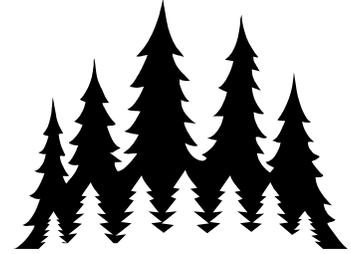


White Mountain National Forest

Forest Discovery Trail

Grades 5-8



Welcome to the White Mountain National Forest - Forest Discovery Trail. The Forest Discovery Trail is a living classroom in ecological management. The trail leads through 85 acres of young hardwoods and stands of old pines, past rocky streams and forest wetlands. Along the way you will see forest practices that are patterned after natural disturbances. The full tour follows a 1.5 mile loop trail with 10 stops along the way. We do not recommend taking students in grades K-4 to the final two stops on the trail, because of travel distance and time required to visit the stops.

The Discovery Trail is a 1.5 mile loop trail with a compacted crushed gravel bed that is 6 feet wide. The trail grade is up to 8% which is easily traveled by a wheelchair. One small section of the trail does have a 14% grade which requires wheelchair assistance. There are benches strategically placed throughout the trail. There are handicapped toilets at the trailhead and a parking lot that will easily accommodate buses.

As you explore the Forest Discovery Trail, you will see examples of the following themes.

1. Plants are physiological systems that are responsible for growth and reproduction.
2. Ecosystems are composed of many interrelationships.
3. Humans are involved in the management and conservation of natural resources.

As you review this guide, you will notice several sites are marked with an icon (☀). These sites best demonstrate the themes described above. You may want to distribute your time appropriately, focusing more attention on these key sites and less on the others.

Pay attention to the following as you walk along the trail:

- Your senses, especially the sounds, sights, and smells of the forest
- What the forest looks like at each site – the variety that exists
- Signs of animal presence (tracks, scat, nests, holes, etc.)
- Signs of human use (roads, cut trees, trails, equipment, etc.)

Vocabulary

Ecosystem: The interacting system of a biological community and its nonliving environment; also, the place where these interactions occur.

Even-aged management: Management practices that result in a forest area in which all the trees are the same age, due to simultaneous harvesting.

Forest: A community of trees, as well as the organisms, soil, water, and air associated with them.

Forester: A person trained in the science of caring for forests.

Forest management: the process a forester uses to care for a forest. This includes three steps: 1) research forest ecology, 2) establish management objectives, 3) determine and implement management practices. Techniques highlighted on the trail include:

- Single-tree selection (site 3)
- Permanent forest opening (site 4)
- Shelterwood cut (site 5 & 11)
- Small group selection harvest (site 6)
- Clearcut (site 7)
- Managing for wilderness qualities (site 9)
- Vegetation buffer (site 10)

Forest management plan: A document that addresses long-term goals and objectives for a forest, typically encompassing a time period of ten years or more. Plans include goals and objectives, a detailed description of the forest, an inventory of species present, and a list of management recommendations with an activity schedule.

Forest stand: A group of trees sufficiently uniform in species composition, arrangement of age classes, and condition to be considered a distinguishable unit.

Habitat: An area that provides an animal or plant with food, water, shelter, and living space.

Logger: A person who cuts trees for a living.

Natural community: A group of all organisms in a particular habitat that are bound together by interrelationships. Natural communities are defined by 1) plant species present at the site; 2) physical structure (i.e. height) of the plants; and 3) physical environment (location, water present, available nutrients, climate, etc.)

Resource manager: A professional who cares for natural resources, applying scientific, economic and social principles to the resource. Examples include a wildlife manager (wildlife and related habitat), a natural resource manager (land and water), and a forester (forests and trees.)

Shade-tolerant: Refers to plants that will grow acceptably in shade.

Shade-intolerant: Refers to plants that cannot thrive in the shade of larger trees. Also called “sun-loving.”

Succession: The gradual replacement of one community by another. Change over time.

Uneven-aged management: Management practices that result in a forest area in which the trees are a wide range of ages, due to harvesting that takes only individual trees or small groups of trees at a time.

