human impacts on the environment.

Teacher Resources

- 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/
- For extension:
  - School protocols for engaging elders and community members.
  - Elders in Schools Handbook - https://www.ntassembly.ca/sites/assembly/files/13-06-3td_84-174.pdf

Materials Needed

- Copies of Understanding Water Issues - Note Taking Worksheet

Cover Photo: Northwest Territories Sunset
Photo Credit: Kenton Hamaluik

- Copies of one or more of the research topic handouts:
  - Hydro Damming Research Topic Handout
  - Mining Impact Research Topic Handout
  - Climate Change and Water Research Topic Handout
- Copies of Planning a Skit
- Notebook and writing tool to take notes
- Individual writing supplies (for individual reflection responses) or computer to type up the response

INTRODUCTION

71% of the world's surface is covered in water, from salt water systems to freshwater systems that we all rely on. However, what happens when our actions as a society impact these vital ecosystems that are part of our daily lives for water, food, and fun? This lesson introduces students to researching and analyzing different human impacts on the environment, and invites students to make decisions that benefit local ecosystems.

Key questions for student inquiry:

- How has human activity impacted the ecosystem, including the people who rely on it? What is being done about the issue? What can you do to help address the issue?

LESSON PLAN PROPER

- **Location:** Classroom (computer room, if desired)
- **Length of activity:** 90-135 minutes/2-3 cass periods
- **Activating Strategies:**
  - *Introduction.* Briefly introduce how the world's changing climate and human activities are having major impacts on the environment. Some of these human activities are things we think are harmless, like recreational activities such as sport fishing, buy may negatively affect fish populations. Some human activities such as mining and industrial development are considered "necessary" by some people for providing jobs and necessary materials, though they have significant impacts on freshwater ecosystem health. Other activities have negative ecosystem effects despite being sustainable in other ways. For instance, hydroelectric dams helpfully replace fossil fuels as more "sustainable" or "green" sources of energy with fewer climate impacts, but they significantly impact local ecosystems.
  - These examples show that human interactions with freshwater ecosystems are more complex than they may seem at first glance! These changes have

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 water and fish from the freshwater systems have a strong awareness of the impacts of human activities in their local areas. These people also find ways to adapt to the changing land. Listening to people who know and understand the land can help us understand these impacts 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 with the river/water body and if they have noticed anything that is impacting or threatening it (i.e is mining polluting the water, is something affecting the fish population, or is the water levels being changed by something?). Invite students to share stories from their elders or family members, or to bring local news articles to class that talk about these issues.

- **Learning Experiences:**

  - *Class Activity.* Choose one of the current water-related issues, and introduce it to the class by showing the appropriate videos. As students view the set of videos, have them take notes using the Understanding Water Issues - Note Taking Worksheet. Discuss student responses to the videos as a class.

    - Hydro damming:

      - "The impact of Manitoba Hydro dams on Pimicikamak's traditional land" (6:42): https://www.cbc.ca/fifth/blog/the-impact-of-manitoba-hydro-dams-on-pimicikamaks-traditional-land

      - "Are Reservoir Dams Bad For The Environment?" (0.31): https://www.youtube.com/watch?v=4KtUk1FbCPA

      - "Remove the Dams to Save the Salmon? | Short Film Showcase" (7:29): https://www.youtube.com/watch?v=DK5nUXkrz8o

    - Mining Development and water damage:

      - "Freezing 200,000 Tons of Lethal Arsenic Dust" (4:33): https://www.youtube.com/watch?v=E4nZDSLdIiM

      - "How Does Mining Affect the Environment? You'll Be Shocked to Know" (3:39): https://www.youtube.com/watch?v=tvVV-tjnmiU

    - Climate Change and water:

      - "How does Climate Change affect our Water?" (1:43): https://www.youtube.com/watch?v=yY49P9E7pbs

      - "Canada in 2030: Future of our water and changing coastlines" (1:43) (Sea ice focus) https://www.theweathernetwork.com/news/articles/canada-climate-change-water-earth-fire-air-2030-global-warming-sea-level-rise/104395

