

Narrator
(pointing to the “Sun”):

Every day, lots of energy comes to Earth from the Sun. That energy can be used for many things, such as heating houses and water, and generating electricity. However, people and other animals cannot use the Sun’s energy for life processes, such as breathing and growth. Only plants can do that.

Sun
(pointing to 10,000 energy
units represented by
squares on graph paper):

*1 entire sheet of graph
paper units = 2000. So,
5 sheets of graph paper
completely filled in.*

I am the Sun. I shine on Earth all day long, sending huge amounts of light energy to the planet’s surface. Most of that energy is reflected back into the atmosphere, but pavement and oceans and plants and other things on which my rays fall absorb some of it. Plants are the only things that can use my energy to produce the chemical energy they need to live. The squares on this graph paper represent 10,000 units of light energy from the Sun.

Plant
(pointing to 100
energy units):

*1 sheet of graph
paper with 100
units filled in.*

I am a grass plant, a producer, and I am able to absorb and store about 1% of the energy that reaches me from the Sun. The rest of the energy from the Sun is reflected away. Through photosynthesis, I turn light energy into sugars and starches, which I store in my stem and leaves. This stored energy is my source of food; I use it to live and grow. I am called a producer because I make food out of the Sun’s energy. Plants are the start of almost every food chain on Earth. We are called the first trophic level. These squares represent 100 units of energy, which is only 1% of the light energy that reached me from the Sun.

Narrator:

Plants store the chemical energy in sugars and starches for their own use. Sometimes, though, a plant is eaten by an herbivore, such as a rabbit, and that food energy is transferred.

Rabbit
(pointing to 10
energy units):

*1 sheet of graph
paper with 10
units filled in.*

I am a rabbit. I eat plants, so I am an herbivore. Sometimes I am called the primary consumer or first level consumer. Herbivores form the second trophic level, or the second step in a food chain. I use most of the energy that I consume just to stay alive—to move, hunt for food, escape enemies, find shelter, build my body, and other life processes. Only about 10% of the energy that I take in is available to whatever might eat me.

Narrator: And there are many things that like to eat rabbits! As you know, meat eaters are called carnivores.

**Coyote
(pointing to 1
energy unit):**

*1 sheet of graph
paper with only 1
unit filled in.*

I am a coyote and I am a carnivore. Since I eat first level consumers, such as rabbits, I am sometimes called the secondary consumer or the second level consumer. Like all consumers, I use most of my energy just to live. I need energy to hunt for and catch my food, or dig a burrow for my den. Why, I use energy just to breathe, digest my food, and to keep my heart beating! Only about 10% of the energy that I take in is available to whatever might eat me.