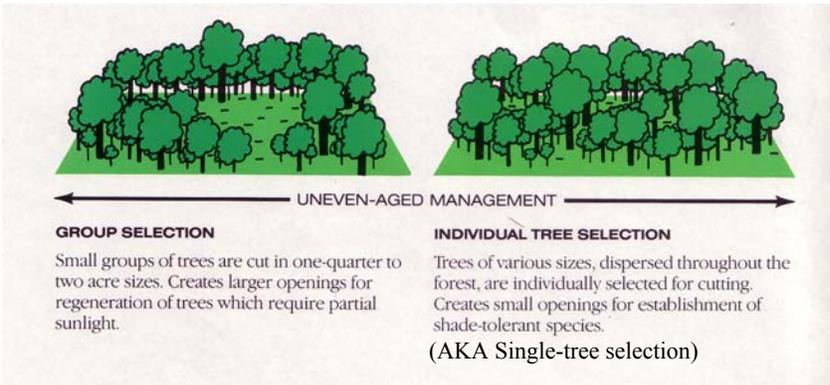
Management Practices Demonstrated by the Forest Discovery Trail

The management practices used at each site have been described within this guide. Additionally, icons on the bottom of each page show the management practices used. A box surrounds the practice used at each site. If no icons are included, no management practice has been highlighted for that site.

Sometimes wind, fire, ice storms or infestations by insects or diseases can kill a forest in a short time. When the forest regrows, the new trees are all about the same age, even though size may vary with growth rate. This type of forest is called **even-aged**.



Other times, a forest may grow for many years with only individual trees or small groups of trees dying. This provides open spaces that soon will be filled by young trees. These forests are called **uneven-aged**.



Over time, each type of forest will take on a different appearance. Certain trees, such as aspen, black cherry, oak, hickory and pine, grow best if they are managed as even-aged forests because of their need for direct sunlight. Other trees, such as maple and beech, can thrive in the shaded environment of an uneven-aged forest. Each type of forest – even-aged and uneven-aged – provides different wildlife habitat (food and shelter.) This means there will be different birds and animals associated with the different forests or parts of forests.



1. The Web of Life: Forest Ecosystems

- *Ecosystems are composed of many interrelationships.*
- *Humans are involved in the management and conservation of natural resources.*

What is an ecosystem? An *ecosystem* is the interacting system of a biological community and its nonliving environment, and the place where these interactions occur. Forests are one example of an ecosystem.

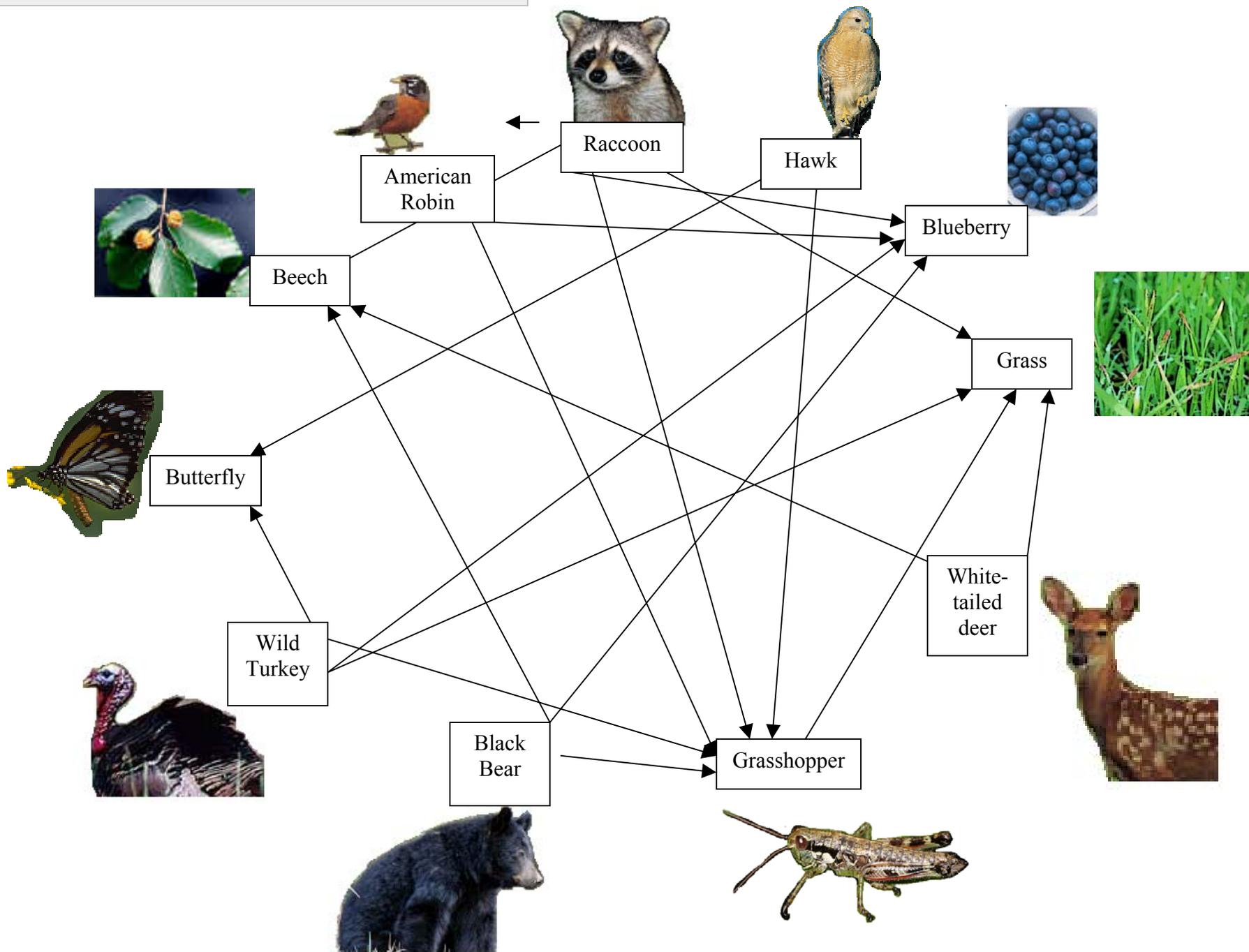
What plants, animals, and nonliving components might you see in the forest? Connections may be hard to notice at first. A group of plants and animals interacting with one another and with their physical environment is known as a *natural community*. Within the White Mountain National Forest, there are dozens of different natural communities. Changes in slope, elevation, soil type, moisture, and exposure to sunlight will influence the composition of plants and animals in an area. A forest community is highly complex, involving many interrelationships between plants and animals and their surroundings. The diagram on the following page shows just some of the many interrelationships you might find at this stop on the trail.

