

**DRAFT MASSACHUSETTS' EMERGENCY RESPONSE PLAN FOR
HIGHLY DESTRUCTIVE INVASIVE FOREST PESTS**

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**MASSACHUSETTS
EMERGENCY RESPONSE PLAN
FOR
HIGHLY DESTRUCTIVE INVASIVE FOREST
PESTS**



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**Prepared by: Massachusetts Department Conservation and Recreation
Massachusetts Department of Agricultural Resources**

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INTRODUCTION:

Invasive pests have had significant negative economic and ecologic impacts upon various ecosystems in Massachusetts for more than 100 years. The accidental introduction of the gypsy moth has affected forest ecosystems across the Commonwealth and has cost millions of dollars in control and management. Increased international trade and travel has led to a significant increase in the accidental movement of pests into new areas. Additionally, fragmentation and disturbance have made forest ecosystems more vulnerable to the establishment and proliferation of invasives that feed on trees and shrubs. These invasive pests once established in the United States will have significant economic impacts. Most non-native, and potentially invasive, pests are prevented from entering this country by USDA-Animal and Plant Health Inspection Service (APHIS) and the Department of Homeland Security, Customs and Border Protection port inspections. However, due to the volume of trade and the cryptic nature of many pests, some escape detection and become established. The early detection and eradication of forest invasive pests, either before they become established, or before populations increase, is critical to limiting their impacts. More than 400 non-native insects that feed on trees and shrubs are now established in the United States.

In Massachusetts, a network of regulations, inspections and surveys are already in place to detect the introduction of an invasive pest. The Massachusetts Department of Agricultural Resources (MDAR) conducts inspections of nursery stock entering the Commonwealth. MDAR also works with the USDA, APHIS Cooperative Agricultural Pest survey to conduct annual systematic surveys for introduced pests of importance to agricultural and natural ecosystems in Massachusetts. The Massachusetts Department of Conservation and Recreation, Bureaus of Forest Fire Control and Forestry, Forest Health Program (MDCR) conducts annual, systematic surveys in forests through the USDA Forest Service's Cooperative Forest Health Program. The purpose of these inspections and surveys is for early detection of forest insects and diseases (pests). DAR and DCR work cooperatively with the public to recognize and report new forest pest problems in Massachusetts.

This Emergency Response Plan will be activated when a new, highly destructive invasive forest pest is detected either through surveys or from public reports, and its taxonomic identification is confirmed by specialists. Submitting specimens for identification, especially pests of regulatory concern, will be coordinated between the MDAR and MDCR and APHIS. Once identification of an exotic invasive specimen is confirmed the Emergency Response Plan will activate the Incident Command System.

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I. PURPOSE:

- A.** To adequately respond to new introductions of highly destructive invasive insect or disease pests that may threaten the forest and shade tree resources of Massachusetts.
- B.** To ensure a unified approach to the detection, identification, delineation, and assessment of infestation or infection of highly destructive invasive forest and shade tree insects and diseases.
- C.** To ensure a unified and safe approach to the eradication or suppression of highly destructive invasive forest and shade tree insects and diseases (See Attachment for specific invasive pest action plans).
- D.** To clearly define agency roles for responding to invading insects or diseases using a modified Incident Command System (ICS) that addresses assessment, outreach, education, eradication and containment, relevant authorities and/or duties, and the allocation of resources.
- E.** To ensure open, effective and timely communication between local, regional, state and federal government agencies, academia, plant industry professionals and the public.
- F.** To effectively notify the public of the threat and likely response activities.

II. DIRECTION:

The DAR and DCR, together with the United States Department of Agriculture, Animal and Plant Health Inspection Service (USDA APHIS) and USDA, Forest Service (USDA FS) will be the lead agencies. Other agencies may assist the lead agencies as necessary, but must first coordinate all activities through the lead agencies. The goal is a unified effort among all participating agencies to execute a coordinated, effective and efficient response.

