Theme 3: Changing Lifestyles

Unit 8: Natural Resources

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Introduction

Thank you for using this Raising Educational Achievement through Cultural Heritage Up (REACH Up) unit in your classroom! The lessons are designed to address the Alaska Science Standards and Grade Level Expectations, Alaska Cultural Standards, and the Bering Strait School District Scope and Sequence goals. All of the activities focus on shrub expansion and related ecological changes from Alaska Native cultural, physical and earth science perspectives. This supplemental unit addresses the place-based question: how does our community utilize natural resources and how can we minimize the environmental impact of our resource use?

The REACH Up Natural Resources unit consists of four activities. Each activity will require a 45-minute class period; discussion could easily be extended into multiple class periods. You may also want to repeat sections of an activity during subsequent class meetings, such as reviewing the Impact on Energy video or having your students practice the vocabulary card games multiple times. If you are utilizing the entire Natural Resources unit, you should introduce the activities in the order they are presented. However, if time is short, any of the activities could be presented independently.

The accompanying student guide is intended for use with multiple groups of students and you should not allow students to write in them. You can either have students record their work on a separate sheet of paper, or create copies of the corresponding worksheets that are included in this teacher's guide.

Whole Picture

Every day, people use natural resources for a variety of purposes. One main use is for energy. People need energy to power their homes, fuel their vehicles, grow their food, make the textiles for their clothing, and to provide heat when the weather turns cold.

Energy sources can be split into two main groups: renewable and nonrenewable. Those that are renewable can be used conservatively again and again without fear that they will disappear. These include solar, wind, geothermal, hydropower, and biomass energy. Nonrenewable sources are those that take millions of years to replenish, and as such, once today's humans have exhausted them, they will disappear. These include oil, coal, and natural gas.

Modern society relies heavily on nonrenewable resources to provide electricity, heat, and fuel for travel. Scientists and elders alike know that the extraction and use of these energy sources are contributing to climate change (Fienup-Riordan and Rearden, 2012; Krupnik and Jolly, 2002). As a result, people around the globe are beginning to develop renewable resources for energy — including in the expansive state of Alaska! Many villages are experimenting with renewable resources, such as biomass, wind, geothermal, and solar, as a way to reduce their dependence on pricey fossil fuels.

Biomass is carbon-rich material from living, or recently living organisms, that is (typically) burned for energy. While the plants are growing, they take carbon out of the atmosphere, and when they are burned, the carbon is released back into the atmosphere. Sometimes, materials used for biomass energy are grown specifically for that purpose, such as grasses and hemp. Other times, biomass energy materials come from the waste products of other sources. For example, waste wood can be used for wood burning boilers, though it is prudent to know how the wood has been treated, so as to avoid toxic off-gassing and ash (Biomass Energy Centre, 2011). In several rural Alaska villages, wood-burning boiler systems are being installed to ease the high cost of using heating fuel — though many of these villages are in interior and southeast Alaska, where wood is a plentiful resource.

The sun is also a source of renewable energy. Solar arrays, designed to capture the sun's energy, are becoming more popular around the globe. Because Alaska is "The Land of the Midnight Sun," many believe that solar energy would be a profitable alternative energy resource. However, due to the long periods of darkness during winter, and the difficulty in storing solar energy long term, "utility-scale solar power plants are uneconomical in Alaska" (REAP, 2015). Nevertheless, stand-alone solar grids in remote areas are useful, and much of the solar development in the state is being done on small scales. In Nome, for example, the Bering Straits Native Corporation has a solar array on their office building, and they are able to offset about "1,000 gallons of diesel fuel annually" (REAP, 2015).

Another useful renewable energy resource in Alaska is wind. Turbines placed in strategic locations can harness the power of the wind, which is then used for electricity, heat generation, and therefore displacement of diesel fuel use. The first wind program in Alaska was installed in Kotzebue in 1997. Since then, additional turbines have been added, and "the wind farm displaces 80,000 gallons of diesel every year" (REAP, 2015). Wind turbines have also been installed in Gambell, Savoonga, Shaktoolik, and Unalakleet, in addition to other villages in the state. These turbines help reduce the price of electricity for villagers, help villages meet their electric demands, and provide the heat for water treatment and drinking water plants.

Other renewable resources, like geothermal and hydropower, are also being developed in Alaska (and are already in use in many parts of the world). Geothermal energy is the heat energy that comes from the earth itself. Steam and hot water reservoirs can be used directly for electric generation, direct heating, and for carbon dioxide for greenhouses, as is the case at Chena Hot Springs, near Fairbanks (REAP, 2015). Hydropower is the energy produced by moving water — rivers and the ocean. As in other instances, this energy is captured and used to generate electricity and heat. Most of the hydropower in Alaska comes from projects in Southeast.

Traditional uses of solar and wind energy include much more than power. In addition to the ways mentioned above, Alaska Native people have for millennia been using energy sources in ways that some westerners might consider uncommon. "According to oral tradition, the sun is a transformed woman who fled to the skyland while being chased by her brother, who became

the moon and continues to pursue her" (Fienup-Riordan and Rearden, 2012, p. 61). Like all other things, people believe that the sun and the wind have animate spirits, and which tell us what to expect from the landscape.

