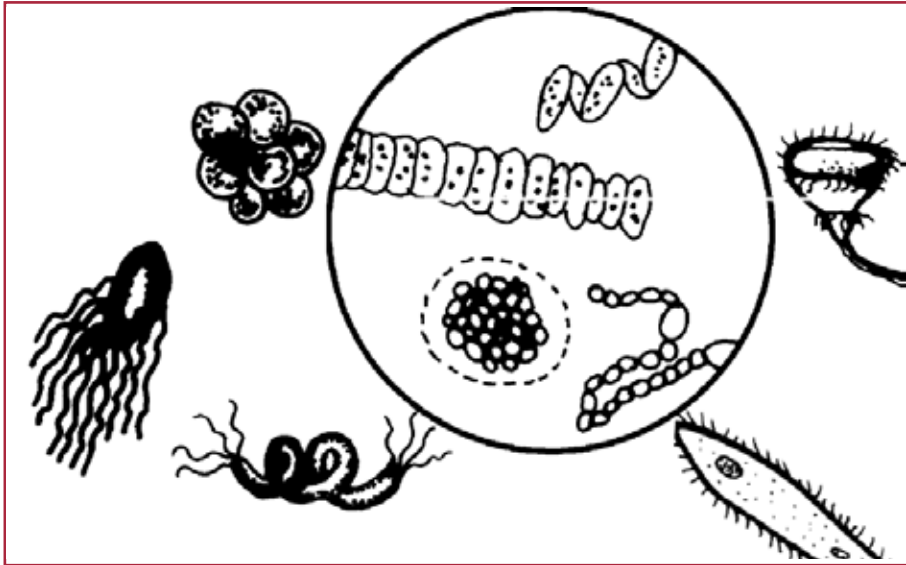


Investigating Monerans and Protists

2 EXTENSIONS *ALERT: ALASKA ECOLOGY CARDS OPTIONAL*



Section 3 ECOLOGY ACTIVITIES

Grade Level: 4 - 12

State Standards: M A-3, M A-6, S A-14, S A-15, S B-1, S B-5, S B-6
NGSS: MS-LS1-1.

Subject: Science, math, language arts, art

Skills: Observing, recording, analyzing, describing, drawing, computing, measuring, estimating, identifying

Duration: 2 50-minute sessions

Group Size: 2-4

Setting: Indoors /outdoors

Vocabulary: Amoeba, cilia, cyanobacteria, euglena, habitat, microscopic organism, Monera, paramecia, Protista

Objectives:

1. Students will observe and describe one-celled organisms in their local ecosystem, noting their visible characteristics in writing.
2. Students will describe some of the habitats where monerans and protists can be found.

Complementary Activities:

“Five Kingdoms But No King,” “Investigating: Soil,” “Investigating Water,” and “It’s Alive or Is It?” in *Section 1, Elements of Ecosystems*. Also all the “Investigating (Living Things)” in *this section*.

Materials:

Microscopes for each pair of students, slides and cover slips, eye droppers, several small jars or containers, masking tape and a marker, boiled rice grains, paper and pencil.
OPTIONAL: guidebook for identifying protists or appropriate *Alaska Ecology Cards*.

Background:

See *INSIGHTS, Section 1, Elements of Ecosystems: “Monerans & Protists” fact sheet; INSIGHTS, Section 2, Community Connections; and INSIGHTS, Section 3, Living Things in their Habitats*.

Procedure:

1. Introduce the fact that many living things in our environment are seldom noticed and best seen under a microscope. Members of the Kingdoms **Monera** and **Protista** fall in that category of living things.
2. Ask students to predict if there are microscopic living things around the school or even in the classroom. *Although all individual monerans and many protists are microscopic, it is sometimes possible to see some types when many are gathered in one spot.*
3. Ask students in what environment what microscopic living things might be found? *Water is a reliable environment to find these organisms.*
4. GO *OUTDOORS* to collect several samples of water from around the school. *Roadside ditches, puddles, pools*



formed by melting snow or ice, ponds, lakes, streams are possible places to collect water. IF WINTER, a neglected vase of flowers might also provide an adequate sample.

5. Tell students to put the water samples in separate jars, marking the source and the water level with masking tape. Collect an extra jar of water from each site (marking the source) as a refill supply (*per step #8*).

6. **BACK IN CLASS**, students place the jars in indirect light (not direct sun). Add 2-3 grains of rice to each sample to feed any organisms in the water.

7. **FOR SEVERAL DAYS**, let the samples stand uncovered or with the lids open part way.

8. Ask students to keep the water level at the original mark by adding water from the original source, if possible. Tap water will work, but make sure it has been standing for several days.

9. **AFTER 3-4 DAYS**, examine the samples through the microscope. Use the eyedropper to take samples of water at the top, middle and bottom of the jar. Demonstrate to the students how to make a wet-mount. (*Procedures for making simple wet mounts are found in most basic science text books.*)

Note: Organisms may dive to the bottom of the wet mount. Make sure students adjust the focus on the microscope at different levels in the mount so that they can see the bottom as well as the top of the drop of water.

10. Ask students to draw the organisms they see in each sample. Count (or estimate) the organisms on each slide. Look at three slides representing the bottom, middle, and top of the jar and make a count for each one.

11. Share results and discuss the drawings. Determine similarities and differences between the organisms, noting things like the existence of **cilia**, method of movement, or how the organisms might gather food.

12. Brainstorm and draw a chart on the board that lists the food, water, shelter, and space characteristics – **habitat** – of each source.

Evaluation:

Draw or describe at least three kinds of microscopic organisms and their food, water, shelter, and space requirements.

EXTENSION:

Observe a colony of protists and conduct experiments.

Many protists are available for purchase from scientific supply companies. If you choose to order live protists, students can create their own ecosystems and transplant the living protists into their water samples.

- Students create ecosystems in jars, using distilled water, mud, rocks, a pinch of yeast, and the purchased protists.
- Students observe and keep journals on their ecosystems, noting changes on a daily basis.
- Students may also develop hypotheses and perform experiments on their ecosystems. For example, what happens when the ecosystem is denied oxygen? How does the ecosystem respond to light? What happens if there is an oil spill in the ecosystem? How do ecosystems respond to fertilizers or phosphates?

This is a good way to incorporate the scientific method: students test their own hypotheses by designing an experiment, collecting data, presenting results, and drawing conclusions from their experiments.

Curriculum Connections:

(See appendix for full citations)

Books:

Guide to Microlife (Rainis)

Monerans & Protists (Silverstein)

Website:

Protist Image Data <megasun.bch.umontreal.ca/protists/protists.html>

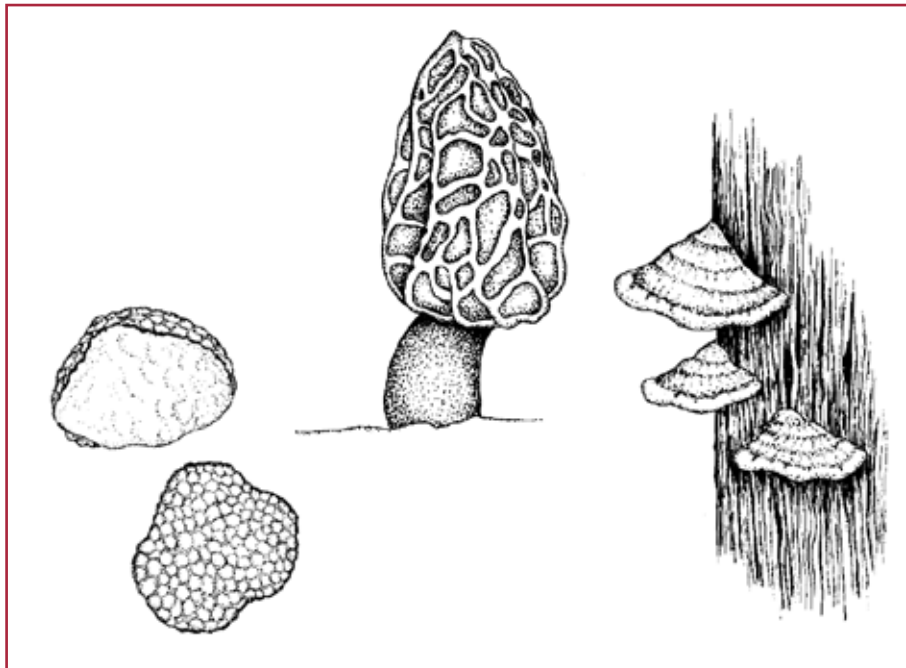
Teacher Resources:

(See appendix)



Investigating Fungi

ALERT: ALASKA ECOLOGY CARDS OPTIONAL



Section 3 ECOLOGY ACTIVITIES

Grade Level: 4 - 12

State Standards: M A-3, M A-6, S A-14, S A-15, S B-1, S B-5, S B-6

NGSS: 4-LS1-1.,5-LS2-1.,MS-LS2-3. HS-LS2-4.

Subject: Science, math, language arts, art

Skills: Observing, recording, analyzing, describing, drawing, computing, measuring, estimating, identifying

Duration: 60 minutes

Group Size: 2-3

Setting: Indoors /outdoors

Vocabulary: Absorption, algae, detritivore, detritus, fungus/fungi, lichen, mold, photosynthesis

Objectives:

1. Students will describe and locate places in an ecosystem where fungi might grow.
2. Students will identify a fungus and determine the non-living elements needed for survival.

Complementary Activities:

“Five Kingdoms But No King,” “Investigating: Soil,” “Investigating Water,” and “It’s Alive or Is It?” in *Section 1, Elements of Ecosystems*. Also all the “Investigating (Living Things)” in this section.

Materials:

Hand lens, microscope, moist bread, plastic bag or container, slides and cover slips, paper and pencil.
OPTIONAL: Appropriate *Alaska Ecology Cards*.

Background:

See *INSIGHTS, Section 1, Elements of Ecosystems: “Fungi” fact sheet*; *INSIGHTS, Section 2, Community Connections*; and *INSIGHTS, Section 3, Living Things in their Habitats*.