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III. AUTHORIZATION:

All actions taken during the execution of this plan are authorized by and conducted in accordance with the provisions of the following:

A. Federal Law:

Federal Noxious Weed Act of 1974, Section 15

Plant Pest Act of 2000, CFR 300-380 as applicable

Agricultural Bioterrorism Protection Act of 2002; 7 CFR 331

B. Commonwealth Massachusetts General Laws:

Title XIX, Agriculture and Conservation, Chapter 128, Agriculture
<http://www.mass.gov/legis/laws/mgl/gl-128-toc.htm>

Title XIX Agriculture and Conservation, Chapter 132, Forestry
<http://www.mass.gov/legis/laws/mgl/gl-132-toc.htm>

Plant Protection Act of 2000

IV. AGENCY ROLES AND RESPONSIBILITIES:

A. Massachusetts Department of Agricultural Resources (DAR) is the lead state agency to prevent the introduction of exotic, invasive plant pests through nursery inspections and the Cooperative Agricultural Pest Survey in cooperation with USDA, APHIS. DAR would cover plant pest emergencies occurring in a nursery or nursery perimeter, greenhouse, agricultural land, or occurrences of noxious weeds. DAR also has legal authority over weeds, insect pests and pathogens that may occur outside agricultural settings. DAR responsibilities will include but are not limited to the following:

- 1) Provide surveillance, detection, identification, assessment, monitoring and follow-up inspections on reported suspect invasive pests.
- 2) Notify and coordinate activities with the appropriate local, state, and federal agencies, other appropriate organizations related to program responsibilities and this response plan.
- 3) Confirm identification of samples or suspect organisms.

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B. Massachusetts Department of Conservation and Recreation (DCR) is the lead agency for suppressing insects and diseases which damage the forest and shade tree resource. DCR is responsible for Forest Health Monitoring, which includes exotic insect surveys. DCR would cover exotic, invasive insects or pathogens that occur in the forest environment on state land in Massachusetts. They would also aid in control of new, noxious weed introductions on lands managed by DCR. DCR responsibilities will include but are not limited to the following:

- 1) Provide surveillance, detection, identification, assessment, monitoring and follow-up inspections on reported suspect invasive pests.
- 2) Notify and coordinate activities with the appropriate local, state, and federal agencies, other appropriate organizations related to program responsibilities and this response plan.
- 3) Confirm identification of samples or suspect organisms.
- 4) Suppress and mitigate damage from highly destructive invasive insect and disease pests of forest and shade trees.
- 5) Provide forest management expertise, advice and liaison with cooperators such as: forest products and tree care industries, private forest landowners and the public.
- 6) Provide liaison with the USDA Forest Service and National Association of State Foresters to request assistance and funding.
- 7) Conduct and assist with forest restoration and mitigation.
- 8) Provide environmental assessment and review.
- 9) Assist with permitting activities when appropriate.

C. DAR and DCR Shared Responsibilities:

- 1) Develop a communication and outreach plan for cooperators and the public on highly destructive invasive forest and shade tree insect and disease pest threats and develop specific messages once a damaging invasive pest has been confirmed in Massachusetts.
- 2) Coordinate the communication of invasive pest information with the United States Department of Agriculture Animal and Plant Health Inspection Service (USDA APHIS), USDA Forest Service (USFS), the University of Massachusetts Cooperative Extension, other appropriate universities, USDA Natural Resources

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Conservation Service (NRCS), local Soil Conservation Districts, tree care professionals, nurserymen and other plant experts.

- 3) Implement and maintain appropriate state and quarantines.
- 4) Review and coordinate control activities to ensure compliance with federal, state and local laws.
- 5) Condemn and seize materials when appropriate.
- 6) Oversee eradication or destruction of infested or potentially infested materials or vectors.
- 7) Provide or assist with procuring funding for survey, outreach and monitoring.
- 8) Provide pest management expertise and advice to all cooperators and the public.
- 9) Coordinate activities through the Incident Command System (ICS) with the appropriate local, state, and federal agencies and other appropriate organizations related to program responsibilities and this response plan.

D. USDA APHIS - Plant Protection and Quarantine (PPQ) is the lead Federal agency to prevent the introduction of highly destructive invasive insect and disease pests of forest and shade trees in the United States and to prevent interstate dissemination.

- 1) Monitor ports of entry and inspect for highly destructive invasive insect and disease pests of forest and shade trees.
- 2) Implement emergency measures at the federal level to prevent dissemination of highly destructive invasive insect and disease pests of forest and shade trees when discovered.
- 3) Identify highly destructive invasive insect and disease pests of forest and shade trees.
- 4) May provide federal funding for survey, outreach, monitoring and response when appropriate.
- 5) Conduct investigations, trace back and trace forward.
- 6) Answer important research questions.