For example, the sun plays an important role in helping people know what to expect from the weather. John Phillip, from Kongiganak, and Paul Kiunya, from Kipnuk, agreed that "dawn shows what the weather will be like during the entire day … They tell us that when the sun rises causing the clouds to turn red, even though the weather is good, it will get bad before day's end. But when the horizon is bright in the morning, the weather might be good all day" (Fienup-Riordan and Rearden, 2012, p. 62–63). Too, when it is going to be very cold, people say that the sun puts on its mittens, as a warning to people of coming temperatures.

Similarly, the winds have the power to indicate what to expect from the ocean and sea ice, as well as the arrival of subsistence animals. If the wind continues for two or three days, people on St. Lawrence Island know to expect sea ice to be blown in. This can be dangerous for hunting, and can make it difficult to bring harvested animals to shore (Krupnik and Jolly, 2002). In the winter, an easterly wind can herald the coming of spring sea mammals; and summer winds might mean that fish are being blown into the rivers (Fienup-Riordan and Rearden, 2012). The wind is also important for knowing whether the weather will be good or bad for fishing. A story told by elders of Tununak recounts how Edward Hooper's grandmother bequeathed a southerly wind to the villagers before she died, "so they could fish during good weather" (Fienup-Riordan and Rearden, 2012, p. 84).

Traditional ways of using energy resources compliment more contemporary uses. While the sun and the wind continue to be faithful companions in indicating what to expect from the weather, they also provide important ways to power our lives. We depend on energy sources for electricity, for heat, and for fuel, as well as for shelter and protection from the elements.

References

Biomass Energy Centre. (2011). "What is BIOMASS?" Accessed from: http://www.biomassenergycentre.org.uk/portal/page?_pageid=76,15049&_dad=portal

Fienup-Riordan, Ann, and Alice Rearden. (2012). Ellavut: Our Yup'ik World and Weather. Continuity and Change on the Bering Sea Coast. Seattle and London: University of Washington Press.

Krupnik, Igor, and Daynna Jolly. (2002). The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change. Arctic Research Consortium of the United States and Smithsonian Institution Presses.

REAP (Renewable Energy Alaska Project). (2015). Accessed from: http://alaskarenewableenergy.org/why-renewable-energy-is-important/.

Unit Vocabulary

Science Terms to Define	
natural resource	anything in the environment that humans use
nonrenewable resource	a natural resource that is not replaced in a useful time frame
renewable resource	a resource that is either always available or is naturally replaced in a relatively short time

Terms for Incorporating Local Indigenous Language				
English	**Iñupiaq**	**Yup'ik**	**Siberian Yupik**	**Local Translation**
airplane	tiŋisuun	tengsuun	tengegkayuk	
barge)	umiam kalia	kangiraulek	angyaghpak	
clothing	atnuġaaq	akluq	atkaq	
fuel	uqsruq	uquq	mesiiq	
nonrenewable resource	atuŋnaittuat	atunqiggngailnguq cat	navyaghqaq	
renewable resource	atuŋnaqtuat	atunqiggluki cat	nutaghquq	

Activity HS.8.1: Ask an Expert

Overview

In this activity, students will interview an elder or cultural knowledge bearer.

Objectives

On successful completion of the lesson, students will be able to:

- demonstrate effective interviewing techniques
- interpret qualitative data from interviews
- describe how different infrastructure was in the past in the local community compared to today
- explain how climate change is affecting infrastructure in the local community

Alaska Standards

Alaska Science Standards / Grade Level Expectations

SA1: The student demonstrates an understanding of the processes of science by:

[9] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating

[10] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring and communicating

[11] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring and communicating

[9] SA1.2 hypothesizing, designing a controlled experiment, making qualitative and quantitative observations, interpreting data, and using this information to communicate conclusions.

[10] SA1.2 reviewing pertinent literature, hypothesizing, making qualitative and quantitative observations, controlling experimental variables, analyzing data statistically (i.e., mean, median, mode), and using this information to draw conclusions, compare results to others, suggest further experimentation, and apply student's conclusions to other problems.

[11] SA1.2 recognizing and analyzing multiple explanations and models, using this information to revise students' own explanation or model if necessary.

SF: The student demonstrates an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives.

Alaska Cultural Standards

[B] Culturally-knowledgeable students are able to build on the knowledge and skills of the local cultural community as a foundation from which to achieve personal and academic success throughout life. Students who meet this cultural standard are able to:

[B3] make appropriate choices regarding the long-term consequences of their actions.

[B4] identify appropriate forms of technology and anticipate the consequences of their use for improving the quality of life in the community.

[D] Culturally-knowledgeable students are able to engage effectively in learning activities that are based on traditional ways of knowing and learning. Students who meet this cultural standard are able to:

[D.4] gather oral and written history information from the local community and provide an appropriate interpretation of its cultural meaning and significance.

[E] Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. Students who meet this cultural standard are able to:

[E.4] determine how ideas and concepts from one knowledge system relate to those derived from other knowledge systems.

