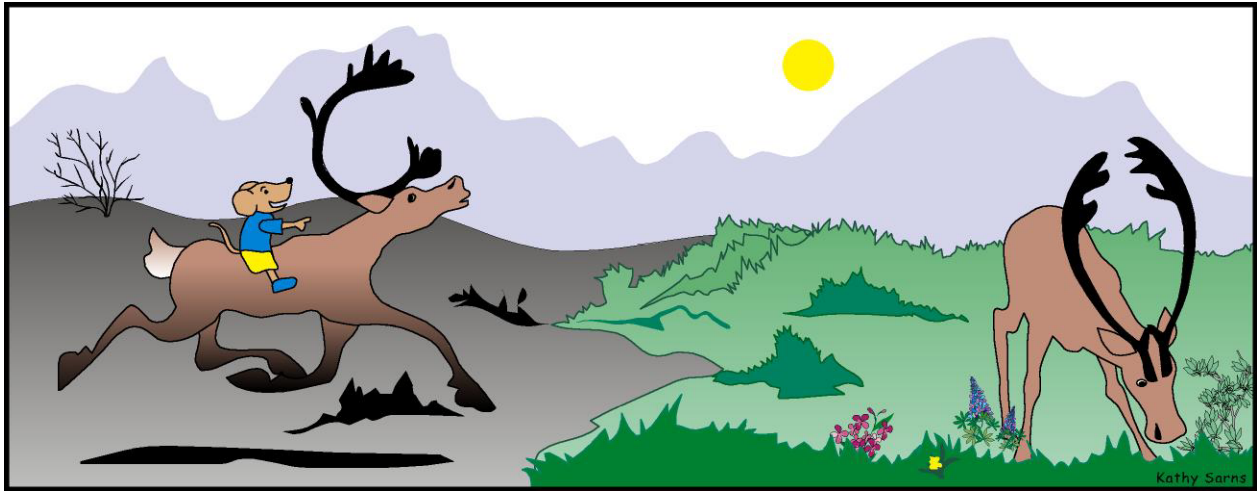


FIRE'S EFFECT ON FOREST AND TUNDRA WILDLIFE



Grade Level: 3-6

Alaska State Content Standards: SA14, SA15, LA3, LA4, LA6

Subject: Science, Language Arts

Skills: Comparison, Description, Generalization

Duration: 1 class period

Group Size: 3-4

Setting: indoors

Vocabulary: successional stage

OBJECTIVE

Students will identify the habitat needs of wildlife, comparing the list of needs to the long and short-term effects of a fire.

TEACHING STRATEGY

Students will depict forest or tundra ecosystems by drawing and coloring these ecosystem habitats.

MATERIALS

- Tundra "Alaska Ecology Cards" or Forest "Alaska Ecology Cards"
- Effects of Fire on Wildlife Population
- White butcher paper
- Crayons, markers, or paints

TEACHER BACKGROUND

Tundra

While tundra areas receive little precipitation, they are often moist or wet because cool temperatures cause low evaporation rates and the water cannot seep into frozen permafrost soils. The soil also contains a high amount of organic material due to the slow rate of decay in cold climates.

Because the organic layer underneath the surface vegetation is moist and will not easily burn, fires often travel fast, burning only the grasses and other plants that are above ground. These types of fires remove the buildup of dead material and return nutrients to the soil. Surviving roots send up new

shoots and abundant regrowth occurs. In very dry years, a creeping ground fire can burn the organic layer of the tundra. This type of fire will destroy giant roots and can smolder for many months, even occasionally through the winter. When this occurs, succession progresses from seeds brought in or roots growing back from those in surrounding unburned areas.

Tundra fires may be started directly by lightning or by fires spreading from adjacent forests. They usually occur during late May, June, and early July when temperatures are warm and fuels are dry. If it has been a dry year, there may be fires later in the summer, which could develop into a creeping ground fires that burn deep into the organic layer. Fire is unique in tundra areas because there is less lightning in the northern and western parts of Alaska where tundra predominantly occurs. One area of tundra may burn almost every year, and other areas may never burn.

To evaluate the potential effects of a tundra fire on wildlife it is important to consider when the fire occurred. The tundra supports many migrant animals that may stay for a very short time and may depend on a specific food source found at a specific time of the year. If that food source is destroyed during a fire, the short-term effect may be slight if the animal is not a current resident of the tundra. However, the impact may be greater if the animal returns and cannot find the important foods needed for migration.