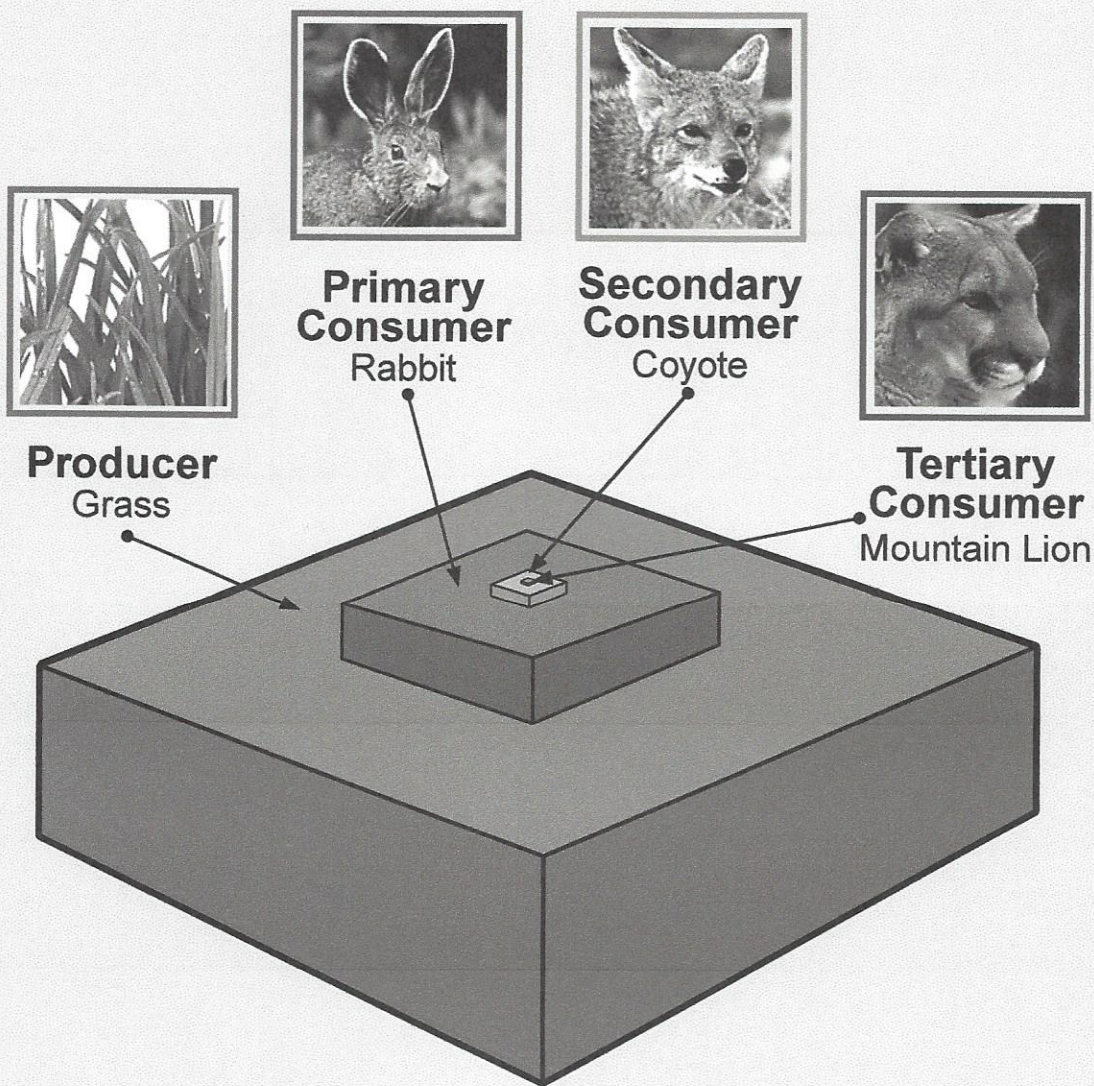
Narrator: Depending on the food chain, another carnivore, such as a mountain lion or wolverine, might eat the first level carnivore. Another example of this is one fish eating a smaller fish, or a snake eating a frog. Sometimes the first carnivore dies and is eaten by a scavenger, or its body is used by decomposers such as fungi and bacteria.

**Mountain lion
(pointing to the mountain
lion energy unit
0.1 square):**

*1 sheet of graph
paper with only .1 of
1 unit filled in.
Very tiny!*

I am a mountain lion and I will eat almost any animal I can find. I will even eat a coyote if I find one! Like all of the other organisms in this food chain, I use most of the energy that I take in just to stay alive! Whether I am a mountain lion eating a coyote, an eagle eating a fox, a crab eating a dead fish, or a million bacteria decomposing a dead bear, I can only capture about 10% of the energy in my food!

Narrator: So we see that only a tiny fraction of the energy that comes from the Sun is stored in plants. Plants use that energy for photosynthesis to produce sugars and starches. In addition, when consumers feed on plants or other consumers, they only capture about one tenth of the energy in their food. And that is why it takes so much energy captured from the Sun to support one wolverine, eagle, salmon, or human being, because so much is lost along the food chain.

