

Grade: 3-5

What are the Impacts of Mining and Using Minerals?

Lesson #4A: Using Our Land

Time: 5-6 class periods

Overview:

Students go outdoors to investigate an undeveloped tract of land, then use their evidence to help weigh the costs and benefits of a possible mine, and to make a decision about mine development.

Essential Questions:

How does mining affect the environment?

How do we make decisions by considering benefits and drawbacks?

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 - "How Did You Do" Sheet
 - Scientist Instructions
 - Using Our Land Poster
 - Using Our Land Article
- Background for Teachers
 - Who Owns Alaska's Land

Source: Partially adapted from previous AMEREF curriculum. Field investigation activity is new.

Using Our Land

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Assessment

Can students:

- Observe, describe, measure, and use tools?
- Use observations and facts to support their ideas and opinions?
- Consider advantages, disadvantages, and scientific information when making a decision?
- Communicate their findings and their decisions?

Vocabulary

- natural resources
- survive
- extract
- zoologist
- forester
- anthropolog
- hydrologist
- Soil
- Organic
- Aesthetic
- Erosion
- Silt
- Accessible
- Economic

Alaska Standards

Addressed:

Science GLEs

The student demonstrates an understanding

-of the processes of science by:

[3] [4] [5] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating. [3] SA1.2 observing and describing their world to answer simple questions. [4] SA1.2 observing, measuring and collecting data from explorations and using this information to classify, predict, and communicate. [5] SA1.2 using quantitative and qualitative observations to create their own inferences and predictions.

-of the attitudes and approaches to scientific inquiry by:

[3] SA2.1 answering, "how do you know?" questions with reasonable answers. [4] SA2.1 supporting their ideas with observations and peer review. (L) [5] SA2.1 supporting their statements with facts from a variety of resources and by identifying their sources. (L)

-of how to integrate scientific knowledge and technology to address problems by:

[3] SE1.1 identifying local problems and discussing solutions. (L)[5] SE1.1 identifying a community problem or issue and describing the information needed to

ist

develop a scientific solution. (L)

Additional Alaska Standards Addressed:

Geography

A2) make maps, globes, and graphs

C3) recognize the concepts used in studying environments and recognize diversity and productivity of different regional environments.

3) analyze resource management practices to assess their impact on future

environmental quality

Government and Citizenship

C7) understand the obligations that land and resource ownership place on the

residents and government of the state

Teacher information and Procedure

Prior knowledge for students: None. The field activity could be enhanced if students knew how to use a topographic map, if they knew the names of local trees, and how mines deal with environmental issues.

Materials needed:

- Copies of:
 - Using Our Land poster
 - Using Our Land article
 - Scientist Instructions
 - Mine Fact Sheet (see "What to Do in Advance")
 - "How Did You Do?" Sheet
- Digital camera(s) (See note for "Day Two")
- Field equipment: hand lenses, 1 pair binoculars, trowel or shovel, small glass jar, pencil and notebooks, measuring tapes, ruler, stopwatch, trash bag, clipboard, an outline of the land parcel to use as the basis of a map.

What to do in advance:

Identify an undeveloped tract of land near your school. If it is not within walking distance, arrange for a field trip to visit the land. Make a simple outline map of the tract of land.

Find adults (particularly those with knowledge of plants, animals, and natural history) to accompany the class when you explore the land.

Make up a "mine scenario (plan)". Include information about the amount of money that would come from a mine, who would get the money, where the minerals would go and how the minerals would be used, how minerals would be transported, what type of mine would be developed (open pit or underground), what kind of jobs would be created, and how the mine will meet environmental regulations and reclaim the land when it closes. Make a fact sheet for students about the proposed mine.

Make copies.

What to do during the lesson:

Day One

• ***Gear up:***

Tell students that because they are residents of Alaska and citizens of the United States they are land managers because they own part of the state.

More than half the land in Alaska is owned by the United States government, more than one fourth is owned by the state government, and more than one tenth is owned by Alaska Natives. Being a good land manager takes knowledge of science, skills in communication, and creative problem solving. Sometimes we make land management choices based on our own needs for our own property. Sometimes, we are involved in land management choices made for property owned by many people. Before we can begin to make decisions about land management, there are many questions we need to answer about the land.

. (this poster needs help - find the original and re-scan it?)

Show students the Using Our Land poster Discuss all the ways the land is used in the picture. Ask the following questions to guide the discussion.

Do you see things in the picture that you would do? If so what?

What things do you see that would be fun to do?