The forest is filled with plants of many ages, sizes, and species. **What kinds of trees are living in this forest? Are they mostly deciduous (broadleaf) or coniferous (cone-bearing) trees? What else lives in this forest besides trees? How might the other organisms in the forest affect or be affected by trees? How might animals use a tree?**

How do forests benefit humans? We use forests for recreation, wood and wood products, to see wildlife, to live in, and for food, clean water, and clean air. In the White Mountain National Forest, foresters manage for a wide range of objectives, including forest health, wildlife habitat protection and improvement, timber harvest, recreation, and harvest of non-timber forest products. *Foresters* are the professionals who manage and care for forests by creating forest management plans. The foresters work with *loggers*, who cut trees based on the management plan. Predict what might happen if a forester managed a forest by studying only one tree.

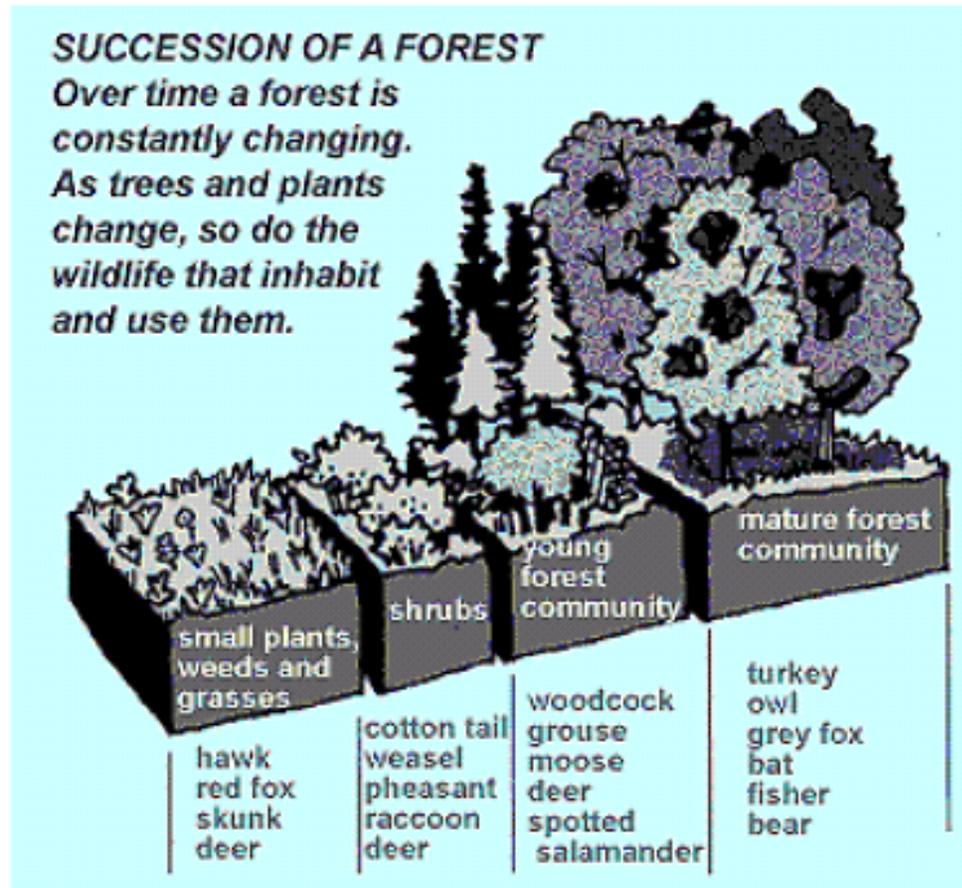
As you walk along the trail, you will pass through many different forest stands. Pay careful attention to the forests, exploring the connections between the living and nonliving pieces of the ecosystem and looking for signs of *forest management* (i.e. cut stumps and paint blazes on trees.)

