

Missouri Invasive Forest Pest Plan

Prepared by the
Missouri Invasive Forest Pest Council

May 14, 2015

**Letter of Approval by the
Missouri Department of Agriculture,
Missouri Department of Conservation,
Missouri Department of Natural Resources and
University of Missouri Extension**

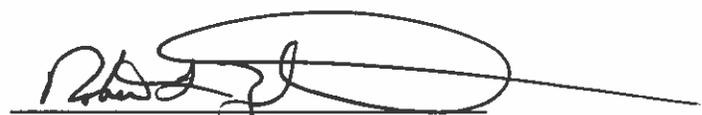
SUBJECT: Missouri Invasive Forest Pest Plan – May 14, 2015

Executive Summary: Many non-native, invasive insects and diseases pose serious threats to Missouri's forest resources and economy. State and federal agencies in Missouri have cooperated in the past to respond to threats posed by individual invasive pests such as the gypsy moth, emerald ash borer and thousand cankers disease. As the potential for spread and establishment of these and other known and unknown invasive forest pests continues, a more comprehensive approach to response planning and implementation is needed. The Missouri Invasive Forest Pest Plan provides an overarching framework for a consistent, coordinated response within Missouri to future invasive forest pest threats. The plan defines roles and responsibilities of cooperating agencies and outlines actions that are common to responses for most damaging invasive pests, specifically: outreach, risk reduction, monitoring, response to detection and management of established populations. In addition, action plans for individual pest species, that are complementary to the Missouri Invasive Forest Pest Plan, will be developed as dynamic documents that define additional response activities specific to those pests.

Successful Cooperation: Missouri's rural and urban forests face many emerging pest threats such as thousand cankers disease of walnut, Asian longhorned beetle and others. The cooperating agencies have worked closely over the years on gypsy moth and emerald ash borer for detection and response activities. With an increasing number of forest pest threats, these agencies will need to continue to work closely together towards the common goals of public awareness, early detection and mitigation efforts. The continued cooperation of these agencies is essential for healthy Missouri forests.

Approval of the Action Plan: This letter approves the *Missouri Invasive Forest Pest Plan – May 14, 2015* and confirms the cooperative, coordinated effort among these agencies. Action plans specific to certain forest pests will be developed by the Missouri Invasive Forest Pest Council as needed. Those plans will be subordinate to the Missouri Invasive Forest Pest Plan.


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EXECUTIVE SUMMARY

Many non-native, invasive insects and diseases pose serious threats to Missouri's forest resources and economy. State and federal agencies in Missouri have cooperated in the past to respond to threats posed by individual invasive pests such as the gypsy moth, emerald ash borer and thousand cankers disease. As the potential for spread and establishment of these and other known and unknown invasive forest pests continues, a more comprehensive approach to response planning and implementation is needed. The Missouri Invasive Forest Pest Plan provides an overarching framework for a consistent, coordinated response within Missouri to future invasive forest pest threats. The plan defines roles and responsibilities of cooperating agencies and outlines actions that are common to responses for most damaging invasive pests, specifically: outreach, risk reduction, monitoring, response to detection, and management of established populations. In addition, action plans for individual pest species, that are complementary to the Missouri Invasive Forest Pest Plan, will be developed as dynamic documents that define additional response activities specific to those pests.

I. PURPOSE

The Missouri Invasive Forest Pest Plan provides a framework for a consistent, coordinated response to invasive insects and diseases that threaten Missouri's forest resources. It defines roles and responsibilities of cooperating agencies and outlines a program to reduce risks of introduction and detect and respond to introductions of invasive forest pests. This Plan supersedes the Missouri Strategic Gypsy Moth Plan (Missouri Gypsy Moth Steering Committee 1997) and the Missouri Emerald Ash Borer Action Plan (Lawrence et al. 2008).

II. INTRODUCTION

Invasive insects and diseases have caused and continue to cause severe and irreversible impacts on North American forests. In the context of this Plan, invasive forest insects and diseases are defined as non-native species that use trees as hosts and cause adverse ecological and economic effects in the regions into which they are introduced. In the last century, chestnut blight essentially removed the American chestnut from our forests. Dutch elm disease has devastated elm populations. The gypsy moth has changed forest composition and caused huge economic impacts throughout the northeastern U.S. In recent years, the roll call of new invasive pest threats has continued at a rapid pace. The emerald ash borer, thousand cankers disease of walnut, Asian longhorned beetle and others threaten devastating impacts on our forest resources.

Increasing global trade provides many opportunities for forest pests to be transported to new continents, as many species of insects and plant pathogens hitchhike internationally on cargo and containers. Regulatory officials are able to open and inspect only a small percentage of containers entering the U.S. They use targeting methods to direct inspection activities toward higher risk cargo.