Bering Strait School District Scope & Sequence

10.5D. Describe causes, effects, preventions, and mitigations of human impact on climate (SD3.1)

- Global warming/climate change

10.10A. Distinguish between renewable and nonrenewable resources.

10.10B. Identify which energy resources are fossil fuels.

10.10C. List alternate energy sources.

11.7E. Students develop an understanding of the dynamic relationships among scientific, cultural, social and personal perspectives. (SF)

Materials

- Natural Resources High School Student Guide
- Student Worksheet: Ask an Expert about Natural Resources
- Internet access and projector

Activity Preparations

1. Identify adults within your school who have lived year-round in the community for many years. This might include teachers, administrators, secretaries, teacher aides, lunchroom/kitchen staff, recess duties, maintenance and custodial staff, etc. Ask these local knowledge bearers if they would be willing to speak with a group of your students about how the use of natural resources in the area has changed. Make sure that the volunteers you have identified will be available during the time that your class will be completing this activity.
2. Ask the volunteers if they speak an Alaska Native Language, and if so, which language(s) and dialect(s) they are familiar with. If applicable, have them translate the written words on the student worksheet, so you have an answer key. Also, ask them to teach you the pronunciation of the terms.

Activity Procedure

1. Distribute the Natural Resources student guide and ask students to work with a partner to read pages 1-4.
2. Show the video, Impact on Energy, available at www.k12reach.org/videos.php. Videos are located under the Multimedia tab. Allow time for students to share comments and ask questions.
3. Explain that students will interview a few community members about local natural resources. Separate students into small groups according to how many knowledge bearers are available to share lake information with your class. Explain if the appointed interviewees speak an Alaska Native Language, so students know whether or not they should pursue that portion of the interview.
4. Review expectations for student behavior while conducting the interview, including introductions and thanking the interviewee at the end of the interview. Discuss suggestions for effective interviewing techniques, such as allowing ample time for the interviewee to answer, and asking follow-up questions.
5. Distribute one Student Worksheet: Ask an Expert about Natural Resources to each group and assign each group one local knowledge bearer to interview. Provide 15-20 minutes for students to locate and interview the knowledge bearer.
6. Reconvene in the classroom and ask groups to share their findings. How have the natural resources that are available to the community changed? What changes have people made regarding their use of natural resources?

STUDENT WORKSHEET: ***Ask an Expert about Natural Resources***

Names of Group Members: _____

Interview a long-term community member to learn more about infrastructure in your area. Take notes about what you learn.

Who did you interview? _____

Ask:

What natural resources did people in our community use in the past? What natural resources do people in our community use today?

How did people travel in the past compared to today? How often did barges and airplanes come to the village in the past compared to today?

How did people heat their homes in the past compared to today?

What kind of food did people eat in the past and where did it come from?

What types of clothing did people wear in the past compared to today? Where did the materials come from?

Other notes:

For Alaska Native Language Speakers:

What language(s) do you speak? _____

What dialect(s)?_____

Could you translate the following words?

airplane: _____

barge: _____

clothing: _____

fuel: _____

nonrenewable resource: _____

renewable resource: _____

Activity HS.8.2: Natural Resources Vocabulary

Overview

In this activity, students will learn key natural resources terminology in English and their local Alaska Native language by playing vocabulary games with peers.

Objectives

On successful completion of this lesson, students will be able to:

- read and speak indigenous terms related to natural resources
- illustrate and define terms related to renewable and nonrenewable resources

Alaska Standards

Alaska Science Standards / Grade Level Expectations

SA1 The student demonstrates an understanding of the processes of science by:

[9] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.

[10] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring and communicating.

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[9] SA1.2 hypothesizing, designing a controlled experiment, making qualitative and quantitative observations, interpreting data, and using this information to communicate conclusions.

[10] SA1.2 reviewing pertinent literature, hypothesizing, making qualitative and quantitative observations, controlling experimental variables, analyzing data statistically (i.e., mean, median, mode), and using this information to draw conclusions, compare results to others, suggest further experimentation, and apply student's conclusions to other problems.

[11] SA1.2 recognizing and analyzing multiple explanations and models, using this information to revise students' own explanation or model if necessary.

SF The student demonstrates an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives.

Alaska Cultural Standards

[B] Culturally- knowledgeable students are able to build on the knowledge and skills of the local cultural community as a foundation from which to achieve personal and academic success throughout life. Students who meet this cultural standard are able to:

[B3] make appropriate choices regarding the long-term consequences of their actions.

[B4] identify appropriate forms of technology and anticipate the consequences of their use for improving the quality of life in the community.

[D] Culturally-knowledgeable students are able to engage effectively in learning activities that are based on traditional ways of knowing and learning. Students who meet this cultural standard are able to:

[D.4] gather oral and written history information from the local community and provide an appropriate interpretation of its cultural meaning and significance.

[E] Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. Students who meet this cultural standard are able to:

[E.4] determine how ideas and concepts from one knowledge system relate to those derived from other knowledge systems.

Bering Strait School District Scope & Sequence

10.5D. Describe causes, effects, preventions, and mitigations of human impact on climate (SD3.1)

- Global warming/climate change

10.10A. Distinguish between renewable and nonrenewable resources.

