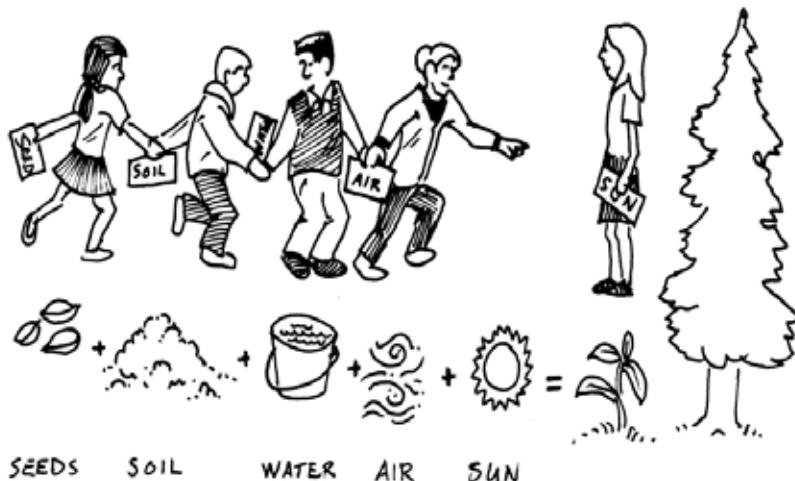


Tree Seed Chain Game

1 EXTENSION



Section 2 FOREST ACTIVITIES

Grade Level: K - 3

State Standard: S A-14

NGSS: K-LS1-1.,K-ESS3-1.,3-LS4-3.

Subjects: Science, physical education

Skills: Classifying, memorizing

Duration: 30 minutes

Group Size: Whole class

Setting: Outdoors (or gym)

Vocabulary: Living, non-living, germination

Objective:

Students will sequentially demonstrate the elements of a forest food web required for the survival of a tree.

Teaching Strategy:

In a game, students race to collect the nonliving requirements for seed germination.

Complementary Activities:

OUTDOOR: “Fungi” and “Detritivores” in this section.

Materials:

For a class of 30 students: six seed cards (labeled “SEEDS” need soil, water, air, and sun”), six soil cards (labeled “SOIL”), six water cards (labeled “WATER”), six air cards (labeled “AIR”), six sun cards (labeled “SUN”). Alternately, you can fill Ziploc bags with seeds, dirt, water, sun cutouts and air (nothing). The seed bags also contain the sentence: “SEEDS need soil, water, air, and sun.”

Background:

See INSIGHTS, *Section 2, Forest Ecosystems*.

Procedure:

1. Divide the class into two groups of equal size, each divisible by 5. If there are extra students, they can become judges at the finish line or markers for the playing field.
2. Hand out one card (or Ziploc bag) to each student, and tell the students to keep their identities a secret (except for seeds). Set the boundaries of the playing area.
3. Tell the students that the goal of the game is for seeds to obtain all the nonliving parts of the ecosystem they need to germinate, **in the order** they need them (*soil, water, air, sun*) and to be the first to cross the finish line. *Without soil, water, air, and sunlight, seeds will not grow.*
4. Begin the game with the seeds at the end of the field opposite the finish line. Divide the nonliving things equally along the two other sides of the field. *Caution students not to run into another tree seed chain.*
5. The seeds will run from one side of the field to the other, asking **only one** person per side if he is soil (or the next requirement on the list). Nonliving requirements (soils, waters, airs, suns) can only answer “yes” or “no.” They



should not tell what they are. Seeds may need to consult with the teacher for the next item on the list, depending on reading-skill level.

6. When a seed finds soil, the seed and the soil join hands to form a chain and head for the opposite side of the playing area to look for the next requirement on the list. This process keeps going until the seed has, in order, all the requirements she needs to survive as a tree. A completed chain proceeds to the finish line. Continue the game until all the seeds have found all their nonliving requirements.

Evaluation:

Students name (in order) the four essential nonliving requirements for tree growth.

EXTENSION:

Experiment with seeds and nonliving elements. Divide the class into four groups to conduct scientific experiments on plants, observing their need for soil, water, air, and sun. Assign a group to each of the following: 1) soil problems, 2) water problems, 3) air problems, 4) sunlight problems.

Using green beans, or other fast-growing plants, students design a growth experiment that demonstrates what happens if there is a missing nonliving component in an ecosystem. Each group should have an experimental and a control plant and design its own tests. Students keep records in daily logs and present their findings to the class.

Credits:

Adapted from Rocky Rohwedder, "Tree Chain Game," Project Learning Tree, Leaflet No.15, 1991.

Curriculum Connections:

(See appendix for full citations)

Books:

Ancient Ones, The World of the Old-Growth Douglas Fir (Bash)

The Big Tree (Hiscock)

Crinkleroot's Guide to Knowing the Trees (Arnosky)

Mighty Tree (Gackenbush)

One Small Square: Woods (Silver)

The Tremendous Tree Book (Brenner)

Teacher Resources:

(See appendix)

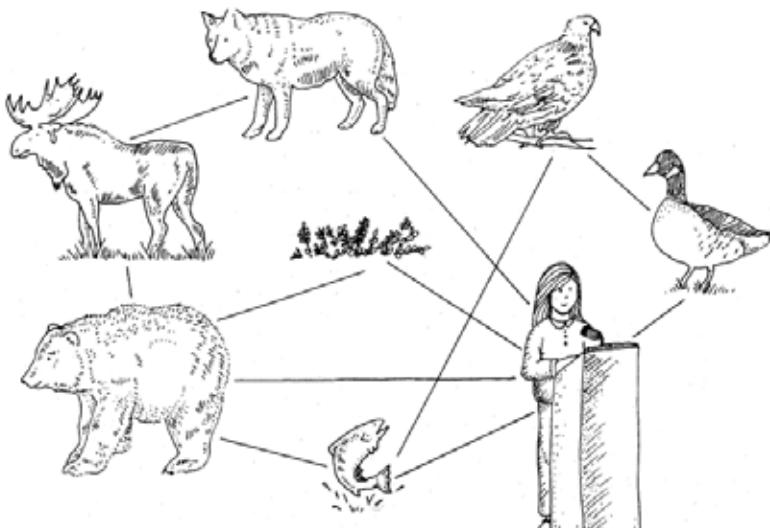
Conifers take a long time to produce and release their seeds compared with broadleafs.
Black spruce cones may hang on branches for many years.



Forest Food Web Game

1 EXTENSION

ALERT: ALASKA ECOLOGY CARDS REQUIRED



Section 2 FOREST ACTIVITIES

Grade Level: 5 - 12

State Standard: S A-14

Subjects: Science

Skills: Classifying, predicting

Duration: 60 minutes

Group Size: Whole class

Setting: Indoors

Vocabulary: Carnivores, consumers, detritivores; ecosystem, energy, food chain, food web, fungi, habitat, herbivores, minerals, omnivores, producer

Objective:

Using pictures, students will construct and describe food webs that include the nonliving elements of a forest ecosystem.

Teaching Strategy:

Students introduce themselves as elements of a forest ecosystem and link with the other elements they need to form a forest food web.

Complementary Activities:

OUTDOOR: "Fungi," "Detritivores," and "Forest Ecosystem Scavenger Hunt," *all in this section*.

Materials:

Selected *Alaska Ecology Cards* (list follows) or other pictures of coastal and boreal forest plants and animals, lengths of yarn 6 inches to 3 feet long, chalkboard and chalk.

Background:

See INSIGHTS, *Section 2, Forest Ecosystems*.

