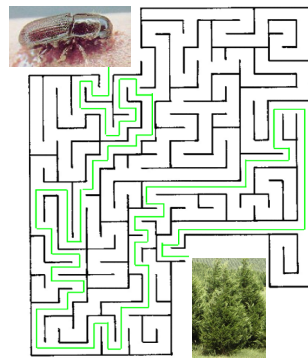


Forestry in the Classroom Series

Use the word key below to find the hidden glossary terms in the puzzle. Look up any words you don't know in a dictionary to find their meaning.

s	n	b	r	c	g	t	y	n	b	n	n	f	r	y	r	d	c	x	z
a	l	o	n	e	i	y	o	u	j	t	r	p	e	t	t	e	y	s	s
u	d	d	i	m	h	n	p	t	e	a	k	p	t	i	j	f	a	s	p
y	a	e	b	t	n	t	s	s	g	s	u	w	e	d	n	o	m	a	e
b	l	e	l	a	a	i	a	m	y	r	u	f	m	i	x	r	i	p	x
e	r	l	t	g	t	t	e	e	d	x	h	o	o	m	g	e	g	m	t
r	n	i	o	n	i	n	s	l	w	y	k	r	r	u	r	s	r	o	z
q	v	i	e	o	t	d	a	e	o	d	l	e	h	h	a	t	a	c	y
e	x	i	p	a	w	r	p	g	r	z	q	s	c	g	z	a	t	a	b
s	c	u	t	h	e	r	n	t	l	o	i	t	y	x	i	t	i	r	o
s	p	i	s	m	h	t	o	m	h	l	f	v	s	f	n	i	o	c	r
x	o	a	e	e	l	t	e	e	b	e	d	f	p	t	g	o	n	i	e
n	d	t	e	m	p	e	r	a	t	u	r	e	a	y	d	n	f	e	r
k	u	d	z	u	m	u	t	y	e	h	a	m	v	r	g	o	r	e	k
n	o	i	t	a	t	s	e	r	o	f	e	r	o	i	m	o	h	i	s
r	v	s	w	s	e	r	i	f	d	l	i	w	t	m	s	i	i	z	e
w	e	i	i	e	s	e	i	c	e	p	s	n	b	i	e	a	n	d	r
e	n	o	r	h	e	m	l	o	c	k	i	f	o	r	g	t	v	g	i
d	m	b	h	g	m	o	r	w	k	o	q	n	z	l	n	y	e	n	f
f	l	h	c	r	a	e	s	e	r	l	q	b	d	m	t	f	m	r	i

adelgid • afforestation • ash • beetle • borer • compass • deforestation • dew • emerald
erosion • farming • fires • forest • fragmentation • grazing • hemlock • humidity • invasive •
kudzu • migration • moisture • moth • nonnative • pine • psychrometer • reestablish
reforestation • research • scientist • species • temperature • thermometer • timber
wildfires • wind • weather



Forest Health



What is Forest Health?

There are many variables that determine the health of a forest. Variables that include the climate of an area, its elevation, its population, any recent logging, any grazing on the land, any mining sites in the area, and whether the land is privately or publicly owned.

The changes that place the most stress on a forest are the ones caused by human activity. This includes things like how many people are living in an area, how much of the land is built up with homes and businesses, and how much of the land is used for cattle grazing. Change is a normal part of the natural environment, but natural change usually takes a long time to occur, and the environment has time to adapt to the changes. When people make changes to the natural environment, the change is usually faster. If the environment does not have time to adapt to changes, it might become more stressed.

There are three main human pressures on forests that continue to reduce forest cover: deforestation, forest fires, and fragmentation. These activities can affect the types and amount of wildlife, the cleanliness of the water, and whether there are a lot of different types of plants growing in an area.



Deforestation

The permanent removal of trees from a forested area can result from a variety of causes. Human activities that directly contribute to deforestation include cutting down trees to convert forest land to agricultural croplands or grazing lands, clearing the forests to make way for development, and flooding land for hydroelectric development.



In many regions of the world, conditions such as poverty, joblessness, and an unequal distribution of land can lead to deforestation. These conditions may force landless farmers to clear forests for farming or grazing because they have no other way to make a living. Other activities indirectly lead to deforestation, including warfare, pollution, and human-caused global climate change.

