

Silviculture and Invasive Insects

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Introduction

Forest or woodlot management has historically tried to address a variety of owner objectives. These have included strategies for preventing, reducing, and recovering from impacts of invasive or exotic insects, as well as native ones. The recent spread of hemlock woolly adelgid, emerald ash borer, and Asian longhorned beetle has heightened concerns about appropriate practices for proactively and reactively responding to their potential effects on our forests. This fact sheet suggests ways that woodland owners and managers can use silviculture to maintain healthy and productive trees, and ways to respond if and when these insects arrive.

Owners and their managers should prepare by learning about the threats and keeping



The hemlock woolly adelgid initially attacks new foliage, but will spread to older foliage. The insect develops through 6 stages and is mobile in the "crawler" stage. Photo by Connecticut Agricultural Experiment Station Archive, Connecticut Agricultural Experiment Station, Bugwood.org.

watch for an approach of these and other exotic insects. They should develop a plan of action, and act promptly when any of the three appear nearby. For the present, management in forests having hemlock, ashes, and maples should capitalize on a variety of methods. These include using silviculture to keep the trees vigorous. Landowners should also regenerate the older trees before any become weakened with age. That may require control of interfering vegetation to assure native species diversity. Where susceptible species occur only as a component of the forest, landowners can reduce their abundance to reduce the risk to their woodland.

Expectations from invasion of woodlands by hemlock woolly adelgid, emerald ash borer, and Asian longhorned beetle.

All of these invasive insects exist in New York¹. Trees die when infested by any of them. If occurring at a large scale, that mortality could have profound ecologic, economic, and social consequences.

The hemlock woolly adelgid occurs in parts of eastern and southeastern New York, and in recently discovered populations of the Finger Lakes region. It attacks eastern hemlock that occurs as a primary species in nine forest community types, and as a component of eighteen others. Hemlock also grows in pure stands along some draws and ravines, and on lower slopes. Its loss would importantly compromise some ecologic conditions, visual qualities, and habitat values in those woodlands. This insect



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¹ Other materials describe the patterns and probability of invasion. See www.ForestConnect.info for related websites.



Tree mortality in southern states associated with hemlock woolly adelgid occurs within a few years. In the north, tree mortality has been slower, but typically occurring within a several years. Photo by William M. Ciesla, Forest Health Management International, Bugwood.org.

could also have a major impact on riparian areas dominated by hemlock trees. Landowners could favor or even introduce another conifer at many sites and still have viable forests. Still, the character of mixedwood and many natural conifer stands would change appreciably.

The emerald ash borer was recently found in New York, and has affected forests near the state's western and northern borders. It attacks white and green ash. These grow mostly in mixture with other species. The former occurs in twenty-six different forest cover types, and the latter in eighteen. Green ash may form pure stands at bottomland sites (US For. Serv. 1990). The vast second-growth forests that regenerated on former farmlands may have appreciable amounts of both species. Loss of these trees would still leave many viable hardwood woodlands, but it could have important ecologic and economic impacts. Except where these species occur in pure stands, landowners could favor other trees during thinning and



The emerald ash borer is small and does not fly long distances. It has a metallic green color, a small body size, and blunt head. Long distance dispersal is commonly associated with movement of firewood. Photo by Howard Russell, Michigan State University, Bugwood.org

other tending operations. Emerald ash borer also attacks black ash. That species grows mostly in swampy woodlands, and other frequently flooded areas (US For. Serv. 1990). Loss of black ash would change the character of poorly-drained sites where it occurs, and reduce the supply of splints for basket making.

The Asian long-horned beetle has been found within the state only in the New York City area. Yet it has recently killed trees in rural forest areas of Massachusetts, and could potentially affect maple-dominated woodlands of rural New York as well. Sugar maple dominates those northern hardwood forests, growing on 31 million acres in Northeastern United



Tree decline associated with the emerald ash borer looks similar to that associated with ash yellows. Photo by Michael Bohne, Bugwood.org

States (US For. Serv. 1990). Red maple also occurs widely throughout the region, and may dominate bottomland and poorly drained sites. To have these species killed off would prove catastrophic. It would drastically change the character of northern hardwood woodlands and have profound economic, ecologic and social impacts. Substituting other tree species for the maples seems impractical.