The following examples can be discussed with students to help them

consider how wildlife use the tundra during various times of the year:

1. Many migrating birds arrive in Alaska during April and May. Waterfowl consume mosquito larvae and plants during breeding and nesting. A fire in early summer could have a detrimental short-term effect on nesting waterfowl. The birds may be forced to abandon their nest or be killed. If the fire occurs late in the nesting period, there may not be enough time to nest again. After eggs have hatched, the young birds can move into lakes or rivers where they can escape fire. Most bird species leave the tundra during August and September and would not be affected by late season fires.
2. It is also important to recognize the long-term effects of fire. In years following a fire, dense grass cover often grows around the shorelines of wetlands. This thick grass provides good nesting cover, which can increase nesting production. Fires also release nutrients back into the soil and nearby water sources. These nutrients increase mosquito larva populations and underwater plant production, providing important food for ducklings.
3. Tundra fires can have both short and long-term effects for caribou. A tundra fire (depending on its size) may have less of an impact on migrating caribou since they can move to other areas to feed. The Western Arctic herd calves and spends the summer on the North Slope feeding on young sedges and willow shoots. In the fall they return south to Western Alaska where they

over winter, eating grasses, shrubs, and lichens. The short-term effect on grasses, sedges and shrubs appears to be mostly positive because of the abundant regrowth available to caribou. However, for some species of lichens that take 30-40 years to develop, fire has a more detrimental long-term effect. There is still some question as to how essential lichens are in the winter diet of the caribou.

For more information see "Facts about Fire, Unit 2 --How do Tundra Fires Affect Wildlife Populations?"

Boreal Forests

Fires have occurred in the boreal forest of interior Alaska for thousands of years. This is clearly shown by charcoal layers in soil, fire scars on trees, and the mosaic pattern of the boreal forest. Scientists believe that lightning-caused fires have occurred in Alaska's boreal forest and tundra since the last ice age, 10,000 years ago. These natural fires, as well as man made fires, have helped create the boreal forests we have today. These fires both harm and help wildlife.

Certainly some animals, including nesting birds, voles, squirrels, and hares, are killed by fire. But surprisingly few dead animals are found after fires. Many birds and large mammals apparently escape the flames by flying or running away. And small mammals, such as voles and squirrels, sometimes escape fire by moving into underground burrows. Scientists think most vertebrate animals killed by wildland fires die of suffocation from the smoke rather than from the heat. Most invertebrate organisms in the surface soil and on vegetation are killed by fire.



The most important effects of fire on wildlife are not the deaths caused by the flames and smoke, but the indirect effects caused by changes in plant communities. Some wildlife species are harmed by these changes, while other species benefit. By removing trees, shrubs, herbs, and lichens, fire essentially removes the food and cover (habitat) for some wildlife. These organisms cannot find homes in recently burned areas and are forced to move to other areas or die. Other species of wildlife move into and use burn sites. The species and numbers of animals that move into a burned area depend largely upon the kinds of plants that become established and the rate at which these plants grow. In general, as plants re-invade a burned area and succession proceeds, wildlife also reappears and some species flourish. The "Effects of Fire on Wildlife" handout provides more information on the effects of fire on specific species of wildlife.

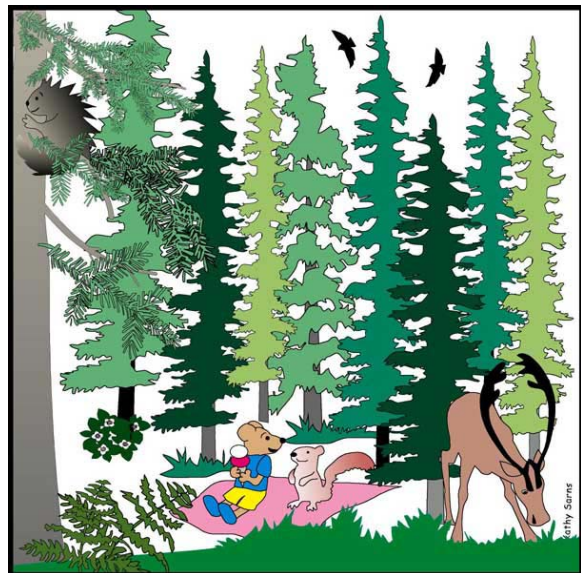
A few wildlife species find food and cover in a burn site immediately after a forest fire. Bark beetles have built-in smoke detectors and heat sensors to

help them locate burned areas. As growing numbers of beetles attack the burned trees, their predators, three-toed and black-backed woodpeckers, congregate in the burned areas to feed. Other predators such as foxes, coyotes, hawks, and owls often hunt in recent burns, probably because the voles and other small mammals that remain have little cover and are easy prey. As plant succession proceeds soils enriched by ashes provide the nutrients needed for a flush of plant growth. Grasses, herbs, and seedling shrubs and trees provide a rich source of food for insects and seed-eating birds and mammals. Far from devoid of life, a young burn is often alive with a wide variety of insects, along with hares, voles, shrews, sparrows, and flycatchers. These animals attract predators like foxes, coyotes, red-tailed hawks, northern hawk-owls, and American kestrels.