In 2013, inspectors intercepted an average of 440 pests of all kinds (not only plant pests) per day at U.S. ports of entry (U.S. Customs and Border Protection data, www.cbp.gov). Among those pests not intercepted at ports, some become established within the country. Twenty-five new non-native species of wood-boring and bark-boring beetles were reported for the first time from 1985 to 2005 as being established in the continental U.S. (Haack 2006). Considering only high-impact invasive species, a new, damaging forest pest is detected in the U.S. about every 2 to 2.5 years (Aukema et al. 2010). The potential for new, unanticipated forest pests to enter the country continues into the foreseeable future.

Once established in North America, invasive pests can spread naturally and be transported by humans to new locations through many pathways, but the movement of firewood is arguably the most serious threat. Wood- and bark-boring beetles can easily hitchhike within firewood and represent 56 percent of all non-native forest insects detected for the first time in the continental U.S. between 1980 and 2006 (Aukema et al. 2010). A 2008 study of firewood movement by travelers in Michigan revealed that almost two-thirds of firewood had either live insect borers or evidence of past infestations (Haack et al. 2010).

Invasive insects and diseases cause a wide array of ecological, economic and quality of life impacts. Tree mortality due to invasive pests alters nutrient cycling, ecological interactions of terrestrial and aquatic organisms and composition, structure and function of forests. Habitat changes caused by invasive insects may in some cases result in population increases in other species such as invasive plants, sparking an “invasional meltdown” (Gandhi and Herms 2010).

Economic impacts of invasive pests are huge, affecting forest landowners, forest industries, homeowners and local, state and federal governments. The greatest costs are borne by municipal governments and homeowners. Aukema et al. (2011) estimated that invasive wood- and phloem-boring insects alone annually cost nearly \$1.7 billion in local government expenditures and approximately \$830 million in lost residential property values in the U.S. As an example, Kovacs et al. (2010) examined the potential impact of the emerald ash borer in 25 eastern states and projected the cost of tree treatment, removal and replacement on urban developed land during 2009-2019 at \$10.7 billion (17 million trees). These estimates do not include other costs, such as increased energy use following the loss of shade trees.

More difficult to quantify are the impacts on quality of life. The denuding of tree-lined streets as has happened with the arrival of Dutch elm disease, Asian longhorned beetle and emerald ash borer can change the character of neighborhoods. During multi-year gypsy moth outbreaks, the presence of millions of caterpillars, insect droppings raining from trees and defoliated tree canopies can degrade outdoor experiences at camping and recreational locations (Moeller et al. 1977). These aesthetic impacts can lead to further economic impacts on communities and businesses.

Missouri Perspective

Trees are a major component of Missouri’s ecosystems and contribute significantly to the lifestyles of Missourians. Forests cover greater than 15.4 million acres (Moser et al. 2013), more than one-third of total land in the state. Private landowners own 84 percent of Missouri’s forest land (Missouri

Department of Conservation 2014). Most of Missouri's recreation and tourism industry is centered in forested regions of the state. Forest industries contributed \$8 billion to the Missouri economy in 2011 (Treiman and Jensen 2013).

Missouri has a lot to lose from both the known and unknown invasive insects and diseases. Oak-hickory forests in the Ozark Highlands are among the most susceptible in the U.S. to gypsy moth defoliation, with about 80 percent of forests in that area having high to very high susceptibility. The gypsy moth is not known to be established in Missouri yet, but when it arrives in Ozark forests it is expected to cause extensive ecological and economic consequences (Liebhold et al. 2004).

The emerald ash borer was first detected in Missouri in 2008 in a rural Wayne County campground and first detected in a major Missouri urban area (Kansas City) in 2012. This invasive pest will have its greatest impact in urban forests, where ash species comprise an average of about 14 percent of trees (compared with 3 percent in rural forests), and well over 30 percent in some parks and residential areas. The potential impact of the emerald ash borer on Missouri's communities and industries has been estimated at over \$180 million (Treiman et al. 2008). In ecological terms, the loss of ash will create large shifts in tree species composition in some bottomland forests and affect plant and animal communities in those areas.

Thousand cankers disease has devastating impacts on black walnut trees where it becomes established. If introduced to Missouri, the effects could be catastrophic. Missouri has more than twice as many black walnut trees as any other state (USDA Forest Service, Forest Inventory and Analysis data), is a major source of valuable walnut wood, and is the world's leading producer of black walnut nutmeats. Black walnut is easily the most economically valuable tree in the state on a per board foot basis (Treiman and Jensen 2014). Treiman and Tuttle (2009) estimated the impact of thousand cankers disease, if established in Missouri, could be \$851 million over a 20-year period.

Many other invasive pests have already become established in Missouri (data from Missouri Department of Agriculture and Missouri Department of Conservation), but often their full impacts are unknown. Butternut canker disease is causing decline and mortality of butternut trees throughout the state. Oak wilt disease has caused mortality of small pockets of oaks in most Missouri counties. The pine shoot beetle is established in northeastern Missouri, but concerns exist about its potential impacts when it eventually reaches native shortleaf pine stands of southern Missouri. In St. Louis, the banded elm bark beetle (invasive Asian insect) has been observed killing drought-stressed 'Homestead' elms bred for resistance to Dutch elm disease (invasive Asian and European disease). Several non-native species of ambrosia beetles have become established in Missouri in recent decades and have become numerically dominant over native ambrosia beetle species (Reed and Muzika 2010). As these examples indicate, the list of invasive insects and diseases affecting Missouri's trees continues to grow, and public agencies in cooperation with the citizens of the State must respond to these threats to our natural resources.