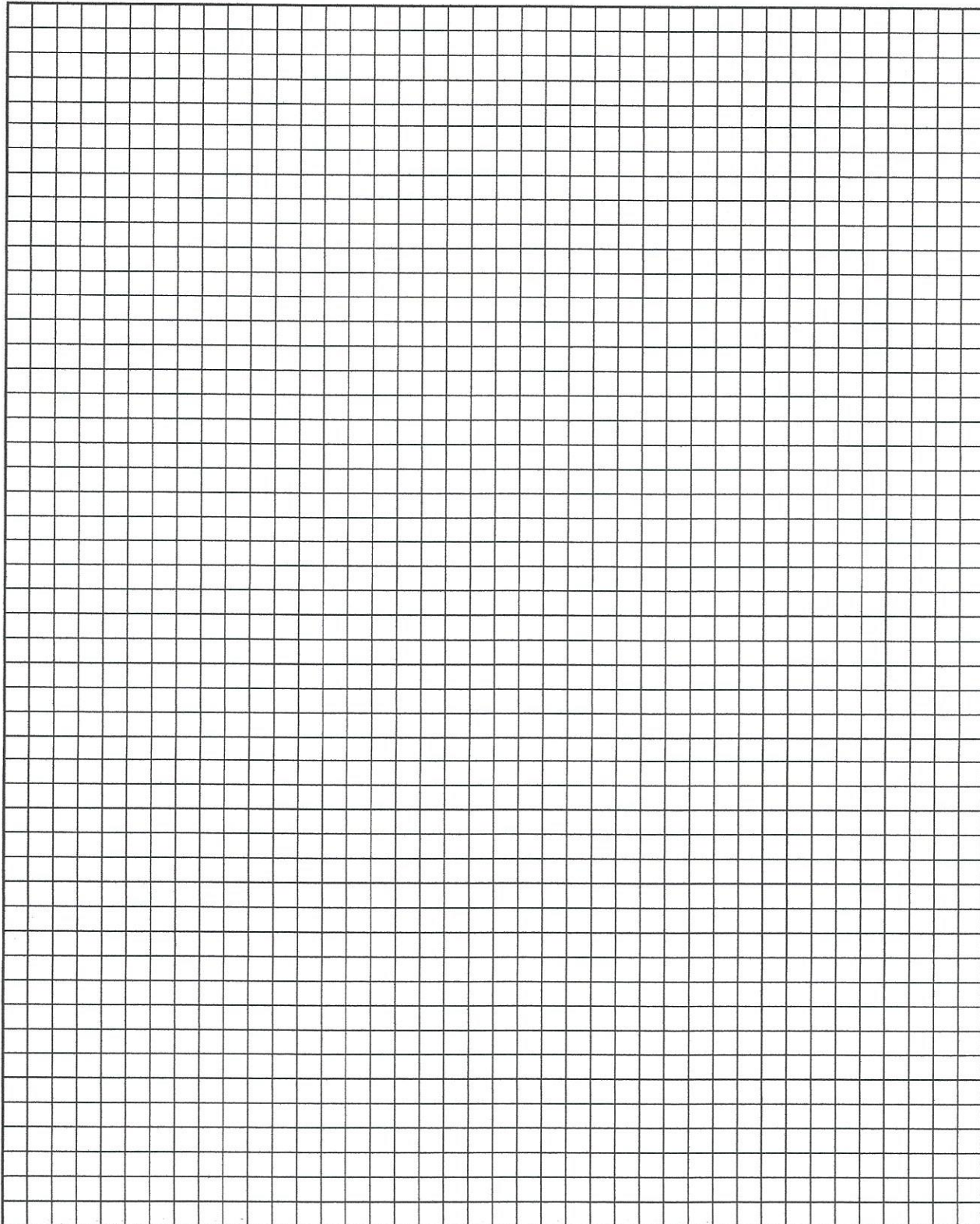
VA #5 Sierra Nevada Energy Pyramid**90% Energy Loss at Each Trophic Level**

2,000 Energy Units

Lesson 3

Name: _____

2,000 Energy Units



▪ Mountain lion unit of energy

Energy Pyramids.