- *Individual or Group Activity.* Introduce the different research topic handouts ("Hydro Damming Research Topic Handout," "Mining Impact Research Topic Handout"), which provide excerpts from reports and quotes from Indigenous knowledge holders about the different issues, along with the assignment details.
- *Group Activity.* Drinking Water Survey
    - Have the students read the provided excerpts and quotes, respond to the questions and further research the selected topic. They may work individually or in small groups.
    - Review the students' responses together as a class.
    - Divide students into small groups to create and present their skits about the water issue. Distribute copies of "Planning a Skit" to help students organize their ideas into a dramatic form. Depending on class enthusiasm, consider inviting younger students or community members to watch the skits.

CONCLUSION

- *Individual or Group Reflection. Write and/or discuss:*
    - These excerpts were gathered as part of a research project to understand local people's knowledge of changes to the water. 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?
    - Optional: conclude the lesson with a 3-2-1 assessment. Ask students to jot down three things they learned, two questions they have, and one thing they enjoyed.
- **Extension.** Invite an Elder or knowledgeable community member to speak about the types of water issues that are of concern to their community.

Keywords: hydroelectric damming, mining/resource development, climate change, water quality

Themes: traditional knowledge, community, livelihood, climate change, water

Student Handout: Understanding Water Issues Note Taking Worksheet

NAME _____ **DATE** _____

Water Issue: _____

As you watch videos about the water issue, think about the following questions. Take notes about what the videos are saying about the topic:

1. What do the videos say about the different impacts that the selected human activity has on the water system?

2. What kinds of scientific tests or community research help to identify these impacts?

3. How do these impacts affect the broader ecosystem, including local Indigenous peoples, local communities, and plants and animals in the area?

4. Is there anything that can be done to address the issue?

5. What else would you like to know about the issue? How can you find out more about the topic?

Student Handout: Hydroelectric Damming Research Assignment

NAME _____ **DATE** _____

QUICK ISSUE DESCRIPTION

Hydro dams can be a source for renewable energy in regions where water is plentiful. They use the force of running water to generate energy through dams across rivers. Hydropower is a replacement for harmful fossil fuels that contribute to climate change. Hydro dams do not release pollutants into the air, meaning the air around them remains clean to breathe.

However, hydro damming has significant environmental impacts on local ecosystems. Hydro damming blocks fish migrations, traps sediments upstream that are important to downstream ecosystems, and keeps Indigenous people from accessing some of their traditional fishing areas.

Here are some statements by local people and reports on how hydroelectric development has impacted their communities and way of life. As you read, underline the key points about hydro damming.

> *We are banned from the best fishing spots by Hydro anyway. They built a fence and put up signs and they have security.* - Thomas Hale, Saulteau First Nation fisher, Treaty 8 Association of BC, p. 64, 2016-2017 Report

> *The fish in the area around Nonacho Lake are considered "ruined" due to the impacts of the Talston River Hydro Electric Project. The flooding that occurred as a result of that project led to changes in mercury levels in fish as well as other changes in the quality of fish tissue such that people no longer consider them good to eat.* - Lutsel k'e portion of the 2016-2017 Tracking Change Report, p. 49

MERCURY:

Mercury is a naturally occurring element that is toxic to humans, causing serious health problems. People are mainly exposed to mercury by eating fish that contain mercury. It is released into the ecosystem as permafrost melts due to climate change. Mercury also enters ecosystems through burning of coal. It also enters water systems after it has been used in mines to extract metals like gold. Fish are exposed to mercury through the water. Mercury levels get higher and higher in organisms that are further up the food chain. So, mercury levels are higher in larger fish, which eat lots of smaller fish, and they may become even higher in humans who rely on fish for food.