Procedure:

1. Ask students to think about the words **fungus** (singular) or **fungi**, sharing any information or examples of fungi with the class. Discuss the Kingdom Fungi and some of its more common members (*mushrooms and bread mold*).
2. Explain to students that most of these organisms (with the exception of lichens) recycle organic material from dead or waste materials to obtain their food.
3. Fungi can be found anywhere that dead plants are found, especially in moist places. Discuss possible locations of **detritus** (dead organisms) that students might find fungi (*dead standing trees, decayed logs, leaf litter on the ground*).
4. To identify fungi, students should look for things that are spongy (such as mushrooms and shelf fungus), things that look like silt or dust (such as mold), or things that are hard and brittle growing very close to the ground or on rocks (such as lichens).

****CAUTION!**** Many people are allergic to molds. Some molds may cause infections or even blindness. Only teachers, not students, should handle molds in the classroom.



You should avoid direct contact with mold and keep mold cultures away from your face to avoid breathing of mold spores.

9. The teacher may prepare a slide of the bread mold for students to observe, or a bioscope might be used for class viewing.

5. *OUTDOORS*, take a walk in the area near your school. Students work in groups of 2-3 to look for examples of fungi. Students draw pictures of what they find, bringing small samples inside. Make notes of where each fungus was found.

6. Students share drawings or samples, noting similarities and differences. Discuss the nonliving elements of the ecosystem that are critical to the survival of these organisms.

7. Discuss what might happen if these organisms did not exist? What would happen if things didn't decay?

8. *IN CLASS*, grow your own fungus. Place some moist bread in a sealed plastic bag or container. In several days, you will have a healthy culture of bread mold, a common fungus.

10. Students draw a picture of the bread mold. As a class, identify the **hyphae** and the **spores** which are common to fungi. What nonliving elements does bread mold need to survive? What happens to bread mold if left in an airtight container for an extended time period?

11. Identify human uses of fungi.

Evaluation:

1. Given several examples and non-examples of fungi, determine which examples belong to the Kingdom Fungi and why.

2. Draw and label a picture of a mold (if applicable).

3. Describe three places in the local environment where fungi might grow.

Curriculum Connections:

(See appendix for full citations)

Books:

Guide to Microlife (Rainis)

Mushrooms (Parker)

Slimes, Molds, and Fungi (Pascoe)

Fungi (Silverstein)

Fungi (Tesar)

Website:

Introduction to the Fungi

<http://www.ucmp.berkeley.edu/fungi/fungi.html>

Teacher Resources:

(See appendix)



Investigating Plants

2 EXTENSIONS **ALERT: ALASKA ECOLOGY CARDS OPTIONAL**



Section 3 ECOLOGY ACTIVITIES

Grade Level: 4-12

State Standards: M A-3, M A-6, S A-14, S A-15, S B-1, S B-5, S B-6

NGSS: 4-LS1-1, 5-LS1-1, MS-LS1-4.

Subject: Science, math, language arts, art

Skills: Observing, recording, analyzing, describing, drawing, computing, measuring, estimating, identifying

Duration: 90 minutes

Group Size: 2-5

Setting: Outdoors /indoors

Vocabulary: Abundance, annual plants, chlorophyll, dominant plants, dormant, fruit, habitat, multi-cellular, transect

Objectives:

1. Students will recognize and identify some plants from their local ecosystem, including plant signs during the non-growing seasons.
2. Students will describe the differences in abundance of plants in their local environment.

Complementary Activities:

“Five Kingdoms But No King,” “Take a Deep Breath,” and all the “Investigating (Nonliving Things)” in Section 1, *Elements of Ecosystems*. Also “Who Eats Whom,” “Mineral Cycling,” and “Create a Classroom Compost Box” in Section 2. Also all the “Investigating (Living Things)” activities in this section.

Materials:

For each student: hard surface for drawing or recording data. For each group: one copy of the “Science Card” several copies of the “Plant Data Sheets I and II” (see following pages), paper for drawing, field guide to plants or *Alaska Ecology Cards*, small plastic cup or container for collecting soil, and a transect line made with a 3-meter

(or shorter – see step #5) piece of rope or string.

OPTIONAL: a journal for drawing and recording names of plants.

Background:

See **INSIGHTS, Section 1, Elements of Ecosystems: “Plants” fact sheet; INSIGHTS, Section 2, Community Connections; and INSIGHTS, Section 3, Living Things in their Habitats.**

Procedure:

1. **IN CLASS:** review how plants are different from fungi, monerans, and protists. (Plants are **multi-cellular** and have **chlorophyll** for performing photosynthesis). Explain to the class that they will investigate their local ecosystem for **diversity** and **abundance** of plants.
2. Explain that students will be locating and drawing as many plants as they can find along **transect** lines. They will include any plants within five centimeters to each side. Demonstrate how to draw a plant and note which characteristics help to identify one plant from another. *Shape,*



size, edges, and texture of leaves are important.

3. Give examples of questions to ask as students draw and take notes about plants they find: *Do leaves form a pattern such as three leaves on a stalk? Are leaves found opposite one another on a stalk or do they alternate? Does the plant hold dried flowers or **fruit**? Is the plant stem woody or easily bent? Does this plant grow under trees, on rocky soil, or in wet places?*

4. Discuss “annual plants” that grow from seeds or buried roots, flower, produce new seeds, and die in one calendar year. What evidence do these organisms leave behind? *Dead leaves, tubers, seed pods, and roots.* Instruct students to include such evidence when they identify plants along their transect lines.

5. **OUTDOORS:** if you are studying an area with a high **biodiversity** (*i.e. many different plant types*), use a shorter piece of **transect** line so that students won’t get overwhelmed.

6. Distribute the “Plants Data Sheets I and II” to each group.

7. Ask each group to lay its transect in a straight line. You may want to challenge the groups to lay their rope so that it touches the highest number of kinds of plants and still maintains a straight line. Have students identify their working area of 5 centimeters to each side of the line.

8. The following roles could be rotated so everyone experiences each assignment: Project Coordinator (*makes sure everything runs smoothly and watches for duplication in plants that are drawn*), Plant Illustrator, Plant Counter, a Plant Classifier (*to key out names for plants*), and a Plant Recorder (*to record the group’s answers to the worksheet*).

9. Students begin surveying. They will describe each kind of plant and then keep a tally of how many of each kind grow along their transect. Students can each draw plants, if desired, checking with the coordinator to avoid duplication. After the observation/drawing session is complete, the Plant Recorder should collect all drawings.

10. When all plants along the transects are drawn and recorded, distribute the Science Cards and ask the groups to sit together and answer the questions.

11. Give each group a small container (such as a paper

cup) to collect soil to take back to the classroom to make a “mystery garden.”

12. **IN CLASS,** share information and drawings on the plants. Was there a pattern in where the groups found certain plants growing? Why do certain plants grow better in some places than others? Focus the discussion on the **habitat** of the plants.

VARIATION

Instead of a making a transect line, have groups make study plots. Cut a 4-meter piece of string and tie the ends together. Instruct students to make a square out of their length of string, thus creating a one-meter-square plot. Students examine all the plants within the plot.

Evaluation:

1. Given drawings, pictures, or specimens, recognize and identify abundant local plants.

2. During discussion, demonstrate awareness of the dominant plants in the local ecosystem.

3. Give examples of evidence of annual plants during the non-growing season.

EXTENSIONS:

A. **Use the drawings to create a display.** Have the students sort through the drawings to find samples of each kind of plant found along their transects. Use those to create posters or a display of schoolyard plants. Students research plant facts from field guides, the *Alaska Ecology Cards*, and other sources.

B. **Make a school herbarium.** Students collect and press *one example* of each plant found. Herbarium specimens may be used by future groups or classes to help identify plants on their transect studies.

NOTE: Before collecting any living thing, discuss with the students the importance of preserving the environment and disturbing the area as little as possible.

- For small plants, collect the entire plant including the root, flowers, stems, and leaves if possible. Shake off any loose dirt.



- For trees and shrubs, collect sample branches, leaves, flowers or seeds. Make rubbings of bark by using paper and crayons or charcoal.
- Press samples in a plant press (between sheets of cardboard and newspaper, bound with rubber bands or weighted with heavy books), changing the newspaper every few days.
- When samples are dry, students mount them on poster board and label with the plant's name, where it was found, who collected it, and the date that it was collected. Also identify plants using local names and uses.

Science of Plants (Bocknek) (Gr. 4-6)

Website:

Plants Database <plants.usda.gov/plants/home_page.html>

Teacher Resources:

(See appendix)

Curriculum Connections:

(See appendix for full citations)

Books:

How Nature Works (Burnie)

Plant (Eyewitness) (Burnie)

Plants (Silverstein)



Plant Transect

1. **Biodiversity.** How many kinds of plants did you find along your transect line?

2. **Identification.** If you haven't already, try to identify the most common plants by using a field guide to plants. If you cannot find the name of the plants in your guide, or if a field guide is unavailable, record details about the plant to help you identify it later.