1. The Web of Life: Forest Ecosystems (cont.)



☀ 2. The Forest: Where Change is the Only Constant (cont.)

Over time, a forest will change from having one set of species to another. This process is called *succession*. Forests are constantly changing, whether it's the simple change of day to night or season to seasons, or the larger changes created by windstorms, fires, and timber harvest. As you walk through the forest, you will notice different stages of succession along the trail.



(Reprinted with permission, NH Project Learning Tree,
Educator's Guide to NH Forests, 2000.)

3. One, Two... Tree By Tree

- *Humans are involved in the management and conservation of natural resources.*
- *Plants are physiological systems that are responsible for growth and reproduction.*
- *Ecosystems are composed of many interrelationships.*

Forestry is an art as well as a science. In practicing this art, foresters develop unique management recommendations for the **forest**, based on scientific research and best management practices. The three steps for sustainable **forest management**, practiced by the White Mountain National Forest, include 1) Research forest ecology, 2) Establish management objectives, 3) Determine and implement management practices.

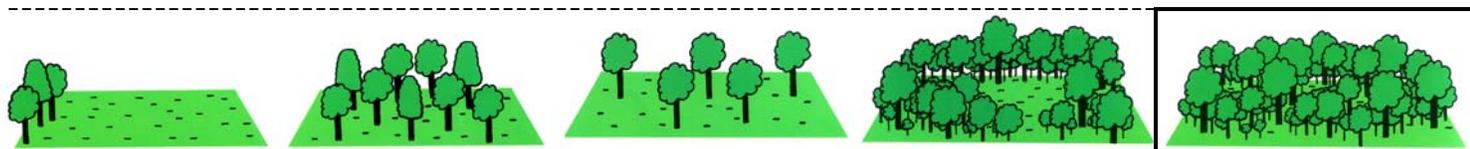
In the case of public lands such as the White Mountain National Forest, **foresters** also consider public needs and values. At this site, **loggers** have cut down several individual trees, rather than large groups of trees. This management technique is called **single-tree selection**, a form of **uneven-aged management** in which the forest maintains a multi-age, multi-layer community.

Single-tree selection:

- Copies what happens in nature when one tree dies and falls down.
- Maintains existing wildlife habitat.
- Doesn't change the environment as much as other methods
- Favors the regeneration of **shade-tolerant** species like sugar maple and beech, because little additional sunlight reaches the understory and forest floor.
- Discourages sun-loving, **shade-intolerant** trees such as paper birch and white pine.
- As trees age and die, or as openings form from disturbances like wind, ice, insect damage, and harvesting, **succession** begins anew.

Investigate the structure of the forest. **How many layers are present?** (canopy, understory, shrub, grasses) A forest is like an apartment building – it has many “floors” or layers, ranging from the forest floor, to the grasses and flowers, to shrubs, to the understory, and canopy. The picture on the following page clearly shows the layers in the forest.

Different plants and animals find food, water, sunlight and shelter in these layers, and can live on different levels at different times in their lives. A maple seed, for example, starts out on the first floor and grows through the layers until it reaches the canopy. A bear lives much of its life on the first floor, rooting for grubs and insects, but eats grass and other low plants, forages for berries, and climbs to the canopy to eat beech nuts, black cherries, mountain ask berries, and acorns. It spends the winter sleeping in the hollows created by upturned root balls and or in downed logs and fallen trees. This information is critical for foresters, who are trying to maintain the forest community. To maintain or improve bear **habitat**, for example, foresters need to consider several forest layers.



3. One, Two... Tree By Tree (cont.)



- ← Canopy
- ← Understory
- ← Shrub
- ← Herbaceous/grassy
- ← Forest floor

The Old Railroad

Between Panels 3 and 4, in the woods on your left, look for a raised berm running roughly parallel to the trail. This is what remains of a railroad bed used more than a century ago to carry logs from the forests to the local mills. J.E. Henry built this railroad system in 1892. With more than 50 miles of track, this network was the largest of more than twenty such railroad logging systems in the Northeast. Train cars carried the logs to the sawmill and pulp mill in Lincoln, NH.