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E. USDA Forest Service is the lead Federal agency for preventing the introduction, detection, identification, and control of highly destructive invasive insect and disease pests of forest and shade trees on all Federal lands. State and Private Forestry's Forest Health Protection Program assists in evaluating, managing and eradicating highly destructive invasive forest and shade tree insect and disease pests should they become established.

- 1) Assist other agencies as needed to detect, evaluate, eradicate, and monitor highly destructive invasive forest and shade tree insect and disease pests.
- 2) Raise awareness about highly destructive invasive forest and shade tree insect and disease pests through information, education and technology transfer.
- 3) Improve management guidelines for new and established highly destructive invasive forest and shade tree insect and disease pests of forest and shade trees through the development of new technologies.
- 4) Provide technical assistance for control activities, including development of NEPA documentation, project planning documents, aircraft calibration, radio communication, and coordination of threatened and endangered species concerns.
- 5) Provide federal funding for survey, outreach, monitoring and response when appropriate.

F. University of Massachusetts Cooperative Extension (MCE) is responsible for assisting the technical transfer of information to cooperators and the public.

- 1) Create increased awareness of highly destructive invasive forest and shade tree insect and disease pests through information, education and technical transfer.
- 2) Provide liaison to the landscape and nursery industry.

V. Incident Command System (ICS)

A. PURPOSE: The ICS will coordinate the overall response, approve action plans, and serve as the final authority on all activities and decisions.

B. MEMBERS:

- 1) **The Invasive Species Agency Coordinating Group (ACG)** will:

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- Determine the need and allocate appropriate resources for emergency responses.
- Approve strategic responses for specific incidents.
- Appoint an Incident Commander appropriate for each response. The Incident Commander will report to the ACG.
- Resolve Incident Response Group issues, when necessary.
- Consist of the following membership:

MDAR Director of Bio-security and Regulatory Services
MDCR Chief Forester
USDA-APHIS PPQ State Plant Health Director
USDA-FS, Forest Health Group Leader

2.) The Incident Command Team (ICT) will:

- Manage the invasive pest outbreak.
- Implement the emergency response plan.
- Amend when necessary emergency response plans.
- Gather and assess data.
- Support or conduct investigations.
- Issue press releases, advisories, and otherwise manage media and public relations as appropriate.
- Consist of the following membership:

3.) Chain of Command

Incident Commander

Command Staff:

Safety Officer
Public Information Officer
Liaison Officer

General Staff:

Operations Director
Finance/Administration Director
Planning Director
Logistics Director

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4.) ICT Roles and Responsibilities:

a) The Incident Commander will be responsible for:

- Official notification of an invasive pest detection incident.
- Overall command of the incident.
- Appointing and briefing individual Command and General Staff.
- Assessing pest risk and determining the appropriate response method.
- Preparing for the ACG approval of amended or revised strategic emergency response plan.
- Mobilizing staff and resources as needed.
- Initiating appropriate state quarantines.
- Assigning and supervising actions taken by Command and General Staff.
- Coordinating and approving all ICT activities.
- Conducting evening close-out briefings and morning deployment tactics (daily Incident Action Plans).
- Resolving issues not easily addressed by any team.

b) The Safety Officer will be responsible for:

- Developing and implementing a safety plan.
- Inspecting and enforcing the safety plan. Emergency response to accidents.
- Investigation of accident
- Working cooperatively with other Teams to ensure safety messages, personal protective equipment, procedures, hazards, and accidents are included in the daily Incident Action Plan, funding request, news releases.
- Preparing the Safety Report section for the ACG.

c) The Liaison Officer will be responsible for:

- Serves as the point of contact for agency representatives assisting at the incident
- Provides briefings to and answers questions from supporting agencies

d) The Public Information Officer will be responsible for:

- Developing and implementing a communications strategy.
- Serving as spokesperson and issue press releases & advisories, etc.
- Managing media and public relations as directed by the ACG and the ICT

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- Developing and delivering educational programs to help the public understand prevention, detection and control mechanisms for specific pests and diseases.
- Communicating accurate information quickly and broadly in a manner that supports the prevention, identification and control of a possible infestation.
- Determining in coordination with Planning Section, the appropriate communication strategy that will be made a component of the daily Incident Action Plan.
- Coordinating activities with technical experts to ensure their availability in press briefings when needed.
- Keeping cooperating agencies, legislative liaison, Department Secretaries and appropriate Directors apprised of all activities as appropriate.