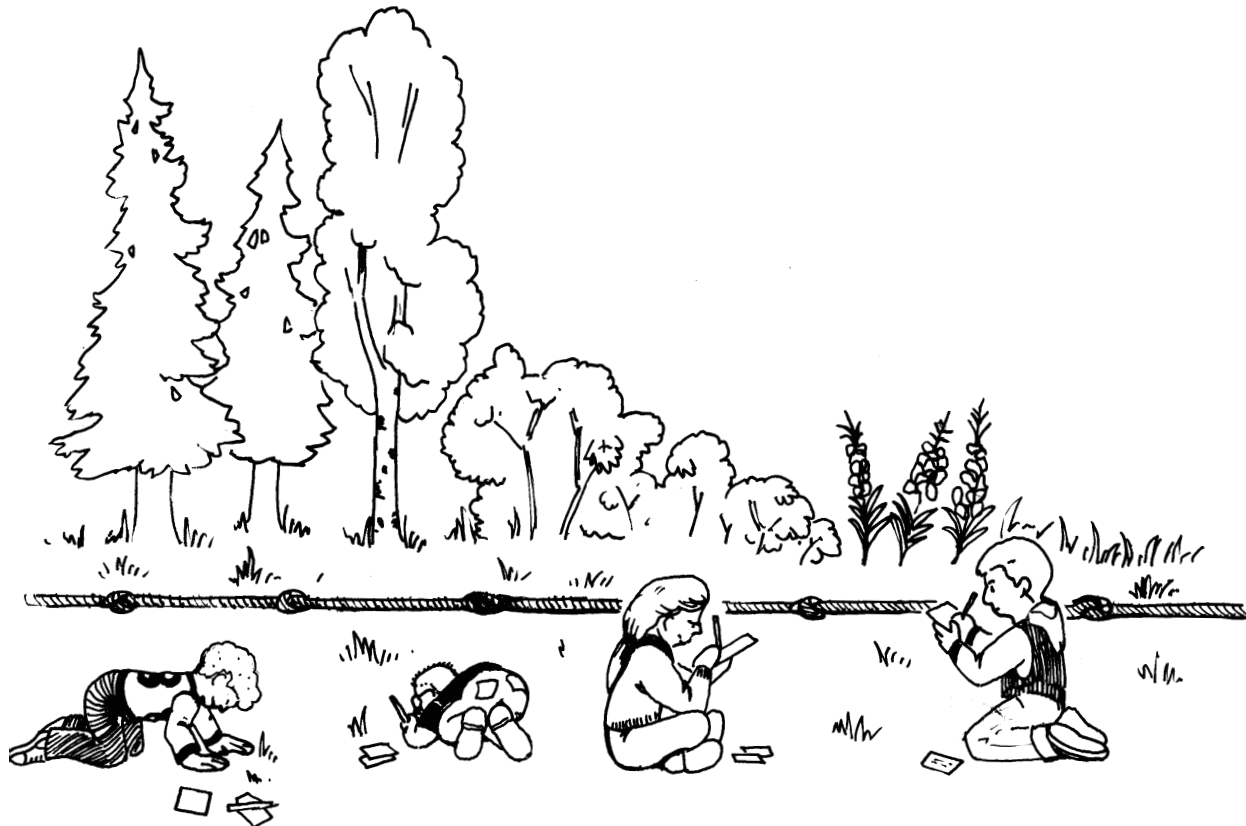
3. **Dominant species.** Which three kinds of plants were the most abundant on your transect? These "dominant" species will have the highest numbers in the third column of your "Plant Data Sheet I." *Make sure that you have counted individual plants, not every leaf or stem. Count a moss clump as one plant.* Write the total for each plant on its drawing.

4. **Dormant annual plants.** Depending on the time of year and where you are, many plants may be dormant,

which means you won't clearly see their leaves, flowers, or even stems. Describe the kind and amount of the following plant remnants that you found on your transect:

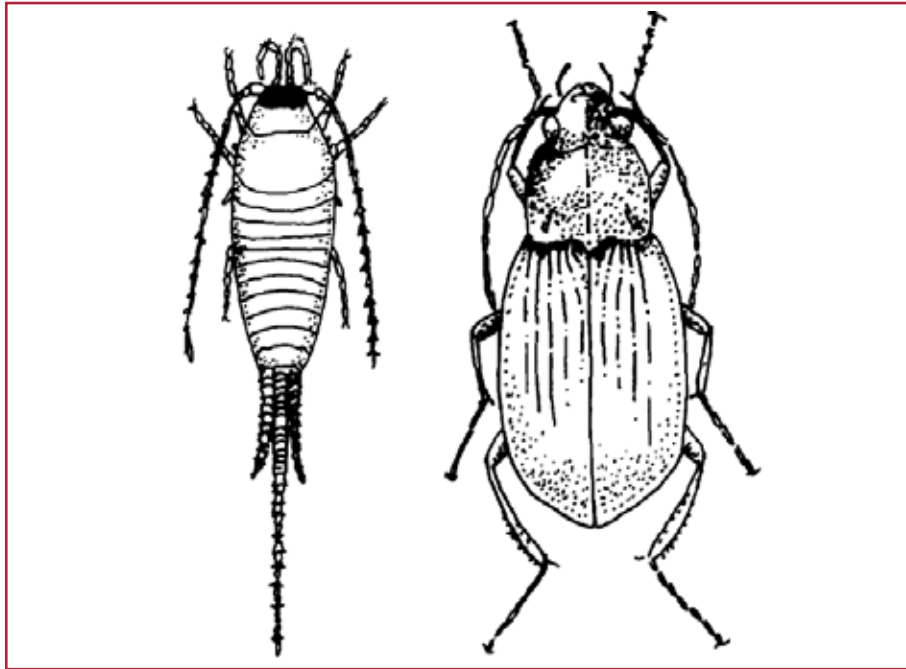
- (a) Dead leaves or needles
- (b) Dead flowers
- (c) Seeds
- (d) Roots above the ground

5. **Mystery gardens.** You can find out more about what plants are in the soil as seeds by taking a small sample of soil back to the classroom, putting it in an open container (an empty milk carton, for example), watering it well, covering it with plastic, and placing it in a sunny spot. Watch your mystery garden closely for 2-3 weeks and record what happens.



Investigating Animals in Soil

1 EXTENSION ALERT: ALASKA ECOLOGY CARDS OPTIONAL



Section 3 ECOLOGY ACTIVITIES

Grade Level: 4 - 12

State Standards: M A-3, M A-6, S A-14, S A-15, S B-1, S B-5, S B-6
NGSS: 4-LS1-1.

Subject: Science, language arts, art

Skills: Observing, recording, analyzing, describing, drawing, computing, measuring, estimating, identifying

Duration: 90 minutes

Group Size: 2-4

Setting: Outdoors /indoors

Vocabulary: Adaptations, domesticated, habitat, insects, larvae, mammals

Objectives:

1. Students will describe signs of animal activity in the soil.
2. Students will describe and name some animals found in local soil habitats.

Complementary Activities:

“Five Kingdoms But No King,” “Take a Deep Breath,” and all the “Investigating (Nonliving Things)” in Section 1, *Elements of Ecosystems*. Also “Who Eats Whom,” “Oh Moose,” “Mineral Cycling,” and “Create a Classroom Compost Box” in Section 2. Also all the “Investigating (Living Things)” in this section.

Materials:

For each group OUTDOORS: coffee can or similar container with holes in the bottom, plastic bag, 4-meter lengths of string, copies of the “Soil Animals Data Sheets I and II” (see following pages), paper, pencil.

INDOORS: microscope or hand-lens, field guides if available, graduated cylinder, white tray. Field guides or *Alaska Ecology Cards*.

OPTIONAL: light, funnel, flask for Berlyse Funnel (see following).

Background:

See INSIGHTS, Section 1, *Elements of Ecosystems: “Animals (Invertebrate)”* fact sheet; INSIGHTS, Section 2, *Community Connections*; and INSIGHTS, Section 3, *Living Things in their Habitats*.

Procedure:

1. *IN CLASS:* review the five kingdoms. Remind students there are many members of the animal kingdom that are very small and seldom seen by humans. Challenge the class to list some tiny animals. (*shrews, mice, weasels, insects, snails, spiders, worms, etc.*)
2. Discuss what kind of habitat or environment would be safe for very small animals. Lead the discussion toward life underground. *Some animals are adapted to spending most of their life in the dark, living on other animals or nutrients found in the soil.*
3. Explain that the students will become scientists, looking for animals and their signs in the soil. Show students pictures of **larvae**, casings, and other evidence that they



may find in the soil.

4. *OUTDOORS*: direct each group to “stake out” a square study plot, 1-meter by 1-meter, using their string as the boundary. Challenge them to examine the area carefully. *Look for small holes or tunnels dug into the ground, droppings, or leaves that seem to have been bitten by a small animal.*

5. Each group has the following duties that may be rotated: Mapmaker, Recorder, Classifier, Counter/Estimator.

6. The Mapmaker draws a map of the plot, noting large rocks, large plants or trees, hills, and depressions.

7. The Recorder writes down evidence of animals that the group finds, noting the location on its plot map. When soil animals are found, the Recorder includes the information on the “Soil Animals Data Sheets I and II.”

8. Using an empty can as a sampling tool, one member of each group presses the open end into the soil until the can is at least half buried. Turn the can right side up and dig out the soil marked by where the can was, filling the can half full.

9. Empty the soil into a plastic bag for transport to the classroom (*since the can has holes in the bottom*).

10 *IN CLASS*, each group places its soil in a tray and sorts through it, looking for

animals, larvae, or any other evidence of life in the soil.

11. All members of the groups draw the organisms they find.

12. Challenge students to identify their creatures by using field guides. The Classifier keeps track of the kinds of creatures so that the same animal is not named twice. If field guides or the *Alaska Ecology Cards* are unavailable, ask students to make up their own descriptive names for each species.

13. Wrap-up the investigation with a class discussion concerning the **habitat** of these small animals. What special **adaptations** do soil animals have that help them to live on or in the soil?

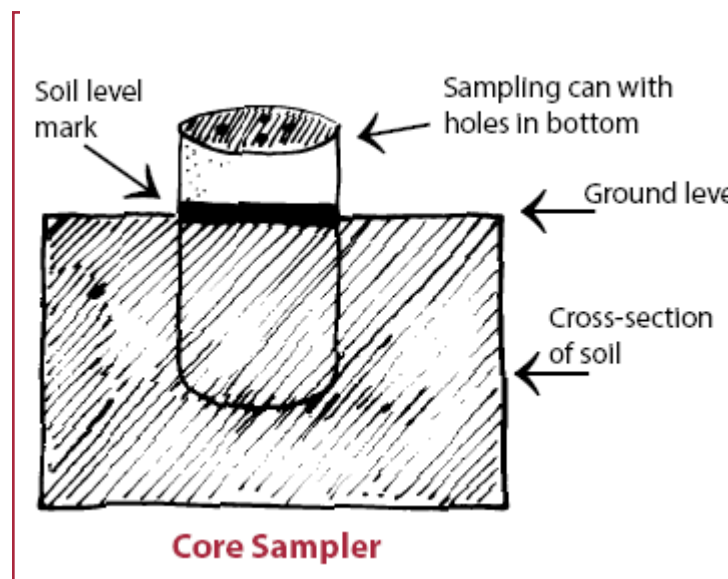
Evaluation:

1. Complete drawings and name animals found in the soil of the local ecosystem.

2. Describe possible signs of animal activity in the soil of their local ecosystem.

EXTENSION:

Use a Berlyse funnel to find more animals. Set up the Berlyse funnel as illustrated for each group (or rotate one for each group to use on succeeding days.) Leave a light shining on the funnel contents overnight. Many of the



living things in the soil will move away from the warm, bright light and fall into the collecting bottle.

