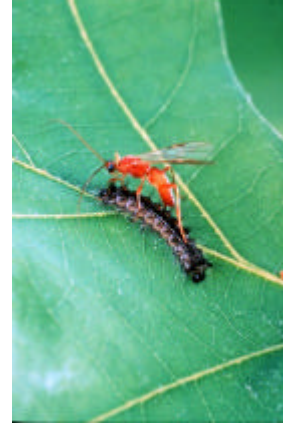




NATURAL PREDATORS OF THE GYPSY MOTH



OVERVIEW

In this lesson, students will become more aware of the dynamics and problems with the introduction of exotic species of plants, animals, and insects into an ecosystem. Students will learn about various species which have been introduced in the past which upset the ecosystem. Students will learn about the Gypsy Moth's effects on Wisconsin and develop a community service plan to slow the spread of this pest.

BACKGROUND – See H-1 that follows.

SUBJECTS

Introductory Agriculture, FFA Community Service, Environmental Science, Biology, Life Science, Ecology, Social Studies, Language Arts, Geography.

CONCEPTS

- Endemic species can exist in non-traditional climates and geographical locations.
- Human interaction with the environment results in positive and negative results.
- Human societies and cultures throughout the world interact with each other and affect natural systems upon which they depend.
- We live in an interacting ecological system, every action, regardless of its scale, affects the biosphere in some way.
- Gypsy Moths are moving across Wisconsin and will defoliate woodlands.
- Natural predators such as mice, birds, parasites and diseases can reduce the impact of the Gypsy Moths.
- All people have a duty to protect the environment we live in.

SKILLS

Acquiring Information, Cooperation, Map Reading, Communication, Decision Making, Public Speaking, Role Playing, Group Participation, Construction, Valuing, Teamwork.

OBJECTIVES

Students will:

- (1) Research nonnative animal and plant species introduced into the USA which have had negative impacts on the environment.
- (2) Consider the methods in which an exotic species relocates itself, or is relocated on purpose, into an environment
- (3) Investigate the effects of exotic species on environments not usually inhabited with that species.

- (4) Realize the interdependence among countries in the world as we live in a global society.
- (5) Become aware of the international scope of biodiversity and non-native species introduction detrimental effects.
- (6) Foster community pride and offer FFA community service in efforts to control the spread of the Gypsy Moth.
- (7) Understand the different methods used to control pests.
- (8) Conduct an FFA community service project to "slow the spread" of the Gypsy Moth in their home county.
- (9) Prepare an informational handout to share with community members.
- (10) Build a bird house to encourage natural predators into the area.
- (11) Remove tires and other persistent garbage from woodlots, hedge rows, and fence rows to remove hiding spots which will also reduce disease carrying mosquitoes.

MATERIALS

Bags of various colored candies: M&M's, Runt's, Skittles, to represent different species. Need same number of colors/ kinds as you have species represented. If you have 20 students, you would want to break into groups of two or three, and you will need 10-15 colors/shapes. I would have at least 20 pieces of candy in each color/shape so at the end, all the students can eat each species.

Napkins to set candy on if outdoors or on the floor.

Background information. **H-1**

Exotic species information cards. **H-2**

- ball of yarn or string. Each student needs 10 feet.
- World Globe or copies of the world map. Copies of the United States with National Parks outlined. Copies of the Hawaiian Islands.

Benefit of Birds information. **H-3**

Building a birdhouse step-by-step instructions. **H-4**

Building a birdhouse VISUAL step-by-step instructions. **H-5**

Bird house materials. See "Think Globally, Act Locally" lab. **H-6**

PREPARATION FOR ACTIVITIES

Make copies of the "Student background information"; "Exotic Species information cards"; Separate out candies according to color and shapes. Cut yarn into 5- 10 foot pieces for each country outline. Copy all handouts **H-3** to **H-7**. Purchase bird house materials.

ACTIVITY 1:

Part A

Researching exotic species 15 minutes

Step 1. Discuss with the class the relocation of exotic species. On an overhead, define an exotic species, and discuss how insects and plants can travel over the ocean.

Step 2. Hand out the exotic species information cards. Assign each student (or group) to a species.

Step 3. Students (or groups) will research their particular species using the "Exotic Species information cards" and the information shared by the instructor.