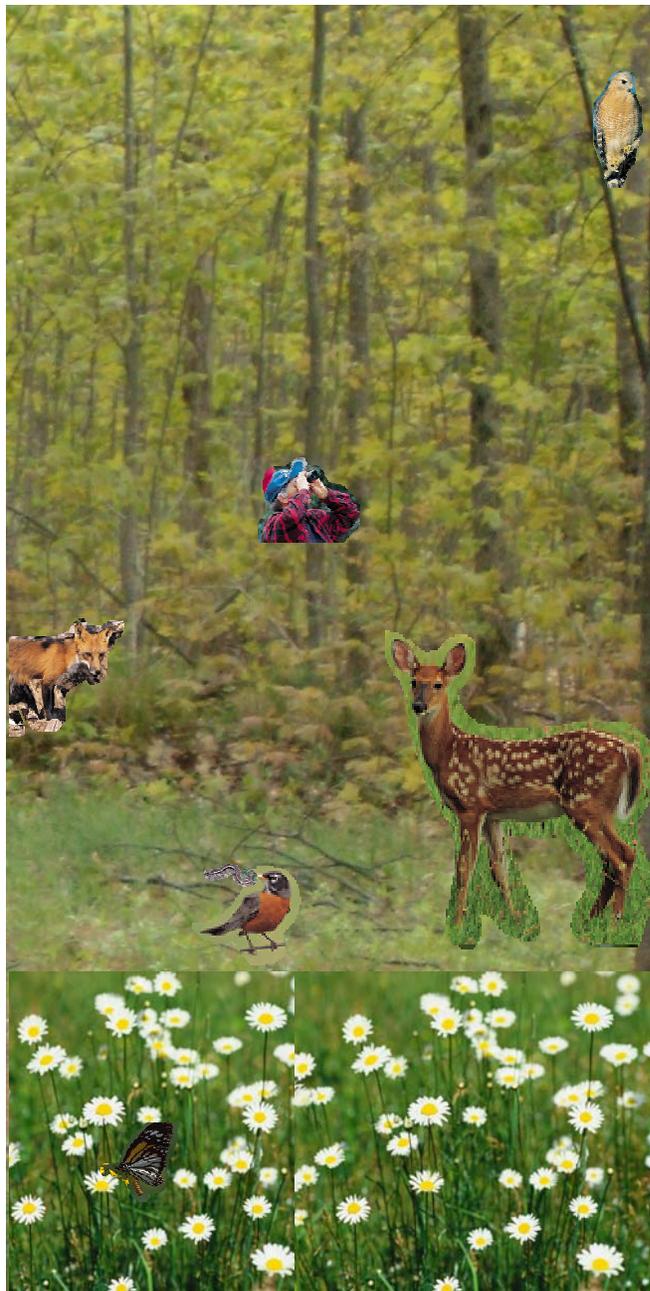
4. Fields in the Forest: Wildlife Openings

- *Ecosystems are composed of many interrelationships.*
- *Humans are involved in the management and conservation of natural resources.*

What are some animals that might use this site? How they could use it? In this sunny opening, sun-loving, *shade-intolerant* grasses, berry bushes, and aspen and paper birch saplings thrive. This creates food sources different from those in mature hardwood forests. In addition, any edge between two *habitats* (in this case, forest and field) is especially diverse because, in addition to those animals that require forest habitat and those that require field habitat, this area attracts those that use both habitats. For example, bluebirds nest in tree holes at the forest edge, but hunt for insects in the clearing itself.

The different plant species that thrive in open areas, particularly berry bushes and grasses, are important food sources for wildlife. Deer, grouse, rabbits, rodents, and moose would find browse (food) material here. Animals that feed on meadow insects, like bluebirds and swallows, will also forage here.

Foresters may choose to maintain this area as a *permanent forest opening* by mowing the grass (mechanical clearing) or by using prescribed burning (the planned application of fire to a forest, stand, prairie, or slash pile, with the intent to confine the burning to a predetermined area) to keep plants and trees from growing tall and shading the area. If left alone, *succession* will occur and *shade-tolerant* trees will gradually replace the sun-loving, shade-intolerant plants currently growing on the site.