Procedure:

1. Separate the *Alaska Ecology Cards* for either the boreal or coastal forest (list follows).
2. Review your students' prior knowledge about **food webs**.
3. Brainstorm the components of an Alaska forest. Encourage students to name a mixture of **nonliving things**, kingdoms of **living things** (*plants, animals, fungi, etc.*), specific organisms (*flying squirrels, woodpeckers, insects, etc.*) and roles of living things (**producers, consumers, etc.**). List whatever they mention on the board.
4. Students divide the list into living and nonliving things. Students then divide the living things into ecological roles (*producer, consumer, herbivore, carnivore, omnivore, and detritivore*).
5. Explain the classification of living things by their ecological roles is important in understanding how a forest **ecosystem** works. *If an ecosystem is to survive changes, then all of the ecological roles must be conserved. For example, if an herbivore disappears then the carnivore that eats it will be*



affected. Explain that the *Alaska Ecology Cards* represent a sample of some of the living things found in Alaska forests.

6. Depending on which forest you have chosen to study, distribute the following *Alaska Ecology Cards* in the following order (to assure that all organisms will interconnect):

BOREAL FOREST

Sunlight
Air
Water
Rocks and soil
White spruce tree
Red squirrel
Goshawk
Carrion beetle
Bacteria
Gilled mushroom
Bark beetle
Hairy woodpecker
Sharp-shinned hawk
Birch tree
Moth
Chickadee
Truffle
Bacteria
Springtail
Flying squirrel
Low-bush cranberry
Vole
Great horned owl
Marten
Polypore or shelf fungi
Protozoans
Lichen
Moose
Grouse
Hare
Lynx
Algae

COASTAL FOREST

Sunlight
Air
Water
Rocks and soil
Sitka spruce
Red squirrel
Goshawk
Carrion beetle
Bacteria
Gilled mushroom
Bark beetle
Red-breasted sapsucker
Sharp-shinned hawk
Hemlock tree
Sawfly wasp
Chickadee
Truffle
Bacteria
Springtail
Flying squirrel
Trailing raspberry
Moth
White-footed deer mouse
Weasel
Polypore or shelf fungi
Protozoans
Lichen
Deer
Grouse
Crossbill
Wolf
Algae

If few students are doing this activity, students hold more than one card from the same ecological role. For example, one student could hold all of the nonliving cards, or all the producer cards.

7. Students circulate around the room and introduce themselves to each other. They give the name of the item they represent, their type (nonliving, producer, consumer), and what they eat or use to survive. *For example, "I am the minerals in rocks and soil. I am nonliving. I do not eat;" or "I am a spruce tree. I am a producer. I make my own food using sunlight, water, minerals, and air;" or "I am a moose. I am an herbivore that eats twigs of birch, willow, and other plants."*

8. Whenever a student meets something that it eats, that eats it, that uses it (in the case of producers), or that is used by it (nonliving things), those students should join together by holding pieces of yarn. Students who are connected by

yarn move together as a group. Students in groups can introduce themselves individually, or the top consumer in each group can do the introductions. Other students will join this group whenever appropriate. *Several separate groups will form at first, but eventually, the whole class should become interconnected.*

9. Congratulate the class on becoming a forest food web! Explain that a food web contains all the **food chains** of an ecosystem.

10. Ask what would happen to the ecosystem if one of the organisms in the food web was removed. Tug on one player as if to remove her. Tell her to pass the tug on to all the organisms she connects. Ask those who feel the tug to raise their hands. Discuss the effects. If desired, repeat this step by removing different kinds of organisms. Which causes the most effects – removal of a producer, herbivore, carnivore, or detritivore?

Evaluation:

1. Students describe the ecological role of producers, consumers, herbivores, carnivores, detritivores.
2. Students draw a food chain of at least 4 living things from the forest environment.

EXTENSION:

Color the posters and find the wildlife. Students color the boreal and coastal forest posters from the *Section 2 INSIGHTS, Forest Ecosystems – Community Connections*. Can they find the following:

COASTAL FOREST: 14 animals? 9 plants? 3 fungi?

BOREAL FOREST: 12 animals? 7 plants? 3 fungi?

How are they connected in the ecosystem?

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska Wildlife Notebook Series (ADF&G)

Ancient Ones, The World of the Old-Growth Douglas Fir (Bash)



Biomes of the World (v.1) (Allaby) 7-12

One Small Square: Woods (Silver)

Taiga (Kaplan)

Taiga (Sayre)

U-X-L Encyclopedia of Biomes (v.3) (Wigel) 7-12

What are Food Chains and Webs? (Kalman)

Who Eats What? (Lauber)

Website:

Alaska Science Forum

<www.gi.alaska.edu/AlaskaScienceForum>

Teacher Resources:

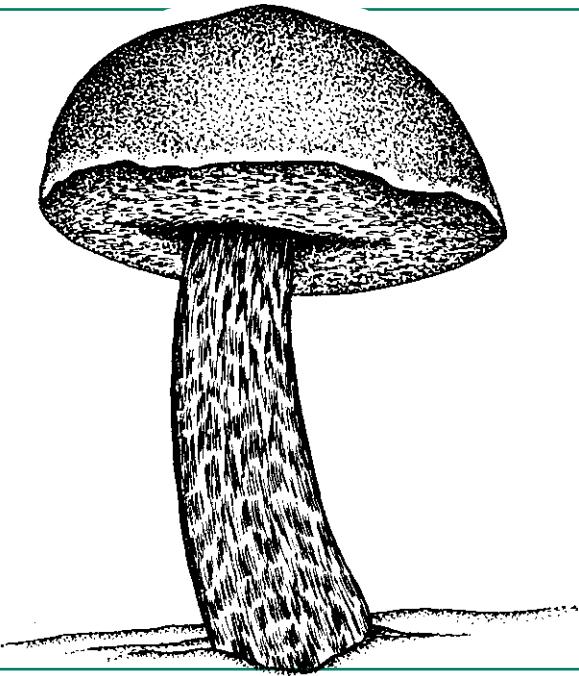
(See appendix)



Fungi

1 EXTENSION

ALERT: ALASKA ECOLOGY CARDS REQUIRED



Section 2 FOREST ACTIVITIES

Grade Level: 5 - 12

State Standards: S B-1. S B-5

NGSS: MS-LS1-5, MS-LS1-6. MS-LS2-2., MS-LS2-3., HS-LS2-4. S-LS2-5.

Subject: Science

Skills: Observing, identifying

Duration: 50 minutes & follow-up several days later

Group Size: Individuals

Setting: Outdoors & indoors

Vocabulary: Consumer, detritivores; ecosystem, energy, food chain, food web, fungi, habitat, hyphae, minerals, photosynthesis, producer

Objective:

Students will identify and describe forest fungi.

Complementary Activities:

OUTDOOR: “Detritivores” and “Forest Ecosystem Scavenger Hunt” in this section; “Snag a Home” in Section 4, Succession. *INDOOR:* “Forest Food Web Game” in this section.

Background:

See INSIGHTS, Section 2, Forest Ecosystems.

Materials:

Fungi cards from the *Alaska Ecology Cards*. Clipboards and writing paper or field note books, pencils or pens. Plastic bags, hand lens, plastic wrap, several small dishes or disposable muffin tins, ingredients for agar mixture (*made by combining 2 cups boiling water, 2 teaspoons sugar, 2 teaspoons beef or chicken bouillon powder, and 4 teaspoons of gelatin*). Copies of Science Card (*following page*).

OPTIONAL: Field guides on mushrooms and other fungi.

Procedure:

IN ADVANCE, look for a forested site that has dead leaves and dead trees to conduct the fungi investigation.

Make an agar mixture (*recipe in Materials list*). Fill small dishes or disposable muffin tins with agar mixture and allow it to set so they are ready when the students return from the forest.

1. *IN CLASS*, discuss the role of **detritivores** in a forest ecosystem. Where would you find them (*in leaf litter and on dead things*). Review the concept of **food chains**. Where are detritivores in forest food chains? Fungi are one of the many kinds of detritivores.

2. Tell the students they will go in search of forest fungi. Review the fungi cards from the *Alaska Ecology Cards* series before going to the forest site.