Part B

Designing the world 5- 7 minutes

Step 4. Give each student a 5-10 foot long piece of string. In a large area the class will create a globe with string, (outside on the grass, in room on several tables pushed together, the floor, hallway, etc.) As a class, the students will first design a clear outline of the USA , including Hawaii, with their string. They then continue mapping the entire world. Each student is responsible to make sure their species native country is appropriately represented and in proportion to the entire world. Hand out the maps if they are getting confused and need a guide.

Part C

Species distribution "Skittle-Skattle" 25 minutes

Step 5. Each species is assigned a special color or a shape of candy. Give student candies. They can justify their color, using creative thinking. Each student (species) places their candies on the country they originated in one at a time. All walk around and observe the countries, and the species (colored candies) in each native country.

Step 6. They then, one by one, place species (candies) on any infested areas/states which the species moved to according to their research information. As students "infest" the USA, have them answer the following questions:

DISCUSSION QUESTIONS

1. Each student describes their chosen species and gives a brief history of the life cycle, diet, behaviors, and habitat?
2. What is some of the historical information they learned about their critter?
3. How were they introduced or transported? On purpose or by accident?
4. What is the level of intrusion?
5. What part of the local ecosystem has benefited from the exotic species; what part has been harmed?

Students will observe the large interconnections of the world as they see the colors forming in the USA from all parts of the world.

Step 7. After all students have been "introduced and relocated" to the USA, have other groups analyze the possible long term effects of these "nonnative species" on our country.

Step 8. Allow students to "destroy" (eat) the nonnative species!

Note: End step 5 of the lesson with the Gypsy Moth group. This becomes a spring-board for an in-depth discussion of the Gypsy Moth.

ACTIVITY 2 "THINK GLOBALLY, ACT LOCALLY"

FFA community service project, building a bird house

Part A

The gypsy moth in Wisconsin 10 minutes

Step 1: Handout recent information on the Gypsy Moth in Wisconsin. Discuss. H-3

Step 2: Discuss the different ways to control a pest.

Examples: Mechanical, Biological, Chemical, Physical.

Step 3: Handout "The Benefits of Birds" information. Read. H-4

Step 4: Develop an FFA community service plan to make bird houses and distribute in community.

Step 5: Construct the bird houses. Follow step-by-step instructions. H-5 & H-6

EVALUATION

- Students will design a handout for community members explaining the Gypsy Moth. This will be given to the bird house recipients.
- Students are given points on their explanations in step 5.
- Students are graded on quality and workmanship of bird house.
- Students will give a speech at a community meeting to share their knowledge about the gypsy moth.

STUDENTS WILL WRITE AN ESSAY ON THE FOLLOWING QUESTIONS:

1. What type of management plan would need to be developed to prevent nonnative species from entering the USA?
2. How can you make a difference in the introduction of nonnative species in the USA?
3. How is a state like Hawaii more vulnerable, yet protected from species introductions?
4. What role should the USA play in controlling the spread on non-native species throughout the world?
5. Which method of controlling a pest is the best to use on a pest like the Gypsy Moth and why?

ACTIVITY 3: "BUILDING A BIRD HOUSE"

Many species of birds are known to feed on gypsy moth caterpillars and adults. Such birds are called predators, and they help to reduce the number of gypsy moths. Nuthatches, chickadees, towhee, vireos, northern orioles, catbirds, blue jays, and robins are also important in keeping Gypsy moth populations low. Cuckoos and flocking species such as starlings, grackles, red-winged blackbirds, and crows may be attracted to areas where gypsy moth populations are already high.

It's important to encourage birds to stay in an area to help keep populations low. And it's something you and others in your community can do. Birds are most effective at eating large numbers of gypsy moths and their larvae when the birds have young to feed. Therefore, helping the birds with their nests is important. Robins can be encouraged to use a nesting platform placed in the branch crotch of a tree. The platform should be made of a well-weathered board at least 6 inches wide and placed here it will be shaded for part of the day. Another way to attract birds is to build a birdhouse.

Most birds don't like the gypsy moth because it is too hairy. Mice, especially white-footed and deer mice, are much more important. However, these are the same species that host deer ticks which carry Lyme disease. This increases mice, which increases Lyme disease, but less Gypsy moth. (One possibility would be to put up nest boxes for mice with insecticide treated nesting materials which kills ticks.)

H-1

BACKGROUND

The gypsy moth (*Lymantria dispar*) is probably the most famous (and infamous) insect pest of hardwoods in the eastern United States. This **exotic species** was brought into Massachusetts in 1869 by a French scientist who was trying to develop a silkworm industry in America. His idea was to interbreed gypsy moths with silkworms. Unaware of the gypsy moth's potential for mass destruction of hardwood trees the scientist did not adequately contain the moth. It escaped and began to breed and proliferate outside the laboratory. Since that time, the gypsy moth has spread to 41 states and several Canadian provinces.