Which things in the picture would you like to try? Why?

Which things in the picture wouldn't you like to try? Why?

Which activities take something from the land?

What might tourists do to enjoy the land? How could they cause harm?

How can money be made from this land? Which kinds of things cost money?

Are there any natural resources on this land that people need to survive ?
What activities in this poster could have an impact on the land, water, or air?
How do the activities in the picture effect each other?
What could be done to minimize the effect on the land and other activities?

- **Explore:**

Tell students that valuable minerals have been discovered underground on a tract of land nearby, and that their job is to help decide whether a mine should be developed. First you are going to visit the land and investigate!

Organize the class into teams of scientists:

- Foresters will study the trees on the land
- Botanists will study plants and shrubs on the land.
- Zoologists will study the animals that live on the land.
- Hydrologists will study the water on the land.
- Soil Scientists will study the soil.
- Anthropologists will study human uses of the land.
- Topographers will study the natural features of the land

(If you live in an area that is all flat and/or treeless, you may want to omit the foresters and/or topographers).

Ask each group to come up with ideas about what they will look for when they visit the land, then give each group their "Scientist Instructions".

(Note: for younger students you may need an older student or an adult volunteer for each group to help with reading the article and the instructions and carrying out the field tasks)

Share the Score Sheet with the students so that they will know what they are expected to do during each of the activities.

Day Two

Go to the land and have each scientist group carry out their tasks, take pictures*, and record their observations.

(Note: Taking pictures for this activity will require a digital camera and a way to download and display (print or project) the pictures. You may want to enlist a parent or several parents to help with this, and to share one or two cameras among the groups. Or, you may want to have an "official photographer" on the field trip.)

Day Three (might take two days)

Give each group time to organize their information and photos, and to write a "field report". They should then share their findings with the class. As they report to the class, they should include information from the article about why their area of investigation was important.

Day Four

Read and/or discuss the remaining sections of the "Using the Land" article with the entire class. Share your "mine scenario" with the students (see advance preparation), and pass out the Mine Fact Sheet. List costs and benefits of mine development on the board

- **Generalize:**

Day Five

Ask students to take a position on whether the mine should be developed as planned, developed with changes to the plan, or not developed. Depending on their age and abilities, you may choose to have them write a paper, give a talk, or participate in a debate to express their opinions.

- **Assess:**

Share the "How Did You Do?" Sheet with students at the beginning of the activity, and use it to assess student's skills knowledge

Related Resources in the AMEREF Kit

- What Is a Mine Coloring Book-Placer Dome
- Hard Rock and Placer Mining in Alaska: The Searchers Video
- Alaska's Mineral Deposits Poster: AMEREF
- Mining Reclamation-Responsible Reuse of Lands Through Planning, Management, and Technology Poster: National Energy Foundation

- Mining Reclamation Newspaper: National Energy Foundation
- Metal Mining and the Environment: AGI

Extensions, adaptations, and more resources:

Interview people in the community about their use of your study area.

Make additional observations at a different time of year.
Invite local scientist to tell the class about their field observations

Find out about mines that have been developed near you, how the decision was made to start mining, and what has happened since the mine began.

Research the impacts of mining.

HOW DID YOU DO? Using Our Land	no	part ly	yes	Extr a!
<u>Processes of science:</u> Did you: -observe closely and carefully? -get information to answer your questions? -take detailed notes on what you saw? -organize your notes? -use tools and measurements when possible? -use tools correctly? -find creative ways to investigate?	0 pts	1-4 pts.	5 pts.	6 pts.
<u>Using evidence:</u> Did you: - compare observations and measurements with the rest of your team? - use factual information in your field report? - use facts found by the class to support your opinions?	0 pts	1-4 pts.	5 pts.	6 pts.
<u>Decision-making:</u> Did you: - consider advantages and disadvantages when you made your decision about the mine? - use scientific observations and evidence to help make your decision?	0 pts	1-4 pts.	5 pts.	6 pts.
<u>Communication</u> Did you: - share your field report with the class so that they had clear and complete information about your observations? - express your opinion in a clear and respectful manner? - explain why you made the decision that you did?	0 pts	1-4 pts.	5 pts.	6 pts.

Foresters will study the trees on the land

- Read the "Are There Trees on the Land" section of the "Using Our Land Article"
- You will need: A camera, a measuring tape, a pencil, a notebook, and a guide to identifying trees in your area.
- You will look for:

What types of trees are on the land?

How much of the land is covered by trees?

Have any trees been cut?