The Asian long-horned beetle is large and typically covered with white or yellowish spots. Adults tend not to move far and may repeatedly infest the same tree. Photo by Joseph O'Brien, USDA Forest Service, Bugwood.org

Hemlock woolly adelgid, emerald ash borer, and Asian long-horned beetle kill trees within just a few years after infesting a site, allowing landowners only limited time to react. Hemlock woolly adelgid generally causes mortality within 4 to 10 years, but even within 3 to 6 years at southern latitudes (US Forest service 2005, Pa. Dept. Conserv. Nat. Resourc. 2008).



Until the recent infestation of Asian long-horned beetle in Massachusetts, insect damage and control efforts have been confined to urban areas. Infestations in rural woodlands and forests create new challenges for forest health specialists. Photo by Michael T. Smith, USDA Agricultural Research Service, Bugwood.org

Secondary agents may shorten the time until tree death (US Forest service 2005). Emerald ash borer kills trees within 3 to 5 years (Ohio Dept Agric 2008), and even in 2 to 3 years (Wikipedia 2008). Asian long-horned beetle causes mortality within 10 years (Hayes and Haugen 2002), but the rate varies with tree size and vigor. Tunneling by the insect damages the wood, and degrades a tree.

The role for silviculture when managing threats of exotic insects

Usually, Integrated Health Management relies on silviculture to reduce potential impacts of natural injurious agents, but may also include direct control of pests and other problems. Current research continues to evaluate biocontrol insects and fungi for use against these three exotic pests, but no candidates have shown immediate promise. For the present, use of insecticides or biologic controls for hemlock woolly adelgid, emerald ash borer, and Asian long-horned beetle seems impractical and unlikely at the stand and forest levels.

For most harmful insects, silviculture attempts to:

1. Keep trees vigorous and remove age classes before they become weakened by maturity. That usually helps to slow or reduce losses to some degree.

2. Change the species composition to reduce the abundance of susceptible ones. That can happen by proper species selection during thinning and related cutting, and through an appropriate reproduction method and seed source.

These measures usually make woodlands more resistant to infestation and more resilient in their response afterward. Thinning can shift the species composition by removing susceptible trees. It also favors vigorous trees and those not yet weakened by old age. These better withstand stress. Vigorous trees may also take longer to die after an infestation by many insects, allowing more time to implement a reaction and recovery plan. Yet tree vigor does not reduce the certainty of mortality or lessen the effects of hemlock woolly adelgid, emerald ash borer, and Asian long-horned beetle. Once they infest a tree, it will die.

Step 1. Be prepared for these three exotic insect pests.

Long before hemlock woolly adelgid, emerald ash borer, or Asian long-horned beetle infest a forest, owners should develop a strategy for minimizing likely losses and adjusting to the change in forest conditions. Exact actions will depend on the management objectives, the species composition of a forest, and how the loss of any one species might compromise an owner's interests. These may include timber and real estate values, as well as non-market benefits derived through recreation, wildlife, and other ecosystem services. In some cases,



Woodland owners should review their ownership objectives with their forester to refine priorities that might influence forest health and how they are able to enjoy their property. Photo by Peter Smallidge.

changes resulting from an infestation might even enhance the values of interest.

But woodland owners should not rush ahead carelessly. Instead they can:

1. Start now to consider the purposes of ownership, and review the management objectives.
 - Write down the values of interest, and their relative importance.
 - Determine what species and forest conditions provide the desired benefits.
 - Study the management plan to evaluate how loss of a susceptible species might alter the desired outcomes and change the management options.
2. Identify specific areas (also called stands) having high numbers of threatened tree species.
 - Make an inventory if none available.
 - Identify susceptible stands for future action, looking for the most susceptible ones to treat and the most valuable trees to salvage.
3. Develop plans for prompt action.
 - Assign specific actions and priorities to the stands.
 - Prepare a treatment list to sequence the containment and salvage cuttings.
 - Identify contractors and mills to do the work and take any usable logs.
4. Watch the situation on and near the forest
 - Keep apprised of regional assessments.
 - Begin on-forest monitoring to detect arrivals.
 - Look for signs of the insects on branches and boles of trees felled for firewood or other uses.
 - Notify authorities immediately as these insects appear nearby.
5. Act promptly when an outbreak approaches.
 - Verify the action plan and treat the most threatened stands first.
 - Engage a contractor without delay if salvage cutting possible.
 - Move ahead promptly and boldly.