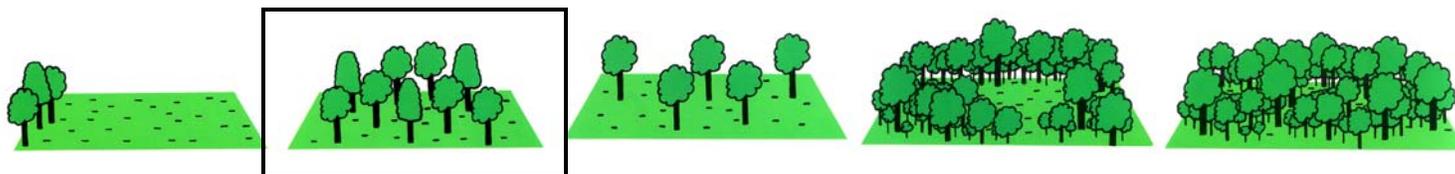
5. The Sheltering Woods

- *Humans are involved in the management and conservation of natural resources.*
- *Plants are physiological systems that are responsible for growth and reproduction.*
- *Ecosystems are composed of many interrelationships.*

What is different about this site? Small groups of trees have been cut down. To create these small openings, *foresters* copied what happens during a natural disturbance such as a windstorm or forest fire, in which small patches of trees fall down, leaving a few sturdy ones still standing.

What are some benefits and drawbacks of cutting small groups of trees, compared to single trees? As the panel suggests, one good reason for performing a *shelterwood cut* is to promote vigorous growth among the trees that are left standing. By the time the remaining trees are cut in 10-15 years, they will have added inches to their diameter, increasing their value as timber. In the meantime, the strong trees left standing serve as seed trees, providing seeds for the next generation of trees on that site. This is a form of *even-aged management*.

Do you expect the species of plants and animals to be the same as at the previous site? To be different? Why do you think the composition of species here is the same or different as the previous site? Listen to the sounds of the forest. What do you hear? How do the sounds here compare to the sounds in the last site? Can you find any other signs that support their conclusions about the plants and animals that are here?

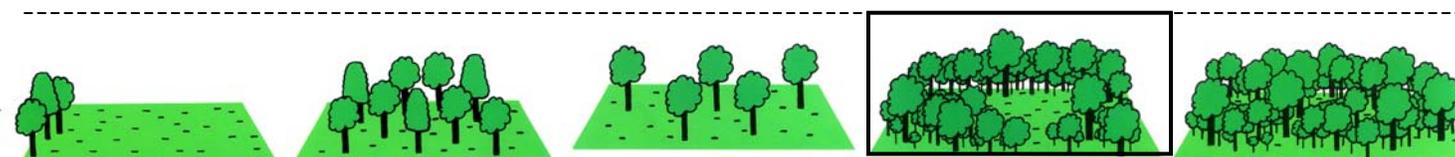


6. Patches of Sunlight Spark New Growth

- *Humans are involved in the management and conservation of natural resources.*
- *Ecosystems are composed of many interrelationships.*

Compare this site to the previous site. The sites are similar, in that small groups of trees have been cut, leaving other patches standing. This method of cutting, called a *small group selection harvest*, is often used when the goal of cutting the trees is to use them for timber, or to create a wide range of wildlife habitat in the area.

How might the process of succession (change over time) affect this site? As the patches of clearing at this site grow in, they will provide a wide range of older trees and younger growth. This is called *uneven-aged management*. Foresters have chosen small group selection harvest deliberately to create this multi-layered forest mosaic, a biologically diverse environment that provides rich *habitat* throughout the forest layers.



7. A Fresh Start

- *Humans are involved in the management and conservation of natural resources.*
- *Plants are physiological systems that are responsible for growth and reproduction.*

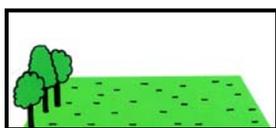
This is a **clearcut**, a large area in which virtually all of the trees have been removed. Each management practice you have seen so far has involved clearing trees in varying configurations and numbers. At a few sites, you've seen small group selections in which all trees in the treatment area were removed, as they have been in this clearcut. It is the size of the area treated that determines whether it's considered a group selection or a clearcut. The Forest Service defines a clearcut as a clearing of at least 10 acres (approximately the size of 10 football fields.) This harvest area is approximately 5 acres; it gives a sense of how a clearcut area would look and feel.

A clearcut not only generates a larger volume of timber than a selection cut, but also encourages reproduction of different species. This is a form of **even-aged management**, as the new trees will all be about the same age, even though size may vary with growth rate.

Shade-intolerant, sun-loving species such as aspen and white birch will grow in this wide-open clearcut, whereas the small group selection area will favor the regeneration of more **shade-tolerant** species, because of the shade provided by remaining trees. **What do you see growing on the ground in the clearcut area?** There are beech saplings sprouting from beech stumps, as well as plenty of pin cherry saplings, grasses, and other plants.) All of the trees in this area were cut down in 2001. In the years since then, the seeds that were in the soil have grown into small plants and trees. Left alone, this area will eventually grow in like the other areas of forest that we have walked through. Remind students that the soil is full of seeds from the trees that were standing here. (Pin cherry seeds can last up to 100 years in the soil!) After a disturbance, forestland in the White Mountains will naturally spring back to life, growing roughly 20,000 new trees in an area the size of a football field.