Classroom Follow-Up:

1. Students place their fungi samples in separate dishes filled with agar, a medium that contains **energy** and **minerals**. Cover these with plastic wrap and place them in a

warm, dark place.

2. Ask students to predict what will happen. For example, will anything grow?

3. Wait a few days, then see if anything has grown. If something does grow, is it more likely to be a **producer** or a **consumer**? *NOTE: If the growth in their sample is fuzzy, it is probably a fungus (mold). If it is slimy, it is probably a yeast (a type of fungi) or bacterial growth (a type of moneran). Students should recognize that the organisms that grow are unlikely to be producers since they did not receive any light, and light is needed for photosynthesis.*

EXTENSION:

1. **Research forest fungi and create a display.** Students use the *Alaska Ecology Cards* or other “Curriculum Connections” resources (*following*) to find out more about forest fungi. They use this information along with sketches or samples to make a poster or display of this seldom noticed forest life.

Curriculum Connections:

(See appendix for full citations)

Books:

The Big Tree (Hiscock)

Fungi (Silverstein)

Fungi (Tesar)

Taiga (Sayre)

Website:

Alaska Science Forum

<www.gi.alaska.edu/AlaskaScienceForum>

Teacher Resources:

(See appendix)

SCIENCE CARD

Fungi

1. Write “Forest Fungi” at the top of a page in your field notebook.

2. Look at the pictures of fungi on the cards, then look around this area carefully and try to locate as many kinds of fungi as you can. Draw pictures of those you see in your notebook.

3. Can you see any evidence that fungi are **detrivores**? Write down any evidence you notice.

4. Probably the first fungi you see are large fruiting bodies of mushrooms or shelf fungi. These visible parts of fungi are minor in comparison with the major, harder

to see feeding parts called **hyphae**, long but tiny or microscopic hair-like threads that can be hundreds of feet long. Look closely at the dead leaves and decayed wood in this area with a hand lens. Can you see any hair-like fuzz or strands?

5. Based on what you know about fungi, select two items from this area that you think might have some kind of fungi growing on them. Place a sample of each in plastic bags. Label the bags *Fungi Sample 1* and *Fungi Sample 2*. Record in your notebook everything about them. Take these samples back to the classroom with you.



Detritivores

1 EXTENSION

ALERT: ALASKA ECOLOGY CARDS REQUIRED



Section 2 FOREST ACTIVITIES

Grade Level: 5 - 12

State Standards: S B-1, S B-5

NGSS: HS-LS2-4, HS-LS2-5.

5-LS2-1.,MS-LS1-5,MS-LS1-6

MS-LS2-2.,MS-LS2-3.,HS-LS2-4.

HS-LS2-5.

Subject: Science

Skills: Observing, inferring, predicting

Duration: 30 minutes & follow-up
several days later

Group Size: 2

Setting: Outdoors & indoors

Vocabulary: Consumer, detritivores;
ecosystem, energy, food chain, food
web, fungi

Objective:

Students will identify, categorize, and compare detritivores based on the type of food they eat.

Complementary Activities:

OUTDOOR: “Fungi” in this section, “Snag a Home” in Section 4, Succession. *INDOOR:* “Forest Food Web Game” in this section. Also “Forests and Soil” an outdoor and indoor activity in Section 4 comparing forested and non-forested sites for detritivores and their work in soil formation.

Background:

See INSIGHTS, Section 2, Forest Ecosystems.

Materials:

Small net bags, rotten meat, rotten fruit, string, labels, forceps or tweezers, magnifying glass or hand lens, *Alaska Ecology Cards*, clipboards and writing paper or field note books, pencils or pens. Copies of Science Card (*following page*).

OPTIONAL: field guides to forest invertebrates.

Procedure:

IN ADVANCE, choose a site anywhere in a forest.

One day or more before class, tie 2 small net bags for each team at nearby spots on the forest floor. One should be filled with rotten meat and the other filled with rotten fruit.

1. *IN CLASS*, discuss the role of **detritivores** in the forest **ecosystem**. Are detritivores **consumers**? What do they consume? Where are they represented on a forest **food chain**? What kind of wildlife will the students be looking for at the outdoor site?

2. Tell the students they will be looking for forest detritivores in action. Review the detritivore cards from the *Alaska Ecology Cards* series before going to the forest site.

Classroom Follow-Up:

1. Students look through the *Alaska Ecology Cards* or field guides of forest invertebrates and insects to find pictures of the organisms that they observed in the field.
2. Students label their field drawings. Be sure to look up carrion beetles, blow flies, springtails, and molds.



3. Discuss student answers to the questions on the Science Card. *Students will likely find more animals around the meat and more fungi around the fruit. Like other organisms, detritivores eat specific kinds of food. Some eat plants; others eat meat. Rotten smells are evidence of microscopic detritivores. Without detritivores, the forest would be overflowing with dead plants and animals.*

EXTENSION:

Research forest detritivores and create a display. Students use the *Alaska Ecology Cards* or other “Curriculum Connections” resources (*following*) to find out more about forest detritivores. They use this information along with sketches or samples to make a poster or display of these seldom seen forest wildlife.

Curriculum Connections:

(See appendix for full citations)

Books:

Fungi (Tesar)

Taiga (Kaplan)

Taiga (Sayre)

Website:

Alaska Science Forum

<www.gi.alaska.edu/AlaskaScienceForum>

Teacher Resources:

(See appendix)

SCIENCE CARD

Detritivores

1. In your field notebook, label a page “Forest Detritivores.” Record your answers there to the questions below.

2. Look carefully at the small net bags that are tied to the forest floor in this area. Divide your page in half with a line and label one side as *Bag 1* and the other side as *Bag 2*. Below the label, record what each bag contains (*either rotten meat or rotten fruit*).

3. Look carefully in, on, and immediately around each bag using the magnifying glass or hand lens. Draw a picture of any organisms or animal signs that you find in your notebook below the appropriate bag label. Look for insects, other invertebrates, and fungi (fuzz or furry coatings or mushrooms).

4. Use the forceps or tweezers to carefully pick up each bag and look underneath it. Use the hand lens to examine anything you find. Draw pictures of any detritivores you find.

5. Compare the kinds of detritivores you find on each type of rotting material. Are they the same or different? What differences did you notice? Why might there be differences?

6. Do you see evidence of any microscopic detritivores?

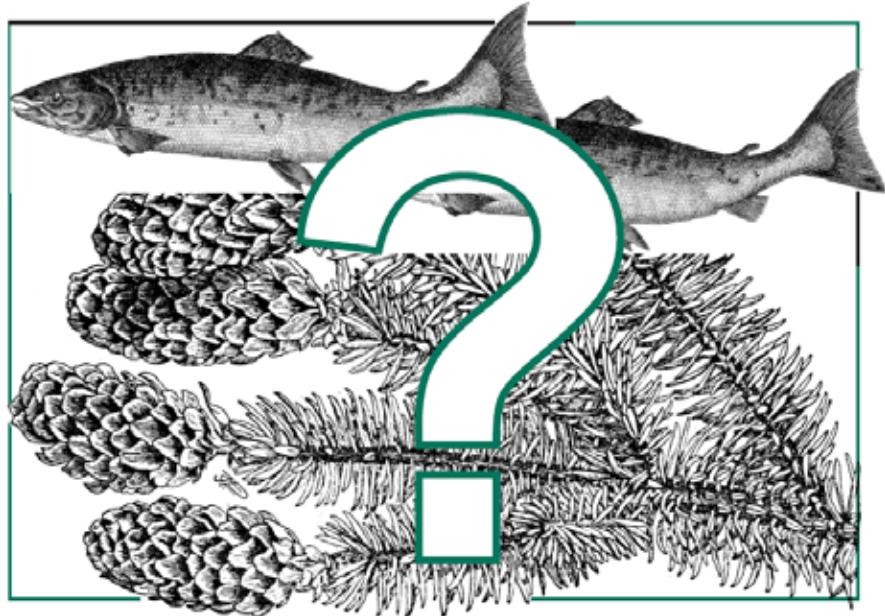
7. What would the forest look like if all these invertebrates, fungi, and microscopic detritivores weren’t around?



