"Report: Gypsy Moth in Rhode Island 2014-2016"

2017 Update

Introduction.
Destructive insects and diseases which may be harmful to native trees are annually monitored the DEM Division of Forest Environment. Analysis of the results of these surveys are used to predict and plan for future conditions.

2016 was the third year of an ongoing outbreak of the invasive Gypsy moth, whose larvae (caterpillars) impacted roughly 226,880 acres of tree canopy in Rhode Island. Most of the affected trees were in the western half of the State, though some urban areas were not spared either. The intensity and extent of the defoliation was summarized in the document "Report: Gypsy Moth in Rhode 2014-2016". That report concluded:

> "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 (April – July 2017). While last year's defoliation event affected nearly one-quarter of the State's terrestrial land mass, the statewide distribution of egg masses indicates that the area affected in 2017 will be larger, and will expand into the previously unscathed suburban and urban 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."

This document provides an update to the original report's predictions, results of 2017 surveys, and an outlook for 2018. Readers are strongly encouraged to familiarize themselves with the original document as it provides background information not included herein.

Methodology.
The survey methods used in 2017 were the same as those used in 2016: an augmented variant of the sequential fixed plot egg mass count, and an Aerial Detection Survey ("ADS"). The exception to the methodology was that for 2017 a fixed wing aircraft was used to conduct the ADS vs. a rotary wing aircraft ("helicopter") used in 2016.

This change had little effect on the data collected, with two exceptions: 1) timing was limited to one survey conducted in late June (as opposed to the 2-3 usually undertaken), making it difficult to differentiate defoliations caused by a single "Damage Causal Agent" (DCA), vs. defoliations caused by multiple DCA's, and, 2) circumstances did not allow complete aerial coverage of the State and therefore certain communities in the East Bay region were surveyed using internet based "forest canopy change detection" (USDA FHTET) data that was later ground-truthed via "windshield" survey. This resulted in under-reporting of acres defoliated for those communities surveyed in this manner.

Results.
Egg mass count. Once again, all 142 historical plots were surveyed this past fall/early winter using

established methods. Figure 1. below compares the number of egg masses tallied for the past three years. The number of egg masses tallied can be used as an indicator of the potential number of caterpillars that could hatch in the Spring of 2018.

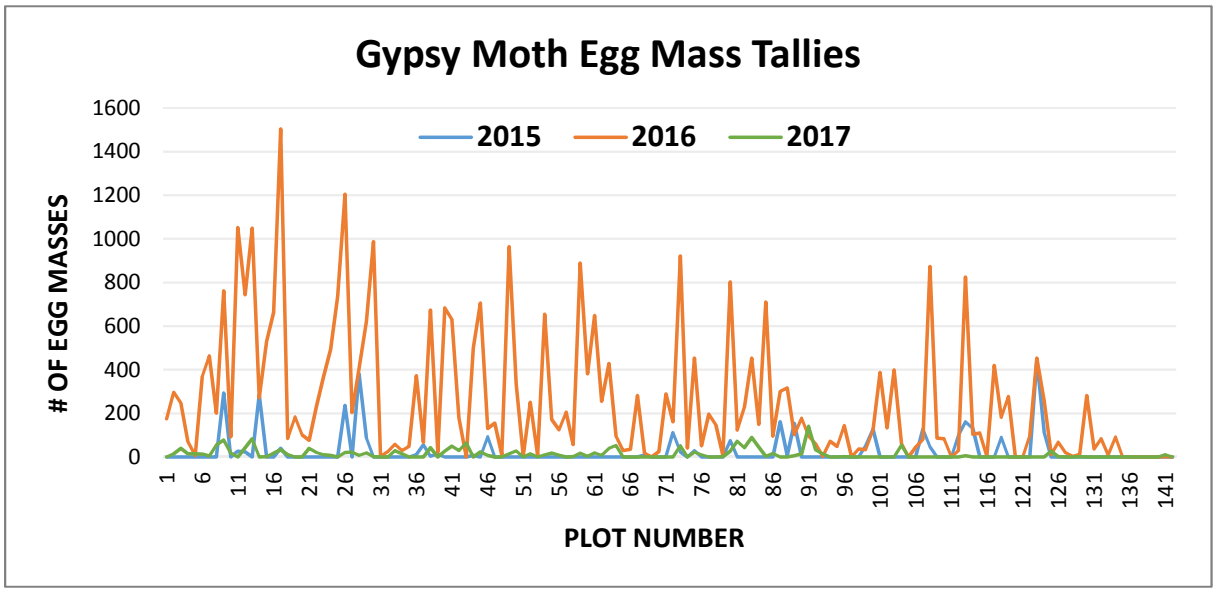

Figure 1. Comparison of the number of gypsy moth egg masses counted/plot during the 2015, 2016, and 2017 egg mass surveys.

