Attachment A – Case Studies for A Decision-making Guide for Invasive Species Program Managers

Case Study #1 – Hemlock woolly adelgid (*Adelges tsugae*) HWA

This is an example of a pest where the decision has been made that eradication and slowing the natural spread of the insect are not realistic. The focus has been on short-term stop-gap measures such as, systemic insecticide treatments on small numbers of valuable trees, and the development of long-term management strategies such as biological control. There is acceptance that damage will occur and other mitigation techniques such as gene conservation and development of resistant hemlock hybrids will be necessary for restoration purposes.

Background:

- Eastern hemlock ranges from northeastern Minnesota eastward through southern Quebec to Nova Scotia, and south in the Appalachian Mountains to northern Georgia and Alabama. It is an important tree for a variety of reasons: fish and wildlife habitat, landscape uses, lumber, aesthetics, and its occurrence/importance in many natural recreation areas.
- HWA was first described in western North America in 1924 and first reported in the eastern United States in 1951 near Richmond, VA. By 2003 damage had increased to where the National Association of State Foresters (NASF) and the National Plant Board (NPB) endorsed establishing a multi-agency initiative to address the issue, which was done.
- The initiative is managed in accordance with a 5 year action plan and is provided direction and oversight by a multi-agency Steering Committee made up of representatives from NASF, NPB, the Forest Service's Southern Region and Northeastern Area, the Northern and Southern Research Stations and the National Office.
- A Technical Working group engages partners and coordinates development of a yearly plan of work for the initiative which is reviewed and approved by the steering committee. This process is designed to support full collaborative management of HWA across the range of eastern and Carolina hemlock.
- The HWA infestation is now very widespread (roughly 50% of the eastern hemlock range), occurring from Maine to northern Georgia. It is far too widespread to eradicate or contain, and due to HWA's means of natural dispersal (wind, birds and small mammals), slowing the natural spread is not a viable option.
- Each state and federal land managing agency is expected to have a hemlock management plan identifying their hemlock resource and priorities for managing HWA prior to USFS funding being made available for control and management programs. Regulatory agencies participate in the initiative, but primary funding is provided through the Forest Service. In 2011 approximately $5 million dollars are dedicated to managing HWA.

Management Actions:

- By 2000, the Forest Service and state agencies were funding efforts to develop, assess and release bio-control agents to help control HWA.
- A significant number of universities and other cooperators continue to be engaged to assess and develop additional biological control agents (*Scymnus, Sasajiscymnus, and Laricobius* species).
- These adelgid specific biological control agents (predator beetles) are released in areas where they will have time to establish prior to hemlocks dying, self-perpetuate and eventually disperse throughout the infested region.
- Small numbers of high value hemlocks are treated with systemic insecticides or sprayed with botanical oils/soaps on public lands. Treatment objectives are typically for: 1) public safety (prevention of hazard trees); 2) genetic conservation; or 3) preservation of unique habitat.
- The time, cost, and labor-intensiveness of insecticide treatments prohibit treating large areas of the infestation; instead, the focus is on treating "Hemlock Conservation Areas". These HCAs are chosen for a variety of attributes that make them valuable and "saveable". It is hoped that this approach will allow for the survival of a small percentage of hemlocks across the landscape until long-term strategies (e.g. biological control and genetic resistance)is realized .
- Maine, Vermont, New Hampshire, Michigan, Ohio and Wisconsin each have a state quarantine in effect that bans the shipment of hemlock from infested areas in the US.
- Funding for survey and control can come through several agencies in USDA but mostly the USFS. Annual surveys are coordinated across the range of HWA to track infestation change.
- Some land managing agencies responsible for the more premiere hemlock resources (i.e Great Smoky Mountain National Park managed by U.S. Department of Interior USDI) also receive internal funds in addition to private donations to implement control strategies.
- Many homeowners opt to treat their hemlocks on their own. HWA information regarding impacts and treatment options for homeowners and others are available on a host of websites.
- Harvard Forest continues to study the impacts of HWA in natural systems, and has developed a guidance document for landowners suggesting that pre-emptive cutting is not a helpful reaction to HWA infestation.