In addition to human activities that reduce forest cover, humans may plant trees to increase forests. Reforestation is when people plant trees or tree seeds in an area where the forest was previously removed or burned. People may decide to reforest an area for commercial purposes, such as a plantation for forest products, or they may want to reestablish the natural forest environment for recreation or noncommercial purposes. The Tijuca Forest in Rio de Janeiro, Brazil, is the largest urban forest in the world and was reforested in the 1800s when erosion threatened the city after the forest was cut for coffee plantations.



When people plant forests in areas where there were no forests previously, that process is called afforestation. Uruguay is one country that has an extensive afforestation program. With the goal of replacing unprofitable farming and livestock grazing on poor soils with profitable forests, those afforested plantations provide timber, pulpwood (for paper), and fuel wood. Afforestation usually requires major human intervention and management.

Insects & Diseases

The forests of Kentucky are a diverse and beautiful ecosystem, dominated by two main forest types: oak/hickory and oak/pine. Even though hardwood species dominate in the state, (including walnut, oak, maple, cherry, hickory and yellow-poplar), there are considerably large areas of natural and commercial pine forests across the state. Common pine species include Virginia, pitch, loblolly and eastern white pine.

One of the most recent threats to Kentucky's rural and urban forests is the Emerald Ash Borer (EAB). This insect was recently discovered in October 2009 in 11 counties. The EAB feeds only on ash trees. Larvae make galleries in the inner bark and outer sapwood, girdling and often killing the tree within two to three years of infestation. Adult beetles are about 1/4" to 1/2" long. The body is brassy-green, with darker, metallic, emerald green wing covers. Females begin depositing eggs on bark in May or June. When the eggs hatch the larvae chew through the bark into the cambium. Adults emerge in Spring through D-shaped exit holes that are 3 to 4 mm in diameter (about the diameter of a cell phone charging cord).



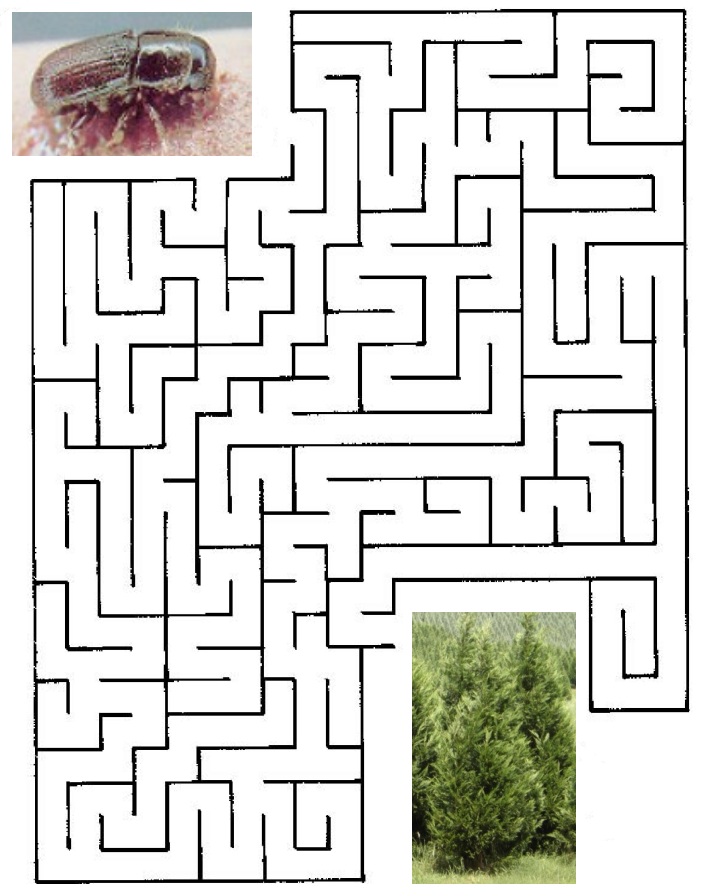
The gypsy moth is one of the most important insect pests in the Northeast. It causes widespread defoliation, often of the entire tree. Gypsy moth larvae are sometimes confused with tent caterpillars or fall webworms because they are all "hairy": but each has distinct color patterns to help you identify them.