Non-traditional plots in the more urbanized areas that were surveyed last year were not visited this year.

Spring rainfall, essential to facilitate the germination and spread of the infectious *Entomophaga* fungus, was well above the 10-yr. mean (Figure 2.).

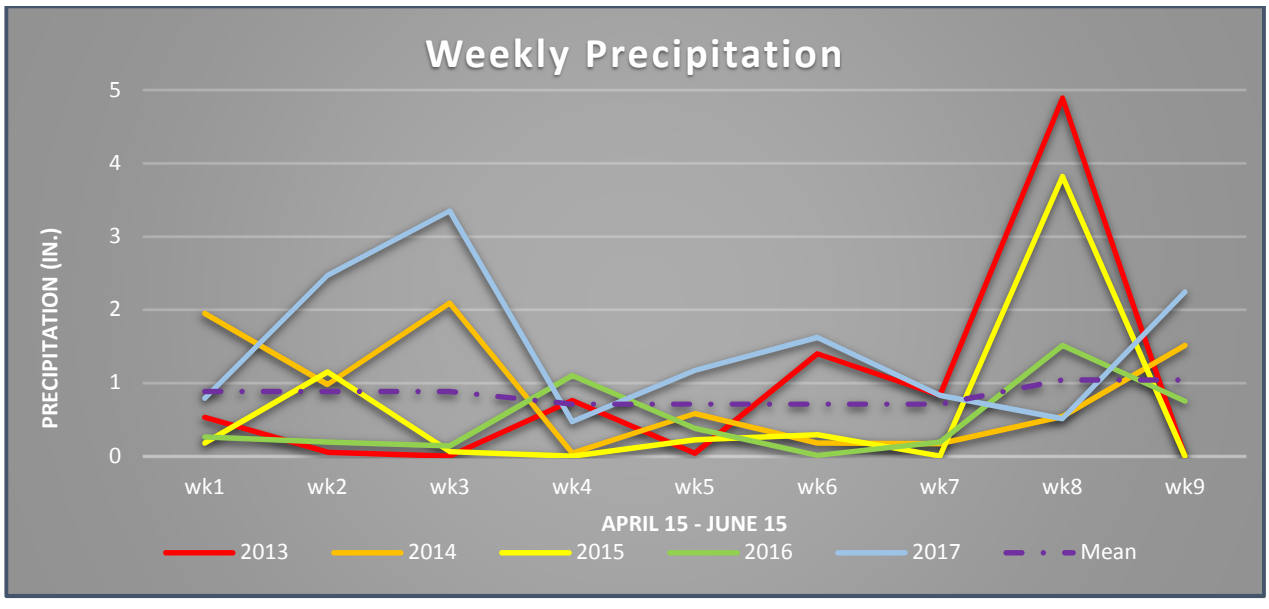

Figure 2. Comparison of weekly spring rainfall totals, 2013-2017.

Aerial Detection Survey (ADS)/Canopy Defoliation. As mentioned in "Methodology" above, only one ADS was flown this season, in late June, due to problems obtaining use of an aircraft. In lieu of aerial survey, visual observations of early season defoliation were undertaken and ground truthed for Damage Causal Agent. These observations aided in assigning DCA's to polygons delineated during the late season flight.