Curriculum Connections:

(See appendix for full citations)

Books:

Handful of Dirt (Bial)

One Small Square: Backyard (Silver)

Our Endangered Planet: Soil (Winckler)

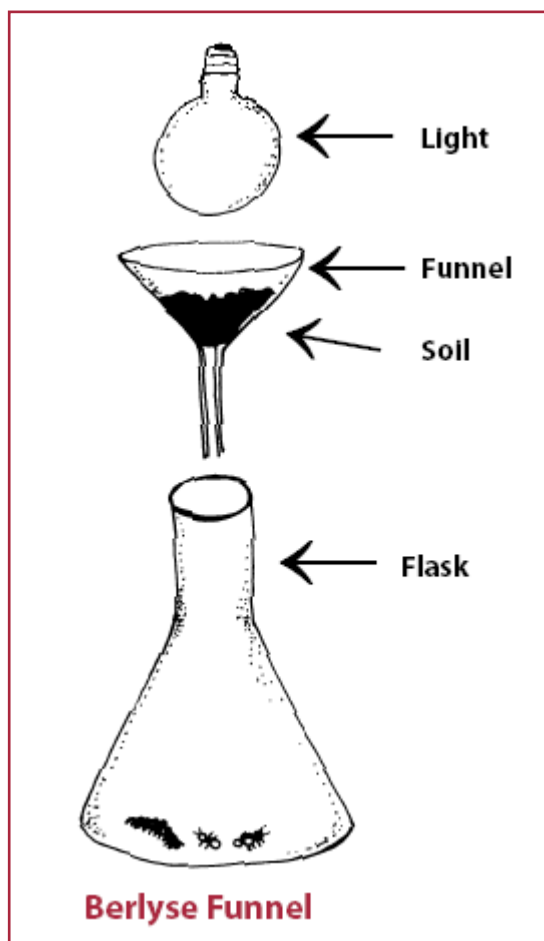
Media:

Dirt Made My Lunch (Audio Tape or CD)

(Banana Slug String Band)

Teacher Resources:

(See appendix)



Soil Animals Data Sheet II

ANIMAL DRAWINGS

Animal # _____ Name _____

Animal # _____ Name _____

Animal # _____ Name _____

Animal # _____ Name _____

Animal # _____ Name _____

Animal # _____ Name _____



Investigating Animals in Water

1 EXTENSION ALERT: ALASKA ECOLOGY CARDS OPTIONAL

Section 3 ECOLOGY ACTIVITIES

Grade Level: 4 - 12

State Standards: M A-3, M A-6,
S A-14, S A-15, S B-1, S B-5,
S B-6

NGSS: 4-LS1-1.

Subject: Science, language arts,
art

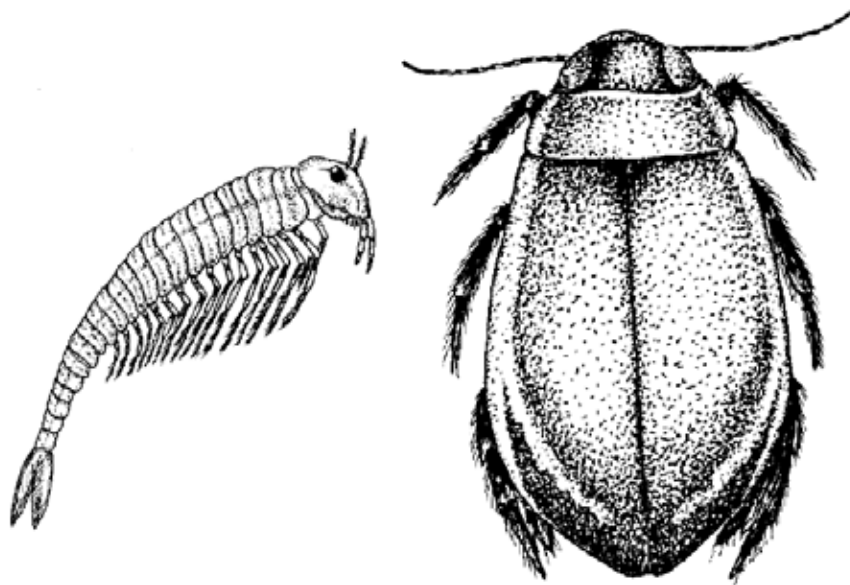
Skills: Observing, recording,
analyzing, describing, drawing,
computing, measuring,
estimating, identifying

Duration: 90 minutes

Group Size: 3-4

Setting: Outdoors/indoors

Vocabulary: Invertebrates,
larvae, pupae, sediments,
wetlands



Objectives:

1. Students will recognize and identify some local water animals.
2. Students will predict and describe the habitats where water animals can be found.

Complementary Activities:

“Five Kingdoms But No King,” “Take a Deep Breath,” and all the “Investigating (Nonliving Things)” in Section 1, *Elements of Ecosystems*. Also “Who Eats Whom” and “Mineral Cycling” in Section 2. Also all the “Investigating (Living Things)” in this section.

Materials:

For each group: underwater viewer, kick sampler, sweep net (*illustration following*), copies of “Water Animals Data Sheets I and II” (*see following pages*).

OPTIONAL: Field guides or *Alaska Ecology Cards*.

Background:

See **INSIGHTS, Section 1, Elements of Ecosystems: “Animals (Invertebrates)”** fact sheet; **INSIGHTS, Section 2, Community Connections;** and **INSIGHTS, Section 3, Living Things in their Habitats.**

Procedure:

1. *IN CLASS:* review the five kingdoms. Remind students there are many members of the animal kingdom that are very small and seldom seen by humans. Challenge the class to list some tiny animals that (*mice, minnows, insects, snails, spiders, worms, etc.*)

2. Discuss what kind of habitat or environment would be safe for very small animals. Lead the discussion toward life in ponds, streams, **wetlands**. *Each wet area in Alaska erupts with young invertebrates (animals such as worms and insects that have no backbone) each spring as ice thaws. These invertebrates are food for fish. Who eats fish?*

3. Explain the students will become scientists, looking for animals in the water. *Many of the easily recognizable flying insects in Alaska such as mosquitoes and dragonflies lay their eggs in water. Larvae and pupae develop from these eggs.*

4. *OUTDOORS:* in groups, students place the underwater viewer on the water surface and look for fish, insect larvae, worms, or other creatures. Record the invertebrates that they see on the “Water Animals Data Sheet I” under the column “Surface Sample.”



5. Students pick up rocks both at the water's edge and in the water and look on the underside of them. *Remind students to put the rocks back in the same place so the animals that live there will still have their home.* Record any evidence of water animals on the "Water Animals Data Sheet I" under the column "Bottom Sample."

6. One student from each group places the kick sampler at the bottom of a stream with the open end facing the current. Another student "kicks" or disturbs the rocks upstream from the sampler.

7. Take the sampler out of the water and check for invertebrates. Students describe and record the invertebrates on the "Water Animals Data Sheet I" under "Kick Sample." *Be sure to treat the creatures gently and to return them to their homes after examining them.* Check field guides to help identify insect larvae and other invertebrates.

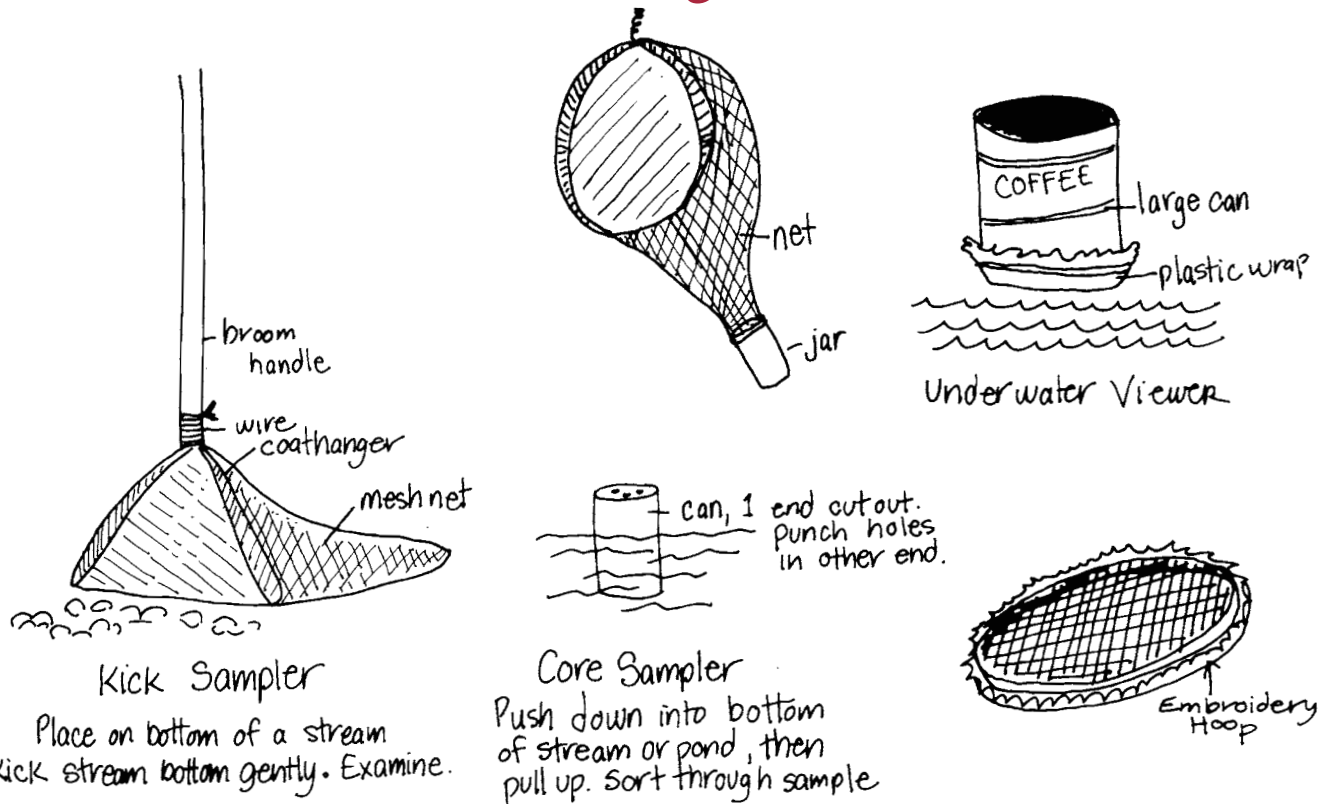
8. Use the "core sampler" to examine animals that live in **sediments**. Each group pushes the can into the bottom of

a stream or pond and then pulls it up. Sort through the sample for invertebrates. Describe and record creatures on the "Water Animals Data Sheet I" under the column "Core Sample."