Gypsy moths do all their damage in the caterpillar stage. The caterpillars feed on the leaves of more than 300 species of trees, shrubs, and vines, although their favorite food is oak. Each gypsy moth caterpillar eats up to 10.8 square feet (1 square meter) of foliage during its development.

Effects of defoliation vary, depending on many factors. When more than 50 percent of the tree's leaves are eaten, a deciduous tree will still re-leaf in midsummer, although these new leaves will be smaller. The process of re-leafing uses the tree's energy reserves and weakens the tree. The weakened tree can usually survive 1-2 years of consecutive defoliation, but an unhealthy tree may die after only one defoliation. Weakened trees are attacked and killed by opportunistic disease organisms and insects that are normal members of the forest ecosystem. Healthy trees resist such attacks.

Scientists and forest managers concentrate on using an approach called Integrated Pest Management (IPM) to help control gypsy moths. IPM involves a variety of control tactics designed to exploit weak points in a pest's life cycle. Tactics combine biological, mechanical, cultural, and chemical methods with natural control. (For additional background information on the gypsy moth, see the Student Page, "Gypsy Moth Background Information.")

The established North American gypsy moth isn't the only population of gypsy moth that threatens the United States and Canada. In North Carolina and British Columbia a different strain of gypsy moth has been introduced, but has not yet become established as a population. These moths, which are from Asia and Europe, differ from the North American gypsy moths in that the adult females can fly. This factor makes inadvertent introductions much more likely.

EXOTIC SPECIES INFORMATION CARDS

Eurasian Zebra Mussel, entered North America in the ballast water of ships, and spread rapidly once it arrived, covering the bottoms of rivers and lakes and venturing into the water works of municipalities and industries. Zebra Mussels reduce natural algae populations and increase nutrient concentrations upsetting natural ecosystems.

Purple Loosestrife, is a perennial plant native to Europe and Asia which became established in the US and Canada. It grows and reproduces prolifically in wetlands and other habitats. Each mature 4-7 foot tall plant produces 30 or more beautiful purple flower spikes that bloom in late summer and can produce over 2.5 million seeds per year. The purple Loosestrife plants dominate native vegetation by out-competing them. As native plant communities are reduced, so too are the wildlife that depend on them. Declines in ducks, geese and other wetland birds as well as muskrats, mink and some amphibians have all been noted.

Balsam Woolly Adelgid, was brought to the USA on nursery stock from Europe, attacks true firs of the genus *Abies*, causing death within 2-7 years by chemical damage and by feeding on the plant's vascular tissue. The small cottony insect is particularly damaging to the Fraser fir, which is found only in the southern Appalachian Mountains (primarily within the high elevations of the Great Smoky Mountains National Park). Since 1963 the adelgid had killed nearly every adult (cone-bearing) fir tree in the **park**.

White Pine Rust, was brought to the USA on nursery stock from Europe. It attacks 5-needle pines and is now killing sugar pines in the forests of Yosemite, Glacier, Yellowstone, Grand Teton and Sequoia Kings Canyon National Parks. The White Pine seeds are an important food source for grizzly bears and other animals.

Asian Tiger Mosquito, larvae of which were brought into the US in used automobile tires that were imported for retreading and resale. In 1986 6.8 of every 10,000 tires were infested. The Asian Tiger Mosquito first became established in the US in the 1980's, and by 1992 had spread throughout 25 states. In its natural range the mosquito is a vector of dengue fever and other human arboviruses. In the US it causes eastern equine encephalitis, an often fatal viral infection of people as well as horses.

Water hyacinth, an aquatic weed pest that originated in the tropics and is now found in the Gulf Coast states, was originally sold in the late 1800s as a nursery plant. Power plant water intakes and other mechanical systems are frequently clogged with the plant.

Kudzu, also known as "the vine that ate the South," was first imported from Asia to help control soil erosion. Kudzu now blankets roadside trees, telephone and power poles, and wires all across the South.

Canada thistle, a native of Eurasia, first appeared in Canada 200 years ago. It is now one of the most prevalent weeds in the northern part of the United States.