Discussion Questions

- ❖ Do we continue to regulate at the town level or should we move to county level? Regional level?
- ❖ How would either of these affect the impacted industries (forestry, horticulture and tourism)?
- ❖ Do we continue with survey and control? If so where should it be targeted?
- ❖ Should people harvest all their hemlock in anticipation of this pest?
- ❖ Should people not plant hemlock?
- ❖ Do we push for state dollars to deal with this situation?
- ❖ Do we put more resources in public outreach?

Case Study #2 – Gypsy Moth (*Lymantria dispar*)

This is an example of a pest that has been in the U.S. for a long time and the decision has been made to contain the insect, implementing a slow the spread (STS) effort across 11 states, control the insect when populations surge in the generally infested area (19 states), and eradicate isolated spots when found in un-infested states. Addressing the gypsy moth is a national Federally coordinated effort involving the U. S. D.A. Forest Service, the U.S.D.A. Animal and Plant Health Inspection Service, and affected states. Implementation procedures are guided by a national Environmental Impact Statement.

Background:

- The gypsy moth is a nonnative invasive insect that was introduced into Massachusetts in the late 1860s and is now established in all-or-parts of 19 Eastern States and the District of Columbia, or roughly one-third of its potential habitat in the United States.
- Once gypsy moth becomes established, outbreaks continue indefinitely. Outbreaks reduce tree growth and increase tree dieback, which eventually kill trees.
- Gypsy moth will feed on over 300 species of trees and shrubs, but are most damaging to oaks.
- Gypsy moth is known to pose human health hazards resulting in substantial social pressure to control the insect when outbreaks occur.
- The STS effort is administered through a non-profit foundation which is governed by a board of directors made up of representatives from the states involved in this effort. This business model has been held up as template for coordinating responses to other invasive forest pests.

Management Actions:

- Trapping is conducted annually across the US and is used to determine specific treatment needs.
- A fungal biological control agent (*Entomophaga*) was developed and released in the generally infested area and provides effective control in years with cool moist spring weather conditions.
- At times populations surge requiring direct control. Treatments are cost shared as high as 50% with states and communities, with the federal portion ranging from $1-$5 million dollars in a given year. In 2010 gypsy moth outbreaks were directly treated on more than 321,000 acres of Federal, non-Federal public, private, and Tribal lands in eight States.
- Early detection and response to eradicate isolated infestations outside the generally infested area eliminate the need for larger, more costly, and frequent treatments later.
- STS has reduced the gypsy moth rate of spread by more than 60 percent. The program is estimated to prevent environmental damage and financial losses on more than 150 million acres over the next 20 years.
- By delaying impacts and suppression costs STS has a benefit-to-cost ratio of more than 3:1. The STS effort costs between $8 and $11 million dollars annually. In 2010 about 532,000 acres were treated in the STS area at a cost of approximately $10 million dollars.
- Treatments are usually done by aerial application. Several treatment options have been developed that include gypsy moth-specific mating disruption and microbial insecticides. Federal coordination of this program is supported by many as resulting in less impact to endangered species than what would result from unregulated individual treatments.

- Continual investment in the gypsy moth program has been questioned in the face of needs to address new invasive pest introductions. However, this effort has effective tools, effective management business models are in place, less than 1/3 of the potential habitat in the US is infested, economic analysis shows a favorable cost benefit ratio, and public outcry for treatment when populations surge is intense.

Discussion Questions

- ❖ Should the federal government continue to coordinate and fund this effort?
- ❖ States and communities already cost share in the treatments, should the full cost burden be shifted to them?
- ❖ Should the federal government back out and say here are the tools, it is up to you to do as you wish?
- ❖ How would either of these affect the impacted industries (forestry and horticulture)?
- ❖ Do we continue with survey and control? If so where should it be targeted?
- ❖ Do we push for state dollars to deal with this situation? At the expense of what other program?
- ❖ Do we put more resources in public outreach?

Case Study #3 – Asian Long-horned Beetle *Anoplophora glabripennis* (ALB)

This is an example of a pest where the decision has been made that eradication can still be successful. The U.S.D.A. Animal and Plant Health Inspection Service has the primary responsibility addressing this insect, with eradication efforts continuing in New York, New Jersey, and Massachusetts.

