

Overview:

The Arctic is particularly sensitive to climate change and begins to exhibit indicators, or harbingers, of change before the rest of the planet. This lesson explores some of the harbingers of climate change in the Arctic.

Objectives:

The student will:

- review Arctic climate change indicators, called harbingers, then apply the knowledge to documented Native observations of change; and
- participate in a hands-on activity that challenges them to find connections among Arctic climate change indicators.

Targeted Alaska Grade Level Expectations OR HSGQE essential skills:

R4.2 Summarize information or ideas from a text and make connections between summarized information or sets of ideas and related topics or information.

Targeted Alaska Grade Level Expectations:

Science:

- [11] SA1.1 The student develops an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.
- [11] SC3.2 The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by analyzing the potential impacts of changes (e.g., climate change, habitat loss/gain, cataclysms, human activities) within an ecosystem.
- [11] SD3.1 The student demonstrates an understanding of cycles influenced by energy from the sun and by Earth's position in the solar system by describing causes, effects, preventions, and mitigations of human impact on climate.

Vocabulary:

harbinger - anything that foreshadows a future event; a sign of things to come

Whole Picture:

Alaska's Native people have a deep connection to the land. Elders are keenly aware of environmental change because they have an understanding of traditional ecological knowledge – generations of learning and experience with the land and wildlife – and can compare it with the changes that are happening today.

Materials:

- Yarn
- Scissors
- Tacks or tape
- VIDEO: "Native Voices from the Heart of Alaska" from WWF (World Wildlife Fund for Nature)
- TRANSCRIPT: "Witnessing Climate Change: Native Voices from the Heart of Alaska" from WWF
- STUDENT INFORMATION SHEET: "Harbingers of Change"
- STUDENT WORKSHEET: "Connections"
- STUDENT WORKSHEET: "Response Sheet"



Activity Preparation:

Review STUDENT WORKSHEET: "Connections" and Activity Procedure 3. Determine ahead of time if you wish to use space on the classroom wall or a piece of chart paper for the activity.

Activity Procedure:

- 1. Hand out STUDENT INFORMATION SHEET: "Harbingers of Change." Choose a reading strategy best suited for the class. Discuss and clarify the material as you read. Students may refer to the paper in a later activity.
- 2. Watch the VIDEO: "Native Voices from the Heart of Alaska" produced by WWF (World Wildlife Fund for Nature). A transcript of the video is included in the lesson. Hand out copies so students can follow along as they listen.
- 3. After listening to "Native Voices from the Heart of Alaska," review the transcript and see if students can identify harbingers mentioned by the people in the clip. For example, Rose Ambrose said, "Weather is getting too old to control itself. It's going to get out of control; that's exactly what Chief Henry mean. Koyukuk River, the water is above the bank. Terrible, terrible, terrible it was exactly like ocean. The was so high, so high." This quote fits well within the category of Changes in Precipitation, which discusses increased flooding.
- 4. Ask for student volunteers to cut out each of the harbinger symbols from STUDENT WORKSHEET: "Connections." Using a space on the classroom wall, or alternatively, a piece of chart paper, place the symbol for warm weather in the center. Place the remaining 11 symbols in a circle around warm weather (approximately 12 to 18 inches away). Connect each to the center with a piece of yarn. Next, ask students to establish relationships between the harbingers. If they can give a good verbal explanation, allow them to place a piece of yarn as a connector. (For example, Early Break Up may affect animal migration, so it can be connected to Animal Range. It may also affect Subsistence and Plant Range.) Ask students to make as many connections as possible. The point of the exercise it to emphasize that climate change does not occur in isolation. See the Answers section for additional ideas for connections. Emphasize that some changes are positive, some negative and some neutral. (A forest fire may devastate an area and trigger permafrost thaw, but early stages of re-growth attract moose, which is good for subsistence.)
- 5. Ask students to think about connections they had not thought about prior to this exercise. If students have a science journal, ask them to complete the following exercise: Write about the connection between two or more harbingers of climate change you many not have realized prior to this lesson. Explain the harbingers and connections. Illustrate your response. If students do not have a science journal, use STUDENT WORKSHEET: "Response Sheet."