Older larvae are brownish-gray, with tufts of hair on each segment and a double row of five pairs of blue spots, followed by six

pairs of red spots, on the back. Mature larvae are from 1 1/2" to 2 1/2" long. Adult male moths are dark brown, with wavy dark bands across the forewings. Female moths are white and cannot fly. Females deposit egg masses on sheltered spaces like under rocks and on tree trunks, houses, picnic tables, campers, mobile homes, and cars. Gypsy Moths will attack just about any tree but prefer hardwoods.

In the forests of the southern Appalachian mountains, eastern hemlock trees grow near mountain streams. Hemlock trees are now threatened by a nonnative invasive insect called the Hemlock Woolly Adelgid. The Hemlock Woolly Adelgid was accidentally brought on ships from Asia to the Northwestern United States in 1924. It has been spreading ever since. This insect's larva feed at the base of hemlock needles, eating sugars stored in the twigs where the needles are attached. In the third year after being attacked by the adelgid, the hemlock tree begins to die.



Invasive Species

What is an Invasive Plant Species?

An "invasive species" is defined as a species that is Non-native (or alien) to the ecosystem under consideration; and, whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Why are invasive plants successful? Many invasive plant species produce large quantities of seeds. The seeds are often distributed by birds, wind, or humans. Some invasives have aggressive root systems that spread long distances from a single plant. These root systems often grow so densely that they smother the root systems of surrounding vegetation. Some plant species produce chemicals in their leaves or root systems which inhibit the growth of other plants around them.

What are the impacts of invasive plant species? Invasive species compete directly with native species for moisture, sunlight, nutrients, and space. Establishment and spread of invasive species can degrade wildlife habitat. Invasive species have contributed to the decline of 42% of U.S. endangered and threatened species. The Chief of the USDA Forest Service has identified invasive species as one of the four critical threats to our Nation's Forests and Grasslands.

Here are a few things that you can do to fight invasive plants and preserve the plant species native to your region:

- Don't pick the flowers of noxious weeds and take them home.
- Don't pick and transport wild flowers that you can't identify.
- Do not camp or drive in weed infested areas.

You can find out more at invasivespeciesinfo.gov.

Ad-libbed Aliens

How many of you have played Mad Libs®? You might remember that you have to list nouns, verbs, adjectives, adverbs, and other words without knowing how they will be used. When we insert these random words into the blanks of a story, the results can be weird, funny, or just plain silly! Try your hand at it.

The Great Cover-up

The other day, _____ stepped out of the house for some fresh air. _____ was tired, so he/she stretched out under a/an _____ tree to rest. He/She fell into a deep sleep just like that old guy in the story named _____. He/she slept like a _____ for _____ weeks. When _____ awoke, he/she could not move a _____ Vines wrapped around _____'s _____ and _____. Above his/her head, _____ saw _____ flowers in the dim light. The tree was gone and so was his/her _____ house. Was this a dream?

Truth is stranger than fiction!

Kudzu is a vine from eastern Asia. The Japanese government introduced the plant to Americans at a Centennial Exposition in 1876. Its abundant vegetation and sweet-smelling flowers made it a popular ornamental plant. Our government promoted it as a plant to feed livestock and to help control soil erosion, but it quickly escaped and took over!

Kudzu can grow up to 12 inches in one day. It grows right up telephone poles and tree trunks. Kudzu covers the landscape and smothers every other plant in its path. Other plants simply can't grow, because kudzu grows so thick that it blocks the sun. When the native plants die, the animals that depended on them can't find the food and shelter that they need to survive. Just like in the story, kudzu is taking over the landscape!

Fragmentation

Construction, such as roads and housing developments, fragments forests into smaller blocks of habitat. This fragmentation diminishes species diversity because it creates different habitat conditions along the edges of the smaller blocks. For example, there may be less moisture and more sunlight and wind near the edges, making it hard for certain plant and animal species to survive and more difficult for animals to find food or shelter. Fragmentation may also block migration routes and open new areas for invasion by nonnative species. In addition, roads provide easier access into the forest for hunting, wood gathering, land clearing, and other activities that alter the forest ecosystem.