Forest Puzzlers

1 EXTENSION

ALERT: ALASKA ECOLOGY CARDS OPTIONAL



Section 2 FOREST ACTIVITIES

Grade Level: 5 - 12

State Standard: S A-14

NGSS: 5-LS2-1., MS-LS2-2.

MS-LS2-3.,MS-LS2-4,HS-LS2-2.

HS-LS2-6.

Subjects: Science, social studies

Skills: Reading, reasoning,
analyzing

Duration: Two 40 minute lessons

Group Size: Small and whole class

Setting: Indoors

Vocabulary: Carnivore,
commensalism, conifer,
competition, detritivore,
ecology, herbivore, herbicide,
invertebrates, mutualism,
parasitism, pesticide, population
explosion, predation, predator,
symbiotic/ symbiosis

Objectives:

1. Students will describe the effects and consequences of forest ecosystem changes.
2. Students will apply their knowledge of forest ecology to real ecological problems.

Teaching Strategy:

Students analyze forest ecology problems and present possible solutions.

Prerequisite:

Students should understand and be able to apply the concept of “habitat” before starting this activity. For more background and teaching activities about wildlife habitat, refer to another book in this curriculum set, Alaska’s Wildlife Conservation, Section 1, Home Sweet Habitat. Additional activities that teach habitat concepts are available in Project WILD.

Materials:

Copies of “Forest Ecology Puzzlers” (*following pages*).

Background:

See INSIGHTS, *Section 2, Forest Ecosystems*.

Procedure:

DAY ONE:

1. Divide the class into three groups and give each a different puzzler.
2. Review the vocabulary words with the class. Ask students to read definitions from the glossary or dictionary and list them on the board.
3. In small groups, students read the facts given, then solve the puzzle at the bottom of the page. Each group makes a summary of the problem, the possible cause, and possible solutions.
4. If time allows, each group trades puzzlers.

DAY TWO:

1. Each group presents its puzzler and the possible solutions.
2. Students read the corresponding “What Ecologists Discovered” and compare their ideas to the ecologists’ ideas.
3. Discuss the precautions people need to consider before changing an ecosystem.

Evaluation:

Students write a paragraph summarizing possible consequences of human changes to ecosystems. Students should also summarize ways to avoid or resolve problems that arise from changes.

EXTENSION:

Research local forest issues. Students research local forest issues and present them to the class. Each problem should have a student-designed solution. Students submit their final solution to a local forest agency.

Credits:

Adapted from Western Regional Environmental Education Council, Project WILD and Project WILD Aquatic Education Activity Guides, 1992. For information on Project WILD, contact the Project WILD Coordinator, Alaska Department of Fish & Game (Address: 333 Raspberry Rd, Anchorage, AK 99518).

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska's Forest Resources (Alaska Geographic Society)

Alaska Wildlife Notebook Series (ADF&G)

Ancient Ones, The World of the Old-Growth Douglas Fir (Bash)

Journey Through the Northern Rain Forest (Pandell)

My Side of the Mountain (George)

Shrinking Forests (Tesar)

Taiga (Sayre)

Websites:

Alaska Science Forum

<www.gi.alaska.edu/AlaskaScienceForum>

Staff-written Alaska newspaper articles: Anchorage *Daily News* Archives <www.adnsearch.com> or Fairbanks *Daily News-Miner* <www.newsminer.com>

Forest Ecology Puzzler

ALDERS AND CONIFERS

The Facts:

- Nitrogen is a mineral element needed by all living things, because it is a basic building block of the chemicals that form cells. Nitrogen is passed from the nonliving environment to plants and other **producers** and then through **food chains** and **food webs**.
- Most of the nitrogen available on earth is in a gas form in the atmosphere. In fact, 78% of the air we breathe is nitrogen.
- Plants cannot use nitrogen from the air; they must obtain it from the soil.
- **Symbiotic** fungi living in the roots of alders are able to take nitrogen from the air and change it to a form plants can use. The alders use this converted nitrogen to build alder leaves.
- When alder leaves are decayed by soil **detritivores**, the nitrogen in the leaves again becomes part of the soil and can be reused by alders or other plants. As a result, soil that is poor in nitrogen becomes enriched with nitrogen after several years of alder growth.

The Puzzler:

Forest researchers want to grow **conifer** trees more quickly. They know that conifers grow quickly if they have good supplies of minerals, sunlight, and water. They notice that slow-growing conifers are often shaded by faster-growing alders. So they decide to reduce the **competition** for sunlight by spraying some experimental sites with **herbicides** to kill alders without harming conifers. For a few years, all the conifers grow faster, but then, those growing on sites with less soil, begin to wither. What do you think caused these results?



Forest Ecology Puzzler

WOLVES, BEAVERS, AND SALMON

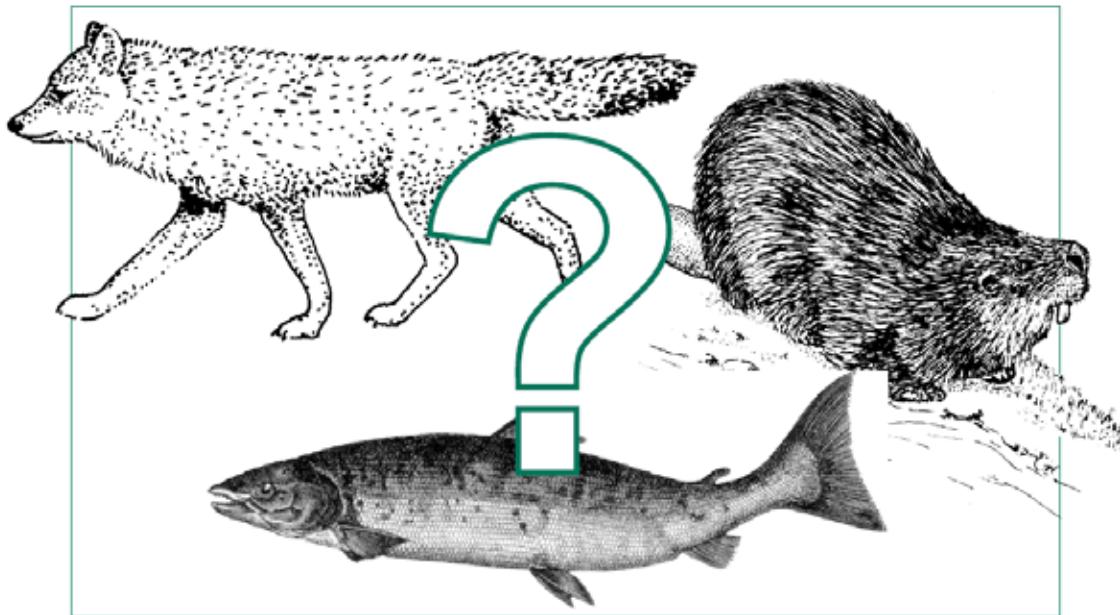
The Facts:

- In order to reproduce successfully, salmon require spawning grounds with gravel of a certain size, water with a particular temperature range and oxygen content, and aquatic **invertebrates** to feed their offspring. These conditions are only met in certain locations in a stream.
- Salmon must have clear access up streams in order to travel between the ocean and their spawning areas. Large waterfalls, log jams, or beaver dams can prevent salmon from reaching their spawning locations.
- Wolves prey on a variety of **herbivores**. In most areas, moose and caribou are their primary prey. But, when these prey are scarce, wolves switch to smaller prey such as spawned-out salmon, beaver, or muskrat.
- The **population** – number – is usually limited by a combination of factors, including **predators**, **parasites**, food supplies, and weather. The relative importance of these factors changes from year to year and place to place. For example, **predation** may be the most important factor limiting numbers in one place and time, while shortages of food may be the most important at another place and time.