10.10B. Identify which energy resources are fossil fuels.

10.10C. List alternate energy sources.

11.7E. Students develop an understanding of the dynamic relationships among scientific, cultural, social and personal perspectives. (SF)

Materials

- REACH Up High School Student Guide: Natural Resources
- Vocabulary card sets (1 per group of 4-6 students)
- Dry Erase Markers (1 per group)
- Information Sheet: Word Games Instructions (1 per group of students)
- Worksheet: Natural Resources Vocabulary
- Timers (optional)

Activity Preparations

1. If your students completed Activity HS.8.1 Ask an Expert, refer to their completed worksheets for the terms you will have them use for the vocabulary word card games.
2. If your students did not conduct interviews with Native language speakers, consult with a local knowledge bearer or language expert to determine which language/ dialect translation provided on vocabulary page of the Student Guide would be most appropriate for your students to practice. The following chart is provided for reference.

Alaska Native Languages in the Bering Strait Region				
Language	**Dialect Group**	**Dialect**	**Subdialect**	**Community**
Iñupiaq	Seward Peninsula Inupiaq	Bering Strait		Brevig Mission
			Diomede	Little Diomede
				Shishmaref
			Wales (Kinikmiu)	Wales
		Qawariaq	Teller	Teller
				Unalakleet
				Shaktoolik
			Fish River	Golovin*
				White Mountain
	Northern Alaskan Iñupiaq	Malimiut		Koyuk
Siberian Yupik		St. Lawrence Island Yupik		Gambell
				Savoonga
Yup'ik		Norton Sound (Unaliq-Pastuliq)	Unaliq	Elim
				Golovin*
				St. Michael
		General Central Yup'ik	Nelson Island and Stebbins	Stebbins

* It is very common for more than one language / dialect, or a combination of dialects, to bespoken in a community. It should also be noted that Inupiaq-Yup'ik bilingualism was common throughout the 1900s in the Norton Sound villages of White Mountain, Golovin, Elim, and Unalakleet. Golovin is listed twice on our chart because specific subdialects were cited in the research found on the Alaska Native Language Center website: http://www.uaf.edu/anlc/languages/.

3. Keep in mind that different individuals may translate certain terms differently. For example, some languages may not have a separate term for "fuel" and "gasoline". Or, distinct terms may exist, but the individual speaker does not know the term for

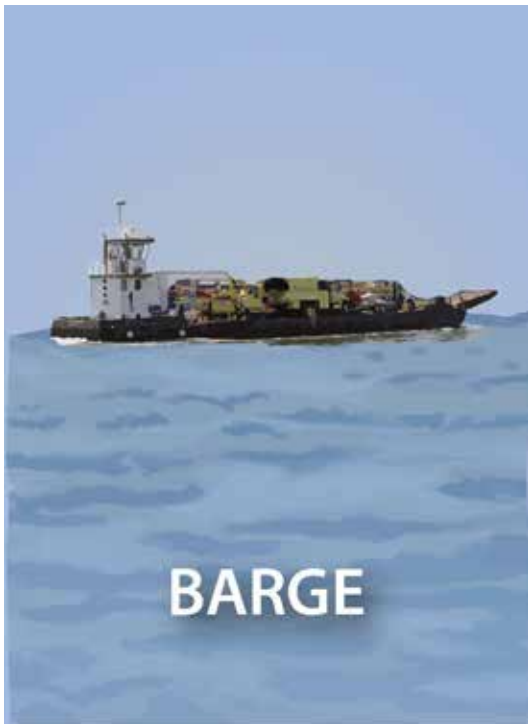
"gasoline", and uses the term for "fuel" in both instances. It's fine to have different student groups working with various translations, or you can choose a set list of words for your whole class to practice. Highlight the diversity and do not attempt to offer an authoritative translation; the goal is to practice an Alaska Native language while discussing climate change topics.

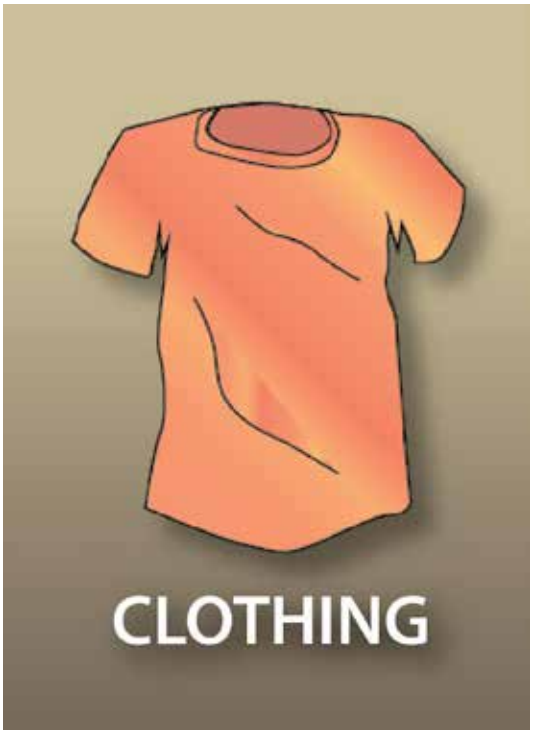
4. If using the Vocabulary Cards provided by REACH Up, label a sample set of cards with local indigenous words using a dry erase marker. If needed, create your own sets of the vocabulary cards from the template provided.
5. Make copies of the Word Games Instruction Sheet (one per group) and the Natural Resources Vocabulary worksheet (one per student).

