New Hampshire ENVIROTHON 2016

Current Issue Challenge: *Invasive Species Impacts on New Hampshire*

Introduction

An invasive alien species is one that is not native to the ecosystem under consideration and whose introduction causes, or is likely to cause, economic harm, environmental harm, or harm to human health (NISC, 2006). Invasive species include aquatic and land-based plants and animals, insects, fungus, and pathogens. Invasive species can threaten biodiversity, alter ecosystem services, affect human health, and impact local economies (*e.g.*, Mercader, *et al*., 2011; Donovan *et al*., 2013; Herms and McCullough, 2014). For example, a recent study by scientists from the United States and Canada estimate that the management of invasion from wood boring insects cost local governments in the United States nearly $1.7 billion, along with approximately $830 million in lost residential property values (Aukema, *et al*., 2011).

The process of alien species invasion typically involves arrival, establishment, and spread (Mercader *et al*., 2011). Once an invasive species has been detected, qualified experts then perform an assessment that involves establishing if the species is new to the area, how far away is the nearest infestation, identification of vectors that transported the alien species, determination of the magnitude and extent of the infestation, identification of the impacts and what stakeholders are impacted, and establishing any local, state or federal regulations related to the species in question. Following this assessment, experts typically identify and evaluate all feasible control options.

One of the most costly invasive species in the past decade is the Emerald Ash Borer (*Agrilus planipennis*), which was accidentally introduced to North America from Asia. Populations of Emerald Ash Borer (EAB) were first detected in Michigan and Ontario in 2002, and have since spread to large areas in central US and Canada, with populations being detected as far west as Colorado and as far east as New Hampshire (USDA, 2016); EAB was detected in Concord, NH in March 2013 and has spread to surrounding towns and communities (UNH, 2016). Since its introduction, EAB has killed millions of ash trees in North America. In some areas of southeast Michigan, more than 99% of the ash trees with stems greater than 2.5 cm in diameter have been killed (Klooster, *et al*., 2013).

In response to the possibility of ash tree devastation on a continental scale, many areas have imposed quarantines to regulate the movement of ash logs, nursery trees, and other ash products from infested counties (*e.g.*, UNH, 2016). While complete eradication of EAB is unlikely, many groups are exploring and testing management options to slow the spread of EAB in North America. Management strategies for invasive species often consist of biological control (*i.e.*, introducing predator species), chemical control (*e.g.*, pesticides; herbicides), and

mechanical/physical control (*e.g*., traps). Mercader *et al*. (2011) explored three potential EAB management options using a population growth and spread model: removal of ash trees; girdling ash trees; and applying a highly effective insecticide. Model results indicated that insecticide application was the most effective at slowing the spread of EAB (Mercader, *et al*., 2011). Biological control of EAB has consisted largely of the introduction of two species of parasitoid wasps that attack and kill EAB eggs or larvae. The wasps were imported from their native habitat in China in 2002 and have been released in 14 states with known EAB infestation (US Forest Service, 2013).

Since EAB was not considered a major pest in its native Asia, it did not appear on any watch lists and was not widely studied. In the beginning of the North American infestation, scientists had difficulty identifying the insect. However, over the past decade there have been many studies into EAB biology, ecology, impacts, and management. As a result, EAB management strategies have been put in place in many regions to combat infestation. One of these strategies, systematic insecticides, has been effective at treating landscape trees; however, options for protecting ash trees in forested settings are limited (Herms and McCullough, 2014).

The Challenge

Because of the possibility of EAB devastating New Hampshire's ash trees, it is very important for the citizens of the state to become aware of EAB biology and control. For this year's Challenge, your team is charged with devising a plan to educate your community on EAB biology, ecology, impacts, and management. To begin, your team will need to perform some general research on invasive species that should include the following topics:

1) General description of invasive species.
2) How invasive species are introduced and spread.
3) What measures are taken to control invasive species?
4) What are some of the roles that local, state and federal government take in dealing with invasive species?
5) What are some of the characteristics of an effective invasive species?
6) How are invasive species infestations often managed?

