Ecology Activity: Spongy Moth and Lyme Disease
Species Information

Oak tree (*Quercus* spp.)

Oak trees are a common hardwood tree with 55 species native to North America, and 16 native to New York. Oak tree seeds are known as acorns. Every so often oak trees have a mast year, or a year in which they produce an overabundance of acorns. During a mast year oak trees throughout a region will equally over produce acorns. The cause of this phenomenon is unknown, but it usually occurs once every 2 to 5 years. Acorns have a high fat content are therefore an important sources of food for large animals such as deer as well as smaller animals such as mice.

Hardwood tree are the preferred host of the spongy moth, and as a result oaks are commonly defoliated by the larvae of this invasive caterpillar.

White-tailed deer (*Odocoileus virginianus*)

White-tailed deer are herbivores and subsist on a large variety of plant material from grass and clover to acorns and corn. Acorns are a major source of fat stores for large mammals and in the autumn deer actively search for acorns and other hard-masts such as hickory nuts. When acorns are readily abundant, they make-up a substantial portion of a deer's diet and during mast years (years in which oak tree produce a prolific number of acorns), acorns can constitute as much as 90% of a deer's autumn diet.

Deer act as hosts for black-legged tick nymphs and adults. The black-legged tick, also known as the deer tick, is the only tick on the eastern United States that carries and transmits Lyme Disease. Deer are a dead end host for Lyme Disease meaning that deer can neither contract Lyme Disease nor act as a reservoir for Lyme Disease. Although deer do not play a direct role in the transmission cycle of Lyme Disease, they do play important role in the survival and proliferation of black-legged ticks. Deer can host a half-million black-legged ticks per year, which accounts for 90% of adult black-legged ticks. Because deer have larger ranges, they also play an important a role in the spread of Lyme Disease by dispersing black-legged ticks infected with Lyme Disease.

How are deer populations affected by acorn abundance?

How do deer populations affect black-legged tick populations?

This activity was adapted from:

D'Avanzo, C. and Musante, S. 2004. What are the impacts of introduced species? Teaching Issues in Ecology. Ecological Society of America. (www.tiee.echoed.net)

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Hardwood tree are the preferred host of the spongy moth, and as a result oaks are commonly defoliated by the larvae of this invasive caterpillar.

White-footed mouse (*Peromyscus leucopus*)

White-footed mice are common throughout the eastern United States. These small rodents are omnivorous feeding on seeds and insects. Mouse densities increase when there is an abundance of acorns. Mice also feed on spongy moth pupas and studies show that despite the large number of predators that feed on spongy moths, mice are considered the most important predator of low-density spongy moth populations and their abundance may be critical in determining whether or not there is a spongy moth outbreak. Although mice eat spongy moths, the presence or absence of spongy moths has not been found to have a significant impact on mouse populations.

White-footed mice act as a host for black-legged ticks. The black-legged tick, also known as the deer tick, is the only tick on the eastern United States that carries and transmits Lyme Disease. Mice play an active role in the transmission of Lyme Disease as 40-90% are carriers of the disease. Black-legged ticks are not born infected with Lyme Disease, but pick it up from their hosts. Black-legged tick larvae attach to small animals such as mice, chipmunks and birds. If their host is infected, then they too become infected. After their first blood meal, larval ticks fall off their host, molt into the nymphal form and overwinter. Black-legged tick nymphs begin to actively look for a host in the spring and are known to feed on both small and large animals. Once they have fed, the black-legged tick nymphs fall off their hosts and molt into the adult form. Adult black-legged ticks feed, mate and overwinter before laying eggs in the spring.

How are mouse populations affected my acorn abundance?

How do mouse populations affect spongy moth populations?

How are mouse populations affected by spongy moth abundance?

How do mouse populations affect tick populations? (Think of this in terms of Lyme Disease.)

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Ecology Activity: Spongy Moth and Lyme Disease
Species Information

Black-legged tick (*Ixodes scapularis*)

The black-legged tick, also known as the deer tick, is an obligate ecto-parasite, meaning that it requires a blood meal from another organism to survive and that it gets this meal by attaching to the outside of the organism. Black-legged ticks have 125 known hosts in North America (27 in New York). Black-legged ticks are known to carry several diseases, the most common being Lyme Disease, which is caused by the bacteria *Borrelia burgdorferi*. Lyme disease is not transmitted from the adult female black-legged tick to its young, so in order to become infectious, ticks must pick up Lyme Disease from an infected host. Although deer do not play a direct role in the transmission cycle of Lyme Disease, they do play important role in the survival and proliferation of black-legged ticks. Deer can host a half-million black-legged ticks per year, which accounts for 90% of adult black-legged ticks. Black-legged ticks are the only tick found in the eastern United States that is capable of transmitting Lyme Disease.

It takes black-legged ticks two years to complete their lifecycle. Black-legged ticks are born in late summer as six-legged pathogen-free larvae. These larvae attach to small animals such as mice, chipmunks and birds. This is their first chance to pick up Lyme Disease. If their host is infected, then they too become infected. Larvae feed for several days before detaching. After their first blood meal, larval ticks molt into the nymphal form and overwinter. Black-legged tick nymphs begin to actively look for a host in the spring and are known to feed on both small and large animals. This is the second chance ticks have to pick up Lyme Disease. Once they have fed, the black-legged tick nymphs fall off their hosts and molt into the adult form. Adult black-legged ticks become active in October. They feed, mate and overwinter. Females lay their eggs in the spring before dying.

How are black-legged ticks affected by deer populations?

How are black-legged ticks affected by mouse populations?

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Ecology Activity: Spongy Moth and Lyme Disease
Species Information

Spongy moth (*Lymantria dispar*)

In the 1880's, the spongy moth was intentionally introduced in Massachusetts for potential silk production. By 1987 the spongy moth had become established throughout the northeastern United States. Currently its range reaches as far south as Virginia and as far west as Michigan. It has become a serious pest of native and ornamental trees. In parts of New England, defoliation of oaks in particular has occurred numerous times due to spongy moth outbreaks.

Since 1980 spongy moths have defoliate about a million acres of forest a year. In 1981 roughly 13 million acres were defoliated – an area larger than Massachusetts and Connecticut combined. Spongy moth larvae prefer hardwoods but feed on hundreds of trees and shrub species. When populations are dense they eat almost any vegetation. Trees are killed when they have been greatly defoliated (more than 50% of summer foliage) several times, or when stressed by other factors such as drought.

The life cycle of spongy moths involves four stages: eggs, larvae, pupa, and adult moths. Only the larvae damage vegetation. Spongy moths overwinter as egg masses laid on tree trunks and branches. Hatching coincides with leaf budding of hardwoods in the spring. Larval dispersal happens ballooning or using silken thread to travel by wind. Humans also play a role in dispersal through the transportation of wood and other objects. Larvae molt several times and in mid-summer they pupate. During this stage, caterpillars undergo complete metamorphosis and emerge as adult moths. Female moths have wings, but cannot fly, so males must seek out female moths to mate. After mating, females lay their eggs and the cycle continues.

Spongy moths have several predators that help reduce their populations including wasps, flies, ground beetles, ants, spiders, birds such as chickadees, blue jays, nuthatches, towhees, and robins, as well as small mammals such as white-footed mice, shrews, chipmunks, squirrels, and raccoons. Despite a large number of predators, mice are considered the most important predator of low-density spongy moth populations and their abundance may be critical in determining whether or not there is a spongy moth outbreak.

How are spongy moth populations affected by mouse populations?

How do spongy moth populations affect mouse populations?

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