How big around is the biggest tree you can find?

(measure around the

trunk at your eye level)

How big around are the "normal" trees on the land?

- More ideas of what to look for:

Zoologists will study the animals that live on the land.

- Read the "What Kind of Animals Use the Land and Water in this Area" section of the "Using Our Land Article"
- You will need: camera, binoculars, pencil, notebook
- You will look for:
 - What kinds of animals and birds do you see on the land?
 - Are there any nests?
 - Is there any evidence that animals have been eating or using the plants on the land?
 - Are there any animal tracks or trails?
 - Is there any scat?
 - Are there any bones or feathers?
 - If there are streams, are they clear? (for fish habitat)
 - Is there any evidence that fish live here?
- More ideas of what to look for:

Hydrologists will study the water on the land.

- Read the "Is There Water On or Under the Land" section of the "Using Our Land Article"
- You will need: Camera, pencil, notebook, hand lens and small glass jar for looking at water samples, measuring tape and stopwatch for measuring stream speed if there is a stream.
- You will look for:
 - Are there any lakes, ponds, or streams on the land?
 - Is there any sign of flooding on the land?
 - Is the land marshy or swampy?
 - Is the water clean? Is it clear?
 - If there is a stream, how fast is it flowing? (measure a distance of 10 feet along the stream and time how long it takes for a stick to float from one end to the other)
- More ideas of what to look for:

Soil Scientists will study the soil.

- Read the "What is the Soil Like?" section of the "Using Our Land Article"
- You will need: Camera, trowel and/or shovel, hand lens, ruler, pencil, notebook.
- You will look for:
 - What does the soil look like when you dig holes?
 - Is there any clay? Sand? Gravel?
 - What kinds of plant and animal material can you find in the soil?
 - When you look at the dark soil with plant material in it, can you tell how deep it goes?
 - Can you find any evidence of erosion?
 - Has anyone dug up soil or used gravel from the land?
- More ideas of what to look for:

Anthropologists will study human uses of the land.

- Read the "How is the Land Used Now" section of the "Using Our Land Article"
- You will need: Camera, trash bag, pencil, paper.
- You will look for any signs that people have been on the land, such as:
 - o footprints,
 - o trash (collect it in your trash bag),
 - o man-made objects,
 - o saw and axe marks,
 - o campfire pits
 - o trails

- More ideas of what to look for:

Topographers will study the natural features of the land

- Read the "What is the Surface of the Land Like? How Hilly or Flat is It?" section of the "Using Our Land Article"
- You will need: Camera, pencil, notebook, clipboard with map of the land.
- You will look for these things and mark them on your map:
 - Are there any hills on the land?
 - Are there any large flat areas on the land?
 - Are there any steep cliffs or drop-offs on the land?
 - What other natural features can you find on the land?
(swamps, ponds,
Streams, holes or depressions, beaches, etc)

- More ideas of what to look for:

Using Our Land Article



WHAT'S UNDER THE GROUND?

Are there any valuable minerals under the surface of the land? If so, a mine, oil well or gravel pit possibly could be developed on this land to extract the valuable minerals. Land with minerals can be very valuable to the landowners. When minerals are removed, landowners receive a considerable amount of money from the mine developer - both from leases for use of the surface lands, and from the sale of the minerals themselves. Today,

the State of Alaska receives more money from oil and gas leases and royalties than from any other source. Thus, if valuable minerals are under the surface of the land, careful consideration needs to be given to the use of the surface of the land. This is to insure that the minerals can be mined and that the land is again useful after the mine or well is gone.

IS THERE WATER ON OR UNDER THE LAND?

Water is necessary for almost all land uses. Farms need water for irrigation; cities need water for home use, firefighting and waste disposal; factories need water for many industrial processes; fish need water for reproducing and as habitat. We need to look carefully at the water on and below the land surface. If the land is marshy, with water standing near the surface year-round, the land may need to be drained before it can be used. Or maybe this land is best left alone as wildlife habitat or open space. If the water is a large river, careful analysis of the river banks is necessary to determine if there are flooding problems. If the water is a deep, clear lake, this could be a good place for vacation cabins and possibly the stocking of the lake with fish. If no water is available nearby, perhaps all settlement and development should be discouraged. The implications of water are many; it is a basic consideration in determining how a piece of land might be used.



WHAT IS THE SOIL LIKE?