Extension Idea:

1. Pick one harbinger and do an in-depth study beyond the connections touched on in the lesson.

Answers:

STUDENT WORKSHEET: Connections

(NOTE: For teachers taking the UNITE US course for credit, there is no student worksheet to send to UNITE US for assessment. If possible, take a picture of the finished display to email with your e-journal.)

Listed are some ideas about the types of connections students could make. The point of the exercise is to emphasize that climate changes do not happen in isolation. The list is not exhaustive, but intended to help facilitate discussion in the lesson.

- Warming temperatures are a catalyst for all the items listed.
- Thawing permafrost can be connected to erosion, changes in plant growth, changes in animal migrations, subsistence changes, and insects.



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- * When a frozen shoreline or riverbank thaws, it becomes unstable and is easily eroded by precipitation, storms and moving water.
- * When permafrost thaws, it changes habitat for the plants that grow in the active layer above it. There is a change in the moisture content of the soil, and a possible change in the soil temperature.
- * As plant growth changes, the animals that depend on the plants will move and change, too. In addition, most animals do not like to walk on wet, soggy ground, so they will avoid thawing permafrost.
- * If the population of animals shifts, then subsistence foods can be affected. Waterfowl rely on wetlands. If the area drains because the permafrost has thawed under it, the waterfowl will move.
- * If thawing permafrost creates standing water in the active layer, more mosquitoes may breed.
- **Early spring break up** can be connected to insects, change in plant growth, change in animal migration and erosion.
- * Early break up means insects can hatch earlier.
- * Plants have a longer growing season when the snow melts earlier.
- * Changes in plants affect the animals that eat them.
- * Early break up means more time for erosion.
- Melting glacier ice can be connected to erosion, plant growth and animal migration.
 - * High water levels from glacial run off increase flooding which erodes riverbanks.
 - * When a glacier drastically retreats, the area is left ice-free; then it is open to new plant growth and habitation by animals.
- **Changes in precipitation** (either more or less) can be connected to insects, changes in plant growth and animal migration, increased forest fires, erosion and subsistence changes.
 - * Wetter conditions allow for more mosquitoes. Conversely, drier conditions lead to different kinds of insects.
 - * The kinds of things that grow are directly connected to the amount of precipitation, which directly affects the kind of animals that live in an area. A change in the animals that inhabit an area affects subsistence.
 - * Less precipitation would lead to more forest fires.
 - ^{*} More precipitation would lead to more erosion.
- **Insects** can be connected to animals, changes in plant growth and increased forest fires.
 - * Many birds, especially waterfowl, rely on a large population of insects.
 - * The spruce beetle can wipe out large areas of forest.
 - * Forests with large insect kill areas are at great risk of forest fire.
- **Change in animal migration** can be connected to changes in subsistence.
- **Changes in plant growth** can be connected to changes in animal migration, changes in subsistence and increased forest fires.
 - * A forest that dies due to insects or due to changes in temperature or the water cycle is at great risk for a forest fire.
- **Changing sea ice** can be connected to erosion and changes in subsistence.
 - * Without sea ice, coastal communities are bombarded by ocean waves which erodes the coast.
 - * Many marine animals depend on sea ice. The population is threatened and the animals must move when sea ice changes.
- **Forest fires** are connected to thawing permafrost, changes in plant growth, changes in animal migration and changes in subsistence.
 - * A forest fire clears insulating vegetation above permafrost which can lead to thaw.
 - * A forest fire starts a new succession of plant growth and changes the plants and animals that live in an area. The bushes and shrubs that tend to grow back in earlier stages actually attract moose which positively affects subsistence.



• Erosion is connected to changes in subsistence. Erosion deposits sediment into rivers which could adversely affect the spawning habits of many species of fish.

