The Ecology House

A Mountain Classroom Pre-Trip Curriculum Lesson Plan
Lesson: The Ecology House

Introduce the basics of ecology to your students through the lens of the “Ecology House” - an analogy that will help students discover that ecosystems, while functioning as cohesive units, have components that influence and rely upon each other.

Objectives

Students will be introduced to the “Ecology House” and the four basic components that make up ecosystems — abiotic factors, biotic factors, cycles, and changes.

Students will become familiar with common examples of each component in the ecosystem.

Students will apply their new knowledge of the “Ecology House” to a local ecosystem example by reading supplemental articles.

Vocabulary

Ecology: The study of how living (biotic) and nonliving (abiotic) parts of the environment interact with each other.

Ecosystem: A system formed by the interaction of a community of organisms and their physical environment.

Abiotic: Non-living factors in the environment. The abiotic factors of the environment include light, temperature, soil, climate, and atmospheric gases.

Biotic: Living factors in the environment.

Cycle: A natural process in which elements are continuously moved in various forms between different components of the environment. Examples include the energy, water, rock, and nutrient cycles.

Changes: Differences or disturbances of the environment most often caused by human influences and natural ecological processes. Environmental changes include natural disasters, human interferences, or animal interaction.

Preparation

Print and cut out the Ecology House Relay Cards.

Find an open area (preferably outdoors) where all of your students have enough space to spread out, and you will have approx. 10-15 ft. to facilitate the relay.

Accommodations

If there is a student who cannot participate in the relay due to disability or illness, you could facilitate the relay as a matching game, where students must work together to match the example pictures with the correct vocabulary terms.
Instructions:

1. Explain to the students they will be learning about ecology and the components of an ecosystem.
   a. Ecology is the study of how living (biotic) and nonliving (abiotic) parts of the environment interact with each other. The suffix “-ology”, or logos in ancient Greek means “the study of.” Examples of other “-ology” studies include biology (the study of life), geology (the study the earth), etc. The term ecology is derived from Greek terms oikos (inhabited home) and logos (the study of), simply translated—ecology is the study of the home.
   b. Organisms interact with other organisms and their physical environments in their ecosystem, similar to how students might interact with the space in which they live and with the inhabitants.

2. Explain to students they will be thinking of the study of ecology and ecosystems using the analogy (comparison of two things for the purpose of explanation or clarification) of the home. Introduce the “Ecology House”, depicted here. It will be helpful for students to visualize if you have the house drawn ahead of time and add the different components as you cover them.
   a. The two main components represent the two different categories of factors within an ecosystem—abiotic and biotic components.
      ⇒ Ask the students to brainstorm what abiotic and biotic factors they interact with in the space they live and have a few students share examples.
   b. The chimney of the house represents an important concept in ecology—cycles. A cycle refers to a natural process in which elements are continuously moved in various forms between different components of the environment. For example, when we burn wood in our fireplace the carbon in the wood changes forms and carbon dioxide is released into the air.
      ⇒ Ask students to think about an example of a cycle present in the place they live, and have a few students share examples. What are some examples of natural cycles that occur in the environment?
   c. Finally, the door to the house represents changes—any kind of difference or disturbance that could affect other components of the ecosystem, for example, if a visitor comes to stay with your family for a while, this would affect the house, undoubtedly, at some level.
      ⇒ Ask the students to think of examples of change and how they would affect the place they live. What are some examples of natural changes? (seasonal change, flood, logging, succession, a new species is introduced, etc.)

Note for Teachers: It is important that your students understand these vocabulary terms before moving on to the other parts of this activity. Be sure to spend the necessary time reviewing these terms before moving on.
Activity—Part II: “Ecology House” Relay

**Instructions:**

1. Explain to the students they will be doing an activity to help them better understand the components of the “Ecology House.”

2. Explain:
   - The class will be playing the “Ecology House” Relay.
   - All of the students are going to be split into two different teams—each team will get a set of the Ecology House Relay Cards.
   - Both teams will start next to one another, and one at a time, a team member will have to run to the opposite end of the playing field (signified by cones, a rope, a water bottle, etc.), complete a task, and run back to their team—tagging the next person in their lines’ hand in order for them to start.
   - The task is for each student to pick up an “Ecology House” component picture at the start of their line, run down to the end of the playing field, and match it with the correct vocabulary term it represents.
   - The winning team is the team with the most correct answers at the end of the relay race—so, while speed does matter, so does their care in placing pictures in the right place.