Whatever happens up here, Peace River, directly impacts us at home. There is a deep fear. One, BC Hydro did their own environmental assessment on Site C [Dam], how is that legal? Two, they are turning away nations saying there will be no impacts to rights and interests. When they first built the Bennett Dam, there were deep impacts, changes to water levels and quality. The Peace River is such an important river. Water is life, we can't eat money. We don't do anything at Beaver First Nation for money—we do things in a forward-thinking way. Money comes and goes, but the land is there forever.

Water is number one. We came here to support anything and everything that T8TA (Treaty 8 Tribal Association) would like to do to support water. We have a real fear of water quality, water shortage. We have to do everything we can. You don't have to be a leader to speak your mind. We need everybody to stand up. If we teach our kids that that drop of water is the most important thing on the planet, they will grow up respecting it." – Chief Trevor Mercredi, Treaty 8 Mackenzie All Chiefs Water Gathering Initiative, p. 40 2017-2018 Report

RESEARCH QUESTIONS

Now, do your own research! Search for other information (web searches, books on dams, etc.) on the impacts of hydro damming. There are some suggested web sources at the end of this handout to help you get started! As you read the quotes and conduct further research, respond to the following questions:

1. How do hydro dams affect the local fish species?

2. What are some of the long term impacts of hydro damming on the local aquatic ecosystem?

3. How has hydro damming impacted the lifestyle of local animals and people who rely on the aquatic ecosystem?

4. What are some values expressed in the various statements and excerpts? What do these values tell us about the impacts of hydro damming that we might not find out from scientific testing of the water and local ecosystem?

5. Who usually makes decisions about hydroelectric dams? Who else could be involved in decision making?

SHARE YOUR KNOWLEDGE

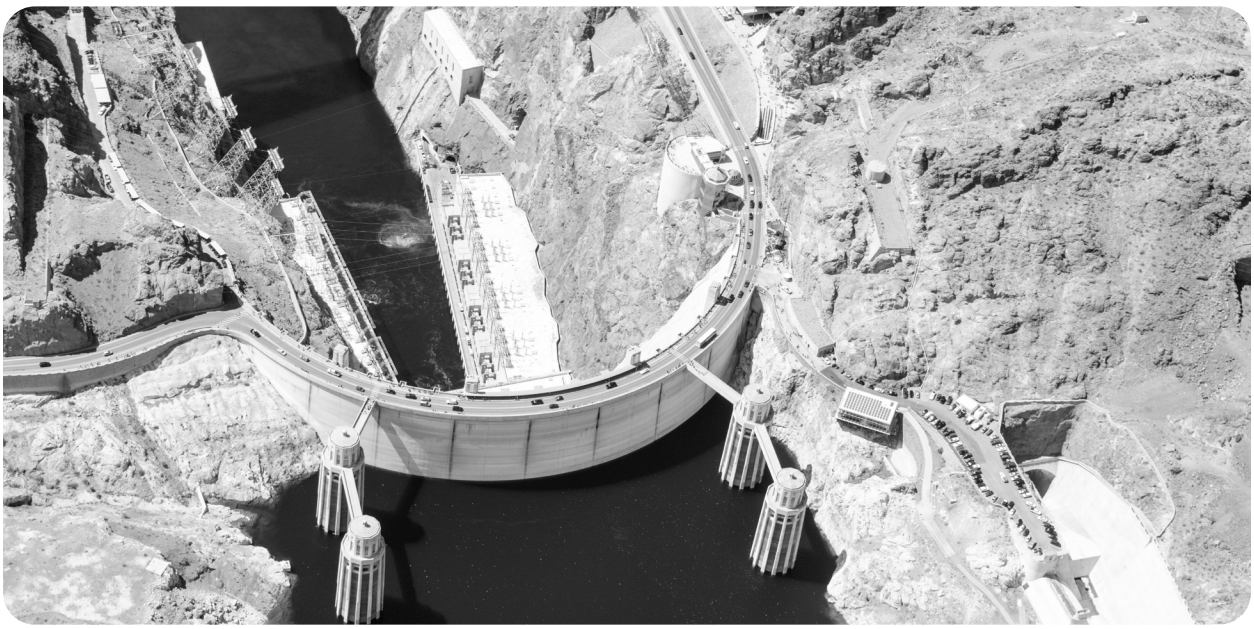
Prepare a persuasive skit or short presentation that shares your learning with the class. The point of your skit is to help people understand the water-related issues you have researched in order for them to make a change. The changes you recommend should fit the imagined audience of your skit. For example, does your audience involve students at your school, a local or territorial government, a council, a hydro power corporation, or someone else? You will want to think about how your research speaks to this audience. In other words, it's time to be creative and persuasive!