9. When all groups are together, discuss any similarities they found among their water critters. Identify any features that have helped water critters to adapt to their environment.

10. Discuss the habitat of these small animals, focusing on elements critical to their survival. How might human activity affect this environment?

Water Investigation Tools



Evaluation:

1. Complete the “Water Animals Data Sheet I and II” and describe where water animals can be found in the local environment.
2. Identify some local water animals and describe their role in your ecosystem.

EXTENSION:

Predict and calculate density. Predict the number of animals in the water by estimation. Students measure the volume of water or sediment that they collected in a measuring beaker or a graduated cylinder. Count the number of organisms found in that sample. Students might also count the number of organisms found per rock examined. Record the number of organisms located per unit area.

Curriculum Connections:

(See appendix for full citations)

Books:

Insects: A Guide to Familiar American Insects (Cottam)

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

Pond and River (Eyewitness Book) (Parker)

Water Insects (Johnson)

Teacher Resources:

(See appendix)



Water Animals Data Sheet II

ANIMAL DRAWINGS

Animal # _____ Name _____

Animal # _____ Name _____

Animal # _____ Name _____

Animal # _____ Name _____

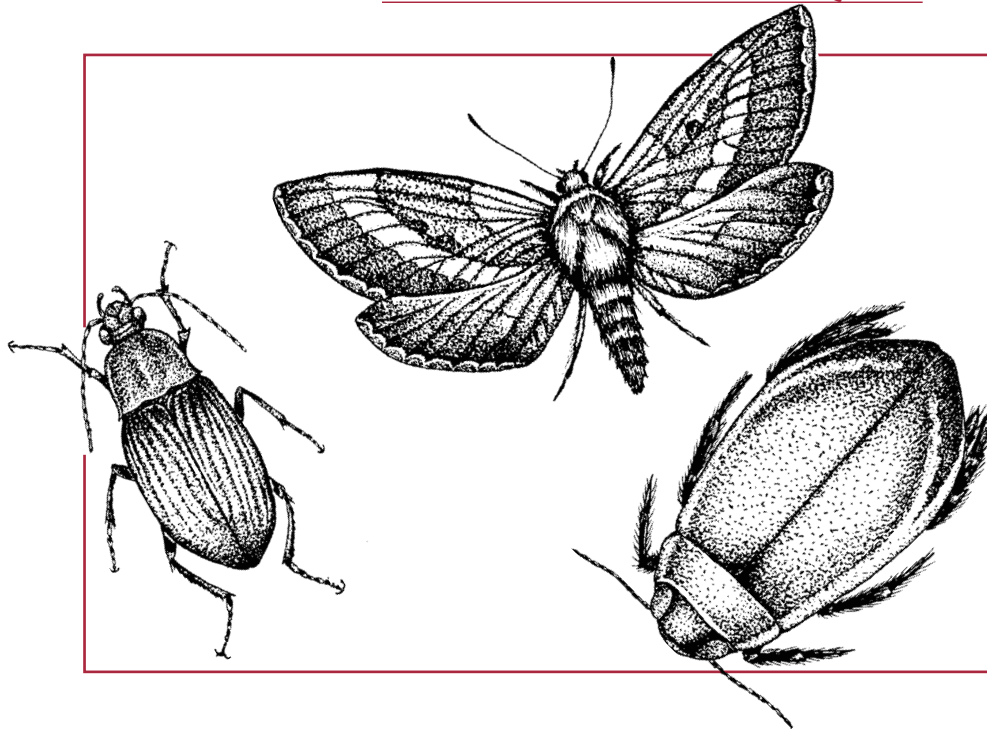
Animal # _____ Name _____

Animal # _____ Name _____



Investigating Insects

1 EXTENSION ALERT: ALASKA ECOLOGY CARDS REQUIRED



Section 3 ECOLOGY ACTIVITIES

Grade Level: 4 - 12

State Standards: M A-3, M A-6, S A-14, S A-15, S B-1, S B-5, S B-6

NGSS: 5-LS2-1, MS-LS2-3, HS-LS2-4.

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

Objective:

Students will identify signs of insect activity and determine its role in a local ecosystem.

Complementary Activities:

“Five Kingdoms But No King,” “Take a Deep Breath,” and all the “Investigating (Nonliving Things)” in *Section 1, Elements of Ecosystems*. Also “Who Eats Whom,” “Follow a Food Chain,” and “Ecosystem Partners” in *Section 2*. Also all the “Investigating (Living Things)” 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 1, Elements of Ecosystems: “Animals (Invertebrate)” fact sheet; INSIGHTS, Section 2, Community Connections; and INSIGHTS, Section 3, Living Things in their Habitats.**

Procedure:

IN ADVANCE: locate a nearby 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 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 an ecosystem. Are insects **consumers**? What do they consume? Where are they represented on a **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.

Classroom Follow-Up:

1. Students should discuss and compare their findings. Where do the found insects fit in the food chain? Students can use the *Alaska Ecology Cards* to learn more about these insects to enhance the discussion.



2. Ask if they think they might find more or less insect signs at other seasons of the year. Why? How does this affect decomposition in the local ecosystem?

3. If they have studied other ecosystems (tundra, rainforests, wetlands, etc.), students compare what they found in their local ecosystem 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 (*below*) to find out more about their local insects. They use this information along with sketches of the insect signs they found to make posters or a display of local 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:

Alaska Science Forum <www.gi.alaska.edu/ScienceForum>

Teacher Resources:

(See appendix)

SCIENCE CARD

Insect Signs

Insects are some of the most important **consumers** in many 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,







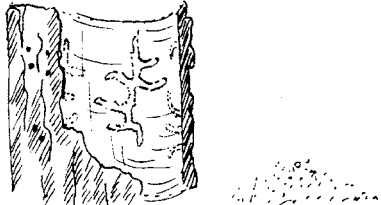

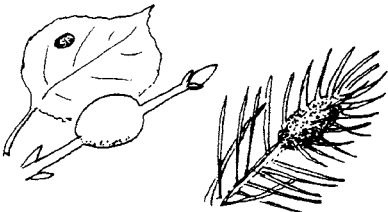


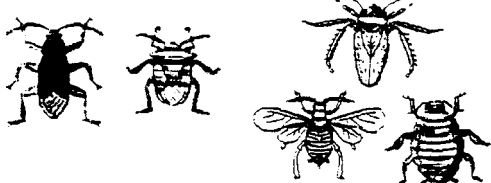
plant, or type of wood where you found the sign – the insect’s **habitat**.

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		 <p data-bbox="846 573 1487 604">Larvae of moths, butterflies, sawflies, and beetles</p>
Leaf-mining Insects		 <p data-bbox="846 835 1435 867">Tiny larvae of moths, beetles, flies, and wasps</p>
Leaf-rollers and Tent Caterpillars		 <p data-bbox="846 1083 1057 1115">Larvae of moths</p>
Cambium-eating Insects		 <p data-bbox="846 1329 1503 1360">Larvae of bark beetles, a few moths, and some flies</p>
Gall-making Insects		 <p data-bbox="846 1577 1438 1640">Wasps, flies, sawflies, gall-making aphids, and spruce aphid</p>
Sap-sucking Insects		 <p data-bbox="846 1881 1016 1913">Adult Insects</p>



Investigating Birds

2 EXTENSIONS **ALERT: ALASKA ECOLOGY CARDS OPTIONAL**

Section 3 ECOLOGY ACTIVITIES

Grade Level: 4 - 12

State Standards: M A-3, M A-6,
S A-14, S A-15, S B-1, S B-5,
S B-6

NGSS: 4-LS1-1.

Subject: Science

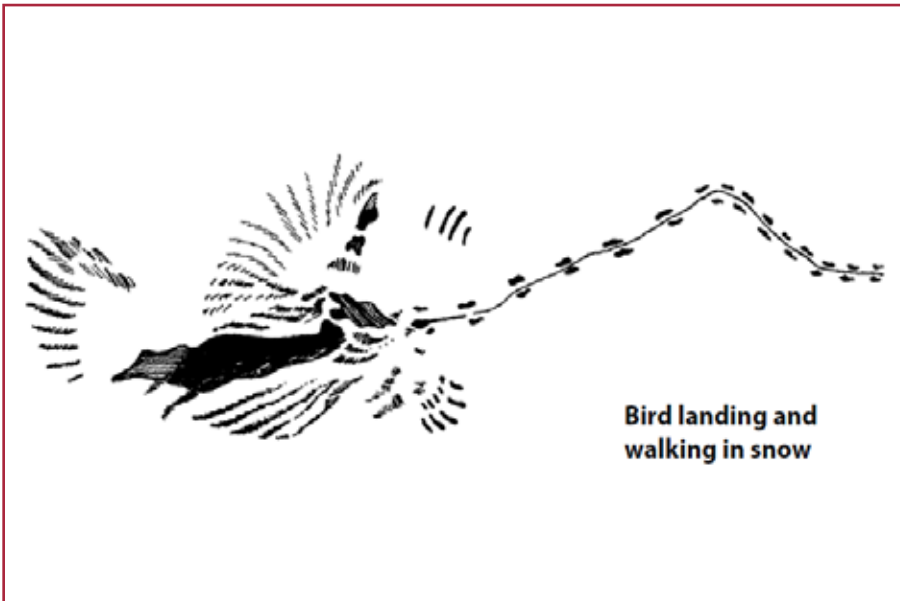
Skills: Observing, identifying,
inferring

Duration: 50 minutes

Group Size: 2

Setting: Outdoors

Vocabulary: Bird names, habitat,
nocturnal



Bird landing and walking in snow

Objective:

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

Complementary Activities:

“Five Kingdoms But No King,” “Take a Deep Breath,” and all the “Investigating (Nonliving Things)” in Section 1, *Elements of Ecosystems*. Also “Who Eats Whom,” “Follow a Food Chain,” and “Ecosystem Partners” in Section 2. Also all the “Investigating (Living Things)” and “Ecosystem Scavenger Hunt” in this section.