Lesson 3

Name: _____

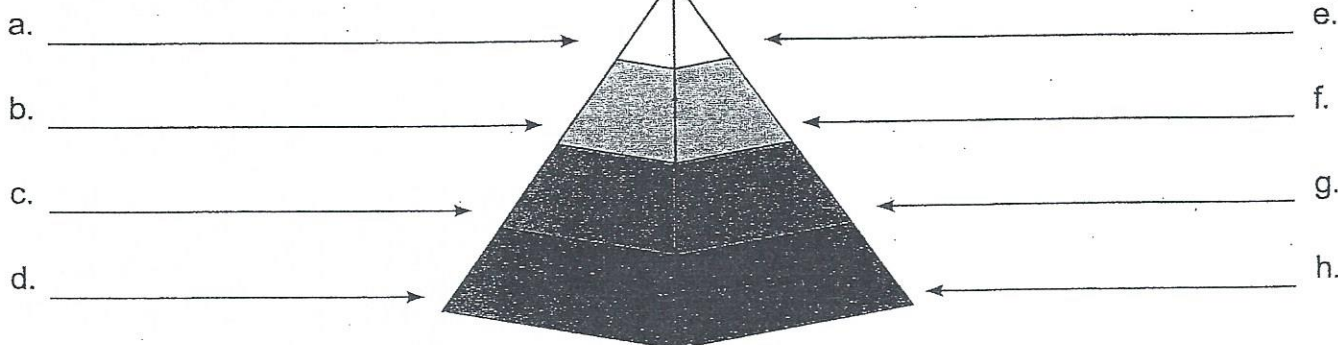
1. Label the trophic levels of the energy pyramid below. Use the following terms in your labels in the left column. Some of the lines will need more than one term. (6 points)

primary consumer	secondary consumer	tertiary consumer
producer	herbivore	carnivore

In the right column, give an example of an organism at each trophic level. (4 points)

Trophic Levels / Types of Organisms

Examples of Organisms



Instructions: Answer the following questions in the spaces provided. (4 points each)

2. A certain amount of grass gets 10,000 kcal of energy from the Sun. How much energy will be available to the next trophic level? Explain how you got your answer.

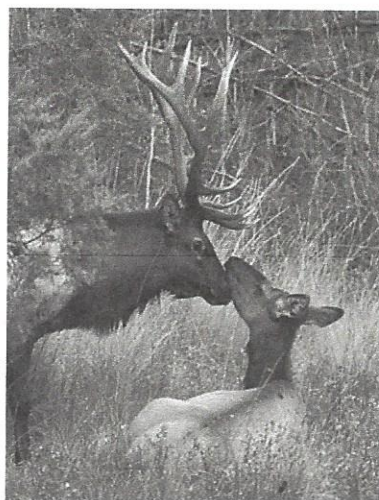
3. Imagine you want to get 1 kcal of energy from a cow. How much energy would the cow need to get from plants? Why?

4. If you want to feed more people using the same amount of farm land, should you provide foods from lower or higher portions of the energy pyramid? Why?



Bear

This animal is an omnivore. It eats seeds, fruits, salmon, small mammals like squirrels or mice, as well as large mammals, such as elk and mule deer. It only gets about 10-15% of its diet from animals.



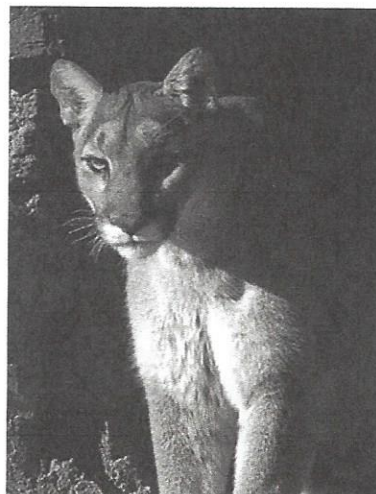
Elk

This animal eats mostly grasses.



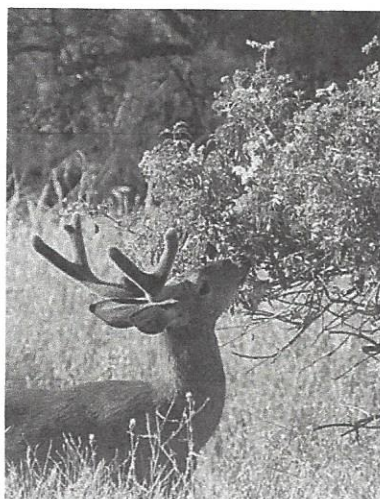
Grasses

These plants get their energy from the Sun.



Mountain Lion

This animal is a carnivore. It eats mostly large mammals, such as deer and elk. It might also eat smaller mammals.



Mule Deer

This animal is an herbivore. It eats mostly shrubs.