The surface of the Earth is covered with a thin layer of material called soil. To most of us, it just looks like dirt. Actually soils are a very complex mixture of sands, silts and clays, pieces of organic matter, and spaces filled with gases and water. Soils provide us with important information with which to make land use decisions. Just as we need water to live, we also need good soils. Only



certain kinds of soil are good enough to grow crops; soils can determine the best places to locate farms. Similarly, only certain kinds of soils are conducive to building houses, locating roads, developing campgrounds, locating industries and producing good wildlife habitat. Soil studies conducted by professional soil scientists provide information about the types of soil in a given area and how they might be used and managed - for example, to insure soils are not blown away by wind or washed away by rain.

WHAT IS THE SURFACE OF THE LAND LIKE? HOW HILLY OR HOW FLAT IS IT?



Questions about the surface of the land are very important because uses of flat land are very different from uses of hilly or very steep land. Farms need to be on nearly level land as tractors and other machinery do not work well on sloping land. Trees can be harvested on hilly land, but there is a point at which the land becomes too steep to log except from a balloon or helicopter. Houses can be located on flat or hilly land, but on land that is too steep, access becomes a problem. It is no coincidence that Anchorage and Fairbanks are located on flat land – land on which it is easiest to put houses and roads.

ARE THERE TREES ON THE LAND?

Trees, which are renewable resources, are important for many reasons. They can be made into lumber and paper - even plastics. It is important to know if there are trees on a piece of land, and whether they are of a size and type to be made into paper, two-by-fours, or plastics. Trees can be valuable to the landowner if he decides to sell them to a logging company for processing. This, in turn, can help the local community by providing jobs for people to cut and process the trees. Trees are important for other, more aesthetic, reasons. People like to look at trees. Places with trees



are nice places to live, and pleasant locations for parks and other recreation areas. Trees protect the soil from being blown away by wind, or washed away by rain. Trees produce much of the oxygen we breathe. There are many land and resource use implications in the presence of forest resources.

WHAT KIND OF ANIMALS USE THE LAND AND WATER IN THIS AREA?



Wildlife resources are some of the most valuable of Alaska's renewable resources. Fishing is an important economy – second only to gas and oil. Fishing actually provides more jobs than any other (natural resource) industry in the state. Every piece of land is habitat for some kind of animal. However, certain pieces of land can be more important to some animals than others. For example, eagles do not build nests just anywhere. Thus, the trees in which eagles nest would be considered important wildlife habitat, and would be protected from cutting or disturbance. Deer often can not find enough food during the winter except along coastlines where the snow is not too deep. These areas would be considered

important winter range because they are important to deers' survival. Salmon spawn only in stream beds which have clean gravel. It would not be good to develop gravel pits in these spawning areas, nor disturb the surrounding land in such a way that eroding soil would clog the spawning beds. It should be clear that the ways in which wildlife use land are very important considerations in land use planning.

Remember these questions. What's under the ground? Is there water on or under the land? What's the soil like and how hilly or flat is the land? Are there trees on it and what kinds of animals live there? The answers to these tell a lot about how land and resources might be used. But these are only half of the questions which need to be answered. There are other questions which look at social and economic factors affecting land and resource use.

HOW IS THE LAND USED NOW?

Knowing how a piece of land presently is used has many implications. A remote lake, which is valued for its solitude and good fishing, might not be a good place to build a road or recreation cabins. Land next to a group of houses probably would not be a desirable place to start a gravel pit. The way in which the land is used now does not need to continue to be the only use, but knowing the present use can help in deciding future uses which would be compatible with existing patterns of use.



WHAT ARE SOME WAYS THIS LAND MIGHT BE USED IN THE FUTURE?

This is often a very difficult question; no answer is necessarily right. For example, consider an area which has valuable coal deposits. While coal is not mined



heavily in Alaska today, someday Alaska's coal might be needed as a supply of energy and raw materials. Thus, today's use of lands with coal resources should not prevent future mining. Similarly, look at an area with lakes, mountains, and good hiking trails. Today this land may be used only by a few people, but fifty years from now-with greater numbers of people demanding places to recreate - this land might be a very important recreation area. This demonstrates that thinking about future Alaskans, and changing needs for land and resources, is important in coming up with good land use recommendations today.

HOW CAN YOU GET TO THIS LAND?

If you cannot get to land conveniently, it will be difficult to use it. It is useless to identify an area as being good for farms if there are no roads over which to transport the crops to market. In Alaska, access means many things besides roads. Coastal Alaska can have access by boat. River Alaska can



be accessible by barge or boat. Mountainous Alaska may be accessible by plane or maybe just trail. Accessibility is also seasonal. Areas which are inaccessible

during the summer, because of lakes and marshes, can be readily reached throughout the winter by dogsled or snowmobile. In looking at a given piece of land, it is important to consider if it is accessible for the uses proposed. If not, one must consider what might be an appropriate type of access, and recommend that the necessary facilities (road, harbor, landing strip, trail, etc.) be developed.