Background:

See **INSIGHTS, Section 1, Elements of Ecosystems: “Animals (Vertebrate)” fact sheet; INSIGHTS, Section 2, Community Connections; and INSIGHTS, Section 3, Living Things in their Habitats.**

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 birds and animal tracks, binoculars, and *Alaska Ecology Cards*.

Procedure:

IN ADVANCE: locate nearby 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.”

2. *IN CLASS:* brainstorm what kind of birds live nearby. Discuss what birds obtain from where they live (*food, shelter, water, space — habitat*) and why this habitat is important for their survival.

3. Tell the students they will go in search of birds. Students may not see specific birds, but they could find bird signs such as feathers, nests, whitewash (droppings), or tracks.

4. 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 habitat do their birds use in the ecosystem?



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

3. 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 habitat does not offer?

EXTENSIONS:

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

B. Set up a winter bird feeding station visible from the classroom. If bird habitat 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.”

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)

Website:

A Guide to Building and Placing Birdhouses
adfg.alaska.gov/species/livingwithwildlife/birds

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.

1. Write “Birds” at the top of a page in your notebook.

2. Record the number of birds whose evidence you find at this site. Then list them by name along the left side of the page.

3. Listen and look carefully, for these birds may still be nearby. Make a “shhh, shhh, shhh” sound. Sometimes birds will move or call when they hear this sound.

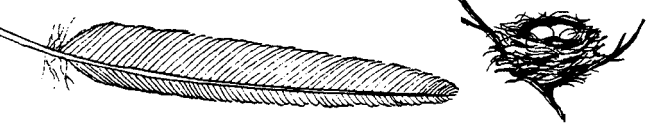

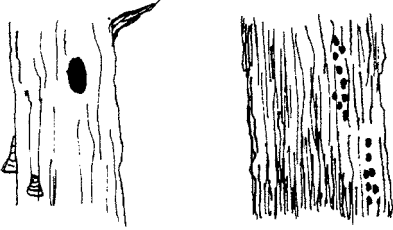

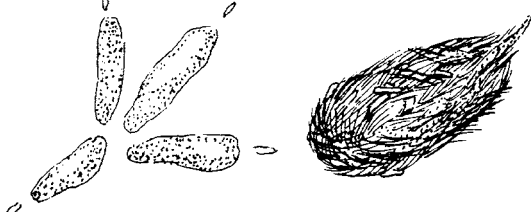
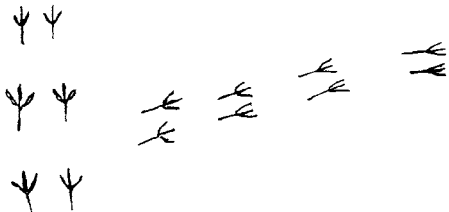
4. If you see birds, watch them. Can you identify them using the guide book? Watch and record their behavior. What habitat do they like most? Are they eating? What are they doing? Record what you see in sketches or words.

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.



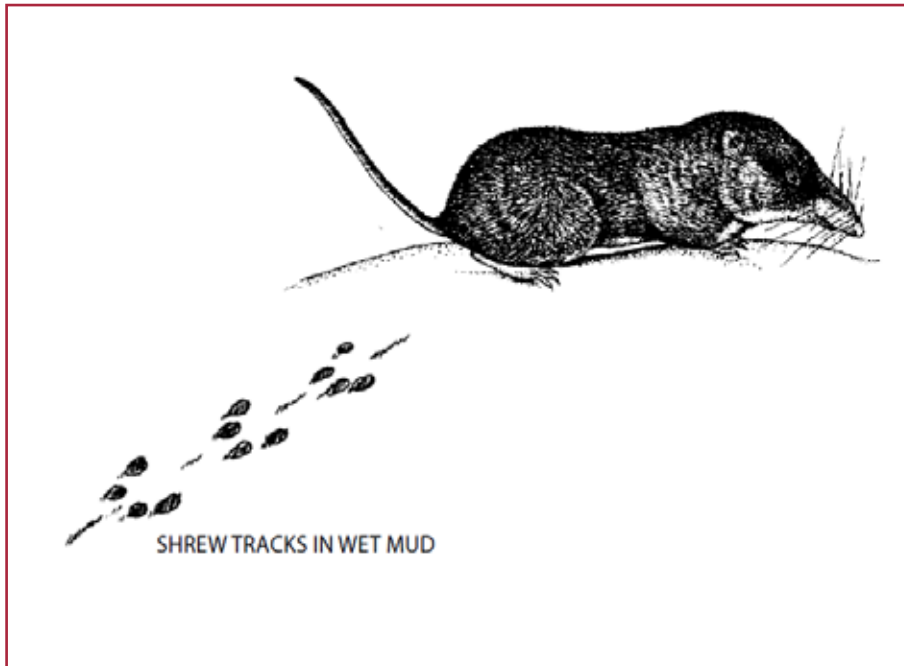
Bird Signs Chart

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.



Investigating Mammals

2 EXTENSIONS **ALERT: ALASKA ECOLOGY CARDS OPTIONAL**



Section 3 ECOLOGY ACTIVITIES

Grade Level: 4 - 12

State Standards: M A-3, M A-6, S A-14, S A-15, S B-1, S B-5, S B-6
NGSS: 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, habitat, nocturnal

Objective:

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

Complementary Activities:

“Five Kingdoms But No King,” “Take a Deep Breath,” and all the “Investigating (Nonliving Things)” in *Section 1, Elements of Ecosystems*. Also “Who Eats Whom,” “Follow a Food Chain,” and “Oh Moose,” in *Section 2*. Also all the “Investigating (Living Things)” in *this section*.

Materials:

Copies of “Mammal Signs Chart” (following pages) 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 1, Elements of Ecosystems: “Animals (Vertebrate)”** fact sheet; **INSIGHTS, Section 2, Community Connections**; and **INSIGHTS, Section 3, Living Things in their Habitats**.

Procedure:

IN ADVANCE: locate nearby 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.

1. *IN CLASS:* brainstorm what kind of mammals live nearby. Discuss what these wildlife obtain from where they live (*food, shelter, water, space — habitat*) and why this habitat is important for their survival.
2. Tell students they will go in search of local mammals. Many mammals move around over large areas and try to stay hidden, and some are **nocturnal**. But they leave signs of their presence. Students will look for animal droppings, tracks, hair, plants that have been nipped or browsed, and dens.



3. Discuss student behavior that will enhance chances of seeing mammals. *It is important for students to be quiet – talking and moving fast and noisily will scare animals away.*

4. 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, what habitat do their mammals use in the ecosystem?

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 illustrated on the Chart that were not found during class? What does that habitat offer that the class habitat does not offer?

EXTENSION:

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

B. **Make plaster casts of animal tracks.** Details are given in the activity “Track Casting” in Section 3 of the companion book *Alaska’s Forests & Wildlife*.

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska’s Mammals (Smith)

Alaska Wildlife Notebook Series (ADF&G)

Animal Tracks of Alaska (Sheldon)

Animal Tracks of Alaska (Stall)

Mammals of Alaska (Alaska Geographic)

Website:

Animal Diversity Web <animaldiversity.ummz.umich.edu/index.html>

Teacher Resources:

(See appendix)

SCIENCE CARD

Mammal Signs

1. Write “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. Do they eat plant or other animals?




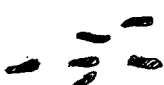
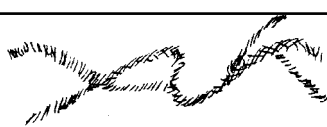



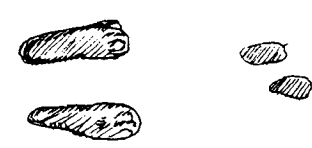


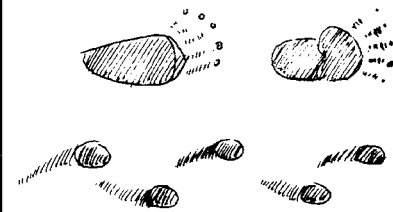

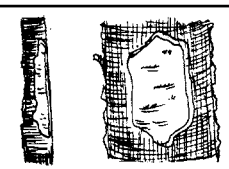


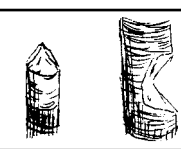


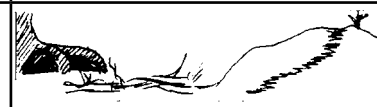
4. Write a short description of the signs next to each animal’s name. Try to compare each sign to something

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?



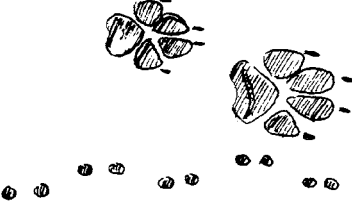

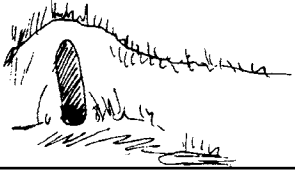
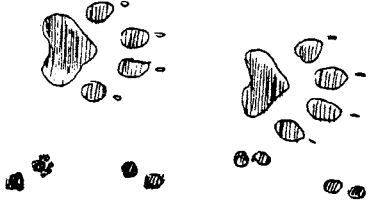

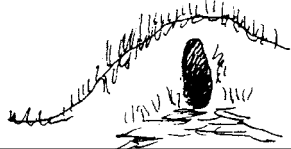



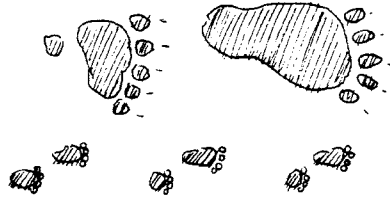





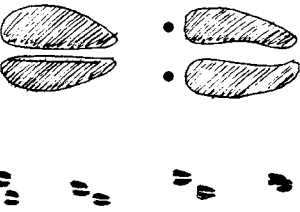
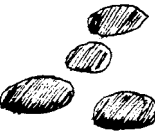
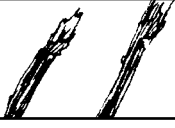


Mammal Signs Chart

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.