Dutch elm disease is caused by a fungus, *Ophiostoma ulmi*, that first arrived in the US in the early 1900s on elm logs shipped from Europe. Dutch elm disease is one of the most devastating diseases of urban shade trees (principally American elm), accounting for tremendous losses throughout the United States. The Dutch elm disease fungus, which originally came from China, is also responsible for large losses of European elms.

Golden Apple Snail, originally brought from Argentina, (South America) to Taiwan to provide a supplemental source of protein and to increase the export income to rice farmers. Local people found snail distasteful, did not eat it, so snail population increased and the snails ate young rice plants. The snails have spread to the Philippines, Indonesia, Malaysia, and Thailand. The cost to farmers has been in the \$45.3 millions, not counting the time spent picking rice by hand, replanting destroyed crops, and controlling the snail with pesticides, and the loss of yield.

Myrica Faya, is a nitrogen fixing tree which thrives on volcanic soil in Hawaii, due to its ability to fix nitrogen from the air and transport it to the roots of the plant, thus increasing the soils amount of biologically available nitrogen for other non-native organisms. The introduction of this Myrica Faya highly increases the introduction of many plant and animal species. The entire ecosystem of Hawaii's volcanic lands is effected.

Gypsy Moth, an insect pest that originally arrived in Massachusetts from Europe in 1869, with a scientist trying to breed the moth to a silkworm to begin a silk industry in America. The moth and accidentally escaped and has been damaging hardwood trees across the US. It does all its damage in the caterpillar stage. The caterpillar feeds on over 600 species of trees, shrubs, and vines, although their favorite food is oak. The defoliation causes trees to weaken, and sometimes die, from secondary disease organisms normally found in the ecosystem. Presently 18 counties in Wisconsin are under quarantine to prevent the spread of this pest.

Starlings, were introduced from Europe in 1890 by a drug manufacturer. Eugene Shceiffelin let 40 pairs of starlings go in New York's Central Park, because he wanted to establish in this country every bird species mentioned by Shakespeare. Starlings are now established throughout North America and are often considered pests.

THE BENEFITS OF BIRDS

H-3

OBJECTIVE: To conduct a community service activity related to slowing the spread of the gypsy moth

BACKGROUND INFORMATION: Many species of animals eat forest-defoliating insects such as the gypsy moth. Combined, these animals constitute a predator community. This community can maintain some potentially serious pest population at relatively harmless levels. Birds are a major component of most predator communities, and they definitely play a role in affecting population levels of the gypsy moth. At low gypsy moth densities, this role is highly significant, but as gypsy moth populations increase, the importance of predation is reduced. This is due to the inability of the millions of larvae that result when gypsy moth population densities are high.

Birds usually move into specific areas in the spring and early summer to raise their young. Often, breeding pairs will produce two broods of four to six young each. From the time of mating until the young are on their own, most birds need a diet high in protein, and insects are eaten extensively.

One method of enhancing the benefits of birds consists of providing suitable cover and nesting sites to encourage the presence of a variety of birds in areas where pest populations occur. Researchers have found that as many as 38 species of birds feed on gypsy moths. Some of these birds can be effective in maintaining sparse gypsy moth population and therefore should be encouraged to stay in potential gypsy moth infestation areas. Birds -in this group include: the black-capped chickadee, blue jay, red-eyed vireo, rufous-sided towhee, scarlet tanager, northern oriole, catbird, and robin.

Another group of birds is less effective when gypsy moth population densities are low, but they are attracted to high level population and can help reduce pest population levels. Included in this group are the cuckoos, crow, chipping sparrow, starling, grackle, red-winged blackbird, and cowbird.

Whenever the gypsy moth is a potential problem, birds from these two groups, as well as others, should be encouraged to stay in an area.

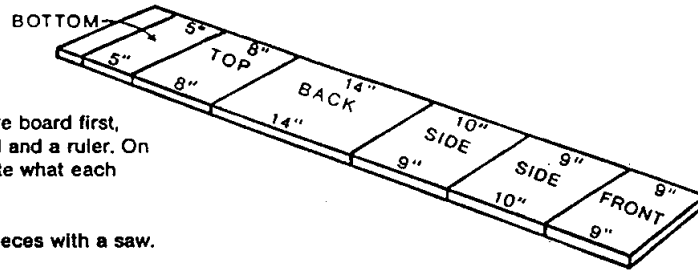
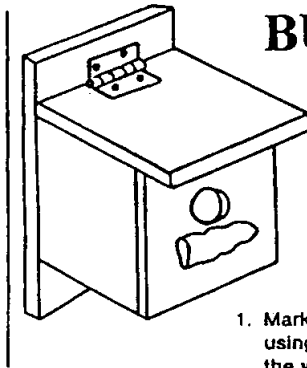
To encourage birds to remain in an area, adequate nesting facilities are essential, in addition to the ample food supply provided by the gypsy moth.