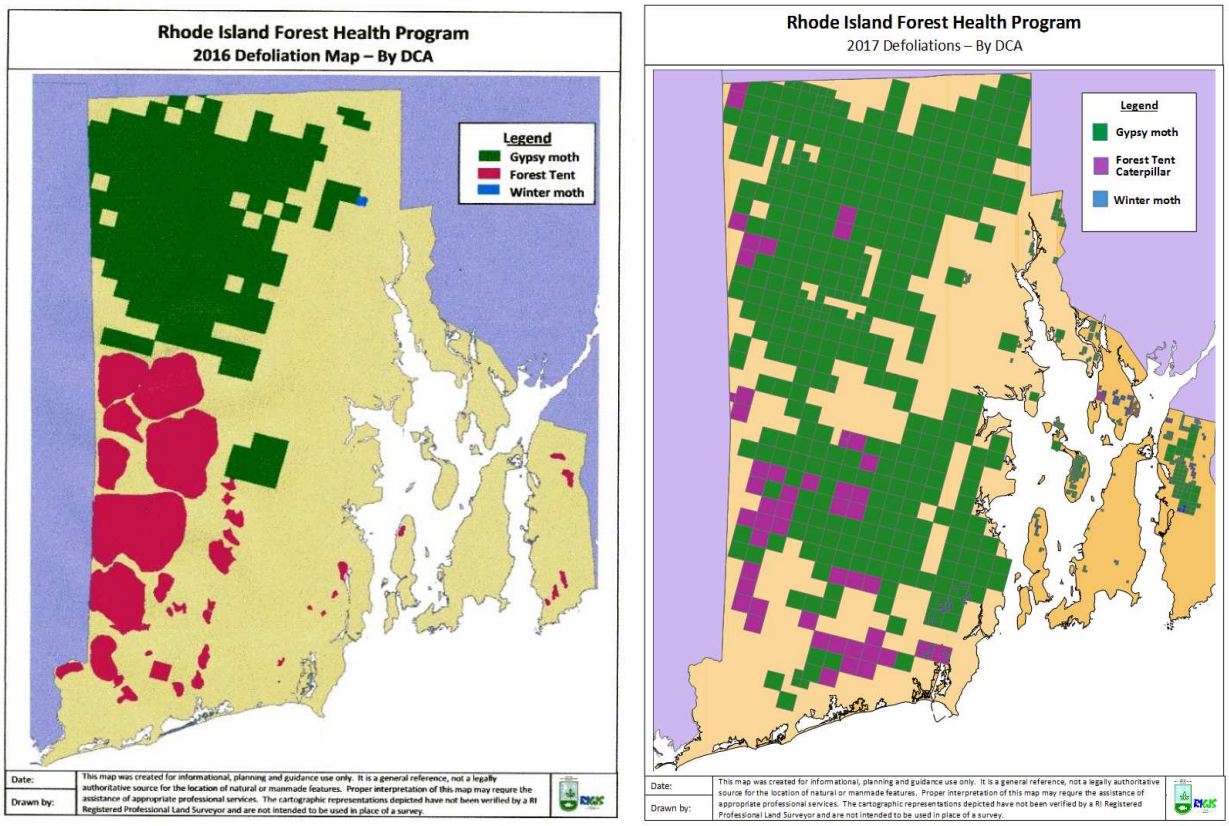

Figure 3. Comparison of area of forest canopy affected by forest defoliators, by Damage Causal Agent, 2016 and 2017.

Discussion.

The "Report: Gypsy moth in Rhode Island 2014-2016" forecast that the Gypsy moth outbreak could continue into 2017, and that canopy defoliation could be more intense and widespread. It also suggested that defoliation intensity and extent would be independent of Spring 2017 precipitation totals. It should have come as no surprise then that despite above average Spring rains (ideal conditions for the germination and spread of pathogens lethal to Gypsy moth caterpillars), our forests experienced a roughly 30% increase in acres of canopy defoliated attributable to Gypsy moth larval feeding behavior.

However, in late Spring/Early summer we also observed significant caterpillar mortality throughout the State due to the *Entomophaga* fungus and NPV virus. This is consistent with typical Gypsy moth pathogen/mortality cycles. Not unexpectedly then, there was a sharp decline in the number of egg masses tallied in the 2017-2018 winter egg mass survey (1804 vs. 36,052). Nevertheless, 1804 egg masses statewide is *not* an insignificant number considering the *sum total* of egg masses counted during the ten years preceding the outbreak was 54!

The concentration of egg masses within the state were somewhat higher in both Providence and Washington counties, areas where defoliation was more intense and widespread. Egg masses were also smaller than in 2017, consistent with historical findings indicative of late stage outbreaks. As smaller egg masses suffer higher parasitism and lower egg survival rates, the *potential* number of caterpillars that may hatch the upcoming Spring is significantly reduced.

Conclusion.

Above average precipitation in 2017 provided perfect conditions for the proliferation and spread of pathogens lethal to Gypsy moth caterpillars, and set the stage for a population collapse in 2018. However, there will still be a defoliation event as the caterpillars must emerge and feed to facilitate the spread of those pathogens amongst themselves.

While the 2018 defoliation may be locally intense and extensive, it will generally be at a smaller scale than the 2017 defoliation. Therefore, the outlook for 2019 looks favorable for the end the outbreak, especially if we should experience at least average precipitation during the Spring, 2018.