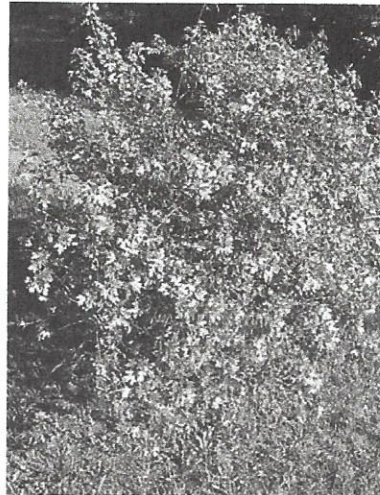
Salmon

This animal is mainly a carnivore. It eats insects and other invertebrates when young, and fish, shrimp, and squid when older.



Seeds and Fruit

These plants get their energy from the Sun.



Shrubs

These plants get their energy from the Sun.



Squirrel

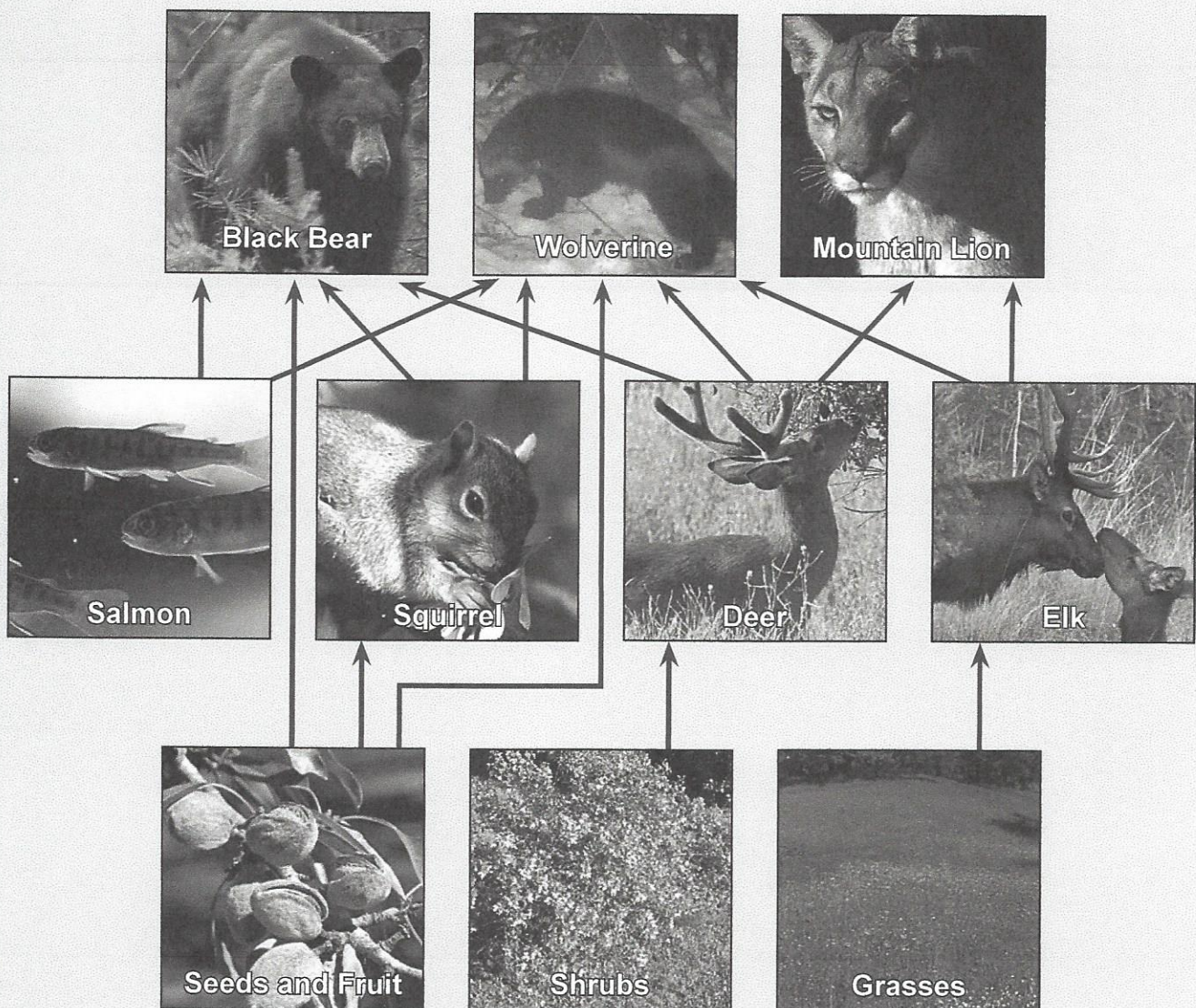
This animal is an herbivore. It eats seeds and fruits which came from plants.