Background:

- The Asian long horned beetle (ALB), an insect from China and Korea, is a serious threat to the United States' urban and rural forests. ALB mainly targets maple, elm, and birch trees. The first U.S. infestation was found in New York City in 1996.
- ALB was later found in Chicago (1998); Jersey City, NJ (2002); Toronto, Canada (2003); Middlesex and Union Counties, NJ (2004); Staten Island, NY (2007); Worcester, MA (2008); and recently, on six trees in Boston, MA (July 2010).
- The Worcester infestation is the largest known outside Asia and the first to occur in a forested setting, posing a real threat of spreading throughout New England.

Management Actions:

- ALB has been eradicated in Chicago and Jersey City. Federal, State, and local officials are working to eradicate ALB at the other infested sites.
- Eradication efforts require imposing quarantines to restrict infested wood movement, close individual tree inspections over large areas, removing and destroying infested trees, and applying insecticides to others.
- Eradicating ALB will cost hundreds of millions of dollars over many years. A coalition letter endorsed by the National Association of State Foresters recommended a 2011 budget of $49 million. While eradication costs are high, the resource and economic damage prevented by eradicating this pest are estimated to far out-weigh the cost.
- Climbing trees is the most effective way to survey for ALB but is costly and time consuming. To date 700,000 trees have been surveyed in just two project areas; Worcester and Boston.
- Research efforts to develop better surveying and trapping techniques are underway, but none have yet proven to be operationally effective.
- Because the Worcester infestation is estimated to have been there for 15 years, there is concern the pest was transported to other areas via commerce or infested firewood. A coordinated survey program across New England is in place to survey in high risk areas.
- Eradication requires intense public outreach as it removes trees from streets and in peoples yards. Replacing yard trees to lessen that social impact costs several million dollars annually.
- As of March 2011, over 29,000 infested and high-risk trees have been removed from the Worcester area and 106,420 trees have been treated with insecticides in New York and Massachusetts.
- Development of bio-control agents is being worked on, but only to a limited degree as initial investigation did not surface likely opportunities for success.
- Much information has been made available to the public about ALB.

Discussion Questions

The Worcester infestation was by far the largest found, had been there for over 15 years, and went undetected even with 10 years of much public information and an inventory of urban trees missed the infestation:

- Should there be a more aggressive urban Forest Health Monitoring effort to detect this and other pests?
- Is there a need for an increased public outreach program? How might such a program be more effectively implemented in your location?
- If ALB is found in another location…. Is an eradication program still appropriate for this pest?
- Should there be increased investment in developing biological control in case eradication is not successful?

Case Study #4 – Emerald Ash Borer *Agrilus planipennis* (EAB)

This is an example of a pest where the initial decision was to eradicate, then after several years of increased surveying knowledge and application, it was determined the pest was so wide spread that eradication was not possible and the program shifted to containment and mitigation, focusing on biological control development, containment through regulatory action, and development of slowing ash mortality treatment methods.

Background:

- EAB is an Asian insect that attacks and kills ash trees. It was found near Detroit in July 2002 and shortly thereafter in Windsor, Ontario. This pest was not on any watch lists, and had been in the Detroit area for 10-15 years prior to identification. During that time infested wood product movement spread the insect to many locations and EAB is now confirmed in 15 States (July 2010) as well as in Ontario and Quebec, Canada.
- Firewood movement has been identified as a major mode of range expansion for EAB and significant national and state-focused programs are underway to address this.
- EAB has killed tens of millions of trees and likely will kill many more. It threatens a major reduction or elimination of several ash species. Ash trees are an important component in rural and urban forests and riparian corridors, are commonly planted in urban landscapes across the country, and the ash resource is valued at $282 billion.
- When first discovered there was essentially no scientific information on this insect. Basic research on its life cycle, flight capabilities, host preferences, natural enemies and how to detect EAB or EAB-infested trees was needed. Since 2003, over 200 scientific publications have been produced greatly increasing our knowledge of its biology and control. Even so, one of the greatest EAB management challenges to this day is the ability to detect infestations early enough to manage them and prevent their spread.
- Dramatic changes in the emerald ash borer (EAB) response program began in 2008. It was recognized that eradication objectives were unattainable and a decision was made to transition the program from one of emergency response to a management program. Regulatory activities, research and methods development, and survey and management would be prominent features of the new program.
- This resulted in implementation of: a national EAB survey effort using purple prism traps, an expanded “leading edge” survey to better delimit the EAB infested area, and a revised policy as to under what conditions eradication actions would be supported…essentially curtailing all eradication treatments of the type pursued in previous years.
- Earmarks of about $4 million have occurred focused on providing highly impacted urban areas in Wisconsin, Michigan, Ohio with money to replace trees. A 2007 Report estimated restoration needs in excess of $90 million. It is certain that need is now much greater.
- A 2009 $2 million earmark was established for a “revolving loan fund” for communities to conduct restoration. The Forest Service is developing implementation procedures such a loan program.

