WHAT GOES UP MUST COME DOWN–THE COMPLETION OF FIELD RESEARCH ON EMERALD ASH BORER AT DOE FARM

By Todd Johnson, Post-Doc, UNH, 15 October 2020

Welcome to the final update on the field portion of our ongoing research project studying the emerald ash borer and the ash trees it attacks at Doe Farm. If you have missed any of our previous updates, you can find our initial project outline here, and our previous three updates from June, July, and September on the Doe Farm website.

In our last update, we described the process of releasing biological control agents against the emerald ash borer at Doe Farm. This included an explanation of the complex interactions that may occur between ash trees with potentially different capacities to defend themselves against the emerald ash borer, and how this may ultimately affect the behavior and success of the two species of parasitic wasps released to control this beetle. We completed the last of three releases of these wasps approximately one month ago. Since then, our parasitic wasps should have had ample time to investigate and parasitize the larvae of emerald ash borer associated with our project. Starting this weekend (October 16-18th), we begin the momentous task of cutting every tree down that we artificially infested with the emerald ash borer in early June.

Removing these artificially infested trees is integral to our project, as well as our agreement with the State of New Hampshire to conduct our research on an invasive species. With respect to our project, removing these trees allows us to collect data on how tree size and species affects the development of larvae of the emerald ash borer. After cutting each tree down we remove three sections from each tree. The first section is a large area above and below the location where placed eggs of the emerald ash borer on trees in June. We remove this area carefully to confirm that we remove any larvae of the emerald ash borer that are in this section of the tree. Our second and third sections come from what we have deemed the "sentinel region", which lies immediately below the crown or top of the tree. Emerald ash borer and many other species of jewel beetles (the insect family Buprestidae) prefer to attack trees immediately under the crown. Removing these sections allows us to assess how many trees at Doe Farm have been naturally colonized by populations of emerald ash borer already present in the region. To further understand this, we also cut down four additional trees that have been used in our study, but were not artificially infested with the beetle. This allows us to better understand the natural populations of emerald ash borer at Doe Farm, as well as control for any irregularities that may arise when we analyze our chemical samples taken earlier in the year.

After we remove each section from our trees at Doe Farm, we begin the collection of data. This includes measuring the length and diameter of each section of tree, as well as collecting measurements of bark structure (which is known to influence the survival of many species of insects that feed in trees). Once these measurements have been completed, we begin the careful process of peeling the bark off of our logs. Within each log, we remove and count the number of larvae of the emerald ash borer, as well as that of any parasitic wasps that may have parasitized these beetles. Later in the laboratory, we will measure each emerald ash borer larva to determine its developmental stage, as well as confirm the identities of each parasitic wasp that was found. As part of bark removal process, we also uncover and take photographs of the galleries, or tunnels created by each emerald ash borer larva. We then take measurements from the photographs to determine how much of the tree was consumed by larvae of the emerald ash borer. As larvae develop, they consume more phloem tissue in the tree. But, there are other factors that may influence how much or how little the beetles consume. If trees are well defended (but not enough to outright kill the invading larva), the quality of the phloem that

emerald ash borer feed on may be comprised. This may cause the emerald ash borer to become stressed, and have to feed over greater distances to compensate for the poor quality of their food source. It is during this period of time that larvae of the emerald ash borer may become more susceptible to attack by natural enemies such as pathogens, predators, and in our case, parasitic wasps. It is also possible that longer galleries make the beetles more difficult to locate by natural enemies. These hypotheses will be tested once we complete the analysis of our images and measurements of our beetles.

The data collected at Doe Farm will help researchers and land managers better understand the growth of populations of the emerald ash borer in the northeast, as well as the success (or lack thereof) of introduced biological control agents against the beetle. Additionally, understanding how tree size/age influence the defensive capacity of trees will inform management not only of emerald ash borer, but other woodboring pests of trees. As we move forward with the analysis of our data we hope to continue sharing our insights into the emerald ash borer with the community at Doe Farm and the Town of Durham. So, please stay tuned in the future, as we will be back to report on our findings. It has been an absolute pleasure to work at Doe Farm and we have enjoyed all of our interactions with individuals along the trails, as well as with the Town of Durham Conservation Commission and Land Stewardship Committee. Thank you for making this research possible.