Some ideas include:

- Panel of experts and community members speaking to a government, industry, or community meeting about the issue
- Guides giving a tour of the dam and local river to tourists
- Local people sharing ecosystem changes with their network of online friends through their Instagram or Facebook stories
- Experienced harvester sharing stories of how fishing has changed over time with a local group of young people

Additional Resources:

- Environmental Impacts of Dams blog: https://www.internationalrivers.org/environmental-impacts-of-dams
- Hydropower dams can harm coastal areas far downstream: https://theconversation.com/hydropower-dams-can-harm-coastal-areas-far-downstream-114171



Areal Image of a Hydroelectic Dam
Photo Credit: Cédric Dhaenens

Student Handout: Mining Impacts Research Assignment

NAME _____ **DATE** _____

QUICK ISSUE DESCRIPTION

Mining is the extraction of valuable minerals or other geological materials from the earth such as metals, precious gems, coal, and gravel. Mining also includes the extraction of non-renewable resources such as petroleum and natural gas. Mining is a human activity that has been going on for ages and is a large part of both our history and our current life.

While mining a common industrial practice, it also has some disadvantages. It impacts local ecosystems and causes major environmental issues, such as water pollution. Mines impact the health of the fish and wildlife near the mines and connected waterways. This is an issue for many Indigenous communities who rely on the fish and wildlife for food.

Here are some statements by local people and reports about the impacts of mining on their way of life. As you read them, underline key issues about mining:

On the topic of seismic testing for oil and gas in the 70s, 80s and 90s in the Dehcho area:

> *A tugboat pushing three or fours barges would stop every kilometre or so and set off an explosion—blasting. Each blast sent water shooting up above the trees. There were many dead fish floating down the river.* - Dehcho K'ehodi Program participant, Dehcho area, p. 36, 2016-2017 report

SEISMIC TESTING:

Seismic testing is when shock waves or dynamite explosions are used to understand what is just below the surface of the earth (subsurface). It is used to help find the best places to drill for oil and gas.

On the topic of mining in the NWT area:

The draining of lakes and rerouting of ground water as a result of diamond mining activity is also a fundamental concern. The closest operating diamond mine - Gahcho Kue Diamond Mine - is less than 100 kilometers from the community of Lutsel K'e. The diamond mine is located in the Lockhart River system that travels from the diamond mine through Artillery Lake and Lockhart River.

> *...it's hard to get by sometimes. We aren't miners, we're bush people. It's really scary. What's happening at the mines. I know they say it's okay, it won't affect the environment, but when they're gone we're going to have to deal with it. I don't know what's going to happen there.* - Joseph Catholique, Lutsel k'e area, p. 51, 2016-2017 Report

The Yellowknives Dene First Nations have been deeply involved in various kinds of research initiatives and consultations regarding the impacts of this mine on their health, culture, and livelihood. It has also made people suspicious about the impacts of other mines. In general, it is believed that where there are mines the fish are unhealthy and where there are no mines the fish are healthy (Yellowknives Dene First Nation Elder). Akaitcho area report, p. 54, 2016-2017 Report

RESEARCH QUESTIONS

The statements above were collected from local people. Now, do your own research! Read the statements and excerpts, and search for other sources of information (web searches, books on mining/development, etc.) about the effects of mining and development. There are some suggested web sources at the end of this handout to help you get started! As you read the quotes and conduct further research, respond to the following questions:

1. How might Indigenous knowledge be beneficial in studying this issue?

2. What are some of the long term impacts caused by mining and development on the local aquatic ecosystem (i.e. fish health, water quality, water levels, etc.)?