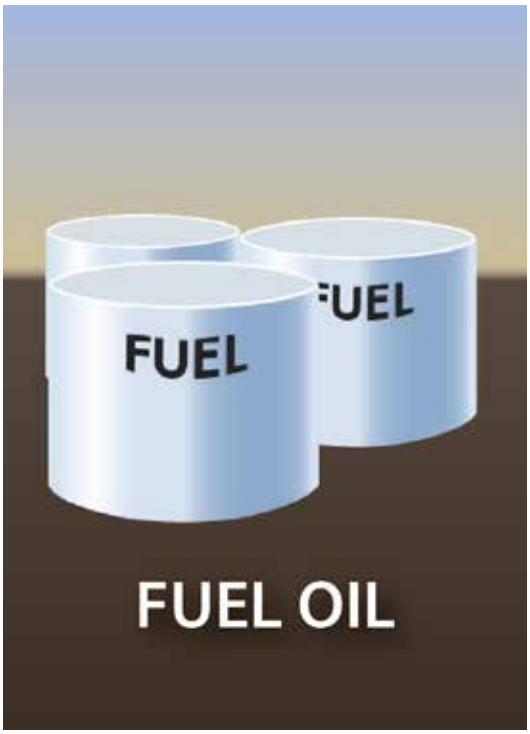
Activity Procedure

1. Distribute the Natural Resources Student Guide and review pages 1-4.
2. Show students the vocabulary cards. Hold up each card. Discuss what each card depicts. How do these terms relate to natural resources in their region?
3. Say the English and local Alaska Native Language word for the illustration depicted on the card. Ask students to repeat the words. Repeat this once or twice, then ask students to call out the correct words as you hold up each card.
4. Divide the class into four groups.
5. Provide each group with the Word Games Instruction sheet, a set of Vocabulary Cards, dry erase marker, and a timer (optional).
6. Instruct students to label their cards with the local indigenous words. Groups can select one student from the group for this task, or take turns.
7. Direct students' attention to the Word Games Instruction sheet. Students can commit to one game for a period of time or mix and match.
8. Encourage students to play the vocabulary games and practice the vocabulary words during free time throughout the duration of the Natural Resources unit. If possible, schedule 10-15 minutes twice per week to practice the vocabulary terms.
9. Write the following terms on the board: natural resource, nonrenewable resource, and renewable resource. Ask students to share definitions for these terms. Refer back to the Natural Resources Student Guide as necessary.
10. Distribute the Natural Resources Vocabulary Worksheet and ask students to complete it.

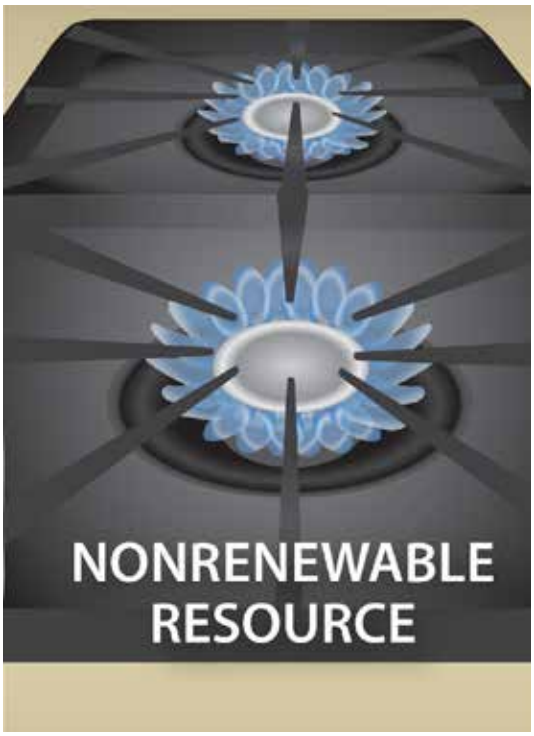
Vocabulary Cards







Vocabulary Cards



Vocabulary Cards

Local Indigenous Word

Local Indigenous Word

Local Indigenous Word

Local Indigenous Word

STUDENT INFORMATION SHEET: *Word Games Instructions*

VOCABULARY SWAP:

1. Distribute one card to each person.
2. Practice the word on your card, then find a classmate. Teach them the word on your card and learn the word on their card. Trade cards.
3. Find another classmate and repeat.

FIND THE CARD:

1. Divide into small groups. Each group will need a set of vocabulary cards. Spread the cards in front of you so that everyone in your group can see the pictures.
2. Listen as your teacher says a word aloud from one of the cards.
3. Work with your group to find and hold up the correct card.