BUILDING A BIRDHOUSE STEP-BY-STEP INSTRUCTIONS

H-4

1. Mark the entire board first, using a pencil and a ruler. On the wood, write what each piece will be:
 - A. Front = 9"
 - B. Side= 9"
 - C. Side = 10"
 - D. Back = 14"
 - E. Top = 8"
 - F. Bottom-7 5"
2. Cut out the pieces with a saw.
3. Nail the front to the bottom.
4. Nail on the sides. Notice that the front goes over the sides, and the bottom fits inside where you can't see it.
5. Nail on the back.
6. Put the roof on and attach the hinge. Notice that the lid is fasten only by the hinge. This will let you clean out the box when the birds are finished with it. (You can also peek inside to see the babies when the parents are away, but don't do this when they are building or have eggs, because they might not come back).
7. Cut the door hole. Make it about 6 inches above the floor and about 2 inches in diameter. The easiest way to cut this round door is with a hole cutting attachment to a power drill (have an instructor help), or you can use a keyhole saw. Drill a small hole to get it started,
8. Drill two small holes on each side just under the roof for ventilation. Drill four *tiny* holes in the floor for drainage in case water gets inside.
9. You can paint the outside only (don't paint the inside) or leave the wood natural. Nail a rough piece of bark just under the door hole to give the birds a firm footing.
10. Nail your birdhouse to a tree or post. A shady spot is best. Houses in the sun can heat up like an oven on a warm day. Birdhouses can also be fastened to windowsills (not beside a feeder) or under the eaves of a house.

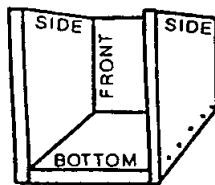
BUILDING A BIRDHOUSE



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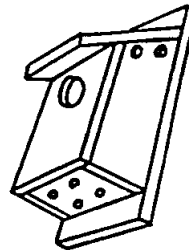
2. Cut out the pieces with a saw.

3. Nail the front to the bottom.

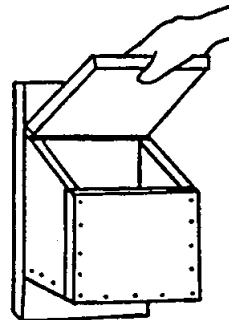


4. Nail on the sides. Notice that the front goes over the sides, and the bottom fits inside where you can't see it.

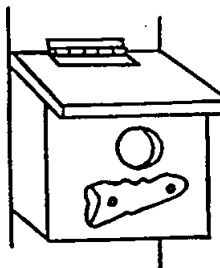
5. Nail on the back.



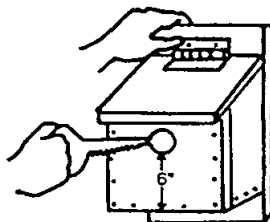
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9. You can paint the *outside only* (don't paint the inside) or leave the wood natural. If you do paint, choose a color that blends with the environment. Nail a rough piece of bark just under the door hole to give the birds a firm footing.



7. Cut the door hole. Make it about 6 inches above the floor and about 2 inches in diameter. The easiest way to cut this round door is with a hole-cutting attachment to a power drill (have an adult help), or you can use a keyhole saw. Drill a small hole to get it started.

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BUILDING A BIRD HOUSE LAB MATERIALS LIST

H-6

Materials Needed for a bird house:

Board - 6 inches wide, 1/2 inch thick, 5 feet long
(a well-weathered board works best)

Price estimate:

\$3.00

Saw

shop

Hinge

\$.79

Pencil

Ruler

Hammer

shop

Nails – finishing

\$1.75/lb.

Drill - bits, hole-cutting attachment

shop

Keyhole saw - if no drill attachments available

shop

Safety glasses

shop

Wisconsin Agricultural Education Standards for the activity:

Natural Predators of the Gypsy Moth - By the end of grade 12 (agricultural) students will:

(Ecology/Environmental) E. 12.1 “Understand the application of agricultural technologies that can sustain production while reducing environmental impact.”

(Ecology/Environmental) E. 9-12.1 “Engage in applied learning opportunities emphasizing ecological and environmental principles.”