The Puzzler:

In one part of Alaska several years ago, populations of deer were low and biologists wanted to do something to help the deer population. They determined that predation by wolves was an important factor limiting the deer population.

So, biologists put poison in some beaver carcasses and placed these as bait for the wolves. Because other prey were in short supply, the wolves readily fed on the carcasses and many died. With this reduction in wolf numbers, the deer population began to increase. A few years later, fisheries biologists were puzzled when salmon numbers dramatically decreased. What happened?



Forest Ecology Puzzler

FORESTS WITH ONLY ONE KIND OF TREE

The Facts:

- The numbers of insects feeding on the leaves or other tissues of trees normally goes up and down. In a natural forest, sometimes their numbers go way up. This is called a “**population explosion**.” Such outbreaks are usually controlled by a combination of **predators**, **parasites**, food supplies, and weather.
- The numbers and kinds of animals living in a forest depend on the variety of habitats available. Generally, forests with many vegetation layers and a mixture of species of live and dead trees provide habitat for more kinds of animals.
- Just as some people do not become sick when a flu hits, some individual trees are better able to resist certain insect pests.
- The number of **carnivores** is always much smaller than the number of the **herbivores** they eat. Certain **pesticides** (such as DDT) are passed through food chains just like nutrients. Carnivores retain most of the pesticides stored in the bodies of all the **prey** they consume. As a result, carnivores accumulate higher doses of pesticides than do herbivores.
- Genetic variation in individuals in a population of insects or trees means that some individuals may be more resistant to a poison, disease, or parasite. This resistance is often passed to offspring.



The Puzzler:

In the past, when people wanted large, healthy trees suitable for timber harvest, they planted a forest of only the species desired. Foresters first selected a few individual trees that were tall, straight, fast-growing, and of high value for their wood. They collected seeds

from these trees, cultivated seedlings, and planted a new forest. To reduce **competition** for sunlight and minerals, they removed other trees and shrubs.

The planted trees grew quickly at first, and it looked as though there would be plenty of timber to harvest when the trees were full-grown. Then one year, the forest was attacked by a mob of insects that ate the leaves of the trees. In some cases, nearly all the planted trees were attacked and began to die.

In order to save their forest, the owners sprayed DDT or other pesticides to kill the insects. This helped at first. The numbers of insect pests dropped, and the trees began to recover. Then, without warning, insect pest numbers rose higher than before. The pesticide used originally no longer worked. Most of the trees in the planted forest died.

Explain why the insect outbreak occurred, why nearly all the trees were killed, and why this would rarely happen in a natural forest.



Forest Ecology Puzzler

WHAT ECOLOGISTS DISCOVERED

Alders and Conifers

When the alders were killed, all the nitrogen in their leaves was returned to the soil. That recycled nitrogen and the nitrogen already present filled the needs of the conifers for a few years. With plenty of nitrogen and more sunlight, the conifers grew faster.

Eventually, those growing on sites with little soil took most of the nitrogen from the soil and stored it in their needles. Unable to use nitrogen from the air, and without alders and their **symbiotic** bacteria to enrich the soil, these conifers were unable to get the nitrogen they needed to grow. Indirectly, the conifers needed the alders, even though the alders competed with them for sunlight.

Wolves, Beavers, and Salmon

Without many large animals to eat, wolves turned to beavers for food. Soon there were fewer beavers. When the biologists poisoned the wolves, the beaver population grew. More beavers built more beaver dams and blocked fish passage to important spawning areas. Because salmon could not reach spawning areas, they could not reproduce. When the adults died, there were few young to replace them.

Forests With Only One Kind of Tree

Today, forest scientists know that the method of growing new trees described in the puzzler actually encourages outbreaks of insects and diseases that kill trees. Here's why.

With only a couple kinds of trees, all of the same age in this planted forest, only a few animals can find what they need to live. With fewer predators and parasites, insect populations are more likely to explode, given good weather and abundant food.

By planting tree seedlings from just a few selected trees, growers created a forest likely to get sick. If the trees were not immune, any insect or disease had an abundant, undefended, food supply. When weather conditions were right, the insect populations (no longer limited by food, predators, or parasites) exploded and overwhelmed the trees.

Spraying **pesticides** at first reduced the numbers of problem insects – and any natural predators and parasites present. If some of the insects survive, they're "resistant." They will pass on to their babies the ability to survive this kind of pesticide. Then that pesticide will no longer kill them.

The natural predators and parasites recover more slowly, if at all, because there were fewer of them before the pesticide was sprayed. Without natural controls, the next problem insect explosion occurs quickly. This explosion cannot be reduced with the same pesticide.



Forest Ecosystem Scavenger Hunt

ALERT: ALASKA ECOLOGY CARDS OPTIONAL



Section 2 FOREST ACTIVITIES

Grade Level: 5 - 9

State Standards: AC E-2, S A-14, S B-1

NGSS: 5-LS2-1, MS-LS2-2, MS-LS2-3,

HS-LS2-4, HS-LS2-5.

Subjects: Science

Skills: Observation, inferring, application

Duration: 45 minutes or more

Group Size: 3-5

Setting: Outdoors

Vocabulary: Broadleaf, carbon dioxide, carnivore, commensalism, conifer, consumer, detritivore, ecosystem, erosion, fungus, herbivore, interdependence, invertebrate, mammal, microscopic organism, oxygen, mutualism, nonliving element, omnivore, parasitism, photosynthesis, predation, producer, recycle, respiration, symbiosis

Objective:

Students will identify concepts and components of a forest ecosystem.

Teaching Strategy:

Students participate in a scavenger hunt to identify and review roles of organisms in a forest ecosystem.

Complementary Activities:

OUTDOOR: “Insect Signs,” “Mammal Signs,” and “Bird Signs” in this section. Also “Track Casting” in Section 3, *Forest Learning Trail*; “Snag a Home” in Section 4, *Succession*.

Materials:

Copy of the scavenger hunt list for each group (*following pages*).

OPTIONAL: *Alaska Ecology Cards*.

Background:

See **INSIGHTS, Section 2, Forest Ecosystems**.

Procedure:

1. Before distributing the scavenger hunt list, add specific animals, plants or other items which represent your local area.
 2. Review the list of items together. Help students define unfamiliar terms.
 3. Explain that some items on the “Forest Scavenger Hunt List” require creative thinking. *For example, students may not see specific animals, but they could find animal signs such as droppings, browse marks or tracks. Similarly, students will not see carbon dioxide, but they can deduce its presence by their own presence or the presence of animals that breathe it out, or by plants which use it in photosynthesis and respiration.*
- Evidence of symbiosis might include a parasitic growth on a plant, a deer or moose (which requires microscopic organisms to digest its food), a swallow (which must have holes in trees made by woodpeckers or fungi to survive), or seeds that stick to someone’s socks.*



4. Explain the rules:

- Although students can review the *Alaska Ecology Cards* or the Glossary, they may not write anything down until the hunt begins. (b) When students find an item, they are to **write each “find” on their list rather than collecting it.**
- Students can use the same item more than once on the list as long as the item fits more than one category.
- The search ends when any team finds one example of each item on the list, or at the end of a specified time.

5. Once the class is outside, set clear boundaries for the hunt. Remind students to respect wildlife and the forest ecosystem by leaving plants as they find them.

6. When the search ends, the first team finished reads aloud its list, explaining why their items are examples or evidence. Other teams follow with items that they found which were different from the first team’s list.

7. All teams cross from their list anything that another team also listed. Any incorrect answers must also be crossed off. Each team then adds the number of allowed items remaining on its list and scores one point per item. The team with the most points wins.