3. Once you’ve explained the directions to the game, split the students into two even teams and have them line up at the starting line. Once everyone is in the right place, play the game!

4. After each team has placed all of their “Ecology House” component pictures, bring the students together and go over each team’s placement of each card. If there are cards matched with the wrong vocabulary words, discuss the correct placement, or alternative options, and move on.

**Discussion Questions:**

*What does it mean to be biotic? What does it mean to be abiotic? What are some examples of each?*

*What is the relationship between abiotic and biotic factors in an ecosystem? Ask the students to provide a few examples.*

*What are a few examples of different cycles found in ecosystems? Can you think of an example, specific to your hometown?*

*What are a few examples of changes that could happen to an ecosystem? Are there any local examples you can think of?*

Activity—Part III: Local Ecosystem Discovery

This last part of the activity will have your students apply their knowledge of the components of the “Ecology House” to a local ecosystem example.

**Instructions:**

1. Choose an article for your students (included at the end of document) pertinent to your area’s ecosystem to read from the list we’ve provided below:
Boston area: Boston deploys goats against poison ivy in Hyde Park
Northern New England: Ticks devastate Maine, NH moose populations
Or, a more universal option: The importance of honeybees

2. Explain:
   - The article the students are reading is a local ecosystem example.
   - The article includes mention of all four of the components of the “Ecology House.”
   - While reading the article, students should: underline any **biotic** factors mentioned, circle any **abiotic** factors mentioned, write down 3 examples of interaction or **cycles** mentioned, and draw a picture of the **change** that occurred in the ecosystem, then record how the other components were affected.

**Discussion Questions:**

*Have students list examples of abiotic and biotic components mentioned in the article. How do these abiotic and biotic components interact with and depend on each other?*

*What cycles or interactions were mentioned in the article?*

*What was the effect of the change in the ecosystem highlighted in the article?*

**Standards**

This online curriculum introduces and covers topics incorporated into the following national standards:

<table>
<thead>
<tr>
<th>Grades 3—5:</th>
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</thead>
<tbody>
<tr>
<td><strong>3-LS4-3 Biological Evolution: Unity and Diversity:</strong> Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.</td>
</tr>
<tr>
<td><strong>5-LS2-1: Ecosystems: Interactions, Energy, and Dynamics:</strong> Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.</td>
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<thead>
<tr>
<th>Grades 6—8:</th>
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<tbody>
<tr>
<td><strong>MS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics:</strong> Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.</td>
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<tr>
<td><strong>MS-LS2-2 Ecosystems: Interactions, Energy, and Dynamics:</strong> Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.</td>
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<tr>
<td><strong>MS-LS2-3 Ecosystems: Interactions, Energy, and Dynamics:</strong> Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.</td>
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<tr>
<td><strong>MS-LS2-4 Ecosystems: Interactions, Energy, and Dynamics:</strong> Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations</td>
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**NH Science Competencies**

**All Grades:**

Energy and Matter in Systems
Systems & System Models

**References**

Activity and content adapted from curriculum designed by Nora Dufilho.
Water

Soil

Sun

Carbon Dioxide (CO₂)
Oxygen ($O_2$)

Rocks

Minerals

Maple Tree
Deer Eating

Nitrogen absorbed by plants

CO₂ released by burning fossil fuels

Seasons
Logging

Flood

Damage from Wind Storm

Invasive Species
Boston deploys goats against poison ivy in Hyde Park

By Faiz Siddiqui

GLOBE CORRESPONDENT  JULY 23, 2014

The leader, Cole, ambled up to the metal fence, and with a wide stare and what looked like a grin, began to survey his new domain.

One by one, the others followed Cole through the gate: Chester, a fellow LaMancha goat with a paintbrush-like black tail; Dalia, an Alpine with perky white ears; and Christopher, another Alpine with a long gray beard that conjured up the image of a wise man.

It was not long before all of Boston’s newest contract employees had disappeared among the tall trees and brush in Hyde Park’s West Street urban wild. Their task: Help to clear 2 acres overrun with poison ivy, buckthorn, Asiatic bittersweet, Japanese knotweed, and other invasive species growing on Parks and Recreation Department property.

Best of all for the cloven-hoofed friends, these menaces are lip-smacking delicacies.