e) The Operations Director will be responsible for:

- Implementing “on the ground” management of highly destructive invasive insect and disease pests of forest and shade tree incidents.
- Organizing field operations to determine the scope of the infestation.
- Implementing quarantines if necessary.
- Implementing daily Incident Action Plans.
- Conducting assessments.
- Restoring impacted areas.
- Providing information to the Incident Commander and teams for Planning, Administration, Finance, and Public Information.
- Working cooperatively with Planning and Administration and Finance Staff to secure resources necessary and appropriate to the scope and intensity of the incident.

f) The Finance/Administration Director will be responsible for:

- Conducting proper financial administrative management of resources.
- All legal, fiscal and technical aspects of the Incident Response.
- Anticipating and requesting future funding needs.
- Keeping the Incident Commander apprised of current financial status.
- Conducting proper contracting and procurement services.

g) The Planning Director will be responsible for:

- Effective planning.
- Obtaining and tracking appropriate human and capital resources.

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- Evaluating and assessing the scope of the incident.
- Securing permits and meeting environmental requirements.
- Determining the amount and type of response effort needed including:
 - Type and amount of materials, equipment and services.
 - Personnel resources needed, including capabilities/expertise.
 - Scheduling work.
 - Interface needed with landowners, other agencies.
- Developing the daily Incident Action Plans.
- Deploying resources.
- Demobilizing resources.
- Preparing the final Incident Report.

h) The Logistics Director will be responsible for:

- Setting up and maintaining facilities including on-site computer networks
- Arranging hotel, food, security, etc. for the ICT
- Supports ICT and resources assigned to the incident such as first aid.
- Ordering personnel, equipment and supplies.
- Providing transportation, vehicle maintenance and fuel.

VI. NOTIFICATION AND MOBILIZATION:

- A)** In the event of the detection of a highly destructive invasive forest and shade tree insect or disease by any agency or cooperator, that agency or cooperator will notify DAR or DCR and upon official verification DAR and DCR will jointly initiate the Emergency Response Plan for Invasive Forest Pests.
- B)** Once a positive identification and confirmation of an invasive pest is determined within Massachusetts, the Incident Command Group will convene a meeting to activate the Emergency Response Plan or activate a “plan of action” and assign an Incident Commander.
- C)** The Incident Commander will designate and assign responsibilities to the Incident Command Team.

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D) The ICT will:

- Determine the appropriate response and begin to develop the Response Plan for the particular pest (See Appendix).
- Address internal and external communication.
- Describe in detail the role and responsibilities of each of the ICTs.
- Delineate and assign sufficient support staff appropriate for successful eradication or suppression of the infestation.
- Conduct delimiting surveys and evaluate the risk of spread.
- Determine the need for quarantines.
- Initiate eradication procedures.
- Request appropriate resources.
- Determine and track budget, record keeping and documentation necessary for the response effort.

VII. QUARANTINE:

When a highly destructive invasive insect and disease pest of forest and shade trees is of federal regulatory concern, the USDA APHIS will set minimum quarantine standards. DAR or DCR may with approval of the USDA APHIS establish quarantines in a smaller geographic area. DAR or DCR will make public the quarantine boundaries through appropriate channels.

A) Notify municipal officials, homeowners, affected industry and community groups using mailings, hand-outs, public meetings, public service news announcements

B) Control movement of host material within quarantine area:

- All host material from within the quarantine area must be treated as infested
- Initiate compliance agreement with related businesses operating inside the quarantine area
- Establish a public information center to answer inquiries with properly trained staff

VIII. DIRECTION:

A) In recognition of the differing responsibilities of participating agencies and cooperators, the DAR or DCR will be the lead agencies.

B) Other organizations may assist the lead agencies in many ways, but should not make survey or eradication decisions on their own.

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- C) All participating agencies and cooperators will communicate frequently and follow all proper communication channels required for a coordinated response led through the Incident Commander
- D) Work force organization will reflect the needs of the event including staff assignments for each of the three ICTs.

X. TRAINING:

Provide annual training on the ICS system, functions of the ICG and ICT, pest identification procedures and control. Conduct a mock emergency response exercise to prepare for an actual infestation as soon as possible and then every other year.

X. REVISING THE EMERGENCY RESPONSE PLAN:

The Emergency Response Plan should be reviewed and if needed revised annually to reflect the most current information available.