Evaluation:

Students write a description of the forest ecosystem using the scavenger hunt list. Students explain the interconnections.

Curriculum Connections:

(See appendix for full citations)

Books:

Ancient Ones, The World of the Old-Growth Douglas Fir
(Bash)

Dead Log Alive (Kittinger)

A Dead Log (Green)

One Small Square: Woods (Silver)

Shrinking Forests (Tesar)

Teacher Resources:

(See appendix)



Forest Scavenger Hunt List

Find examples or evidence of the following and list them in the space at the right or on another sheet of paper:

- a producer
- a carnivore
- a symbiosis
- photosynthesis
- parasitism
- an insect
- a detritivore
- an herbivore
- mutualism
- predation
- commensalism
- an omnivore
- an animal
- a fungus
- a plant
- microscopic organisms
- a nonliving element
- an invertebrate
- a mammal
- interdependence
- a broadleaf
- a consumer
- a tree
- water
- erosion
- a bird
- oxygen
- humans
- carbon dioxide
- conifer
- recycling of minerals
- a tree or plant that tolerates shade
- a tree seedling
- a tree that died
- a tree that is dying
- a place where two different kinds of trees grow next to each other
- moss on a tree



Home is a Tree

ALERT: ALASKA ECOLOGY CARDS REQUIRED



Section 2 FOREST ACTIVITIES

Grade Level: K - 3

State Standards: S A-14, S A-5, S B-1, A A-1

NGSS: K-ESS3-1

Subjects: Science, art

Skills: Analyzing, drawing, recording

Duration: 2 30-minute classes

Group Size: Whole class

Setting: Indoors

Vocabulary: Broadleaf, evergreen, habitat, names of forest animals

Objectives:

Students will describe why trees are important to wildlife by making a mural with pictures of wildlife peeking out from their homes in trees.

Materials:

Copies of forest wildlife from the *Alaska Ecology Cards*, scissors, crayons or markers, butcher paper for mural, tape.

Background:

See INSIGHTS, Section 2, *Ecosystem Connections: "Home is in a Tree" Fact Sheet; and Alaska Ecology Cards.*

Procedure:

1. Ask students to brainstorm animals that depend on trees as part of their **habitat**. What role do trees play in each animal's life? Record their observations on the board.

2. Distribute copies of appropriate *Alaska Ecology Cards* and explain that these animals use trees or the areas around them for shelter, food, or nesting sites. *The animals wouldn't*

necessarily all use the tree at the same time because different animals use trees for different reasons during different times of the year.

3. Ask the students to draw and color a large **evergreen** tree and a large **broadleaf** tree on the butcher paper. Add a fallen log. Students also color the animals on the copies of the *Ecology Cards*. If an animal that the students' brainstormed is not represented on the cards, the students should draw their own.

4. Decide where each animal would live in and around the trees. Draw with pencil a box at that spot smaller than the *Ecology Card* picture. (Perhaps make a template for younger students.)

5. Using scissors, cut three sides of the box on the murals. Then fold the flap back along the uncut side. The cut flaps should work like little doors.

6. Make a tab for each door by cutting a small piece of paper 1 inch long by $\frac{1}{2}$ inch wide. Tape half of the piece of paper to the back of the door so that $\frac{1}{2}$ inch hangs free and forms a tab. Be sure to tape the piece of paper to the



back of the door edge opposite the uncut side. You can use the tabs to keep the doors closed by tucking them under the cut edges.

7. Place the animal *Ecology Cards* behind their proper “doors” on the mural and glue or tape in place.

8. Open the doors to see what is underneath the leaves and bark and around the roots and under the rotting log.

Credits:

Adapted by Jeanne L. Williams, teacher at Kingikmiut School, Wales, Alaska, from National Wildlife Federation, *Home is Where the Habitat Is — National Wildlife Week Educator’s Guide*, 1995.

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska Wildlife Notebook Series (ADF&G)

The Big Tree (Hiscock)

The Gift of the Tree (Tresselt)

In a Tree (Schwartz)

Look Closer: Tree Life (Greenaway)

Once There was a Tree (Romanova)

A Tree in the Ancient Forest (Reed-Jones)

Tree Trunk Traffic (Lavies)

Media:

Once There was a Tree (Video) (Reading Rainbow)

Teacher Resources:

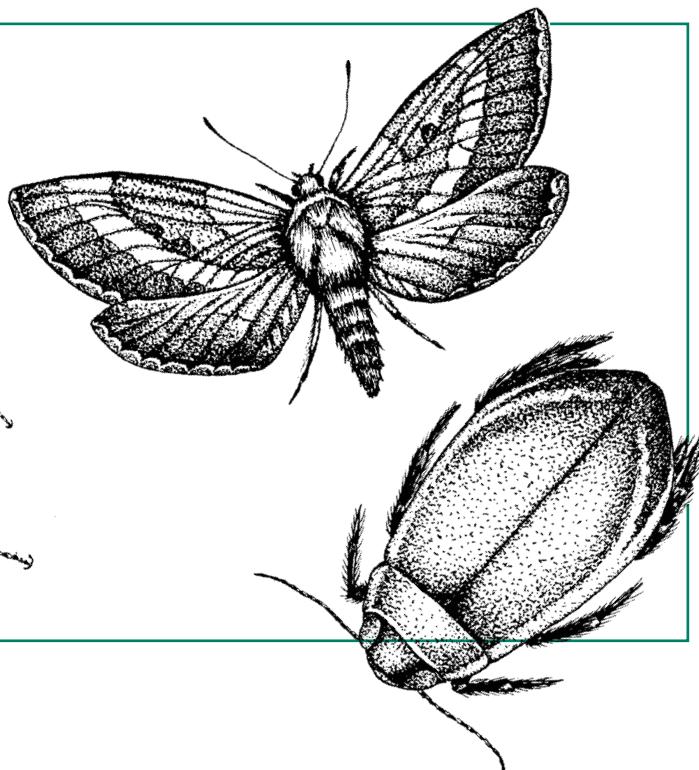
(See appendix)



Insect Signs

1 EXTENSION

ALERT: ALASKA ECOLOGY CARDS REQUIRED



Objective:

Students will identify signs of insect activity and determine the role of insects in a forest food chain.

Complementary Activities:

OUTDOOR—“Detritivores,” “Forest Ecosystem Scavenger Hunt,” “Mammal Signs,” and “Bird Signs” *in this section*; “Snag a Home” *in Section 4, Succession*. *INDOOR*—“Forest Food Web Game” *in this section*.

Materials:

Copies of “Insect Signs Chart” and “Insect Signs Science Card” (*next page*) for each student, hand lens, clipboards and writing paper or field note books, pencils or pens. *Alaska Ecology Cards* of forest insects.

Background:

See INSIGHTS, *Section 2, Forest Ecosystems*.

Procedure:

IN ADVANCE, locate a forest site with a variety of live plants (trees, shrubs, and groundcover) and dead leaves. Look for a spot that shows galls (*see illustration on Insect Signs Chart*) on plants, or a tree with bark engravings or

Section 2 FOREST ACTIVITIES

Grade Level: K - 12

State Standards: A A-1, L B-3

NGSS: K-LS1-1., K-ESS3-1., 2-LS4-1 3-LS4-3., 4-LS1-1, 5-LS2-1. MS-LS2-3.

Subject: Science

Skills: Observing, comparing, inferring, identifying

Duration: 50 minutes

Group Size: Individuals

Setting: Outdoors & indoors

Vocabulary: Cambium, consumer, food chain, gall, habitat, larvae, names of insects, predator, prey, sap

reddish brown sawdust at its base. Record the number and location of insect signs you find for later comparison with student notes.