VOCABULARY SLAP:

1. Select one student to serve as the "caller" for this game. That student should make a list of the vocabulary words on a separate sheet of paper. The words can be found on the back of the cards.
2. Place the cards in a circle, picture-side-up, in the middle of the playing area.
3. The caller should call out a word from their list. Everyone else should quickly place their hand on the picture that they believe represents that word.
4. Turn over the card or cards that students selected to see who chose correctly. Each student who placed his or her hand on the correct card earns a point.
5. Put the card(s) back in the circle and play again.
6. Play for a designated period of time. At the end of the time, the person with the most points wins.

TEAMWORK:

1. Divide your group into two teams. Each team will need a pencil and paper.
2. Shuffle the vocabulary cards and stack them picture-side up in the middle of the table.
3. Work with your team to write down the local Alaska Native Language terms for the picture on the card.
4. After both teams have written answers for the top card, turn the card over to check. Teams get 1 point for the correct Alaska Native Language word.
5. Repeat until all cards are gone. The team with the most points wins.

STUDENT WORKSHEET: ***Natural Resources Vocabulary***

Name: _____

1. Draw a line connecting each definition to the term that it represents.

natural resource	a natural resource that can be replenished by natural processes at least as quickly as it is being used
nonrenewable resource	anything in the environment that humans use
renewable resource	a natural resource that is being used up faster than it can be replaced by natural processes

2. Complete the chart by writing the local Alaska Native Language terminology and illustrating the missing terms.

My Community: _____

English Word	Local Alaska Native Language Word	Illustration
airplane		
barge		
clothing		
fuel		
nonrenewable resource		
renewable resource		

Answer Key: *Natural Resources Vocabulary*

Name: _____

1. Draw a line connecting each definition to the term that it represents.

natural resource	a natural resource that can be replenished by natural processes at least as quickly as it is being used
nonrenewable resource	anything in the environment that humans use
renewable resource	a natural resource that is being used up faster than it can be replaced by natural processes

2. Complete the chart by writing the local Alaska Native Language terminology and illustrating the missing terms.

My Community: _____

English Word	Local Alaska Native Language Word	Illustration
airplane	Answers will vary depending on language and dialect spoken in this community.	Sketch should illustrate word at left.
barge	Answers will vary depending on language and dialect spoken in this community.	Sketch should illustrate word at left.
clothing	Answers will vary depending on language and dialect spoken in this community.	Sketch should illustrate word at left.
fuel	Answers will vary depending on language and dialect spoken in this community.	Sketch should illustrate word at left.
nonrenewable resource	Answers will vary depending on language and dialect spoken in this community.	Sketch should illustrate word at left.
renewable resource	Answers will vary depending on language and dialect spoken in this community.	Sketch should illustrate word at left.

Activity HS.8.3: Renewable and Nonrenewable Fashion Show

Overview

In this activity, students will classify clothing material sources as renewable resources or nonrenewable resources.

Objectives

On successful completion of the lesson, students will be able to:

- distinguish between renewable and nonrenewable resources
- conduct research independently
- give a short oral presentation to a classroom audience

Alaska Standards

Alaska Science Standards / Grade Level Expectations

SA1 The student demonstrates an understanding of the processes of science by:

[9] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.

[10] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring and communicating.

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[11] SA1.2 recognizing and analyzing multiple explanations and models, using this information to revise students' own explanation or model if necessary.

SF The student demonstrates an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives by:

[9] SF1.1-SF3.1 describing the scientific principles involved in a subsistence activity (e.g. hunting, fishing, gardening)

[10] SF1.1-SF3.1 analyzing competition for resources by various user groups to describe these interrelationships.

Alaska Cultural Standards

[B] Culturally- knowledgeable students are able to build on the knowledge and skills of the local cultural community as a foundation from which to achieve personal and academic success throughout life. Students who meet this cultural standard are able to:

[B3] make appropriate choices regarding the long-term consequences of their actions.

[B4] identify appropriate forms of technology and anticipate the consequences of their use for improving the quality of life in the community.

[D] Culturally-knowledgeable students are able to engage effectively in learning activities that are based on traditional ways of knowing and learning. Students who meet this cultural standard are able to:

[D.4] gather oral and written history information from the local community and provide an appropriate interpretation of its cultural meaning and significance.

[E] Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. Students who meet this cultural standard are able to:

[E.4] determine how ideas and concepts from one knowledge system relate to those derived from other knowledge systems.

Bering Strait School District Scope & Sequence

10.10A. Distinguish between renewable and nonrenewable resources.

Materials

- REACH Up High School Student Guide: Natural Resources
- Clothing items that students bring to class (both store-bought and homemade)
- Computers or tablets with internet access
- Student notebooks or scratch paper

Activity Preparations

1. The week before you plan to teach this lesson, ask students to bring in clothing items to be modeled in the Fashion Show. Ideally, you will have a variety of modern and traditional clothing. (Students may need to get family permission to bring in valuable items, particularly homemade traditional Native garments such as mukluks, parkas, kuspuks, fur-lined hats and mittens, etc.)

