Preliminary Lessons – Ecology and You

Introduction

These lessons are designed to give the students a general understanding of ecology and their place with in an ecosystem. For students to understand the concept of Integrated Pest Management (IPM) they must first be aware of some of the basic components of ecology because IPM is a form of applied ecology. The following lessons will give the students an understanding of population dynamics and of factors of environmental resistance that serve to regulate densities within a community. Additionally they will understand how organisms fulfill specific roles in an ecosystem and what elements are necessary for organisms to sustain life. These lessons are meant to be precursors to the integrated pest management lessons, in which students will apply their knowledge of ecological relationships to the study the pest populations they will discover in the IPM lessons.

Appropriate SC Science Standards for the Following Outlined lessons

Grade 2:

- I-B-Inquiry, 1d
- II-Life Science, A-Characteristics of Organisms,1a, 2a,b
  C-Organisms and their Environments, 1a.

Grade 3:

- I-Inquiry, A-Process Skills, 1, 2a, 4a
  B-Inquiry, 1a,e
- II-Life Science, A-Characteristics of Organisms, 1a
  C-Organisms and their Environments, 1a,b, 2a,f

Grade 4:

- I-Inquiry, A-Process Skills, 1, 4a, 5a
  B-Inquiry, 1a,e
- II-Life Science, A-Characteristics of Organisms, 1c
  B-Organisms and their Environment, 1a,b, 2a,b, 3a,b, c, d

Grade 5:

- I-Inquiry, A-Process Skills, 1, 2a, 4a
- II-Life Science
  B-Populations and Ecosystems, 1, 2a,b, 3a,b, 4a,b, c, d, e, f

Grade 6:

- I-Inquiry, A-Abilities Necessary to do Scientific Inquiry 1a,d 5, 7a,b
- II-Life Science, C-Regulation and Behavior 1,2,3

Grade 7:

- I-Inquiry, A-Abilities Necessary to do Scientific Inquiry, 1a,d, 4a,b 5, 6, 7a,b,c
- II-Life Science, B-Regulation and Behavior, 1a,b
  D-Populations and Ecosystems 1a,b, c, 2a,b, c, 3a,b, c

Resources for the Following Ecology Lessons

Lesson Planet
http://www.lessonplanet.com/search/Science/Ecology
http://www.education.com/common/resources/lp/sci/9711104s.html

Yale-New Haven Teachers Institute
http://www.cis.yale.edu/ynhti/curriculum/units/1992/5/92.05.10.x.html
http://www.cis.yale.edu/ynhti/curriculum/units/1992/5/92.05.10.x.html#s
http://www.cis.yale.edu/ynhti/curriculum/units/1992/5/92.05.10.x.html#e
http://www.cis.yale.edu/ynhti/curriculum/units/1980/5/80.05.12.x.html

Steve Trash
http://www.stevetrash.com/booking/ecoleson.htm
http://www.stevetrash.com/booking/lessons/lesson1.htm

MC Biology
http://www.marietta.edu/~biol/102/ecosystem.html

Access Excellence – Design an Ecosystem
http://www.accessexcellence.org/AE/ATG/data/released/0079-KarinWesterling/index.html

Bottle biology: See it, touch it, smell it, taste it
http://www.bottlebiology.org/

Lesson 1 – EcoTag

Introduction
This is a fun activity in which students are allowed to discover something about food chains and food webs. It is a guided inquiry approach to revealing the food web. Students will become excited to tell you how the food web works, and enjoy designing trophic interactions. This activity helps students conceptualize predator-prey relationships, address ecosystem and population dynamics, and allows students to see how ecosystems sustain themselves. This is a good activity to refer to throughout the following lessons because students will remember this activity.

Duration 1-1.5 hours

Objectives
Students will:
- Discover the fundamental components of ecology
- Learn about predator-prey relationships
- Understand how organisms fulfill niches within an ecosystem
- Learn what organisms need for survival (shelter, food, water, space)
- Understand the consequences of man's actions upon an ecosystem

Vocabulary (for Ecology Lessons 1-3)

Ecology	Herbivore	Prey
Ecosystem	Carnivore	Population
Producer	Habitat	Energy
Consumer	Omnivore	Niche
Decomposer	Predator	Community

Materials needed for activity
Large colored index cards or construction paper
Safety pins or string to attach the name tags
Markers
Large open space to play

Discussion
Begin by asking students questions that will lead their thoughts to basic relationships within the ecosystem. Start by making the lesson personal. Ask the students about what they need to survive, and what kinds of things they eat. Then relate that information to animals in nature.

1. What did you eat for breakfast this morning?
    - Cereal, toast, eggs, etc.
2. Where did you find that food? How did it get there?
    - In the cabinet, refrigerator, etc. Mom or Dad bought it.
3. Did you have anything to drink with breakfast?
    - Water, juice, etc.
4. Where did you eat breakfast?
    - At the house, in the kitchen.
5. Imagine now, that you were a baby squirrel, and it was time for breakfast. What would you eat and drink?
    - Nuts, human scraps, milk from my mother, maybe water
6. Where did you get the food? How did it get to you?
    - From trees in the forest, Mother or Father brought it to you
7. Where did you eat it?
    - In the nest.