A state-mandated quarantine will prevent movement of firewood, logs, and lumber from trees attacked by emerald ash borer and Asian long-horned beetle. So waiting until these insects enter a forest compromises the opportunity for salvage cutting. Instead, owners should anticipate their arrival by removing maple and ash trees as soon as monitoring detects these insects nearby.

Step 2. Act promptly when the insects arrive.

No one knows where and how rapidly these insects will spread. Some areas may escape an infestation altogether. Yet with such fast acting and certain killers, owners must respond promptly. That requires vigilance, particularly as any of these insects appear even in the vicinity of a forest. Woodland owners must remain particularly watchful in regions where all three might occur together. Immediate action should include:

1. Notifying state forest health specialists so they know about the infestation.
2. Cooperating with authorities to contain an emerald ash borer or Asian long-horned beetle infestation by cutting and chipping all affected trees right where they grew.
3. Salvaging the timber from trees affected by hemlock woolly adelgid.
4. Adjusting management plans to restore the values of interest.

Once hemlock woolly adelgid, emerald ash borer, or Asian long-horned beetle infest a forest, landowners can only attempt to contain an infestation. Local and state forest health specialists will help landowners to identify appropriate actions for their woodland. Movement of wood from infested trees may spread the emerald ash borer and Asian long-horned beetle to new sites. So, quarantines usually prohibit transportation of wood products from any tree affected by these insects, and even from seemingly healthy trees within a quarantine area. As a consequence, wood from infested ash and maple trees should remain in the forest.

Landowners can salvage or transport logs from hemlock trees after loss to hemlock woolly adelgid, especially in regions where the

insect has become common. However, to control inadvertent spread of the hemlock woolly adelgid, logging contractors should power wash equipment before moving to a new site.

Step 3. After the infestation, manage to rehabilitate the woodlot

Rehabilitation treatments should follow an infestation to reestablish the values of interest, though emphasizing species less susceptible to these exotic pests. Where an infestation does not compromise the objectives, owners may only want to monitor the forest conditions to watch for unexpected changes that deserve attention at some later time.

Where impacts require a post-infestation intervention, the recovery plan might include:

1. Manipulating the spacing and density of desirable trees and species in partly affected stands that had moderate losses, perhaps leaving a lower stocking and reduced species diversity.
2. Regenerating other desirable species as replacements in understocked stands, doing this with some urgency where needed.
3. Reducing hazards by felling dead trees along trails and roads, near buildings, and within frequently visited areas.

Both the mortality of large trees and overstory cutting should trigger an understory response. That may include development of



Beech root suckers may develop following canopy opening associated with harvest or decline of overstory trees. Beech thickets create dense shade the together with deer can inhibit the regeneration of other desirable hardwood species. Photo by Peter Smallidge.

both tree seedlings and of some interfering plants that cause regeneration failures. Problem species like ferns, grasses, American beech root suckers, striped maple, witchhobble, pin cherry, and black birch often increase and grow rapidly following a heavy to moderate overstory disturbance due to natural causes or cutting. Woodland owners need to control interfering understory plants if they occur on 30% or more of the stand area. Approved herbicides usually prove most effective for all but small areas. Landowners must insist on appropriate and safe application by skilled people.

Reestablishing susceptible tree species in the aftermath only perpetuates a problem. So landowners should treat them as interfering plants, and limit their regeneration following an outbreak. Lack of an alternate seed source in devastated stands may require tree planting to restock a forest, even introducing new species that may importantly transform the ecosystem.

Additional Assistance

Hemlock woolly adelgid, emerald ash borer, and Asian long-horned beetle will require continued vigilance. Everyone should learn to identify these insects, understand their habits and effects, and how to deal with them. Educational materials are available through Cornell University Cooperative Extension, SUNY College of Environmental Science and Forestry, and articles in publications by the New York

Forest Owners Association or the Catskill Forest Association. Woodland owners should communicate with the NYS Department of Environmental Conservation about changes in the presence of these insects on and near their forests. Foresters and other natural resource managers should periodically contact that agency for updates about the status of these insects in or near their area, and participate in educational events through the Society of American Foresters and other organizations.

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