1. *IN CLASS*, discuss the role of insects in the forest ecosystem. Are insects **consumers**? What do they consume? Where are they represented on a forest **food chain**?
2. Using the information on the *Alaska Ecology Cards* of forest insects, review some of the traits, **habitats**, **prey**, and **predators** before going to the forest site.
3. Discuss and compare student findings. Where do the found insects fit in the food chain? Students can use the *Alaska Ecology Cards* to illustrate information and enhance the discussion.
4. Pose the following questions: Will you find more or less insect signs at other seasons of the year. Why? How does this affect decomposition in the forest?
5. If they have studied other ecosystems (tundra, rainforests, wetlands, etc.), students compare what they found

in their local forest to the work and abundance of insects elsewhere.

EXTENSION:

Research forest insects and create a display. Students use the *Alaska Ecology Cards* or other “Curriculum Connections” resources (*following*) to find out more about their forest insects. They use this information along with sketches of the insect signs they found to make posters or a display of forest wildlife.

Curriculum Connections:

(See appendix for full citations)

Books:

Insects: A Guide to Familiar American Insects (Cottam)

Insects and Diseases of Alaskan Forests (Holsten)

National Audubon Society Field Guide to North American Insects and Spiders (Milne)

Website:

<https://www.gi.alaska.edu/AlaskaScienceForum/>

Teacher Resources:

(See appendix)

SCIENCE CARD

Insect Signs

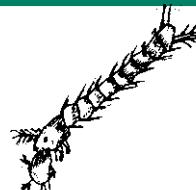
Insects are some of the most important **consumers** in forest ecosystems. The “Insect Signs Chart” shows some of the evidence insects leave behind. How many of these signs can you find in this area?

1. Write the heading “Insect Signs” on a page in your field notebook. Record the number of different types of insect signs you find in this area.

2. List each type of insect for which you find evidence. Draw a sketch to remind you what its sign looked like. Your sketch or its label should include the leaf or type of wood where you found the sign – the insect’s **habitat**.

3. Where do the insects whose evidence you found fit in the food chain? Would another kind of forest have different insects? Record your answers in your notebook.

4. If you find the insects themselves, draw a picture of them in your notebook to help you identify them later.



Insect Signs Chart

FEEDING METHOD	SIGNS	EXAMPLES OF INSECTS THAT LEAVE THESE SIGNS
Leaf-chewing Insects		
		Larvae of moths, butterflies, sawflies, and beetles
Leaf-mining Insects		
		Tiny larvae of moths, beetles, flies, and wasps
Leaf-rollers and Tent Caterpillars		
		Larvae of moths
Cambium-eating Insects		
		Larvae of bark beetles, a few moths, and some flies
Gall-making Insects		
		Wasps, flies, sawflies, gall-making aphids, and spruce aphid
Sap-sucking Insects		
		Adult Insects

Mammal Signs

1 EXTENSION

ALERT: ALASKA ECOLOGY CARDS OPTIONAL



Section 2 FOREST ACTIVITIES

Grade Level: 5-12

NGSS Standards: 5-ESS3-1.
MS-LS2-1., MS-LS2-2.

Subjects: Science, language arts

Skills: Observing, identifying,
inferring, comparing,
descriptive writing

Duration: 50 minutes

Group Size: Individuals

Setting: Outdoors

Vocabulary: Animal names,
carnivore, consumer, food chain,
habitat, herbivore, predator, prey

Objective:

Students will use a variety of signs to identify the presence of specific mammals and determine their diet.

Complementary Activities:

OUTDOOR – “Forest Ecosystem Scavenger Hunt,” “Insect Signs,” and “Bird Signs” *in this section*. “Track Casting” *in Section 3, Forest Learning Trail*. “Snag a Home” *in Section 4, Succession*. INDOOR – “Forest Food Web Game” *in this section*.

Materials:

Copies of “Mammal Signs Chart” (*following*) and “Mammal Signs Science Card” for each student, clipboards and writing paper or field note books, pencils or pens.

OPTIONAL: *Animal Tracks of Alaska* and *Alaska Ecology Cards*.

Background:

See INSIGHTS, Section 2, Forest Ecosystems.

Procedure:

IN ADVANCE, locate several forest sites where you find evidence of two or more mammals. Good choices may be near open water, sites with snow, and areas with a variety of shelter. Record the number of signs you find on the instruction card below as an incentive for students. Make a separate record of the mammal signs at these sites for later comparison with student notes.

If desired, you can have students make a plaster track prints of what they find. See “*Track Casting*” in Section 3, *Forest Learning Trail*.

1. *IN CLASS*, brainstorm what kind of mammals live in a forest. Discuss what these animals obtain from a forest (*food, shelter, water, space—habitat*) and why forest habitat is important for their survival. Review **predator** and **prey** relationships.

2. Tell the students they will go in search of forest mammals. Students may not see specific animals, but they could find animal signs such as droppings, browse marks, or tracks.



3. Give each student the “Mammal Signs Science Card” and the “Mammal Signs Chart.”

Classroom Follow-Up:

1. Students discuss and compare their findings. Based on what they found, where do their animals fit in a forest **food chain** and forest **food web**?

2. Ask if they think they might find more or less mammal sign at other seasons of the year. Why?

3. Where might they go to find signs of mammals on the chart that were not found during class? What does that habitat offer that the class forest does not offer?

EXTENSION:

Research forest mammals and create a display. Students use the *Alaska Ecology Cards* or other “Curriculum Connections” resources (below) to find out more about their forest mammals. They use this information along with sketches of tracks and signs to make posters or a display of forest wildlife.

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska Mammals (Smith)

Alaska Wildlife Notebook Series (ADF&G)

Animal Tracks of Alaska (Sheldon)

Animal Tracks of Alaska (Stall)

Mammals of Alaska (Alaska Geographic)

Teacher Resources:

(See appendix)

SCIENCE CARD

Mammal Signs

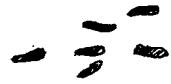
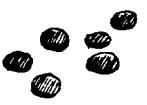
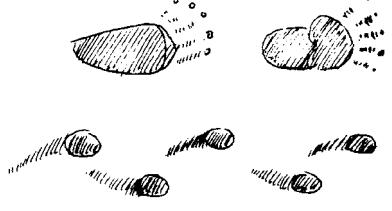
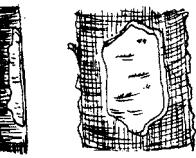
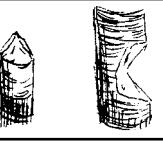
1. Write “Forest Mammals” at the top of a page in your field notebook. Record the number of mammals whose evidence you find in this area.
2. List mammals whose evidence you find along the left side of your page.
3. Write what you think they eat based on the signs you find on the right side of the page. Decide whether they are **herbivores** or **carnivores**.
4. Write a short description of the signs next to each animal’s name. Try to compare each sign to something

familiar. Make a rhyme, or a humorous statement in order to help you remember which sign is evidence of which animal. (*For example: Deer droppings look like big chocolate chips. Hare-browsed willows are sharp. Ow!*)

5. If you find signs of other mammals while walking to or from this site, make notes of your findings on the page. The “Mammal Signs Chart” shows evidence of mammals that you might find in this forest. There are signs of at least _____ kinds of mammals in this area. Can you find these signs and identify them?



Mammal Signs Chart

ANIMAL	TRACKS	DROPPINGS	OTHER SIGNS
Shrew			
Vole, Mouse, or Lemming			 Tunnels under the snow or, after the snow melts, small piles of grasses lying in patterns like tunnels.
Squirrel			 Middens or large piles of cones, cone scales, and cone cobs. Also, mushrooms hanging in trees.
Snowshoe Hare			 Willows, birch, rose, aspen, or other plants with stems neatly clipped.
Porcupine			 Large strips or patches of bark missing from a tree trunk.
Beaver			 Tree stumps or branches with gnawing marks; lodges or dams of sticks and branches.
River Otter			 Strong odor; trampled grasses and plants, dens under tree roots, and sledding trails on small slopes.