WHO OWNS THE SURROUNDING LAND?

Alaska has many landowners. To determine the best use of a piece of land, one must consider who owns the surrounding land. Federal, state, or local borough or city governments, Native corporations, or other private individuals could be landowners. For example, in some parts of Alaska, the state owns millions of acres in large blocks. In these areas, the way the state uses this land usually does not significantly affect adjacent landowners, except along the borders. Other parts of Alaska have complex patterns of land ownership where what one landowner does to the land definitely can influence the value and use of the surrounding land. For example, it might not be wise to encourage residential or commercial development right next to a national wildlife refuge. Such intensive development could significantly affect the public land. In order to plan for land and resource use in places where land ownership involves many owners, teams could be formed of people representing each owner's interest and responsibility. Such teams are called cooperative land management teams, and usually consist of representatives from federal, state, and local governments, Native corporations and other private landowners in a given area. This is one way which is acceptable to all landowners involved.



WHAT ARE THE COSTS AND BENEFITS OF A PARTICULAR LAND OR RESOURCE USE?

In evaluating a particular land use, one needs to consider four types of costs and benefits: economic, human, environmental, and energy. To understand how these costs and benefits fit into land use decision-making, consider the following fictional land use proposal. Near a community in Alaska there exists a parcel of land which is being proposed for timber harvest. The land is covered with tall, old trees, the soil is rich, and clear salmon stream runs through the center of the parcel. In considering economic costs and benefits, the first question is how profitable will it be to harvest trees on that land. The developers must figure out how much it will cost to cut the trees, transport them to a mill, process them, and transport them to a market. The costs of any necessary road construction must be

included in their figures. Once the costs are added up, the developers must compare them to what will be earned once



the tree products are sold. If the costs are higher than the money received from selling the tree products, then the costs outweigh the benefits and it would be economic folly for the developers to go ahead with the proposal. Of course, if the economic benefits outweigh the costs, then the developers would be wise to pursue the proposal.

Harvesting trees from that parcel of land also will bring costs and benefits to the people who live near that land. One cost might be that the people of the nearby community lost the use of that land for

recreational purposes. The harvesting operation might be an eyesore, or bring additional people noise and traffic to their community - significant changes to the character of the community. On the other hand, people in the community could benefit from new jobs brought in by the logging development or road building needed to accommodate the logging activities. Human costs and benefits must be taken into account when considering proposed land uses.

Most land uses affect the environment of the area and its surrounding. Sometimes the changes brought about are beneficial; sometimes they are harmful. In the case of the proposed logging development, environmental costs to the parcel of land include the possibility of the salmon stream becoming so filled with debris that salmon eggs couldn't hatch. Or, the habitat created by the old trees might be disturbed so significantly that area animals would die or have to move to other areas. There may be environmental benefits as well. The old trees may be diseased, thus harvesting them would enable healthy trees to take their place. Also, a new habitat created by the young forest might permit other plants and animals to flourish in the area. Clearly, environmental costs and benefits must be part of any land use decision. As certain sources of energy, such as oil and gas, become more scarce and expensive, the energy costs of land and resource development become more important to the land use decision-making process. While there certainly are more energy costs and benefits associated with the tree-harvesting example, such energy costs and benefits are easier to see by examining another example. Consider a town. We all recognize that cars and buildings require energy, but we often ignore the effects of land use on the amount of energy consumed by cars, buildings, and other elements in a town. For example, a town that is spread out over a large land area requires many miles of expensive and energy-consuming roads, power lines, and other services. People have to drive their cars greater distances, thus the residents use more gasoline to get around. The location of a town also affects energy costs and benefits. A town which is built on the north side of a mountain - the colder

side which receives little direct sunlight - uses more energy to heat its buildings than one built on the south side of a mountain. As these examples make evident, energy costs and benefits cannot be ignored, especially in Alaska where the climate is extreme and where much energy is used already to transport supplies here from Outside. Answering these questions is not easy. It requires the help of people who live in the area, and people with special skills such as foresters, soil scientists, geologists, wildlife biologists, economists and sociologists. The answers to these questions lead to a better understanding of the people who use the land.

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Who Owns Alaska Land?