XI. APPENDIX:

A. Invasive Species Agency Coordinating Group:

DAR Director of Regulatory Services, Brad Mitchell, 617-626-1771
DCR Chief Forester, Jim DiMaio, 617-626-1430
USDA-APHIS PPQ State Plant Health Director, Patty Douglas, 203-269-4277
USDA-FS, Forest Health Group Leader, Bernard Raimo, 603-868-7708

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B. Incident Command Team Assignments:

Each agency (DAR and DCR) will maintain a list of resources available to each including:

- **Licensed pesticide applicators (federal/commercial - general office contact for getting these lists)**
- **Available equipment for removal and disposal of plant materials**
- **Vendors and contracts for the following:**
 - Boom sprayers and aerial equipment**
 - Landfills and incinerators**
 - Haulers**
 - Tree removal**
 - Car or truck rental**
- **Potential Staging area**

The following ICT Chart will be updated on an annual basis:

Position	Urban Regions	Southeast Region	Northeast Region	Central Region	Western Region	Nurseries Statewide
Incident Commander						
Safety Officer						
Liaison Officer						
Public Inform. Officer						
Planning Section						
Operations Section						
Admin/Finance Section						
Logistics Section						

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C. Invasive Species Individual Response Plans:

ASIAN LONGHORNED BEETLE (ALB)



Distribution

The Asian Longhorned Beetle (ALB), *Anoplophora glabripennis* is a native of China where it is considered a destructive insect and kills many hardwood species. It is believed to have been introduced to the United States in solid wood packing material from China prior to 1996. Currently found infesting trees in New York, Chicago, and New Jersey in the United States, and Toronto, Ontario in Canada, ALB has been intercepted in warehouses and ports all over North America. As of April 2007 the infestation in Chicago is considered eradicated due in large part to a cooperative effort of various federal, state and municipal agencies.

Biology

The Asian Longhorned Beetle has one generation per year. The adults are large (.75 to 1.5 inches long) with long black and white banded antennae. The body is glossy black with irregular white spots. Adults can be found from late spring to fall depending on climate. The adult female deposits a single egg in a niche she chews through the bark into the xylem layer. The egg hatches in 10 to 15 days and the young larvae feed in the xylem/phloem before tunneling into wood where they continue to feed and pupate. Adults emerge from the pupation site by chewing a tunnel in the wood and creating an approximate 3/8 inch round emergence hole. The entire time from egg to adult is 12 to 18 months.

Impacts on Species

In the United States the Asian Longhorned Beetle feeds on many species of deciduous trees, maple species (*Acer*s spp.) being preferred. Other host species include willows, elms, birches, horsechestnut, sycamore, and poplar. Damage occurs because the larval feeding interrupts the flow of water and nutrients. Further damage is done by the larval tunneling which can result structural weakening and failure. External signs of an ALB infestation are the presence of the niche used for egg laying, the round emergence holes, sap oozing from egg niches and the accumulation of coarse sawdust around the base of infested trees or branches.

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Management Options

Early detection of an infestation is the key to controlling the spread of exotic insects. Once an infestation is confirmed, an intensive core area survey should be conducted. This survey must include visual inspection of all known host trees within a ½ mile radius of the initial find. This survey may require the use of tree climbers and or bucket trucks. If additional infested trees are located, the ½ mile radius will be extended from the outermost find. Further surveys extending up to 1 mile from the intensive core survey area should be conducted annually on all roadside host trees.

The prompt removal of all host trees with egg-laying niches, emergence holes, or the presence of adults is the first step in controlling an infestation. The removal of host material includes all above-ground plant parts as well as the stumps to a depth of 9 inches below ground. All infested wood should be chipped into pieces no larger than 5/8 of an inch and burned. Care must be taken in the movement of suspected infested materials to prevent the spread. All debris should be burned within 24 hours of arrival at the burn site.

All known host trees within 1/8 of a mile of infested trees should be chemically treated to suppress undetectable populations or prevent the spread. The USDA-APHIS does not recommend chemical treatment for the control of known infestations without the removal of infested trees. Chemical treatments are most effective when done during periods of adult emergence. Several application methods have been proven effective including soil injection, trunk injection and bark spraying. Prior to any pesticide application, the Massachusetts Department of Agricultural Resources (DAR), Pesticide Program should be contracted for guidance on the pesticide materials that are currently registered for the intended application.

There are no known biological controls known for this species.