Activity Procedure

Part One: Research Day

1. Distribute the Natural Resources Student Guide and review pages 1-4. Emphasize the definitions for "renewable resource" and "nonrenewable resource." Then, introduce the Fashion Show activity on pages 5-6.
2. Assign students to partner groups for conducting the interview described in Step 2 of the Student Guide. Explain your expectations for Internet research. Allow 10-15 minutes for the first partner interview and then prompt students to switch roles. Circulate and assist.
3. Allow 10-15 minutes for students to prepare and practice their speeches for introducing their partner during the Fashion Show. Circulate and assist to ensure that the speeches correctly identify the clothing items as renewable or nonrenewable resources.

Part Two: Fashion Show

4. Determine the order in which students will present. When it is their turn, both partners should stand at the front of the room. Encourage confident attitudes from the presenters and models, and good audience behavior from the rest of the class.

Extension Activity

- Discuss the uses of the various types of clothing and the advantages and disadvantages of the various materials. For example, cotton is soft and comfortable but useless for retaining warmth once it is wet. Water resistant materials include seal gut and synthetic fibers. Insulation can be made from either synthetic material or renewable resources such as goose down. Discuss which clothing materials perform better in Arctic conditions.

Activity HS.8.4 The Carbon Footprint of Shipping

Overview

In this activity, students will calculate the carbon emissions produced by shipping products.

Objectives

On successful completion of the lesson, students will be able to:

- identify shipping methods and shipping routes
- define carbon footprint
- estimate weights and distances
- calculate values using a formula

Alaska Standards

Alaska Science Standards / Grade Level Expectations

SA1: The student demonstrates an understanding of the processes of science by:

[9] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.

[10] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring and communicating.

[11] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring and communicating.

[9] SA1.2 hypothesizing, designing a controlled experiment, making qualitative and quantitative observations, interpreting data, and using this information to communicate conclusions.

[10] SA1.2 reviewing pertinent literature, hypothesizing, making qualitative and quantitative observations, controlling experimental variables, analyzing data statistically (i.e., mean, median, mode), and using this information to draw conclusions, compare results to others, suggest further experimentation, and apply student's conclusions to other problems.

[11] SA1.2 recognizing and analyzing multiple explanations and models, using this information to revise students' own explanation or model if necessary.

SB2: The student demonstrates an understanding of how energy can be transformed, transferred, and conserved by:

[10] SB2.1 examining energy (i.e., nuclear, electromagnetic, chemical, mechanical, thermal) transfers, transformations, and efficiencies by comparing useful energy to total energy

SF: The student demonstrates an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives by:

[9] SF1.1-SF3.1 describing the scientific principles involved in a subsistence activity (e.g. hunting, fishing, gardening)

[10] SF1.1-SF3.1 analyzing competition for resources by various user groups to describe these interrelationships.

Alaska Cultural Standards

[B] Culturally- knowledgeable students are able to build on the knowledge and skills of the local cultural community as a foundation from which to achieve personal and academic success throughout life. Students who meet this cultural standard are able to:

[B3] make appropriate choices regarding the long-term consequences of their actions.

[B4] identify appropriate forms of technology and anticipate the consequences of their use for improving the quality of life in the community.

[D] Culturally-knowledgeable students are able to engage effectively in learning activities that are based on traditional ways of knowing and learning. Students who meet this cultural standard are able to:

[D.4] gather oral and written history information from the local community and provide an appropriate interpretation of its cultural meaning and significance.

[E] Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. Students who meet this cultural standard are able to:

[E.4] determine how ideas and concepts from one knowledge system relate to those derived from other knowledge systems.

Bering Strait School District Scope & Sequence

10.5D. Describe causes, effects, preventions, and mitigations of human impact on climate (SD3.1)

- Global warming/climate change

11.7D. Use scientific processes and inquiry to directly support concepts of energy thermodynamics. (SA)

11.7E. Students develop an understanding of the dynamic relationships among scientific, cultural, social and personal perspectives. (SF)

Materials

- REACH Up High School Student Guide: Natural Resources
- Clothing items with tags
- Student Worksheet: The Carbon Footprint of Shipping (or student notebooks)
- Computer or tablet with internet access
- Scale that measures in grams (optional)

Activity Preparations

1. A day or two before you plan to teach this lesson, ask students to bring in at least three store-bought clothing items. Clothing items should have tags that identify country of origin.
2. Make copies of the Student Worksheet: The Carbon Footprint of Shipping (one per student). You could also have your students record their calculations in their science notebooks.

Activity Procedure

1. Distribute the Natural Resources Student Guide and briefly review pages 1-6.
2. Introduce the concept of carbon footprint. Read aloud (or have a student volunteer read aloud) page 7 of the student guide. If time allows, have students explore an online carbon footprint calculator.
3. Ask students if they can think of unique challenges that may cause someone living in Alaska to have a higher carbon footprint. (Answers may include: Extra energy used to heat homes in a colder climate, and Alaska's remote location means products are shipped long distances.)
4. Direct students to read page 8, "Heating our Homes" and page 9, "Importing the Products We Use" with a partner. Discuss as a class.
5. Introduce the activity on pages 10-13, then distribute a student worksheet to each student. Go through the examples together as a class.
6. Allow students time to complete their worksheets while you circulate and assist.
7. Invite students to share their calculations with the rest of the class.
8. Discuss the conclusion questions on page 13 together as a class.
    a. Which method of transportation contributes the most pollution (CO_2)?
    b. Which method of transportation contributes the least pollution (CO_2)?
    c. What are some ways you can reduce the carbon footprint of your clothing?