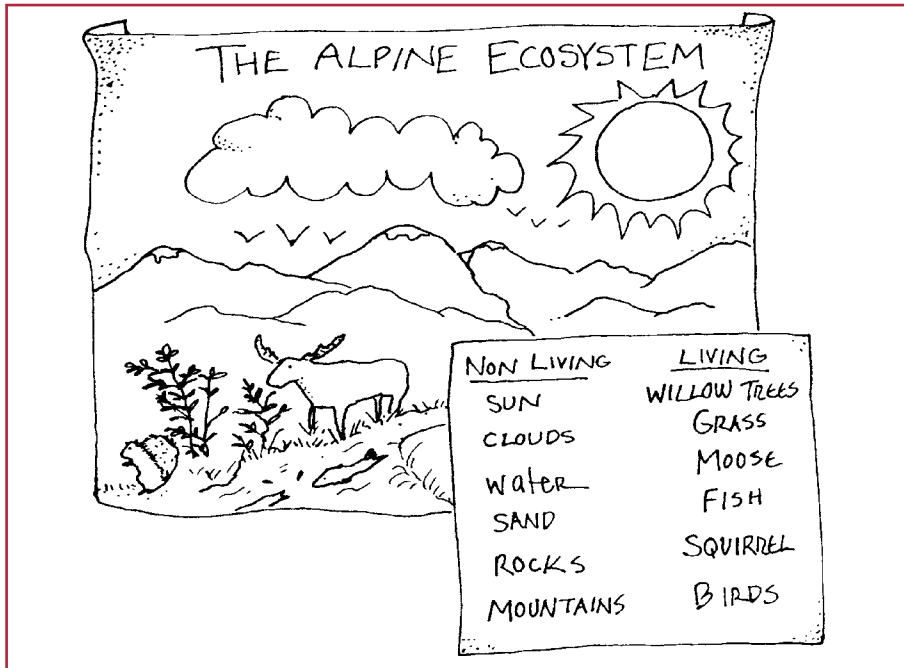
Mammal Signs Chart

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).



What Makes an Ecosystem?

2 PARTS & 1 VARIATION



Section 3 ECOLOGY ACTIVITIES

Grade Levels: 3 - 6

State Standard: S A-14
NGSS: 5-ESS3-1.,MS-LS2-1.
MS-LS2-2.

Subjects: Science, language arts

Skills: Listening, visualizing, writing, observing

Duration: 60 minutes

Group Size: Any

Setting: Indoors

Vocabulary: Ecosystem, energy, living, nonliving

Objective:

Students will be able to identify the living and nonliving components of an ecosystem and how they interact.

Teaching Strategy:

Students take an imaginary or real walk through the schoolyard and create their own imaginary ecosystems.

Complementary Activities:

“Five Kingdoms But No King,” “Take a Deep Breath,” and all the “Investigating (Nonliving Things)” in *Section 1, Elements of Ecosystems*. Also “Who Eats Whom,” “What’s for Dinner?” “Ecosystem Partners,” and “Create a Classroom Compost Box” in *Section 2*. Also all the “Investigating (Living Things)” in *this section*.

Materials:

Alaska ecosystem posters from *INSIGHTS, Section 3, Living Things in their Habitats*, or pictures of Alaskan natural environments. Examples of living and nonliving things (plants, rocks, plastic), paper and crayons.

Background:

See *INSIGHTS, Section 1, Elements of Ecosystems: “Five Living Kingdoms”* fact sheets; *INSIGHTS, Section 2, Community Connections*; and *INSIGHTS, Section 3, Living Things in their Habitats*.

Procedure:

PART ONE

1. Review the terms **living** and **nonliving**. Use the classroom to point out examples. Ask students to think about what makes something “alive” and write a class definition for “living things.”

2. Ask the students to visualize a wild area near their school with which they are familiar. Some examples might be the tundra, forest, wetlands, stream or river valley, ocean, or park near the school. Each student, working alone, makes a list of all of the living and nonliving elements of this local habitat.

3. Make a class list of all of the elements of the local habitat, under the categories “living” and “nonliving.”



4. Review the definition of the **ecosystem** (*a community of living things and its nonliving surroundings linked together by energy and nutrient exchange*). Discuss how your local wild area fits this ecosystem definition.

5. Work together to show the connection between the parts of the ecosystem, showing how each part depends on another. If possible, take a walk into the ecosystem surrounding the school and look for things to add to the class list. *Some nonliving things require creativity to “see.” Energy is observable in the form of heat, sunlight, wind, and the movement of body parts and body fluids in living things.*

PART TWO

6. Discuss how different ecosystems have different *nonliving environments* and therefore, different living things. *Some ecosystems are dominated by hot or cold temperatures, lots of rain or hardly any rain, for example.* Can a fish that lives in an ocean ecosystem also live in a desert ecosystem?

7. If appropriate, show poster or picture examples of Alaskan ecosystems.

8. Challenge the students, working in groups or as a class, to create their own real or imaginary ecosystem as a drawing, mural, model, or a collage. The ecosystems should include at least 5-10 living things and the nonliving things on which the living things depend.

Students might start by listing the living and nonliving things that might be a part of their ecosystem and how they are connected or interdependent. The living creatures can be fictional, but must stick to the definition of “living” that the class discussed earlier. Nonliving elements must be present on earth. If using fictional creatures, students should provide a description, including what the creatures need to live.

The murals or drawings should clearly show the connections between the living and nonliving parts. The imaginary ecosystems may include a descriptive paragraph entitled “A visit to the _____ ecosystem.”

7. Students share their ecosystems, pointing out the living and nonliving elements, and how they are connected. After sharing their paragraphs, students discuss whether or not they would like to live in their ecosystems.

VARIATION FOR YOUNGER STUDENTS

1. Ask students to close their eyes, listen carefully, and imagine themselves walking in a wild area nearby, in an “ecosystem.” Ask them to imagine that they have extraordinary senses and can see and feel everything that is going on around them.

2. Explain that you will read a few lines to get them thinking, but then they will continue their walks in their own imaginations. Read the following passage aloud to the class:

*“What a beautiful day to spend outside.
Most of the winter snow has melted,
leaving the ground wet and muddy.
The air is still a little chilly, but the sun breaks
through the big fluffy clouds and warms my face.
High above me, a flock of geese honk wildly,
heading to their nesting places.
I have the whole day to enjoy this!
I wonder what I will find ...”*

3. Wait a few minutes. Then ask students to write a list or a paragraph describing what they saw, felt, and heard in the wild area. Younger students can do this verbally, as a class.

4. Ask a few students to read their list/paragraphs. List on the board the things that were mentioned in the reading passage that the students observed, *such as sunshine, clouds, water, snow, and geese.*

Encourage students to share the things they imagined on their own after listening to the passage, *such as plants, animals, people, and man-made things.* Note whether students visualized any interactions between the living things.

5. Using the list on the board as examples, brainstorm the differences between living and nonliving things. Summarize the differences.

6. Give each student a box of objects representing living and nonliving things. Students divide objects into living and nonliving piles.

7. Students choose two objects from each category to draw and label an imaginary ecosystem for the objects.



Evaluation:

1. Students identify living and nonliving parts of an ecosystem and explain their interaction.

2. Students identify what makes ecosystems different and provide examples using the created, imaginary ecosystems.

Curriculum Connections:

(See appendix for full citations)

Books:

Ecology (Pollock)

A Caribou Journey (Miller)

A Dead Log (Green)

Disappearing Lake: Nature's Magic in Denali National Park (Miller)

Earthwatch: Earthcycles and Ecosystems (Savan)

A Freshwater Pond (Hibbert)

One Small Square Series (Silver)

Polar Bear Journey (Miller)

The River of Life (Miller)

A Tidal Pool (Steele)

Under a Stone (Green)

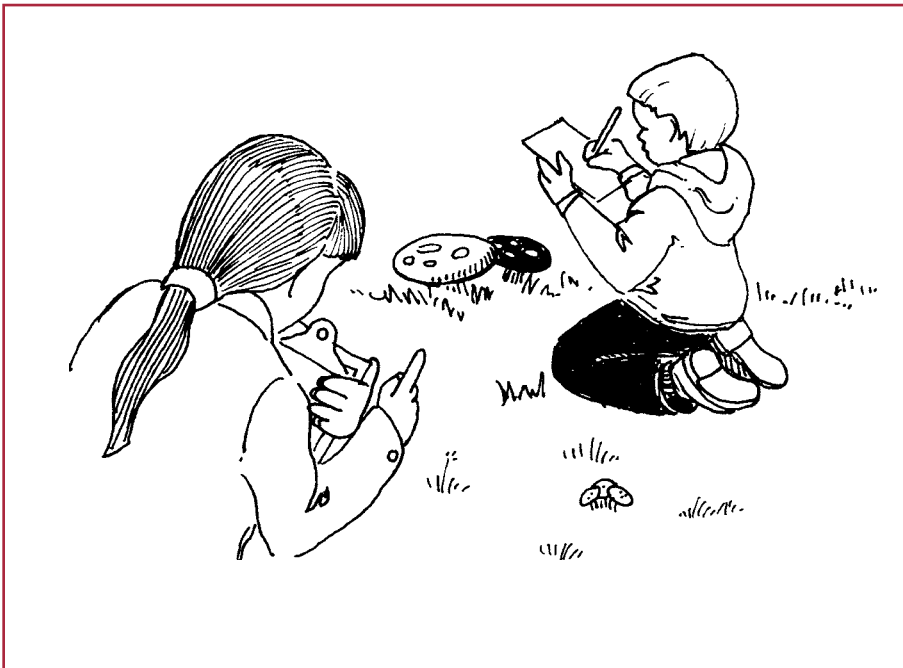
Teacher Resources:

(See appendix)



Ecosystem Scavenger Hunt

ALERT: ALASKA ECOLOGY CARDS OPTIONAL



Section 3 ECOLOGY ACTIVITIES

Grade Level: 5 - 9

State Standards: S A-14, S A-15

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

Subjects: Science

Skills: Observation, inferring, application

Duration: 45 minutes or more

Group Size: 3-5

Setting: Outdoors

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

Objective:

Students will identify concepts and components of their local ecosystem.

Teaching Strategy:

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

Complementary Activities:

“Five Kingdoms But No King,” “Take a Deep Breath,” and all the “Investigating (Nonliving Things)” in Section 1, *Elements of Ecosystems*. Also “Who Eats Whom,” and “Create a Classroom Compost Box” in Section 2. Also all the “Investigating (Living Things)” in this section.

Materials:

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

OPTIONAL: *Alaska Ecology Cards*.

Background:

See *INSIGHTS, Section 1, Elements of Ecosystems: “Five Living Kingdoms” fact sheets*; *INSIGHTS, Section 2,*

Community Connections; and INSIGHTS, Section 3, Living Things in their Habitats.