3. How has mining impacted the lifestyle of local animals and people who rely on the aquatic ecosystem?

4. What are some values expressed in the various statements and excerpts? What do these values tell us about the impacts of mining that we might not find out from scientific testing of the water and local ecosystem?

5. Who usually makes decisions about the operation of mining and development in the area? Who else could be involved in decision making?

SHARE YOUR KNOWLEDGE

Prepare a persuasive skit or short presentation that shares your learning with the class. The point of your skit is to help people understand the water-related issues you have researched in order for them to make a change. The changes you recommend should fit the imagined audience of your skit. For example, does your audience involve students at your school, a local or territorial government, a council, a hydro power corporation, or someone else? You will want to think about how your research speaks to this audience. In other words, it's time to be creative and persuasive!

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Additional Resources:

- "This is Giant Mine" blog: https://thenarwhal.ca/this-is-giant-mine/
- News article "Arsenic has changed Giant Mine site in N.W.T. 'indefinitely:' scientist": https://www.ctvnews.ca/sci-tech/arsenic-has-changed-giant-mine-site-in-n-w-t-indefinitely-scientist-1.3034082
- Seismic Surveys Blog: https://www.neaq.org/blog/offshore-oil-and-gas/
- Alaska's Pebble Mine could generate $1 billion a year. Is it worth the risk to salmon? (video): https://www.latimes.com/world-nation/story/2019-10-23/pebble-mine-alaska-salmon

Giant Mine Remidiation Project
Photo Credit: Kevin O'Reilly

Student Handout: Climate Change and Water Research Assignment

NAME _____ **DATE** _____

QUICK ISSUE DESCRIPTION

Climate change is a term that describes any significant long-term changes in the temperature, precipitation, and wind patterns in an area. Some changes include, hotter summers, warmer winters, late freeze-up/early spring thaw, and changes in water levels in freshwater and saltwater ecosystems. Not only does climate change affect the ecosystem and weather conditions but it affects the life that relies on the ecosystem - from fish to whales, fox, bears and so on - as well as humans as a society.

Despite our strong reliance on the environment for food, water, and clean air, the greatest thing contributing to climate change is the behaviour of our own people. For example, emissions from cars and industrial operations emitting greenhouse gases that contribute to climate change, roadways disrupting wildlife habitat, chemical runoff from farms polluting the water, and hydroelectric dams disrupting water levels. These environmental impacts are exaggerated by the extreme and unpredictable weather brought about through climate change. Many Indigenous peoples, especially in the north, live in close connection to the land and notice changes to the fish, water, and wildlife their communities rely on.

.Here are some statements by local people and reports about how their communities have been impacted by climate change. As you read, underline key points about climate change:

On the topic of Chemical and Mercury Pollution of water:

> *All that clearcutting, every time it rains, all the silt and chemicals from the forestry area, it drains down and eventually comes down to our lakes. And the fish are affected. It's true those chemicals are in the sand but the fish eat from the bottom. Everything is going downhill. There is already mercury in this lake* - Lesser Slave Lake Elder, Treaty 8 FN of Alberta, p. 87-88, 2016-2017 Report

CLEARCUTTING:

Clearcutting is when every single tree is cut down from a selected area. Forestry companies prefer this method of harvesting trees as it is the cheapest and most efficient way of harvesting timber. This leaves vast areas of forestry open and exposed to the elements.