STUDENT WORKSHEET: Response Sheet

Answers will vary





Witnessing Climate Change: Native Voices from the Heart of Alaska

An audio slideshow programme designed and produced by the Athabascan community in the small, remote village of Huslia, Alaska.

SECTION 1: Introduction & Spring

Effie Williams speaks in her Native language about climate change: "In our Koyukon Athabascan language, the word for climate is Jaajetnaaw Hawdeelta. Both long ago and today, it is the climate that rules the seasons, our wild foods, and our way of life. Changes in the climate over the last 30 years have greatly affected the land, animals, and people of Interior Alaska. As a community, we have witnessed the unpredictable nature of these changes throughout the year. For the sake of all future generations, we want to share our observations."

Catherine Attla: "All our old people study the weather changing in Alaska. This one old man that was living here, Chief Henry, he say 'My grand-children, you live up to a warm weather that wouldn't be the right place at the right time'."

Rose Ambrose: "Weather is getting too old to control its own self. It's going to get out of control; that's exactly what Chief Henry meant. Koyukuk River, the water is above the bank. Terrible, terrible, terrible - it was exactly like ocean. The water was so high, so high."

Tony Sam, Sr.: "It's getting warmer and warmer all the time. All the rivers that I travel many years change quite a bit because the erosion is not only out here. I think in 50 years, all those peoples out on the bank will move 1000 feet back."

Jack Wholecheese: "We're getting really early springs. If you ever go out to the river, you'll see permafrost melting and hits the soft sand out here in front of town. And that's where it's cutting in."

Section 2. Summer

Sarah Oskolkoff: "My son was milling around with a thermometer, and he put it on my back stairs and that thermometer read 108 degrees in the dead air. You know, that's the hottest it's ever been."

Stan Ned: "When you live out there, you know, that's like your farming ground; where you harvest. The fire takes away part of that because it burns a certain amount of area. And there was no beaver for a while because all the birch and the willows that the beaver lives on was completely burned. So they died out; muskrat died out; the fish in the lakes died out."

Marie Yaska: "All the birds have songs for us. The one song that we notice that's really changed is the robin. It just sing half its song and then it go 'ha ha ha,'- wonder why?"

George Attla & 'Ross Sam': "Yeah, we'll go ahead and put the fish net in first. 'OK.' Wait Ross, let's get some of this rope. 'This is the front.' If we need more rope we could just tie these. 'Yeah., there's the other end of it right there. It don't look that bad - could see most of the floaters.' We're getting there, Ross. Just step on it. 'Right here?' Yeah, there you go. Hey, that's a pretty good-looking fish. 'Curls itself right in here.' This one isn't, this is a pale fish."

Ross Sam, 'Al Yatlin' & ~**Eleanor Yatlin~:** "What's up, Al? 'Hi Ross.' When we catch fish because the water is so warm, the fish turns mushy in a few hours and it spoils after that. 'Throw them in there when you're done.' ~So I took these down from this middle pole and then I spread them out so they can dry a little bit. Well, this box isn't long enough, Al?~ 'Yeah.' ~I guess I just have to fold them up. Taste pretty good, huh? Some might be a little bit smoke. Have a good smokehouse - that's one thing.~



Al Yatlin: "On the river, the permafrost is melting on the banks. It seemed like especially this year, it's a lot warmer than it was in the past. Well, I think it'll just keep on warming up, and I don't know what's going to happen after that."

Virginia McCarty: "This is not the same kind of land we grew up in. No matter where you walk, it is so far in between the berry bushes. There might be a lot of berries this year, but this is the least amount of bushes I have ever seen. These grasses are way higher than they have ever been. Since the weather is changing and everything, I don't know. That's how we used to clean berries; let the wind blow it all."

SECTION 3. FALL

Butch Yaska: "I remember islands were pretty big in the lakes. Now their permafrost melted and some of those islands are getting smaller. I notice a lot of grass lakes nowadays."

Thomas Henry: "Back in the 50's, where you see the grass, that was all water. They used to paddle here to hunt fishducks. They don't have that no more. All these lakes under the hill is dried up like this."