“’It’s not only cute, but it makes really good sense,” said 27-year-old Jessica Muscaro, the project coordinator for the Hyde Park Green Team.

Department officials said it was the first time Boston has sought the help of goats for a city project. Officials say the hairy, four-legged weed whackers represent a fast, clean, and efficient way to clear the area for green space without using herbicides or loud and polluting machinery.

The four goats will live in the urban wild for eight weeks, protected by a solar-powered electric fence. People are encouraged to look, but not touch, as the poison ivy oils may stick
to the goats’ coats, even though it does not harm their digestive tracts.

Teenagers from the Hyde Park Green Team will provide water and food to supplement the goats’ diet, then begin pruning trees and building trails once the area cleared.

“Goats are an ecofriendly way to regulate overgrowth and manage pests and weeds, while giving nutrients back to the earth,” Mayor Martin J. Walsh said in a statement.

Tony Barrows, who has lived in Hyde Park for 27 years, remembered taking his young daughter to the site, alongside the Neponset River, in the 1990s. That was before the trees had been choked by the Asiatic bittersweet and the trails covered by other invasive plants.

“I’d like to see some development along the river bank where people can jog, or just sit down, read a book,” he said.

The goats will live on site at the West Street Urban Wild for eight weeks.

The $2,800 to rent the goats is being covered by grants provided to the Southwest Boston Community Development Corporation. James Cormier, owner of the Goatscaping Co. in Plympton, is providing the animals, which range from 120 to 170 pounds.
“It would be way more time-consuming for the city to come in and start chop, chop, chopping away,” he said.

The community development corporation’s assistant director, Pat Alvarez, said she came up with the idea to use goats after hearing about other cities using animals to make way for urban greenspace. Goats, sheep, llamas, and wild burros have cleared brush at O’Hare International Airport in Chicago. In Washington, D.C., goats helped clear the Congressional Cemetery in 2013.

Alvarez fondly remembered being chased around her yard by a “mean” billy goat as a child.

The four goats deployed in Boston were similarly mischievous Wednesday.

One began to chew on a Goatscaping sign dug into the dirt, prompting Cormier to yell, “Hey, don’t eat the sign!” Another, Dalia, attempted to climb a tree before giving up.

But they soon got down to business. Christopher's beard flapped against his chin as he chomped on a leafy bush. Dalia’s long ears wiggled as she chewed a dense shrub to the stem. Within an hour, small sections of foliage had been cleared.

“They’re quiet, unlike machinery,” Alvarez said. “We also think they’re going to be great ambassadors for the urban wild. Plus, they’re just fun.”

Faiz Siddiqui can be reached at faiz.siddiqui@globe.com.
The importance of honeybees

Take a look at the sheer number of plants that rely on these under-appreciated workers for pollination, and you’ll start to understand what all the fuss is about.

MARIA BOLAND
May 3, 2010, 1:23 p.m.

Honeybees pollinate more than just flowers; they’re a vital part of our agricultural cycles. (Photo: Fraubuerch/flickr)

Just how important are honeybees to the human diet? Typically, according to the U.S. Department of Agriculture, these under-appreciated workers pollinate 80 percent of our flowering crops, which constitute one-third of everything we eat. Losing them could affect not only dietary staples such as apples, broccoli, strawberries, nuts, asparagus, blueberries and cucumbers, but may threaten our beef and dairy industries if alfalfa is not available for feed. One Cornell University study estimated that honeybees annually pollinate $14 billion worth of seeds and crops in the U.S. Essentially, if honeybees disappear, they could take most of our insect pollinated plants with them, potentially reducing mankind to little more than a water diet.

Bees are of inestimable value as agents of cross-pollination, and many plants are entirely dependent on particular kinds of bees for their reproduction (such as red clover, which is pollinated by the bumblebee, and many orchids). In many cases the use of insecticides for agricultural pest control has created the unwelcome side effect of killing the bees necessary for maintaining the crop. Such environmental stresses plus several species of parasitic mites devastated honeybee populations in the United States beginning in the 1980s, making it necessary for farmers to rent bees from keepers in order to get their crops pollinated and greatly affecting the pollination of plants in the wild. In recent years commercial honeybee hives have suffered from colony collapse disorder, which, for unknown reasons, left many bee boxes empty of bees after overwintering. Bee venom has also been found to have medicinal properties, used for treating arthritis, multiple sclerosis and even fibromyalgia, and more recently to treat sexual dysfunction, cancer, epilepsy and depression.