Forest For The Birds

Birds are one of the first species impacted by forest fragmentation. In the following activity, role-play each of the scenarios, and consider what might happen to you, as a bird, if each one actually occurs.

Before you begin each scenario, place one token (a scrap of paper, a penny, etc.) on a tree in the landscape for each bird species. You should start each scenario with 12 tokens on the board.

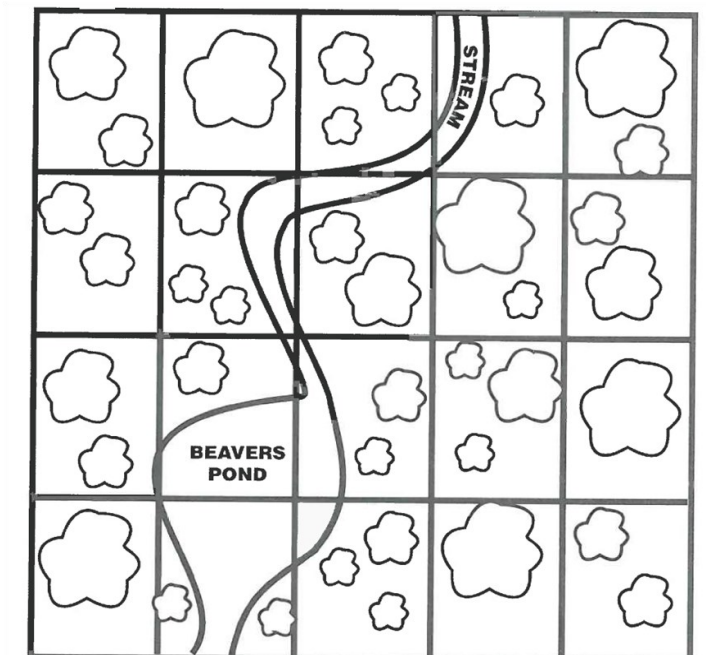
Scenario 1: A new suburban town has just been developed. 8 sections of forest were cut to develop this town. (Mark through 8 sections from the forest. Remove the birds that were in these sections.) This new development has opened many new areas for the Brown-headed Cowbird to feed. A female Cowbird flies into the forest and lays its eggs in the nests of Warbling Vireos. The Cowbird hatches first. When the Vireo eggs hatch they are pushed out of

the nest. (If you are a Warbling Vireo, your breeding was unsuccessful. Remove the Vireo.) How will this affect the numbers of Warbling Vireos inhabiting this forest in the future? What do you think eventually happened to the birds that had to leave the forest?

Scenario 2: Bird watching is one of Jesse and Trina's favorite hobbies. This spring when Jesse and Trina arrive at the forest, they notice that a large part of the forest had been cleared for a new development. 8 sections of forest were cut for this development. (Mark through 8 sections from the forest. The birds that were in these sections must move over into the remaining sections.) They also notice that they could not find any of their favorite birds of prey. They meet a wildlife biologist. She explains that clearing the land for the development caused many small mammals to leave. Because there are fewer small mammals, the birds of prey left to find more food. (If you are a Cooper's Hawk, Great Horned Owl, or Long-eared Owl, you can not find food and must leave the forest.)

Why do you think the hawk and the owls left the forest? What happened to the birds that had to move to another place in the forest?

List of Birds: Cooper's Hawk, Great Horned Owl, Wood Duck, Long-eared Owl, Pileated Woodpecker, Wood Thrush, Hairy Woodpecker, Black-capped Chickadee, White-Breasted Nuthatch, Wood Thrush, Brown Creeper, Warbling Vireo, Yellow-Throated Warbler



Forest Fires and Weather

Wildfires can be a threat to the health and safety of people and animals. Wildfires might be started by mistake, as when people are not careful with campfires or with matches. Wildfires may also be started by lightning or by other natural means during dry weather. Most people know that weeks of dry weather will increase the danger of a wildfire. Whether a wildfire spreads may also depend on the weather that occurs each day. If the weather on some days is more likely to help a wildfire to spread, people should be extra careful with matches or with fire during those days.