George Attla: "You see that duck? Right in front of you? OK, you just paddle your heart out towards that. Hold it - hold it. We could have a feast tonight; all we got to do is pluck it. This is not a fat duck - he's not fat like he's ready to make the long journey. I have a few more to go. I'm not going to quit until I'm done. Seems like the last feather to burn is the ones under the arms."

Ross Sam: "*Ut-Ut-Ut!* Let's go lay him straight back - that'll be easiest, I think. OK, pull it. Fat, anyway. Ah, I just got to find a soft bone in there."

Josslin Olin: "That used to be the potlatch part, long time ago. I really didn't learn this on my own. I watch those old people; Steven, Tony, Cue Bifelt. That's where most of the information is at."

Angeline Derendoff: "Everybody's excited about what's going on. It's warm. No snow. Raining, how many years now? So I dream about it. And I thought, "what's going on anyway?" It's scary; scary winds come."

Alda Frank: "The way the weather is going, we don't know what will happen. In my days, the Elders said everything will change. And they used to talk about there's going to be two summers and two winters together."

Section 4. Winter

Hudson Sam: "It was a lot colder when I was young, months at a time. This weather nowadays is unpredictable; it just comes and goes anytime it wants to go. Even trapping is unpredictable now."

Steven Attla: "Long time ago by this time, it used to be really cold weather; dog tail used to freeze right off. But the way people used to make it, there was lots of rabbits. Any time in the winter."

Cue Bifelt: "Beaver: It's hard work to trap beaver. When we were in our prime it was just an everyday thing. Country is changing; I don't know what direction, nobody knows. Stephen and I, in our lifetime, there's a awful big change."

Al Yatlin & 'Catherine Attla': "Back in the 50's, there used to be lots of 'oonyeeyh,' we called them. 'Black fish?' Black fish. 'Ah-hum.' There used to be lots of muskrats when I was growing up, but the last few years, there's big decline in their population."



Ed Vent: "I noticed the changes on the spruce trees, that they're brown. They don't get enough water and the weather was so hot this summer it dried the trees up, even the green trees. I don't know about that weather; getting dangerous, you got to watch when you are traveling."

Wilson Sam: "From about 10 years ago maybe, it never really freeze-up that hard, and ice is never that thick, and it's just been warm most of the time. That's what I mean by big change, big difference."

Angeline Derendoff: "Up north, I heard that ice melted. They say it never melted all these years. And then I thought, 'OK, it's going to change, but little by little.' And I hope it's not that bad, but it might change the world. I really miss that snow."

Section 5. Credits

All audio and visual content of this audio slideshow program was approved by the Huslia Tribal Council, which holds the legal copyright © 2005. Funding for this project was provided by the WORLD WILDLIFE FUND (WWF).

Elders, tribal council members, and community members worked with the students of Huslia to produce this audio slideshow program. Production consultation and studio services were provided by Kathy Turco of *Alaska's Spirit Speaks: Sound & Science*, with technical assistance from audio engineer Ed Smith and programmer/graphic artist Roger Topp of *General Systems Vehicle* (GSV).

Recordings were made by:

Huslia students LeAnn Bifelt, Ryan Olin, Sheila Esmailka, Kenny Sam, Athena Sam, Dustin Nollner, Teri Vent, Willis Derendoff, Leah David, and Aimee Nollner. Thanks to Sharon Strick, John Christian, Annette Watson, Shannon McNeeley, and Julie Vadnais for assisting the students. Natural sounds and subsistence activities were recorded by Kathy Turco.

Voices of the following individuals were included in the soundtrack:

Effie Williams, Catherine Attla, Rose Ambrose, Tony Sam, Sr., Jack Wholecheese, Sarah Oskolkoff, Stanley Ned, Marie Yaska, Ross Sam, George Attla, Jr., Al Yatlin, Eleanor Yatlin, Virginia McCarty, Butch Yaska, Thomas Henry, Josslin Olin, Angeline Derendoff, Alda Frank, Hudson Sam, Steven Attla, Cue Bifelt, Ed Vent, and Wilson Sam.