Summary
Continue asking the students questions that will allow them to draw conclusions and form relationships. What things did you find you needed to survive the morning, that are the same as the baby squirrel, food, water, protection/home/shelter, and a space for that home. What is the importance of these things? Surviving, and living. You may then want to ask more questions about the significance of shelter as protection from predators, as it will become more significant in the activity.

Activity
This is essentially a game of tag, but one in which students will gain an appreciation of ecology, food webs, and predator-prey relationships. The food chains (within the food web) should be constructed to be appropriate for organisms in your area. This will enhance the students' understanding of their own ecosystem. It is best played outside or in a gym.

Create nametags for participating "organisms" using large colored index cards. The nametags should reflect organisms involved in an actual food pyramid, and allow each student to play. An example food chain might be: Hawks-squirrels-fish-flies-grasshoppers. Write on each nametag, in large print, the name of each animal (Predator) the student will represent. Under that animal, in smaller print and in a different color, write the names of the animals which may be eaten (prey) by the predator. (Writing the names of the prey is optional, and you may choose to exclude it for older students) Be sure that only a few students represent the animals at the top of the food chain, such as

hawks, and that there are larger groups of students representing the animals at the lower end of the food chain, such as grasshoppers and flies.

Randomly give each student a nametag; students "become" that animal. Explain that they are only allowed to tag (hunt/kill) the food that they would take as prey. Once outside, each animal group has a specific "safe site" that represents their shelter, this might be a tree or a corner of a building, and when the student is touching that tree or building, they are safe in their "shelter". The last student (or students) standing are the best hunters or winners.

Versions of Play

1. Once a predator has tagged its prey, the prey may sit out until the top predators have no more prey to hunt. Then you may mix up nametags and allow the students to become a different animal. Continue play.
2. For grades 6-7: You may also choose to make stock cards of detritivores (animals that feed on dead or decaying material, such as flies or bacteria) and when a prey is tagged, the predator brings their prey to you and you may exchange the prey tag for a detritivore tag. This represents recycling in a true ecosystem, and promotes an idea of how ecosystems sustain themselves.
3. For grades 6-7: You may also choose to stop the game in mid-play and describe some imaginary complication on some part of the playing field, such as fire, or a human interruption such as a road through the middle of the playing field, to provide students with more limitations. This allows students to contemplate man's effect on ecosystems. With this option you may choose to play under version one, or version two.
4. You may also choose to add flags in the game, to represent plant materials that herbivores feed on. They must gather at least 3 flags during the duration of the game, (or a set time limit you choose to give them) or they will starve. Remember to provide name tags for herbivores.

Follow-Up

It's recommended that you end the game a few minutes early to discuss with the students the basic components of the ecosystem.

- Which animals were the carnivores, herbivores, detritivores etc?
- Which animals were the producers and consumers?
- What represented each animal's habitat, and what would constitute an ideal habitat for that animal?
- Which animals were the predators, which were prey?
- How did energy transfer in the food web?
- Using the game as an example, define an individual, population, and community.
- What is a niche? What is the niche of the predator, of the prey?
- How were populations regulated?
- Ask them what they have learned, and what is necessary for an organism's survival.

Example Name tag for Lesson 1 – Eco-Tag

(Predator)

Hawk

(Prey)
Squirrels
Fish
Mice

Lesson 2 – Design a Food Web

Photo courtesy of Bigelow.org
(http://www.bigelow.org/edhab/fitting_algae.html)

Introduction
This lesson is designed to reinforce the material learned and discussed previously in Eco-Tag. It allows the students to formulate the concept of ecology using individual creativity.

Duration 1-1.5 hours

Objectives
Students will:
- Observe and make note of their immediate ecosystems
- Draw specific simple food chains
- Draw and expand food chains into more complex food webs

Materials needed for activity
A hiking area
Shoes for hiking
Colored pencils, crayons, or markers
Overhead projector
Marking pens

Discussion/Presentation and Motivation
Review the components of the ecosystem that were previously learned in Eco-Tag. Allow students to explain what happened to the different animal groups as the game was played. Then you may want to take students on a brief nature hike to allow them to observe their immediate ecosystems. As you are hiking help them make notes about:
- In what way do animals need plants?
- In what way do plants interact with other plants?
- How do plants and animals depend on each other?
- Which living things need each other to survive?
- Identify the nonliving components in the environment. What part do they play in the lives of living things?
- What is energy?
- Where does it come from?

Activity/Assignment
Discuss with students what they observed on their nature hike. Be sure to reemphasize and relate it to what they practiced in Eco-Tag. Introduce the concept of energy and that the sun is the ultimate source of energy.