Procedure:

IN ADVANCE: before distributing the scavenger hunt list, add specific animals, plants or other items which represent your local area.

1. Review the list of items together. Help students define unfamiliar terms.
2. Explain that some items on the “Ecosystem 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.

3. Explain the rules: (a) 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.** (c) Students can use the same item more than once on the list as long as the item fits more than one category. (d) The search ends when any team finds one example of each item on the list, or at the end of a specified time.

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

5. 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.

6. 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 their local ecosystem using the scavenger hunt list. Students explain the interconnections.

Curriculum Connections:

(See appendix for full citations)

Books:

Ecology (Pollock)

Dead Log Alive (Kittinger)

A Dead Log (Green)

One Small Square: Backyard (Silver)

Under a Stone (Green)

Teacher Resources:

(See appendix)



Ecosystem 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 consumer

a tree

water

erosion

a bird

oxygen

humans

carbon dioxide

recycling of minerals

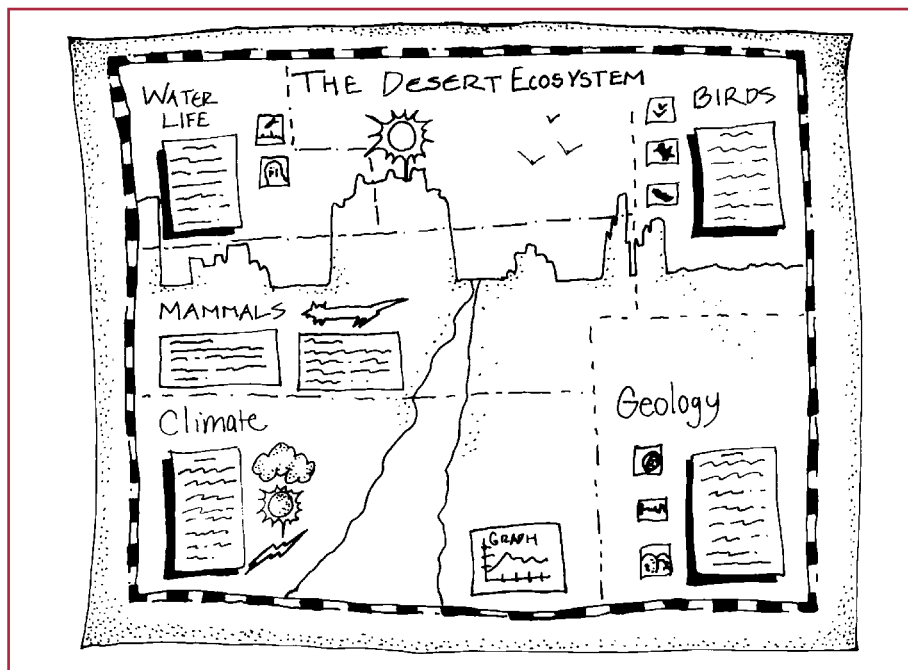
a tree that died

moss



A World Tour

2 VARIATIONS and 3 EXTENSIONS



Section 3 ECOLOGY ACTIVITIES

Grade Level: 4 - 10

State Standards: S A-14, Geo C-1, Geo C-3

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

Subjects: Science, social studies, art

Skills: Observing, listening, hypothesizing, comparing, writing

Duration: 100 minutes

Group Size: Whole class and small groups

Setting: Indoors

Vocabulary: Biomes, ecosystem

Objectives:

1. Students compare and contrast characteristics of different ecosystems.
2. Using photographs and reference materials, students in small groups will recognize that the nonliving components of an ecosystem affect the characteristics of the living things in that ecosystem.
3. Students identify and connect nonliving and living components of different ecosystems.

Teaching Strategy:

Working in groups, students create posters showing different ecosystems. Students “visit” them by going on a “world tour” in which they observe and record the similarities and differences between the systems and draw conclusions on the impact of the nonliving surroundings on the living things.

Complementary Activities:

This is a good synthesis, so all previous activities apply. Also “What Makes an Ecosystem” in this section; and “Create and Destroy” and “Spinning a Yarn about Ecosystems” in

Section 5, Human Impacts.

Materials:

Drawings, photos, films, or videos of wild areas around the world; reference materials about wildlife and the environment of a variety of ecosystems (*desert, rainforest, tundra, prairie, forest, etc.*); cardboard or tagboard for making posters; crayons, markers, paints; collage materials for making posters; 3 x 5 cards for taking notes.

Background:

See **INSIGHTS, Section 1, Elements of Ecosystems;** **INSIGHTS, Section 2, Community Connections;** and **INSIGHTS, Section 3, Living Things in their Habitats.** Also see **Alaska’s Tundra & Wildlife – INSIGHTS, Section 3: Adaptations fact sheets.**

Procedure:

IN ADVANCE: choose several ecosystems from around the world. *Ideas include the Mojave desert, tropical rainforests, Antarctica, prairies, redwood or eastern deciduous forests, lakes or rivers, Florida everglades, and coral reefs.*



Gather background and reference materials about your chosen ecosystems. (See *Teacher Resources in appendix.*) You may wish to photocopy pictures and information from reference material to provide background for the groups. See also *VARIATIONS A & B.*

1. *IN CLASS:* review the term **ecosystem**. Discuss how ecosystems differ and why. What makes nonliving things different in different places? *Focus the discussion on climate, geology, latitude, and altitude.*

2. Students list as many ecosystems as they can that are found in Alaska and then in the world. Compile the list on the board.

3. Tell each group to choose an ecosystem from the lists on the board. Students will be (a) researching their ecosystem, (b) discovering what living things exist there and describing their nonliving surroundings, and (c) how they are connected.

4. Challenge groups to create a poster that reflects the nonliving and living components that make their ecosystem *unique*.

For example, wetlands are characterized by year-round water, the nesting and growth of young insects and animals, specific kinds of vegetation such as sedge grass and willows, and migrant waterfowl.

5. Posters can include drawings, writing, collage, or real samples of living and nonliving elements. Posters should clearly show the connections between the components and how the different members of an ecosystem depend on one another. Posters may include an identification of geographic locations of their ecosystem on a world or state map.

6. Assign each member of the group a specific research responsibility. Some suggestions for dividing research responsibilities are as follows:

- Climate (average rainfall, average summer and winter temperatures, snow accumulation)
- Geology of rocks and soil conditions (pH, amount of soil accumulation)
- Plants, algae, and fungi
- Fish
- Reptiles and amphibians

- Birds
- Mammals (including humans)

7. Students can record data on 3 x 5 cards which they may later tape to the ecosystem posters.

8. Ask all groups to follow a similar poster format so that the information in the posters may be compared.

9. When finished, groups present their posters to the rest of the class. Place the posters around the room and offer a world tour of the ecosystems.

10. Working individually or in small groups, students analyze each ecosystem compare and contrast the nonliving and living components.

11. After the world tour, brainstorm about the similarities and differences that the students noted.

- Where were certain plants and animals most numerous?
- Where were certain plants and animals non-existent (or very small in number)?
- Why can't all plants and animals live in all the ecosystems?
- Are there similar animals in several ecosystems that have slightly different characteristics (size, shape, color, or length of appendages)? (*For example, tundra hares have shorter ears than desert jack rabbits because they need to conserve heat.*)

11. Conclude the discussion by emphasizing the impact that the physical environment (*the nonliving components of the ecosystem, such as soil, rainfall, temperature, wind, etc.*) has on determining the living components of the ecosystem.

VARIATIONS

A. If the teacher uses posters from previous classes or collects pictures and creates the collages, (without words or information) the activity can begin with the "world tour." Use strategies for viewing real wildlife on the classroom tour (*no loud noises, safe and appropriate distance, no harassing, etc.*). Following the tour, students can pick one poster and determine what makes it different from the other ecosystems.

B. Use photos or pictures of wild areas around the world to show to the class and identify the sites on a globe or map. Divide the students into small groups to examine



all the photos and decide what the areas have in common (*air, water, soil, sun, plants, animals, etc.*). Students guess whether they might find other similarities if they visited the areas. Would they all have insects? Microscopic living things? Fungi?

Evaluation:

1. Students name five animals and five plants which could be found in their particular ecosystem. Students name nonliving elements that all ecosystems share and which are vital to the survival of living things in their ecosystem.
2. Given a certain plant or animal (an imaginary one made up by the teacher works well) with certain adaptations, students will place it in an appropriate ecosystem.
3. Students understand why the nonliving elements of an ecosystem differ.

Extensions:

A. **Compare living kingdoms in ecosystems.** Divide into groups to compare particular groups of organisms (*the five kingdoms – birds, mammals, fish, and invertebrates, or specific groups – rodents, hawks, frogs, etc.*). Have students research the similarities and differences of the groups in different ecosystems.

- Are the number and variety of species, their physical appearances (*color, size, shape, appendages*), food habits, habitat preferences, timing of breeding, and number of young produced per year the same or different?
- Are there any trends or any generalities about the differences in the living things found in the different environments?
- If so, hypothesize why such differences exist and try to think of a way to test these hypotheses.

B. **Predict animal adaptations.** Examine and discuss some of the adaptations of animals to the Arctic. (*See Alaska's Tundra & Wildlife INSIGHTS, Section 3: Adaptation fact sheets.*) Then have students predict the adaptations of animals that live in a desert or tropical forest.

C. **Link to a class in another ecosystem.** Locate a teacher and a class in a different part of Alaska or elsewhere in the world willing to study the ecosystem of their area. Exchange observations with your class.

Credits:

Adapted from “Graphnaminal,” Project WILD *K-12 Activity Guide*, Western Regional Environmental Education Council, 1992.

Curriculum Connections:

(See appendix for full citations)

Books:

Biomes of the World (Allaby)

Exploring Earth's Biomes series (Sayre)

One Small Square series (Silver)

Our Natural Homes: Exploring Terrestrial Biomes of North and South America (Collard)

Webs of Life series (Fleisher)

What is a Biome? (Kalman)

U-X-L Encyclopedia of Biomes (Weigel)

Media:

Songs of the Earth (Audio Tape or CD) (Banana Slug String Band)

Website:

Biomes of the World <www.ucmp.berkeley.edu/glossary/gloss5/biome>

Teacher Resources:

(See appendix)