As the shrub stage develops wildlife begins to flourish. Young trees and tall shrubs provide new nesting and feeding sites for birds. New species, including some warblers, sparrows, thrushes, and sharp-tailed grouse, may begin using the burn site at this stage. Due to abundant herbs, grasses, shrubs, and cover provided by fallen trees, the shrub stage of succession may provide habitat for larger numbers of small mammals and certain ground-nesting birds than any other **successional stage**. This abundance of prey supports similarly high numbers of predators, including fox, weasels, and marten. In general, these species of predators are more abundant in this early stage forest than in any other stage. If hardwood trees and shrubs are abundant, moose and snowshoe hares may also find an abundant and nutritious food supply in

this successional stage. As their numbers increase, predators such as wolves and lynx may also move into the burn area.

Once the saplings have grown into trees, they shade out smaller shrubs, other saplings, and many ground cover plants like fireweed and grasses. In this maturing forest animals that needed these plants die out or are forced to move to other areas in search of appropriate food and cover. Among the affected species are moose and hares when tree branches have grown out of their reach. Many of the seed-eating and shrub-nesting birds are also displaced, including most sparrows. Other species of wildlife, including ruffed grouse, Swainson's thrushes, yellow-rumped warblers, and sharp-shinned hawks, find ideal habitat in this forest stage.



As hardwood trees are replaced by spruce, wildlife that prefers spruce trees displace those that need hardwood forests. As this forest matures or ages, porcupines, red squirrels, caribou, white-winged crossbills, spruce grouse,

boreal chickadees, goshawks, Swainson's thrushes, and Townsend's warblers become the wildlife typical of old stands of spruce trees.

Fires rarely burn evenly. They burn in patches, completely burning some parts of the forest or tundra and leaving other parts untouched. This patchy burning pattern helps maintain the vegetation mosaic of different successional stages. The areas of the mosaic where different habitat types meet are called **edges**. Because some wildlife require more than one habitat type to provide their needs, edges offer the opportunity for the greatest diversity of animals. Many wildlife species prefer the edges found between vegetation types, using these areas for feeding and travel. Many animals will feed in earlier successional stages and seek cover in old forests, particularly during winter. These include snowshoe hares, lynx, bear, marten, moose, and resident birds.

Many of the wildlife of the boreal forest depend upon repeated and sporadic fires to create and maintain the forest mosaic. Just as plant populations change through succession, so do those of wildlife. Some boreal forest wildlife find the best habitat in recent burns or the shrub-sapling stage of succession, while others fulfill their habitat needs in old forests (see "Effects of Fire on Wildlife" handout). Some species apparently require both early and late stages of succession. The abundance of wildlife in the boreal forest is largely a result of the variety of habitats and edges provided by the forest mosaic.

PROCEDURE

1. Divide the class into groups of 3 or 4.

2. Randomly distribute several Forest or Tundra "*Alaska Ecology Cards*" to each group. Have the groups discuss the habitat needs of each wildlife species.
3. Give each group a large piece of white butcher paper and something to color or draw with. Each group is to design either a forest or tundra ecosystem that provides all the necessary habitat requirements for their wildlife. Students can be creative and design habitats that they think would be more beneficial to the wildlife than a natural ecosystem might be.
4. When the students have completed their drawings, each group will present their ecosystem to the class and explain how it supports each type of wildlife included. As the presentations are completed, place the drawings in a display on the wall and tape the wildlife cards to each drawing.
5. Have each student write a paper explaining the short-term and long-term effects of fire on each wildlife species in their habitat drawings. Try to answer the following questions:
 - a. If fire burned through just one of the drawings, would there be habitat available for all the wildlife to move into the habitats provided by the other drawings?
 - b. Would the fire's impact on wildlife be different if the fire burned early or later in the summer?
 - c. In a boreal forest habitat, what would be the effect of the area

- developing into the next successional stage?
- d. If there was a village on the edge of one of the drawings, how would fire affect the people? Would the fire affect subsistence?
 - e. Discuss how diversity in vegetation will support a larger diversity in wildlife. Notice that the different drawings create a vegetative mosaic.

EVALUATION

Have students choose one animal in their drawing and write a story about the effects of a fire from the animal's point of view.

EXTENSION

Students may wish to make diagrams of habitats needed by their wildlife.