Not Just Honey

<table>
<thead>
<tr>
<th>Crop</th>
<th>Value in billions</th>
<th>% Pollinated by honeybees</th>
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</thead>
<tbody>
<tr>
<td>Soybeans</td>
<td>19.7</td>
<td>59%</td>
</tr>
<tr>
<td>Almonds</td>
<td>7.5</td>
<td>60%</td>
</tr>
<tr>
<td>Oranges</td>
<td>8.1</td>
<td>90%</td>
</tr>
<tr>
<td>Grapes</td>
<td>1.3</td>
<td>80%</td>
</tr>
<tr>
<td>Cherries, sweet</td>
<td>0.6</td>
<td>90%</td>
</tr>
<tr>
<td>Grapefruit</td>
<td>0.4</td>
<td>90%</td>
</tr>
<tr>
<td>Tangerines</td>
<td>0.1</td>
<td>90%</td>
</tr>
</tbody>
</table>

SOURCE: U.S. Dept of Agriculture, AP
Roger A. Morse and Nicholas W. Calderone, Cornell University

Pollination is transfer of pollen from the anther (the male part of the flower) to the stigma (the female part of the flower). Some plants can pollinate themselves: in this case, the pollen passes from the anther to the stigma inside the same flower, and this is
called self-pollination. Other plants need pollen to be transferred between different flowers or different individuals of the plant. This is cross-pollination. Many plants can be pollinated both ways. Plants can be pollinated by wind or animals.

Flowers pollinated by bees most often bloom in daytime, and can be different colors (though seldom red). The scent of daytime, bee-pollinated flowers tends to be less strong than that of night-pollinated flowers, often pollinated by bats or moths.

Honeybee-pollinated flowers have nectar tubes no more than two centimeters long. They have nectar guides (patterns to direct the bee towards the nectar) and often a landing place for bees. Bees are especially attracted to white, blue and yellow flowers. Plants pollinated by insects are called “entomophilous,” and insects are generally the most important pollinators. Usually a honeybee can visit between 50-1,000 flowers in one trip, which takes between 30 minutes to four hours. Without pollen, the young nurse bees cannot produce bee milk or royal jelly to feed the queen and colony. If no pollen is available to the colony, egg laying by the queen will stop.

Humans' intense agricultural practices have greatly affected the pollination practices of bees within the U.S. The increased use of pesticides, the reduction in the number of wild colonies and the increased value of both bees and pollinated crops have all added to the importance of protecting bees from pesticides. Furthermore, many homeowners believe dandelions and clover are weeds, that lawns should be only grass to be mowed down regularly, and that everything but the grass should be highly treated with pesticides. This makes a hostile environment for bees, butterflies and other pollinators. Many bee poisoning problems could be prevented by better communication and cooperation among the grower, pesticide applicator and the beekeeper.

Related on MNN:

- 5 things that probably aren't killing honeybees – and 1 thing that definitely is
- 5,000 honeybees strap on tiny backpacks in the name of science
- Honey bees could help to clear dangerous land mines in Croatia

Maria Boland originally wrote this story for MNN State Reports.
Ticks devastate Maine, N.H. moose populations

A moose was captured for a tick count.

By Brian MacQuarrie

GLOBE STAFF  JANUARY 13, 2017

An insidious pest is killing about 70 percent of moose calves across Maine and New Hampshire, and their deadly work is being aided by warming temperatures and shorter
winters that allow the parasites to survive longer, scientists believe.

They are winter ticks, which attach themselves to a single moose by the tens of thousands. Adult females can expand to the size of a grape and engorge themselves with up to four milliliters of blood.

“The moose are being literally drained of blood. This is about as disgusting as it gets out there,” said Pete Pekins, chairman of the Natural Resources Department at the University of New Hampshire.

Pekins and UNH are at the center of the largest study of New England moose ever conducted, a three-state effort stretching across the woods of Maine, New Hampshire, and Vermont in which researchers are attaching tracking devices to the moose as part of an effort to learn how ticks are affecting them.

If the reduction continues, researchers said, the range of New England moose is likely to shrink northward. And for many moose that survive, the ravages of winter ticks could render them less healthy and less likely to reproduce.

“It’s like a sinister, evil horror movie,” said Lee Kantar, the Maine state moose biologist.