Rhode Island Department of Environmental Management

Gypsy Moth in Rhode Island - Introduction

Background

The European Gypsy Moth, *Lymantria dispar*, is one of North America's most devastating forest pests. Having evolved in Europe and Asia, it has existed there for thousands of years. By the 1800's gypsy moth had become a prominent pest in Europe, causing widespread forest defoliation.

In the 1860's there was keen interest in developing a silk industry in the United States, and several entrepreneurs skilled in entomology, were experimenting with various species of moths that might work for this purpose. One such person was Etienne L. Trouvelot, working in Medford, Massachusetts (Figure 1).

Fig 1. Etienne L. Trouvelot

In either 1868 or 1869 Mr. Trouvelot received a shipment of potential silk moth candidates from a colleague in France. The shipment, whether by accident or on purpose, included some gypsy moth eggs. Mr. Trouvelot began rearing gypsy moths and some escaped into the wild. Understanding the potential impact of this accidental release Mr. Trouvelot notified the proper authorities, but no action was taken at that time. About 10 years after their initial introduction, the first gypsy moth "outbreaks" began in Trouvelot's neighborhood.

Since their initial introduction gypsy moth has become well-established in the northeast, and is well-known as a pest of forest and landscape trees. In its larval (caterpillar) stage, it is voracious in its consumption of tree and shrub foliage, earning its namesake "the Destroyer" (translation of the Latin *Lymantria dispar*).

Outbreaks

Figure 2. Photo taken during 2016 aerial detection survey showing the expanse of canopy defoliation. Scituate, looking westward. SR-102 north of SR-14 can be seen in mid-photo.
(Photo: P. Ricard).

Gypsy moth caterpillars periodically emerge in great numbers, spreading rapidly over large geographic areas. During these "outbreaks" gypsy moth caterpillars cause significant defoliation events as they consume foliage of their preferred host broadleaf tree or shrub, especially oaks, aspen, birch, and alder. When caterpillar numbers are high they will feed on non-preferred conifers such as pines, firs, and spruces. By the end of June, they will have stripped bare a majority of all trees and shrubs in the area. Forest and lawn trees end up looking more like they do in January than in July.

The caterpillars can also cause a significant disruption for people in the infested area. During outbreaks, people find the insect to be highly objectionable. Besides harm done to trees, caterpillars seem inescapable. They descend from trees and crawl on lawns. Their droppings fill gutters and cover outdoor spaces. They are, in a word, obnoxious. People would prefer to be rid of them.

In the recent past outbreaks have generally lasted 2-3 years, but in some areas significant defoliations had continued for as many as 10 years. Why gypsy moth populations remain below outbreak levels is not completely understood, nor is what causes an outbreak, but it is widely accepted that the delicate

balance of naturally occurring "bio-controls" and environmental conditions are largely responsible. Bio-controls include predators of the gypsy moth larvae including small mammals and birds, parasitoids of the gypsy moth eggs and larvae, of which there are several wasps and flies, and two pathogens: a naturally occurring fungus (*Entomophaga maimaiga*) and a virus, the Nucleopolyhedrosis virus (NPV).

The most important environmental condition required is adequate precipitation throughout the gypsy moth larval stage (mid-April through late June) which is necessary for the production and spread of *Entomophaga*. In 2014 below average rainfall started a cascade of unpredictable events that heralded the start of the current outbreak (Figure 3).

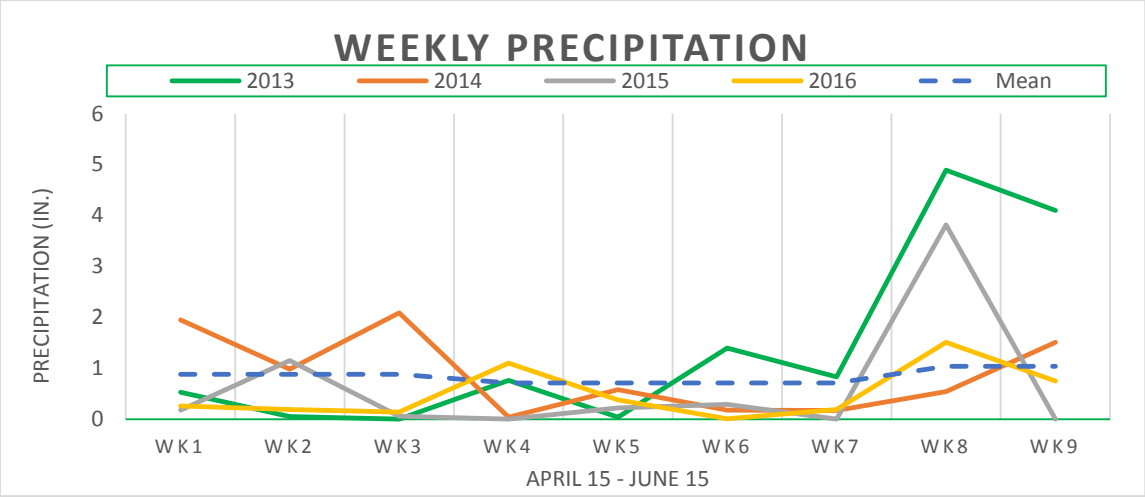

Figure 3. Deviation of precipitation from the 10-yr. mean during the critical time (weeks 1-7) for the production and spread of the *Entomophaga maimaiga* fungus.

While *Entomophaga* has more of an impact while gypsy moth numbers are low, NPV plays a significant role in gypsy moth population control when larval numbers and densities are high, such as during an outbreak when more suitable conditions exist for caterpillar to caterpillar transmission. During an outbreak, NPV can cause an "epizootic" episode (massive die-off). Unfortunately this usually doesn't occur until the latter stages (mid-late June) of the defoliation event.