Wolverine

This animal is an omnivore. It relies on deer and elk for most of its energy, but will also hunt small mammals, salmon, and young birds. It even eats occasional seeds and fruits as part of its diet.

VA #6 Partial Wolverine Ecosystem Food Web



Trapping Wolverines

Trapping wolverines in California was common in the late 1800s. Wolverines were seen as pests. In some places, they were trapped for their fur.

In California, trapping wolverines is now illegal. In other parts of North America, such as Alaska and Canada, people still hunt wolverines for their fur.

How might trapping wolverines affect the food web in the wolverine's ecosystem?

Mining and Development

In the 1800s in California, people built mines to find gold. They also built roads, farms, and towns to support mining. All of these practices break deer and wolverine habitat into small, unconnected pieces. This makes it harder for deer and wolverines to survive. Mining for minerals and oil still occurs in many deer and wolverine habitats around the world.

How might mining and development affect the food web in the wolverine's ecosystem?

Burning Fossil Fuels

People burn fossil fuels to make electricity and run their cars. Burning fossil fuels puts carbon dioxide into the atmosphere. This helps trap Earth's heat and may cause temperatures to go up. If temperatures increase, the amount of snow in the mountains may decrease.

How might burning fossil fuels affect the food web in the wolverine's ecosystem?

Recreation

In many cold regions where the wolverine lives, people like to ride snowmobiles. These loud machines can disturb deer and wolverines, making it harder for them to survive.

How might recreation in the wolverine's habitat affect the food web in the wolverine's ecosystem?

Hunting Mountain Lions

Currently, hunting mountain lions is illegal in California. There are some exceptions. The Department of Fish and Game may kill a mountain lion if it is killing livestock or pets, threatening public safety, or threatening bighorn sheep. In general, though, hunting of mountain lions is not allowed.

Laws can be changed.

What do you think would happen if the law changed? What might happen if people began hunting mountain lions again?

Fire Suppression

Fires occur regularly in California. They open up forests and allow young shrubs and other plants with seeds and fruits to grow. As people build more homes and businesses in California, they worry more about fire. For many decades, Californians have suppressed, or tried to prevent, forest fires. Fire suppression leads to forests that are dense. These forests have fewer shrubs and fewer plants that bears eat.

How might fire suppression affect the food web in the wolverine's ecosystem?

Building Dams

To produce electricity and control water supplies, Californians have built dams across rivers. Some dams prevent salmon from going up rivers to reproduce. This reduces the salmon population.

How might building dams affect the food web in the wolverine's ecosystem?

Livestock Grazing

Cows, sheep, and other grazing livestock change the areas where they eat. Ranchers control where their livestock eat and how long they stay in any particular area. Light grazing can cause more shrubs to grow. If grazing is heavy, more grass will grow instead.

How might grazing affect the food web in the wolverine's ecosystem?

Name: _____

Instructions: In your group, take turns presenting the **Human Practices Cards** to the group and leading a discussion. Ask, “How would this practice change the wolverine food web? Why?” After discussing each card, record your answers in the chart below. (2 points each)

Human practice	Prediction: How could this practice change the food web in the wolverine’s ecosystem? Explain your reasons.
Hunting mountain lions	<hr/> <hr/> <hr/> <hr/> <hr/>
Fire suppression	<hr/> <hr/> <hr/> <hr/> <hr/>
Building dams	<hr/> <hr/> <hr/> <hr/> <hr/>
Livestock grazing	<hr/> <hr/> <hr/> <hr/> <hr/>

Name: _____

Human practice	Prediction: How could this practice change the food web in the wolverine's ecosystem? Explain your reasons.
Trapping wolverines	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
Mining and development	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
Burning fossil fuels	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
Recreation	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/>