When air temperature is high and the amount of water in the air is low, large or dangerous wildfires are more likely to burn. Of these three measurements, dew point depression is the single best measurement to use when trying to predict wildfires. When dew point depression is low, there is a lot of water in the air, and wild-fires are not as likely to burn. When dew point depression is high, there is little moisture in the air and a wildfire is more likely to become large or dangerous.

Is it important to be able to predict on which days a wildfire might burn? Why or why not?

You can read all about Dr. Potter and his research in the article *Dew It!* in volume 4, number 1 of the Natural Inquirer. The Natural Inquirer is a middle school science education journal! Each article tells you about scientific research conducted by scientists in the USDA Forest Service.

All of the research in this journal is concerned with nature, trees, wildlife, insects, outdoor activities and water. First students will "meet the scientists" who conduct the research. Then students read special information about science, and then about the environment. Students will also read about a specific research project, written in a way that scientists write when publishing their research in journals. Students become scientists when they do the Discovery FACTivity, learning vocabulary words that help in understanding articles.

At the end of each section of Natural Inquirer articles, students will find a few questions to help think about the research. These questions are not a test! They are intended to help students think more about research & can be used for class discussions.

Check out all of the Natural Inquirer journals at www.naturalinquirer.org.

Air temperature, humidity, and wind affect the spread of a wildfire. A wildfire can generate its own wind, thus helping to spread itself. When the air above a flame gets heated, it rises. When it rises, fresh air rushes in to fill the vacuum. The fresh air provides a new source of oxygen for the fire. Thus, if fuels are available and there is a lack of moisture in the air, a wildfire can continue to spread in part by creating its own wind.

Dr. Potter, a scientist, helped determine which daily weather conditions are most related to forest wildfires. His research showed that air temperature, relative humidity, and dew point depression were the three weather measurements most associated with wildfires. Dew point depression is the air temperature minus the dew point temperature. The dew point temperature is the air temperature at which the air is saturated with water.

Let's Experiment

In this FACTivity, you will determine the air's dew point temperature. Dew point is the point at which the air, at a given temperature, can hold no more moisture. The question you will answer is: What happens when the air can hold no more moisture?

For this activity, you will need a cleaned-out vegetable can, filled three-quarters high with water, a thermometer, a spoon, ice, paper, and a pencil.

Let the vegetable can filled with water sit for a few hours outside in the shade. It should reach air temperature before you continue. Using the thermometer, measure the air temperature in the shade and record the air temperature on the graph.

Next, hold the thermometer against the outside of the can so you can measure the temperature of the air immediately outside of the can. Put some ice into the water and stir. The dew point of the air surrounding the can is the temperature registered on the thermometer when the first sign of moisture appears on the outside surface of the can. Record the temperature at dew point.

What has happened? The ice has caused the air immediately surrounding the can to cool. As the air cools, it absorbs moisture which you cannot see until it can hold no more moisture. Now calculate the dew point depression (Air temperature minus dew point).

If the air temperature and the dew point are far apart, the air is dry and the relative humidity is low. This is when wildfires have a better chance to occur.

Supplies needed:

- vegetable can
- water
- thermometer
- spoon
- ice
- paper
- pencil

Weather reports often give the air's dew point temperature. Knowing the dew point will help you to determine whether dew or fog is likely to occur.

Keep a record for several days to see how the Dew Point Depression changes. Try to take the readings at the same time of day.

	Air Temp in Shade	-	Dew Point Temp.	=	Dew Point Depression
Day 1		-		=	
Day 2		-		=	
Day 3		-		=	
Day 4		-		=	
Day 5		-		=	
Day 6		-		=	
Day 7		-		=	

Firefighters use fire weather kits to monitor wind direction, wind speed, and relative humidity, the 3 critical weather patterns that help them determine suppression tactics and strategies.



The core tools in a fire weather instrument kit are:

- a wind meter that measures the wind in MPH,
- a compass to calculate wind direction and fire location,
- a sling psychrometer & slide rule to calculate relative humidity, and
- a notebook and pencil to record weather measurements and related data such as location, exposure (ridgetop, slope), vegetation density, elevation, aspect, and cloud cover.