Rhode Island DEM Forest Environment routinely monitors gypsy moth populations by conducting annual egg mass counts on 142 fixed ground plots. Analysis of data collected prior to 2014 gave no indication of an impending outbreak. Nevertheless, in 2015 a moderate defoliation event occurred in scattered areas throughout the western portions of the state. While *relatively* few acres (46,800) were defoliated, it was the largest since the mid-1980s (Figure 4).

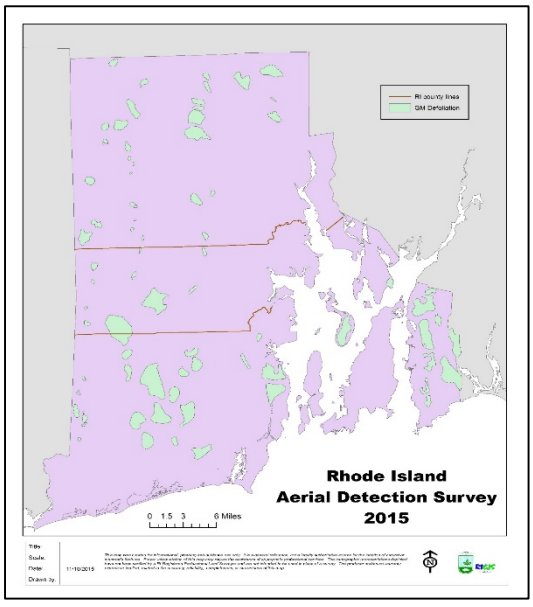

Figure 4. Locations of defoliation attributed to gypsy moth larvae, mapped during the 2015 aerial detection survey.

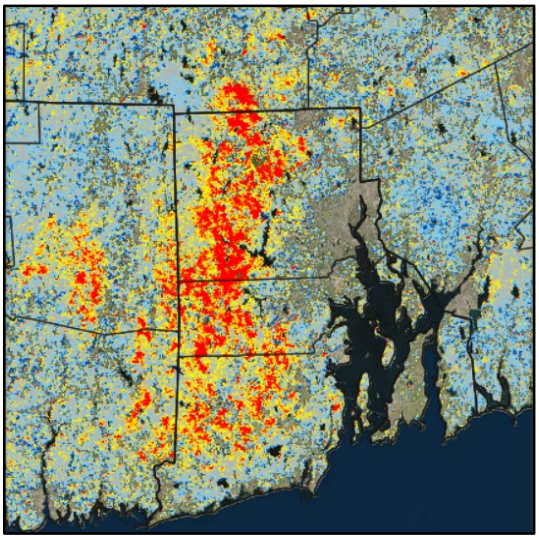

Figure 5. Area of forest canopy affected by defoliation, May, 2016. Source: USDA Forest Service Forewarn satellite imagery.

The number of egg masses counted (3,532) during the 2015 fall egg mass survey was *significantly* higher than in 2014 when only 44 were found. Thus millions of caterpillars emerged in the spring of 2016.

By late May defoliation had spread in its extent and intensity throughout most of the western half of the state, and involved over 226,800 acres. The disturbance to the forest canopy was so severe that it was identifiable from orbiting satellites! (Figure 5).

Areas of Connecticut and Massachusetts also experienced defoliations caused by gypsy moth in 2016, but not as concentrated as that which occurred in Rhode Island.

The number of egg masses counted (36,226+) during the most recent (2016) egg mass survey represents over a tenfold increase from 2015. Estimates of the number of caterpillars emerging in the spring of 2017 are simply too large to comprehend.

Outlook

It is difficult to predict the future status of a gypsy moth outbreak because of the number of variables involved and complexity of the relationship between the environment and the insect. However two major factors can be considered: potential number of caterpillars, and the abundance and distribution of the bio-controls (*Entomophaga* and NPV) that will ultimately cause a gypsy moth population collapse. As discussed above, there were a tremendous number of egg masses counted last fall, and they are distributed throughout most of Rhode Island.

In 2015 and 2016 The Connecticut Agricultural Experiment Station (CAES) analyzed samples taken from gypsy moth caterpillars collected in Connecticut to determine the presence/absence/relative abundance of *Entomophaga* and NPV in the environment. Little to no inoculum of *Entomophaga* was detected in 2015 or 2016; no NPV was detected in 2015, and only little was detected in 2016. However, given proper conditions (sufficient rainfall & caterpillar density), each of these pathogens can multiply rapidly and cause mass mortality. While no such sampling occurred in Rhode Island it is not unreasonable to assume a similar situation exists here.

The substantial number of egg masses tallied in the 2016 egg mass survey and the number and distribution of egg masses observed in the supplemental visual survey, together with the scarcity of natural pathogens, suggest that there is a high probability for another significant defoliation event this coming season (May – July, 2017). While last year's defoliation event affected nearly one-quarter of the State's terrestrial land mass, the more or less statewide distribution of egg masses indicates that the area affected in 2017 will be larger, and will expand into the previously unscathed metropolitan areas and east bay communities. Areas heavily defoliated in 2016 can expect a similar defoliation in 2017, while trees in areas with moderate to no defoliation in 2016 can expect increased defoliation.

Until conditions (i.e. periodic consistent rainfall from late April to mid- June) are such that the naturally occurring bio-controls can regain the upper hand on the gypsy moth, the outbreak will likely continue. Even if spring weather conditions are perfect for the production and spread of gypsy moth pathogens, because of the method of transmission and dispersal of *Entomophaga* and NPV, we are still likely to experience a significant defoliation event in 2017. A high rate of larval mortality in 2017 can prevent or minimize defoliation for 2018.

To end the current outbreak frequent periods of rainfall are needed from May through June. Even then we expect, and should prepare for another season coping with gypsy moth.