

Gypsy Moth Defoliation

Objectives

1. Students will be able to understand how defoliation by gypsy moths affects trees.

Materials

1. Diagrams 1 and 2 of tree cross-sections.
2. Tree cookies if available.

Background

As a tree grows, its trunk gets larger in diameter. This growth is the result of the addition of a new **annual ring** to the inside of the bark layer. The width of the annual ring indicates how much the tree grew in that particular year.

What environmental conditions are necessary for tree growth? There are basically four conditions: **light energy, carbon dioxide, water, and a place for photosynthesis to occur (the leaves of a tree)**. If any of these four conditions are lacking, the tree cannot make enough food for adequate growth. The tree, in this case, is experiencing **environmental stress**. When a tree experiences stress it is more susceptible to disease. Thus, a stressed tree is at a greater risk of possible death.

Gypsy Moths exert stress on a tree by eating the leaves and reducing the sites available for photosynthesis. Thus, the tree makes less food for itself – the tree is starving.

Procedure

1. Read the background information and the article on gypsy moths.
2. Determine the age of the tree from the cross-section in diagram 1 by counting the annual rings.
3. Determine at what ages the tree in diagram 1 experienced environmental stresses.
4. List possible sources of environmental stress for trees in our area. Hint: one is defoliation by gypsy moths.
5. Using the tree cross-section in diagram 2, match the annual rings to the events listed in question number 4.
6. If tree cookies are available, construct a tree chronology for the tree cookie given to you.
7. Answer the remaining questions.

Although its native home is Europe and Asia, the gypsy moth has become a serious forest pest in the United States. It eats the leaves of over 500 species of trees and shrubs and often defoliates trees completely. Although it can cause serious defoliation in its native habitat, outbreaks there are less frequent and of shorter duration than those in the United States because of the many native enemies that use the gypsy moth as a major food resource. These enemies include insects such as predatory beetles and parasitic wasps as well as birds and small mammals. Several diseases found in Europe are specific to the gypsy moth and these also help to keep populations from increasing.

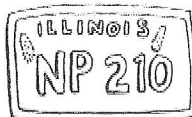
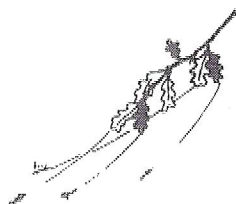
How did the gypsy moth get to the United States in the first place? Leopold Trouvelot, a French scientist working in Medford, Massachusetts, brought the gypsy moth to this country in 1869. He believed that by crossing the European gypsy moth with the silk moth he could develop an improved silk-producing caterpillar. This attempt failed, however, because the moths were of different genera and incapable of mating with each other. Nevertheless, the memory of Trouvelot lives on because some of his research insects escaped. Beginning in 1879, massive outbreaks of gypsy moths were reported in the Medford and Boston areas.

The gypsy moth has become a serious pest in the United States for several reasons. First, it was introduced without its natural checks of predators and disease agents. Second, female gypsy moths lay a tremendous number of eggs—up to 1,000 per female! Third, it was introduced into an area that had an ample supply of food and favorable climatic conditions. With few controls acting on its numbers, gypsy moth populations in the United States have steadily increased.

Since its introduction into the United States, the gypsy moth has spread naturally throughout the northeastern states. The rate of natural dispersal is estimated to be 15 miles per year and depends primarily on the wind. Newly-hatched larvae spin silken threads from which they dangle. Air currents pick up the hairy and buoyant caterpillars, and they hang-glide until deposited at a new location. Not all locations are equally suitable for the larvae, however. Some land on trees and are content, but others find themselves in lakes, on pavement, or splattered on car grills.

Cars and other vehicles cause the demise of a few larvae, but they also help to disperse the gypsy moth. In areas with high gypsy moth populations, female moths will deposit egg masses on any convenient surface, including cars, campers, outdoor furniture, and fireplace logs. When people travel from infested to uninfested areas of the country, these unknown hitchhikers (egg masses and/or pupae) also go along. This method of dispersal is responsible for spot introductions of the gypsy moth into Illinois, Michigan, Oregon, and California.

Gypsy moths spend about three-quarters of their lives in the egg stage. During fall, winter, and early spring each egg within



the hairy egg mass is protected from adverse conditions such as drought and cold temperatures, and from predators and parasites.

In the spring, egg hatch is triggered by warm temperatures, and the tiny larvae begin feeding immediately. Adapted for eating and quick growth, gypsy moth larvae are literally "eating machines." Their only protection against predators and parasites is their spiny skin and their habit of feeding on the undersides of leaves. Since the main "occupation" of larvae is to eat and grow, they have no use for reproductive organs and can be considered asexual.

During the pupal stage, gypsy moths rearrange their internal and external structure to become adults. Often referred to as the "resting stage," pupae are actually doing just the opposite. Internally a great change takes place that includes an almost total reorganization of the cells of the insect.

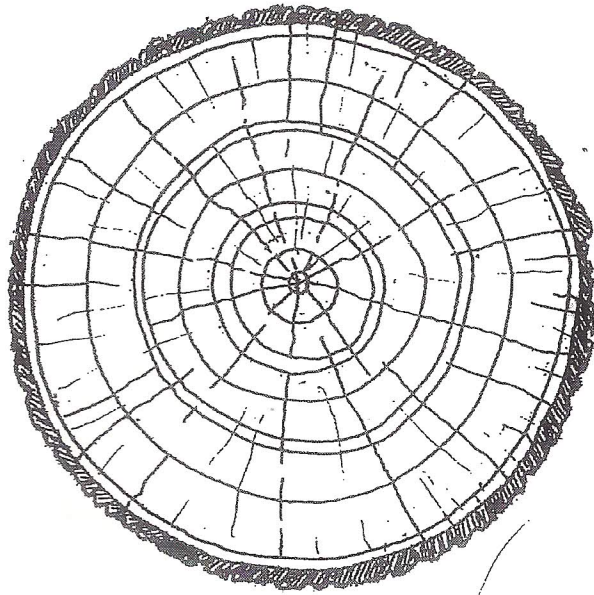
The adult stage is the reproductive or sexual stage of the life cycle. Survival adaptations in this stage are designed to help the moth produce offspring. Male adaptations include strong flight ability and feathery antennae to help locate females; the dark mottled brown coloring helps to deceive predators. Female adaptations include a large abdomen for producing and laying many eggs and glands for producing a male attractant called a pheromone.

What ever happened to Leopold Trouvelot? From all accounts he seems to have returned to his native France and disappeared. Nevertheless, his name lives on in the United States as the man who introduced the gypsy moth.



Tree Cross-section Diagrams

Tree Cross-section Diagram 1



Tree Cross-section Diagram 2