2006 Picture



Bear Tree

As the trail curves through the lower part of the clearcut, you'll pass a tall, lone beech on your right. Be sure to take a close look. **What is special about this tree?** This tree is full of animal signs! The curved row of black dots on the tree trunk are the marks from a black bear's claws. The bear climbed this tree to get to the top and eat the beech nuts. **Why might a forester leave this tree standing?** When creating clearcuts, foresters try to leave trees that are used for nesting cavities, or trees that hawks and owls use as perches. In this case, the tree was left standing because black bears regularly use it as a food source. **Do you notice any other bear trees around?**



8. Forest Roads: Where Do They Lead?

– *Humans are involved in the management and conservation of natural resources.*

Can you spot the grown-over forest road near the panel? This road, last used in 1971, was used to get logging equipment in and out of the forest. It has been left alone to grow back. In managing a forest, *foresters* decide where to place roads to access logging sites. They also decide which roads to leave open and intact after the logging operation is over, and which roads to close.

Foresters may choose to maintain a road to increase opportunities for hiking and skiing in an area where they have constructed logging roads, or because they plan to harvest the area again in the next 10-15 years. Roads left in place will require maintenance; foresters must consider these costs. For these reasons, sometimes roads will be torn up with heavy equipment to rehabilitate the roaded area to its pre-logging condition.

Foresters consider wildlife needs in assessing where they create roads and whether the roads will be temporary or maintained permanently as part of the a forest management infrastructure. If continually used, however, roads can create a barrier to travel for some animal species, can increase wildlife mortality due to increase hunting pressure, and can increase human disturbance to sensitive wildlife species. Abandoned roads, on the other hand, are used by wildlife as corridors from one habitat to another.



9. The Old Timers: Nature's Hardwood Forests

- *Humans are involved in the management and conservation of natural resources.*
- *Ecosystems are composed of many interrelationships.*

Choosing to allow natural processes to dominate the landscape is a strategy that *foresters* use to provide a sense of solitude and wildness to humans while maintaining the forest community's health. Such forests provide important *habitat* for animal species that require undisturbed, mature forest. **What do you notice about this forest? What is the same? What is different? Do you think it is the same age as the other forest areas?**

This forest has not had any harvests or cuts since the late 1800's. Instead, the trees were allowed to grow older and *succession* occurred. This area will continue to mature into a climax northern hardwood forest community, dominated by sugar maple, beech and yellow birch. Natural forest disturbances (death of individual trees, insect attacks, blow downs, etc.) occur periodically, creating openings that return the disturbed site to a different successional stage. This will maintain a mix of young and old forest.

Listen to the sounds of the forest. **What do you hear? Are the sounds the same as in previous sites? What animal signs do you notice?** Some of the animals that live in this area include red-shouldered hawk, barred owl, pileated woodpecker, ovenbird, and other birds that prefer undisturbed forest-interior sites. The dead standing trees are called snags. Snags provide homes to over 60 different species of birds and other animals. The fallen logs on the ground also provide important habitat to animals. These animals, like salamanders, porcupines, and mice, find homes, food, and shelter within the logs. Over time, the logs will also break down into soil.

The pictures on the next page show some animals you may find in this type of forest, and the signs they may leave behind. Remember that you might not always see the animal itself, but nests, tracks, and other signs show that an animal has been there.

9. The Old Timers: Nature's Hardwood Forests (cont.)



**Spruce grouse
& track**



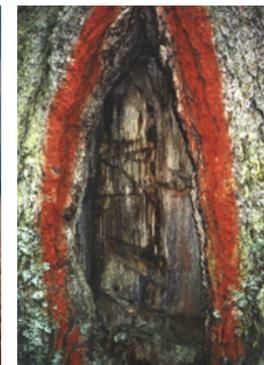
**Downy Woodpecker
& Nest**



**Fisher
& track**



Human & blazed tree. (marking trail)