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EMERALD ASH BORER (EAB) RESPONSE PLAN



Distribution

The Emerald Ash Borer (*Agrilus planipennis*), an exotic flat head borer, is a native of Asia. It was first identified in 2002 in southeast Michigan. Its introduction is believed to be from solid wood backing material. The Michigan infestation is believed to be six to ten years old at the time of discovery. Since 2002, infestations have been discovered in Indiana, Ohio, Illinois, and Ontario, Canada. Infestations have also been discovered in Maryland and Virginia, these being the result of the illegal movement of infested nursery stock.

Biology

The emerald ash borer is generally considered to have a one-year life cycle, but could require a second year in colder climates. The adult beetles are a slender, elongate, metallic emerald green beetle approximately 7.5 to 13.5 mm long. Adult emergence begins in early June and continues until August with the peak emergence in late June to early July. The adult beetles live about 3 weeks. After mating, the female can lay between 60 and 90 individual eggs in bark crevices on the trunk and branches. Eggs hatch in 7 to 10 days. The young beetle larvae tunnel through the bark and feed from the phloem and outer sapwood resulting in the formation of serpentine galleries. It is these galleries that interrupt the flow of water and nutrients, leading to the decline and death of infested trees. Feeding is completed in early fall and the larvae form a pre-pupal chamber in the outer sapwood. Pupation begins in late April or May. Adults emerge through a D-shaped hole, 3-4 mm in diameter.

Impacts on Species

In the United States Green Ash (*Fraxinus pennsylvanica*), White Ash (*Fraxinus Americana*) and Black Ash (*Fraxinus nigra*) as well as several horticultural varieties have been killed. Trees that have been infested for two years often lose up to 50% of the canopy and die in three to four years.

New infestations are often difficult to detect. Woodpecker feeding may be the first signs of an infestation. After the tree has been infested for one year, the D-shaped adult emergence holes may be observed as well longitudinal bark splits above the larval

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feeding galleries. Dense epicormic shoots along the tree trunk may be another sign of infestations.

Management Options

Early detection of an infestation is the key to controlling the spread of exotic insects. Once an infestation is confirmed an intensive core area survey should be conducted. This survey must include visual inspection of all known host trees within a ½ mile radius of the initial find. This survey may require the use of tree climbers and or bucket trucks. If additional infested trees are located the ½ mile radius will be extended from the outer most find. Further surveys extending up to 1 mile from the intensive core survey area should be conducted annually on all roadside host trees.



The prompt removal of all host trees with emergence holes or the presence of adults is the first step in controlling an infestation. The removal of host material includes all above ground plant parts as well as the stumps to a depth of 9 inches below ground. All infested wood should be chipped into pieces no larger than 5/8 of an inch and burned. Care must be taken in the movement of suspected infested materials to prevent the spread. All debris should be burned within 24 hours of arrival at the burn site.

The use of insecticides has proven successful on trees that are not heavily infested or on healthy trees as a means of protection. Insecticide treatments are not recommended on heavily infested trees because of the larval feeding damage that interrupts the flow of water and nutrients. When appropriate, insecticides may be applied by trunk or soil injection, but this type of application should be completed early in the growing season to allow the tree to absorb the control material. Spraying of tree trunks and foliage may prove effective when adults are present. Prior to any pesticide application, DAR's Pesticide Program should be contracted for guidance on the pesticide materials that are currently registered for the intended application.

There are no known biological controls for this species; however ongoing studies of several parasites look promising.

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SIREX WOODWASP (SWW) RESPONSE PLAN



Distribution

The Sire Wood wasp (*Sirex noctilio*) is a native to Europe, Asia, and northern Africa where it is generally considered to be a secondary pest. It has become well established in Australia, New Zealand, South America and South Africa. In North America, it has been intercepted at ports in solid wood packing materials. It has become establish in northern New York and Canada.

Biology

Sirex woodwasp is expected to complete one generation per year in most of the United States. Adult emergence is expected to be from July through September, with peak emergence in August. Females are attracted to highly stressed trees after an initial flight. They drill their ovipositor into the outer sapwood to inject symbiotic fungus (*Amylostereum aareolatum*), toxic mucus, and eggs. The fungus and mucus act together to kill the tree and create a suitable environment for larval development. Females can lay from 25 to 450 eggs. Unfertilized eggs develop into males, while fertilized eggs produce females. All larval instars feed on the fungus as they tunnel through the wood. The larval stage generally lasts from 10 to 11 months. The mature larvae pupate close to the bark surface and adults emerge about three week later.