> *The fish were good back in the 1950s because there was no forestry and oil activity in the hills. But since then the fish are becoming poor. It's also the farmer's fields and all the chemicals that they use for their crops and it drains into the creeks and streams and goes into the lake* - Lesser Slave Lake Elder, Treaty 8 FN of Alberta, p. 89, 2016-2017 Report

Climate change leads to increased algae in the water due to warmer temperatures:

> *Since the last two years it's not deep anymore, you never used to see algae floating on the lake, now you see them out in the waters now and it tells you there's changes to the water.* - Yellowknives Dene First Nations, Akaitcho area report, p. 58, 2016-201 Report

> *Algae is growing in areas where [the]river water has gone down to expose the river bottom, and near the river edges and on rocks and reefs that are exposed.* - Yellowknives Dene First Nations, Akaitcho area report, p. 58, 2016-201 Report

Climate change also impacts water levels:

> With low water levels now people of Smith's Landing First Nation and Deninu Kųę First Nation have noticed that fish are not moving to their spawning habitat, and this is one of the reasons they see less fish in the river. The population is a lot lower now than in the past

> According to some elders, this may be because *"sometimes the fish can't move up creeks and small rivers along the Slave River to span because of low water"* - Elder, Smith's Landing First Nation

RESEARCH QUESTIONS

Now, do your own research! Read the statements and excerpts, and search for other sources of information (web searches, books on mining/development, etc.) about the effects of mining and development. There are some suggested web sources at the end of this handout to help you get started! As you read the quotes and conduct further research, respond to the following questions:

1. How does climate change affect the local waterway systems?

2. What might some of the long term impacts of climate change be on the local water ecosystem?

3. How has climate change impacted the lifestyle of local animals/ people who rely on the aquatic ecosystem for food and water?

4. What are some values expressed in the various statements and excerpts? What do these values tell us about the impacts of climate change that we might not find out from scientific testing of the water and local ecosystem?

5. Who usually makes decisions about how to address the changes caused by climate change? Who else could be involved in decision making?

SHARE YOUR KNOWLEDGE

Prepare a persuasive skit or short presentation that shares your learning with the class. The point of your skit is to help people understand the water-related issues you have researched in order for them to make a change. The changes you recommend should fit the imagined audience of your skit. For example, does your audience involve students at your school, a local or territorial government, a council, a hydro power corporation, or someone else? You will want to think about how your research speaks to this audience. In other words, it's time to be creative and persuasive!

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- Local people sharing ecosystem changes with their network of online friends through their Instagram or Facebook stories
- Experienced harvester sharing stories of how fishing has changed over time with a local group of young people

Additional Resources:

- Information/Encyclopedia on algae blooms: http://www.waterencyclopedia.com/A-Bi/Algal-Blooms-in-Fresh-Water.html
- Yukon Example of low water levels affecting fish migration (make sure to keep scrolling): https://projects.thestar.com/climate-change-canada/yukon/
- USA example of climate change affecting water: https://blogs.ei.columbia.edu/2019/09/23/climate-change-impacts-water/
- Government of the Northwest Territories page on climate change (go through for general information, check out the sidebars): https://www.enr.gov.nt.ca/en/services/climate-change

Image: Sign at a Climate Change Protest
Photo Credit: wMarkus Spiske

Student Handout: Outline
Planning a Skit

Supporting Evidence for Argument/Concern #1:

Let's think about the different parts of a skit and how these can communicate your ideas to the audience. The plot is important, but it is not the only thing to consider.

Think about the setting of the skit and how to help the audience imagine where the skit takes place. Think about the characters: who are they, what are they like, and what roles do they play in the story? Think about the mood of the skit and how this will impact the audience: will it make them feel sad about what is going on, will it inspire them to act, or will it make them laugh?

Plot:

How does the skit begin?

What happens in the middle? Is there a problem or conflict that need to be resolved?

How does the skit end?

Student Handout: Outline Planning a Skit

Setting:

Where will your skit take place?

When will your skit take place?

Why did you select this setting for the skit?

How will you show this setting to the audience?

Mood:

What is the mood of your skit?

Student Handout: Outline
Planning a Skit

Character 1:

Who is this character? What are they like? What is their role in the skit?

Character 2:

Who is this character? What are they like? What is their role in the skit?

Character 3:

Who is this character? What are they like? What is their role in the skit?