**Porcupine
& track**



**Wood thrush
& nest**

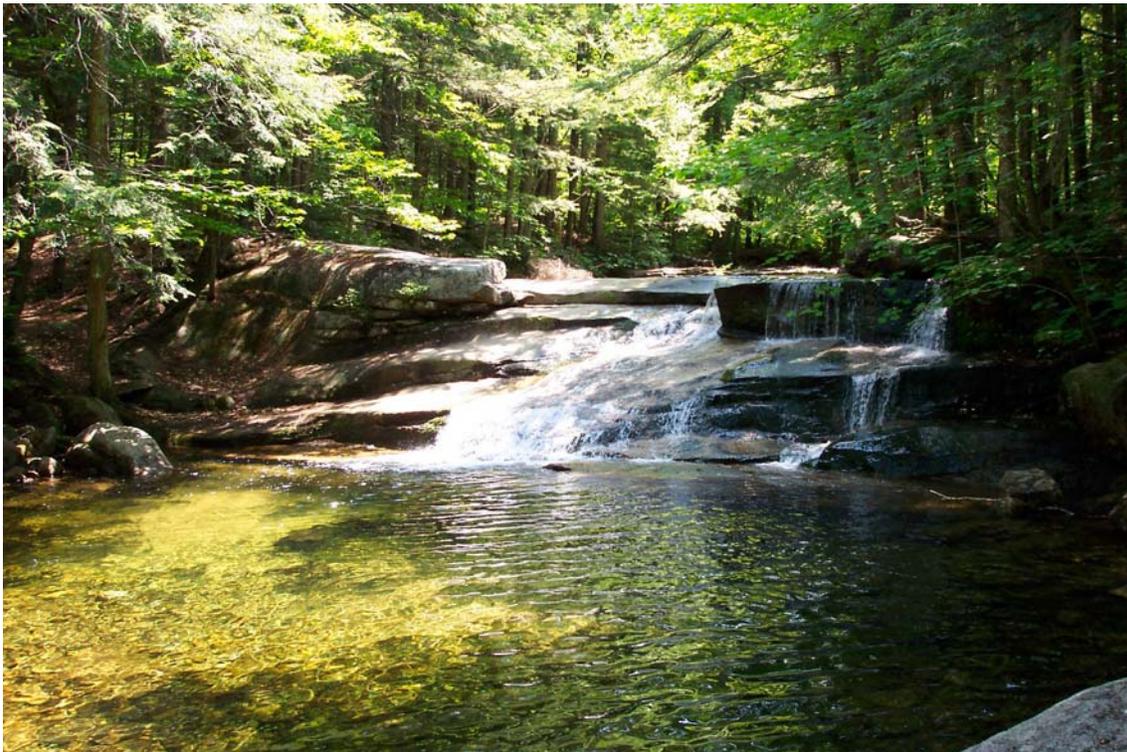


10. Stream banks and Salamanders: The Riparian Zone

- *Ecosystems are composed of many interrelationships.*
- *Humans are involved in the management and conservation of natural resources.*

Forest streams, like this one, are an excellent example of systems working together within a forest. Streams like this one are for the forest community what arteries are for your body, delivering clear, clean, highly oxygenated water for both aquatic (water-dwelling) and terrestrial (land-dwelling) animals. Up to 90% of all animals in the forest come to streambanks like this in search of food, water, and shelter. Plants and trees growing along the sides of a stream are called **vegetation buffers**. **What are some ways that a buffer could benefit the stream and the organisms that live in it?** Buffers shade the water, preventing temperature fluctuations that can harm aquatic animals, many of which cannot tolerate the high water temperatures that occur in unshaded streams. Roots of buffer plants soak up runoff during storms, preventing silt from entering the stream and making it difficult for aquatic animals to breathe (much like heavy smog makes it difficult for people to breathe.) The roots also hold the banks in place so they don't erode during heavy rains or runoff.

It is important for *foresters* to understand stream ecology as well as forest ecology. The USDA Forest Service is the largest forest research organization in the world. Their research has provided the scientific basis upon which many forest management practices have evolved. In the past, the Forest Service kept streams like this free from fallen logs and debris, believing that to be the best management practice for the stream. Now, they understand that natural debris such as logs and branches forms critical habitat for aquatic insects and fish, maintains lower water temperatures critical to many species, and filters and holds sediment, keeping water clear. Managers will sometimes even anchor natural debris in streams to improve habitat!



11. Openings in the Forest

- *Humans are involved in the management and conservation of natural resources.*
- *Ecosystems are composed of many interrelationships.*

This site is another example of a ***small group selection harvest***, a form of ***uneven-aged management*** in which small patches of trees were taken down in an area. These openings were created by humans, but small openings in the forest can be caused by windstorms, lightning strikes, or attacks by insects. **Why might foresters and loggers have left the branches of harvested trees scattered in the harvest area?** (Branches decompose and return nutrients to the soil, while providing cover for small animals.)

What kind of trees do you notice at this site? The majority of trees here are conifers. Because the openings in the forest are so small, very little sun gets down to the forest floor. This means that only ***shade-tolerant*** plants will grow here.