Next, your research should concentrate on the Emerald Ash Borer and its ecological, economic, and social impacts by focusing on the following topics:

1) EAB North American impacts to date
2) History of EAB in New Hampshire
3) EAB biology and ecology
4) Factors contributing to EAB effective infestation
5) Ecological, economic, and social impacts of EAB infestation
6) EAB detection and management strategies
7) Potential impacts of EAB on New Hampshire ash trees
8) Potential impacts of EAB infestation management strategies

As part of the Challenge, your team **must present evidence** that you have educated your community on the ecological, economic and social potential impacts of EAB infestation in New Hampshire. This could be a presentation at a town meeting, a presentation to the community at your school where the public is invited, or a poster or electronic media that your team produced that was distributed to your community.

References

Aukema JE, Leung B, Kovacs K, Chivers C, Britton KO, Englin J, et al. (2011) Economic Impacts of Non-Native Forest Insects in the Continental United States. *PLoS ONE* 6(9): e24587. doi:10.1371/journal.pone.0024587

Donovan G.H., Butry D.R., Michael Y.L., Prestemon J.P., and Liebhold A.M., (2013). The Relation between Trees and Human Health: Evidence from the Spread of the Emerald Ash Borer. Am. J. Prev.Med. 44:139–45.

Herms, D. A. and McCullough, D. G. (2014). Emerald Ash Borer Invasion of North America: History, Biology, Ecology, Impacts, and Management. *Annual Review of Entomology* (59). doi: 10.1146/annurev-ento-011613-162051.

Klooster W.S., Herms D.A., Knight K.S., Herms C.P., and McCullough D.G. (2013). Ash Mortality, Regeneration, and Seed Bank dynamics in Mixed Hardwood Forests Following Invasion by Emerald Ash Borer (Agrilus planipennis). *Biol. Invas*. doi:10.1007/s10530-013-0543-7

Mercader, R. J., Siegert, N. W., Liebhold, A. M., and McCullough, D. G. (2011) Simulating the effectiveness of three potential management options to slow the spread of emerald ash borer (Agrilus planipennis) populations in localized outlier sites *Canadian Journal of Forest Research*, 41(2): 254-264, 10.1139/X10-201

NISC, 2006. Invasive Species Definition Clarification and Guidance White Paper, The National Invasive Species Council, http://www.invasivespeciesinfo.gov/docs/council/isacdef.pdf, accessed November 20, 2015

UNH 2016, University of New Hampshire Cooperative Extension Invasive Species Information, http://nhbugs.org/, accessed November 30, 2015.

US Forest Service, 2013. *Emerald Ash Borer Research: A Decade of Progress on an Expanding Pest Problem.* United States Department of Agriculture, Forest Service, Research Review No. 20, Summer 2013.

USDA, 2016. United States Department of Agriculture, Forest Service, and Michigan State University Emerald Ash Borer Information, http://emeraldashborer.info/, accessed December 10, 2015.

Resources

New Hampshire Cooperative Extension Invasive Species

http://nhbugs.org/

USDA/Michigan State University EAB Information

http://emeraldashborer.info/

Battle of the Ash Borer by Matthew Miller. An informative narrative about how the EAB devastated southeast Michigan. Accessed December 1, 2015. http://www.lansingstatejournal.com/story/news/local/2014/09/03/michigan-emerald-ash-borer/14796695/

NH ENVIROTHON 2016 Current Issue Challenge Committee

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NH ENVIROTHON 2016 Oral Presentation Guide

1) Students have the option of presenting their solution to the Current Issue Challenge using a PowerPoint presentation.

2) If using a PowerPoint presentation, teams must bring their own laptop computer. The NH ENVIROTHON will supply a projector and screen in each presentation room.

3) Any embedded videos in the presentation must be produced by the NH ENVIROTHON team making the presentation. In other words, no videos downloaded or streamed from the Web can be used in your presentation. Videos should be no longer than one to two minutes.

4) Because a reliable internet cannot be guaranteed, your presentation should not contain any embedded links to web sites or videos.

5) All five team members must participate in the presentation. Your team will have exactly 15 minutes to make your presentation, followed by 5 minutes of questions by the judges. Plan and rehearse your presentation accordingly.

6) Work on the challenge is restricted to the five team members and two alternates. You may seek additional information from any source, but you are not permitted to get help on your solution to the challenge (your analysis, proposed project, the proposal itself, or any handouts or displays) from parents, teachers, advisors, consultants, professionals or anyone else. You may, and should, get help and guidance in rehearsing your presentation.