Extension Activity

- Discuss which shipping methods are more energy efficient and why.

Assessment

Answers will vary. You can compare students' answers with the example provided to quickly check if their calculations are reasonable.

Student Worksheet: The Carbon Footprint of Shipping

Name: _____

1. Choose 3 garments. Look at the tag on each article of clothing to determine where it was made.

	Item	**Country**
1.	_____	_____
2.	_____	_____
3.	_____	_____

2. Estimate how much each item weighs. The following chart of average garment weights may help you make your estimates. The actual weight of garments can vary greatly due to thickness of fabric and size of the garment. (Optional: Measure the mass of each item on a scale.)

Item	**Weight in grams**	**Item**	**Weight in grams**
T-shirt	200	Leggings	300
Jeans	700	Track pants	600
Hoodie	400	Shorts	300
Pair of shoes	1125	Sweater	400
Pair of boots	2250	Button-down shirt	250

	Item	**Weight in grams**
1.	_____	_____
2.	_____	_____
3.	_____	_____

3. Determine the shipping methods and mileage for each item. Shipping methods can include ocean freighter, barge, airplane, railroad, and truck. Most items traveling long distances across the ocean will be on ocean freighters, with barges being used for river travel or shorter distance ocean travel. For villages off the road system, all shipped items arrive by airplane or barge. If your item was made in the USA, it may have travelled by truck or railroad across the Lower 48 before being shipped by airplane or barge to Alaska.

   To determine distances, you can use an Internet application such as Google Maps. For international shipping routes, try the website *www.ports.com*.

Example: T-shirt made in Bangladesh			
From	**To**	**Method**	**Miles**
Bangladesh (Port of Chalna, Bangladesh)	Anchorage (Port of Anchorage, USA)	Ocean Freighter	18,980
Anchorage	Unalakleet	Airplane	400

Item 1:			
From	**To**	**Method**	**Miles**

Item 2:			
From	**To**	**Method**	**Miles**

Item 3:			
From	**To**	**Method**	**Miles**

4. Determine the carbon contribution of each item. Each vehicle produces carbon dioxide, but of course your garment is not the only cargo the vehicle is carrying!

Mode	Functional Unit	Emission Factor (grams CO2)
Airplane	grams per ton-mile	2,050.0
Barge	grams per ton-mile	17.5
Railroad	grams per ton-mile	22.9
Truck	grams per ton-mile	161.8
Ocean Freighter	grams per container-mile	42.6

4a. For items that were shipped by airplane, barge, railroad, or truck, the carbon dioxide emissions are calculated based on weight. There are 1,000,000 grams in a metric ton. Use the miles you calculated in Step 3 in the following equation:

Distance (miles)	X	Emission Factor for that mode of travel	÷	1,000,000	X	Weight of Garment (grams)	=	Grams of Carbon Dioxide

4b. For items that were shipped by ocean freighter, the carbon dioxide emissions are calculated based on volume. The items are packed into metal shipping containers (often referred to as Conex units) that are 8ft wide, 8.5ft tall, and 20ft long. Use the chart below to help you estimate how many garments fit in one shipping container.

Item	Approximate Number in one 20ft Shipping Container	Item	Approximate Number in one 20ft Shipping Container
T-shirt	36,000	Leggings	30,000
Jeans	10,000	Track pants	12,000
Hoodie	8,000	Shorts	30,000
Pair of shoes	5,000	Sweater	9,000
Pair of boots	2,400	Button-down shirt	30,000

Distance (miles)	X	Emission Factor for that mode of travel	÷	Approximate number in one shipping container	=	Grams of Carbon Dioxide

Example: T-shirt from Bangladesh					
Mode	**Distance**	**x Emission Factor**	**÷ 1,000,000 (omit this step for ocean freighters)**	**x Weight of garment OR ÷ number of garments per container**	**= Grams of carbon dioxide (round to nearest 10th)**
Ocean Freighter	18,980	42.6	N/A	36,000	22.5
Airplane	400	2,050	1,000,000	200	164
				Total:	

Item 1:					
Mode	**Distance**	**x Emission Factor**	**÷ 1,000,000 (omit this step for ocean freighters)**	**x Weight of garment OR ÷ number of garments per container**	**= Grams of carbon dioxide (round to nearest 10th)**
				Total:	

Item 2:					
Mode	**Distance**	**x Emission Factor**	**÷ 1,000,000 (omit this step for ocean freighters)**	**x Weight of garment OR ÷ number of garments per container**	**= Grams of carbon dioxide (round to nearest 10th)**
				Total:	

Item 3:					
Mode	**Distance**	**x Emission Factor**	**÷ 1,000,000 (omit this step for ocean freighters)**	**x Weight of garment OR ÷ number of garments per contaier**	**= Grams of carbon dioxide (round to nearest 10th)**
				Total:	

Conclusions

5. Which method of transportation contributes the most pollution (CO2)?

6. Which method of transportation contributes the least pollution (CO2)?

7. What are some ways you can reduce the carbon footprint of your clothing?