- Several Forest Service State & Private Forest Redesign and American Recovery and Reinvestment Act (ARRA) projects have provided funds to states to conduct EAB survey, preparedness, management and restoration.
- Despite the best efforts to eradicate and manage the pest, EAB has proven to be an elusive target. In some areas, communities and land managers may need to identify the highest-value areas and most unique ecosystems they wish to protect.
- Whereas APHIS remains the lead agency on eradication and regulatory actions, the Forest Service (FS), continues to provide technical and financial assistance on EAB management to state, Tribal, private and federal land managers, local communities and other organizations, and conducts research on EAB.

Management Actions:

Survey

- APHIS continues to support an annual, national detection survey in support of regulatory efforts and which is likely to find more emerald ash borer outbreaks.
- A unique biological detection tool, the solitary wasp, *Cerceris fumipennis*, is being field tested in cooperation with nine State forestry and agriculture agencies.
- USFS and USDA ARS are involved in developing tr*apping methodologie*s, searching for biological control options, and are involved in survey (FS) as well.

Treatments

- Development of an integrated treatment method with the **SL**ow **A**sh **M**ortality (**SLAM**) project in Michigan's Upper Peninsula has been initiated and is being repeated in two other states. These multi-agency pilots could be the basis for an integrated management strategy to reduce EAB populations and slow the progression of ash mortality.
- A biological control agent is under development with initial releases having occurred.
- With the dire threat EAB poses to ash, a genetic conservation plan has been developed and work is in progress on germplasm conservation, identification of resistant ash strains, and silvicultural guidelines.

Public Outreach

- Extensive public outreach with a host of materials distributed by states and support of the national EAB portal Web site: www.emeraldashborer.info are in place. USFS and PPQ also have excellent web sites.
- Nation-wide info product outreach to resource professionals such as EAB identification kits (responsible for identifying EAB infested firewood at a CA border inspection station) continues. It has been recognized that firewood may provide a significant pathway for the inadvertent transport of EAB and broad public outreach campaigns to educate the public about the movement firewood threatening the health of the nation's forests have been launched. (See Don't Move Firewood Site http://www.dontmovefirewood.org/)

- Through cooperation with universities, education, outreach and training is being provided to professionals and the public. Live webinars have and continue to be provided to the public through University cooperators.

Discussion Questions

- ❖ Now that it is recognized that this pest is well established and will continue to be spread to new locations… Do we continue with survey and control? If so where should it be targeted?
- ❖ Should this pest continue to be regulated and at what level (county level with State lead or State level with Federal lead)?
- ❖ How would regulatory actions affect the impacted industries (forestry, horticulture and tourism)? Which would be more effective reducing the spread of EAB?
- ❖ Should people (and cities) harvest all their ash in anticipation of this pest?
- ❖ Should people not plant ash? Do we put more resources in public outreach?
- ❖ Should the federal government now reduce funding for this pest and use those resources to find the next exotic introduction sooner in hopes of being able to eradicate that one?
- ❖ Should funding for community preparation, surveying and pretreatment be the focus for investments?
- ❖ Should cities be on their own for replacing killed trees or should there be federal assistance?