Mammal Signs Chart

ANIMAL	TRACKS	DROPPINGS	OTHER SIGNS
Marten			
Fox or Coyote			
			Dens
Wolf			
			Dens
Lynx			
			Scraping around droppings
Bear			
			Grasses and sedges that have been grazed or clipped off. Skunk cabbage that is torn or dug up.
Deer			
			Huckleberry or other shrubs with stems that appear to have been chewed off.
Moose			
			Birch, aspen, willow, or other plants with stems roughly browsed (not neatly clipped).

Bird Signs

2 EXTENSIONS

ALERT: ALASKA ECOLOGY CARDS OPTIONAL



Bird landing and walking in snow

Section 2 FOREST ACTIVITIES

Grade Level: 5 - 12

NGSS: 5-ESS3-1., MS-LS2-1.
MS-LS2-2.

Subject: Science

Skills: Observing, identifying,
inferring

Duration: 50 minutes

Group Size: Individuals

Setting: Outdoors

Vocabulary: Bird names, food
chain, food web, habitat

Objective:

Students will recognize bird signs and identify the species and behavior of any birds in the area.

Complementary Activities:

OUTDOOR – “Forest Ecosystem Scavenger Hunt,” “Mammal Signs,” and “Insect Signs” in this section; “Snag a Home” in Section 4, Succession. INDOOR – “Forest Food Web Game” in this section.

Background:

See INSIGHTS, Section 2, Forest Ecosystems.

Materials:

“Bird Signs Chart” and “Bird Signs Science Card” for each student, clipboards and writing paper or field note books, pencils or pens.

OPTIONAL: Field guides to animal tracks and birds, binoculars, and *Alaska Ecology Cards*.

Procedure:

IN ADVANCE, locate several forest sites where you can find evidence of several birds. Good choices may be near open water, sites with snow, and areas with a variety of

shelter. *It is okay to salt the area you choose with a feather or raptor casting.* Record the number and kinds of bird signs you find for later comparison with student observations and notes. Fill in the number of signs on the “Bird Signs Science Card.”

1. *IN CLASS*, brainstorm what kind of birds live in a forest. Discuss what these wildlife obtain from a forest (*food, shelter, water, space — habitat*) and why forest habitat is important for their survival. Review the concept of **food chains**. Where are birds on the forest food chain?
2. Tell the students they will go in search of forest birds. Students may not see specific birds, but they could hear birds or find bird signs such as feathers, nests, whitewash (droppings), or tracks.
3. Give each student the “Bird Signs Science Card” and the “Bird Signs Chart.”

Classroom Follow-Up:

1. Students discuss and compare their findings. Based on what they found, what do their birds need in the forest ecosystem? Where do they fit in the forest **food web**?



- Ask if they think they might find more or less bird sign at other seasons of the year. Why?
- Where might they go to find the birds or their signs illustrated on the Chart that were not found during class? What does that habitat offer that the class forest does not offer?

EXTENSIONS:

A. Research forest birds and create a display. Students use the *Alaska Ecology Cards* or other “Curriculum Connections” resources (*following*) to find out more about their forest birds. They use this information along with sketches of tracks or signs to make posters or a display of forest wildlife.

B. Set up a winter bird feeding station visible from the classroom. If a wooded area is near your classroom window, depending on grade level, students set up a winter bird feeding station after researching the best devices, food, and location through their local Alaska Fish and Game office, Audubon Chapter, or “Curriculum Connections” (*below*).

Students keep a class chart of the kinds of birds that come to their feeding station, how often they are seen, and note their behaviors. Before the school year ends, students calculate the results and discuss the seasonal changes in bird visits.

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska Wildlife Notebook Series (ADF&G)

Guide to the Birds of Alaska (Armstrong)

The National Audubon Society North American Birdfeeder Handbook (Burton)

Teacher Resources:

(See appendix)

SCIENCE CARD

Bird Signs

You have heard of mammal tracks. Did you know birds leave signs too? Open your eyes and look carefully, you will be able to find ____ bird signs that are in this area.

- Write “Forest Birds” at the top of a page in your notebook.
- Record the number of birds whose evidence you find at this site. Then list them by name along the left side of the page.
- Listen and look carefully, for these birds may still be nearby. Have one person in your group repeatedly make a shhh, shhh, shhh sound. Sometimes birds will move or call when they hear this sound.
- If you see birds, watch them. Can you identify them using the guide book? Watch and record their behavior.

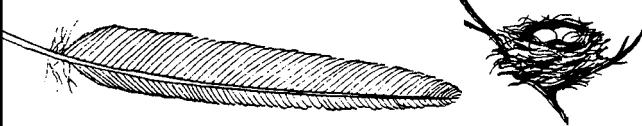
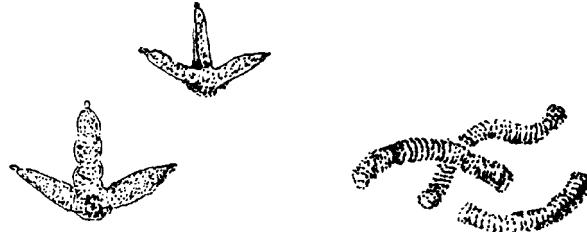
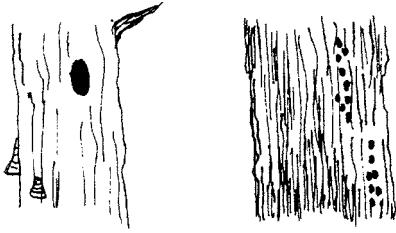
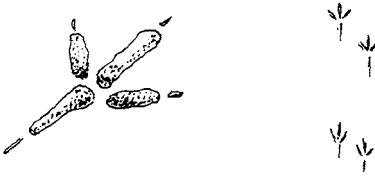
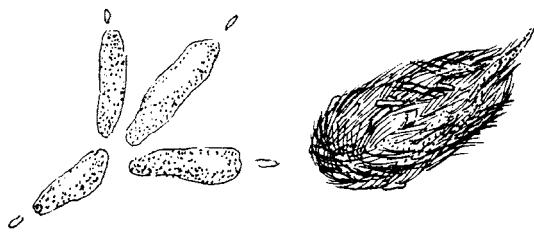
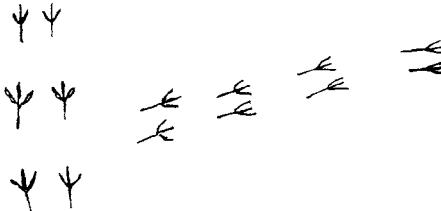
What trees do they like most? Are they eating? Gathering sticks? Record what you see in sketches or words.

5. If you found signs of grouse or woodpeckers, look for these groups in a field guide to birds. Based on the season and the habitat you are in, can you figure out which kind of grouse or woodpeckers might be in this area? List the species you think are most likely to have made the signs.

6. If you find signs of other birds enroute to the site, make notes of your findings in your notebook.



Bird Signs Chart

BIRD	SIGNS	
Signs Left by Many Birds		Feathers, sticks or grass nests
Grouse		Grouse make 3-toed tracks on solid snow or wet soil, but in deep soft snow they make a trail that looks like a ditch in the snow. Their droppings seem dry and are shaped like fat worms. Listen for their hooting or low drumming calls.
Woodpeckers		Listen for tapping or drumming sounds. Look on live and dead trees for small or large holes that look like something drilled into the bark of the tree. Also look for flakes of bark around the base of trees.
Raven		Droppings and tracks around a dead animal. Hoarse croaking sounds.
Hawks and Owls		Hawks and owls regurgitate pellets of fur, feathers, and other indigestible bits of the prey. These pellets are cleaned of all meat, so that they smell and feel clean.
Songbirds		Listen for twittering, chirping, or other calls and songs.



LEARNING TRAIL