For grades 5-7: Make an overhead of the wetland ecosystem drawing (omit the words at the bottom of the drawing), then project the diagram of the wetland ecosystem. You may have to introduce some animals if they are not well known to your area. You may also choose to design your own ecosystem or find a similar diagram. Allow students to tell you who-eats-who in the predator prey relationships. Draw the arrows of energy transfer to the predators (arrows point to those who gain energy). This will allow the students to begin to visualize a food web. Discuss, or ask students to define the differences between food webs and food chains. Discuss with students how the transfer of energy from one organism to another enables an ecosystem to be efficient and sustainable.

Have students design a diagram of an original habitat with specific food chains; encourage them to expand these food chains into larger food webs. Remind students to include: producers, consumers, decomposers, energy, predators, prey, water, and shelter. These creative and colorful food webs will be great reminders for organism needs as they expand into the IPM lessons.

Wetland

Circle the items
in the picture

cattails 

muskrat
lodge 

bulrushes 

trees 

frog 

Lesson 3 – Creating an Ecosystem (Enrichment for grades 6 and 7)

Introduction
For grades 5-7: This activity will give older students a sense of ownership and appreciation for their environment. It gives them another chance to learn and understand the components and dynamics of an ecosystem. Students create and maintain their own ecosystems while reinforcing what they have previously learned. Bottle biology: See it, touch it, smell it, taste it at http://www.bottlebiology.org/ is a website that provides directions, necessary materials and appropriate backgrounds for ecocolumns (a soda bottle terrarium).

Duration 1-3 hours

Objectives
Students will:
- Design and create an individual ecocolumn
- Design and create specific ecosystem relationships that will exist in the column
- Develop oral presentation skills by sharing individual columns with class

Materials needed for activity

Bottle biology website	Probes
Several 2 Liter bottles	Soil
Scissors	Plant life
Glue	Insects

Activity/Assignment
This activity is hands-on and will enable students to create their own ecosystem. Have students plan an ecosystem with paper and pencil to be built with 2-Liter bottles, soil, plant materials, insects and any other living organisms. Encourage students to be creative in their design. Some students may choose to create a farm ecosystem, an ornamental ecosystem, or a woodland ecosystem. Next follow the instructions for creation of an ecocolumn that can be obtained from the Bottle biology website. Allow the students a few class periods to build their ecocolumn.

Follow-Up
You may choose to assess this activity in several ways.
1. Allow the students to present their ecocolumns to the class. Students should present the relationships, food webs, and habitats that are present in their columns and how their column functions as a whole ecosystem. Have them address how certain habitats would change if certain components of their ecocolumn were changed.
2. Bottle biology rubric.

Rubric for Bottle biology: Ecocolumn

Grades: Good, Fair, and Poor

Graded values:

1. Bottle construction
2. Column construction
3. Creativity
4. Observations
5. Exploration

1. Bottle construction:
    A. Good: Bottles not bent (for strength), labels removed cleanly, cuts are clean, sufficient ventilation holes, airtight sealed joints where appropriate.
    B. Fair: Bottles slightly bent, labels not completely removed, jagged cuts, lacking in enough air holes, joints leaky.
    C. Poor: Bottles smashed, labels on, jagged cuts, no air holes, super leaky joints

2. Column Construction:
    A. Good: Appropriate number of columns for habitats 3 or more (plant or animal, soil decomposition, aquarium), sufficient drainage holes, and air holes, sufficient components for habitats (i.e. ample soil, water, and organic matter)
    B. Fair: 2-3 habitat columns, too few drainage holes, not enough air holes, not enough soil, or too much water
    C. Poor: Only one habitat, no drainage holes, no air holes, not enough water or soil.

3. Creativity:
    A. Good: 3 or more chambers for habitats (aquariums, decomposing fruit, animals, plants, soil, etc.), varying species per habitat, or soil types, addition of branches, leaves, and twigs
    B. Fair: Less than 3 chambers for habitats, uniform species or soil types, little additions of branches etc
    C. Poor: One chamber for habitat, no species or only a few insects, no additions

4. Observations:
    A. Good: Student notices changes, precipitation, decompositions, increase or decrease in insect populations, proper draining, growing roots, reproduction and death cycles, soil changes. Observations noted in lab notebook.
    B. Fair: Student observes only a few changes from those listed above, and makes few notes in notebook
    C. Poor: Student makes no observations and makes no notes.

5. Exploration:
    A. Good: Students explore **each** habitat of their column by changing it, either adding to the habitat or taking away from it. Noting in lab notebook how the changes affect that habitat and other habitats.
    B. Fair: Students only explore a few habitats, and make little notes about changes to only one or the other affected habitats
    C. Poor: Students do not explore any habitats and make no notes.

	Poor 1-4 pts	Fair 5-7 pts	Good 8-10 pts (max total 50 pts)
Bottle Construction max 10 pts			
Column Construction max 10 pts			
Creativity max 10 pts			
Observations max 10 pts			
Exploration max 10 pts			