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WNITE US

HARBINGERS OF CHANGE

STUDENT INFORMATION SHEET (page 1 of 2)

Harbinger: anything that foreshadows a future event; a sign of things to come

Warmer temperatures: The average temperature of the Arctic has increased about 4° Fahrenheit over the past 30 years. The Arctic is sensitive to even a slight shift in average temperature when that shift persists over a period of years and/or decades. Climate specialists have identified patterns of events related to such temperature shifts. Often these symptoms, or harbingers, are important indicators of climate change.

Here are some harbingers of climate change in the Arctic:



Insects: Some communities in Alaska have reported an increase in the number of mosquitoes. In the past decade Alaska has lost a record number of forests to spruce bark beetles. Worldwide, insects like mosquitoes spread disease. A greater number and range means greater risk of disease.

Early spring break up: The ice on rivers and sloughs is thinning earlier in the year, which affects the ability to safely travel to spring subsistence sites. Worldwide earlier spring thaw may disrupt animal migrations and affect the nesting habits of birds.





Change in animal migrations: Animal migration patterns shift to accommodate the search for food and stable ground. Global trends indicate animals usually move to higher latitudes and elevations when temperatures increase. When suitable habitat is unavailable, animal populations can decline or become extinct.

Change in plant growth: As with animals, plants usually move to higher latitudes and elevations when temperatures increase. A plant that is not usually found in a region, but has "moved in" is called an invasive species. Invasive species can drive out the native plants.



STUDENT INFORMATION SHEET (page 2 of 2)



Changes in precipitation: Some climate model projections predict some mid-to-high latitudes may experience an increase in precipitation – heavy snowstorms, more rain, etc. This could lead to increased flooding. Other areas may have less precipitation resulting in a drier climate.

Increased forest fires: The number of forest fires in Alaska has increased both in number and intensity in the past decade. Warmer temperatures mean drier conditions. Warmer temperatures also increase the vulnerability of trees to insects and disease, and dead trees are quick to burn. Vulnerability to fire due to warmer temperatures and drier conditions is a worldwide threat to forests.



NITEUS



Changing sea ice: Loss of sea ice changes the habitat of many Arctic animals. It also makes it more difficult to hunt spring walrus. And, there is less protection from severe storms for coastal communities. Sea ice protects coastal communities from the waves caused by severe storms. With less ice, those communities are bombarded by ocean waves.



Melting glacier ice: Increased glacial melt means higher water levels that lead to flooding and erosion of river banks. This threatens many communities.

Coastal/river bank erosion: Thawing permafrost and increased wave action from lack of sea ice is forcing many coastal communities to move as the land under their home slides into the sea. Similar degradation along river banks means buildings must be moved and the bank reinforced.





Thawing permafrost: Infrastructure like utilities, roads, pipelines and buildings, are damaged when the ground beneath them becomes unstable. Airports and runways need constant repair. Repair, replacement and relocation of structures damaged by thawing permafrost is costly.

Subsistence changes: Many Athabascan communities have noted changes in the distribution of moose and a decrease in the number of salmon, important subsistence foods. In fact, the behavior and population of many important animals are changing as seasonal patterns change.





NAME: _____ CONNECTIONS



SUBSISTENCE



EROSION



WILDFIRE





QNITE US

STUDENT WORKSHEET (page 2 of 3)

NAME: _____ CONNECTIONS



PLANT GROWTH



EARLY BREAK UP





INSECTS



NAME: _____ CONNECTIONS



THAWING PERMAFROST



MELTING GLACIERS



PRECIPITATION CHANGES



WARMER TEMPERATURES

NAME: _____ RESPONSE SHEET

Directions: In the space provided, write about the connection between two or more harbingers of climate change you may not have realized prior to this lesson. Explain the harbingers and the connections. Illustrate your response in the space at the bottom of the page.

Harbinger: anything that foreshadows a future event; a sign of things to come