Impacts on Species

The Sirex Woodwasp primarily attacks 2 and 3 needle. The most susceptible species in North American are *Monterey pine* (*Pinus radiate*), *loblolly pine* (*Pinus taeda*), *Scotch pine* (*Pinus sylvestris*), and *Austrian pine* (*Pinus nigra*). Other highly susceptible species include *lodgepole* (*P. contorta*), *Jack* (*P. banksiana*), *Jeffrey's* (*P. jeffreyi*), *ponderosa* (*P. ponderosa*), *red* (*P. resinosa*), *shortleaf* (*P. echinata*), *slash* (*P. elliotii*), *Virginia* (*P. virginiana*) and *Pitch* (*P. ridiga*). *Eastern White Pine* (*Pinus strobes*), is considered to be of low susceptibility. In other countries, this woodwasp also infested other species of conifers such as firs, spruces, and larch.

Generally, Sirex woodwasp will attack living pines. At low populations, this woodwasp will select the suppressed, stressed, and injured trees for egg laying. Foliage of infested trees initially wilts, and then changes color from a dark green to light green, to yellow and finally to red over a four- to six-month period. Infested trees may have resin beads or

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dribbles at the egg-laying site, which is most common at the mid-bole level. The larval galleries are tightly packed with fine sawdust. At adults emerge they chew round exit holes that vary from 1/8 to 3/8 inches in diameter.

Management Options

In the Southern Hemisphere the damage from Sirex Woodwasp has been greatly reduced by maintaining a healthy stand using good forestry practices. There are no known chemical controls.

The Sirex Woodwasp has been successfully managed in the Southern Hemisphere using a parasitic nematode, *Deladenus siricidicola*. This nematode infects the larvae, and ultimately sterilizes the adult female. When the infested adult female emerges, she lays infertile eggs that are filled with the nematodes. There are several native parasitoids that have also proved successful.

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SUDDEN OAK DEATH (SOD) *PHYTOPHTHORA RAMORUM*



Distribution

The fungal disease *Phytophthora ramorum* has been shown to be the cause of Sudden Oak Death. First observed in coastal California in 1995, it was not identified until 2000. The disease has spread through coastal California and Southern Oregon. It has been found in European nurseries and in nurseries and garden centers in Washington, Oregon, and British Columbia, Canada. In 2003 and 2004, West Coast nurseries shipped potentially infested nursery stock to 49 of the 50 states in the U.S. Many of these plants were planted in residential landscapes. It is unknown how many of these plants remain in the environment.

Biology

Phytophthora ramorum has three distinct disease symptoms, bark cankers, leaf spots, and twig dieback. Infested oaks develop bark cankers. These infested trees may survive up to several years, but in the final stage, the leaves turn from green to brown within a few weeks. Black or reddish ooze often bleeds from the cankers. The cankers generally expand until they girdle the tree, cutting off the flow of water and nutrients.

More than two-thirds of the known host plants are horticultural species, some small fruit trees and some forest plants. On these plants, the disease causes leaf spots and twig dieback. The pathogen can produce spores on these plants which can serve as a reservoir for inoculum. These spores are likely transported as windblown rain. On the remaining plant species stem or bole cankers form. These cankers and non-spore producing and thus are dead in hosts.

Temperature and humidity play a major role in the establishment of this disease.

Impacts on Species

Phytophthora ramorum could have a major economic impact on the forest, horticultural and small fruit industries. At the present time there are over 40 known host plants.

DRAFT MASSACHUSETT'S EMERGENCY RESPONSE PLAN FOR HIGHLY DESTRUCTIVE INVASIVE FOREST PESTS

Management Options

There are no chemical or biological controls for *Phytophthora ramorum*.

The most effective means to combat *Phytophthora ramorum* is to prevent its introduction, establishment, and spread. This can best be accomplished by restricting the shipment of host nursery stock from infested states. Education of professional horticulturalist and the public about the potential damage from this disease hopefully will reduce the chances of accidental introductions.

The current eradication method delineates the current infested area and then adds 100 feet as a buffer. All host materials within the delineated area should be cut and burned. Additionally a ground fire should be used to consume all leaf litter. Intensive follow-up monitoring should be conducted and re-treatment as necessary.