Missouri Response

Missouri has a long history of multi-agency cooperative efforts regarding invasive forest pests. Annual detection surveys have been conducted for the gypsy moth, emerald ash borer and thousand

cankers disease since 1980, 2004 and 2010, respectively. Cooperative groups composed of state and federal agencies and other partners have led the response planning, monitoring, outreach and management activities (Gypsy Moth Advisory Council, Gypsy Moth Steering Committee, Emerald Ash Borer Action Team and Missouri Invasive Forest Pest Council). These groups developed the Gypsy Moth Position Paper (Missouri Gypsy Moth Steering Committee 1994), Missouri Strategic Gypsy Moth Plan (Missouri Gypsy Moth Steering Committee 1997), Missouri Emerald Ash Borer Action Plan (Lawrence et al. 2008) and Thousand Cankers Disease of Black Walnut Action Plan (Wright et al. 2012).

With the continuing threats of known and new, unknown invasive forest pests, it is evident that a more comprehensive approach to response planning and implementation is needed. The agencies with primary responsibilities for response activities are the same for all invasive forest pests. Many of the core activities (monitoring, outreach and regulation) are similar for most invasive forest pests. Many of the pathways for pest movement (e.g., firewood) and target audiences for outreach efforts are similar. Furthermore, a coordinated response plan is needed for unknown species of invasive pests that may suddenly be detected within the state. Therefore, this plan has been developed to provide an overarching framework that will define a consistent approach to invasive forest pest response in Missouri.

Objectives

The primary objectives of the Plan are outlined in the following sections of the document:

III. Cooperation

- Establish a cooperative network of public agencies.
- Define agency roles and responsibilities in a coordinated response to invasive forest pest threats.

IV. Readiness

- Assess potential threats of invasive forest insects and diseases.
- Prepare responses to threats of invasive forest insects and diseases.

V. Outreach Program

- Communicate with stakeholders and the public about invasive forest pest threats and response activities.

VI. Risk Reduction

- Promote actions to be taken by government agencies, industries and the public to reduce risks of introduction and establishment of invasive forest pests.

VII. Monitoring

- Maintain monitoring activities to detect and assess invasive forest pest threats and enhance the ability to respond to an introduction.

VIII. Response to Detection of an Invasive Forest Pest

- Ensure coordinated, science-based responses to new detections of invasive forest pest introductions.

IX. Management of Established Populations of Invasive Forest Pests

- Promote appropriate actions by government agencies, private industry and the public to manage established populations of invasive forest pests and mitigate impacts on forest resources.

III. COOPERATION

Objectives: Establish a cooperative network of public agencies and define agency roles and responsibilities in a coordinated response to invasive forest pest threats.

A. Establish a cooperative network.

1. The **Missouri Invasive Forest Pest Council (MIFPC)** will serve as the lead group in planning and coordinating readiness and response activities in Missouri for invasive forest insect and disease pests.
2. MIFPC consists of public entities (government agencies or universities) with responsibilities for public land management, plant regulatory activities, or providing natural resource management information to the public.
3. Initial members of MIFPC are listed in Appendix A. These agencies routinely cooperate in responses to invasive forest pest threats in Missouri.
4. Additional public entities as described above may be admitted to MIFPC membership by consensus of current members.
5. Functions of the following invasive forest pest groups have been incorporated into MIFPC.
 - a) Missouri Gypsy Moth Advisory Council and Missouri Gypsy Moth Steering Committee (established in 1980 and activities outlined in the Missouri Strategic Gypsy Moth Plan of 1997).
 - b) Missouri Emerald Ash Borer Action Team (established in 2008 by the Missouri Emerald Ash Borer Action Plan).
6. A Chair will serve as the primary MIFPC officer. Other officer positions will be established as needed.
 - a) Officers will be selected by consensus of MIFPC membership.
 - b) Officers will serve for one calendar year. Their term of office may be renewed annually by consensus of MIFPC members.
7. The Chair will serve as the leader of MIFPC activities and will be selected from staff of a state government agency having plant regulatory responsibilities or natural resource or public land management responsibilities.

8. Pest Coordinators will be selected as needed to coordinate activities relating to individual invasive pest threats and to assist the Chair in managing all MIFPC activities. Pest Coordinators may be selected from any organization participating in MIFPC.
9. Outreach Coordinators will be selected as needed to coordinate outreach activities and work with MIFPC members and other partners to develop outreach projects and communicate accurate information to the public and stakeholders about invasive forest pests. Outreach Coordinators may be selected from any organization participating in MIFPC.
10. MIFPC will meet at least twice per year, or more often as needed.
11. MIFPC will make decisions by consensus among the participating agencies. If consensus cannot be achieved, the agency with legal authority has the responsibility to make the final decision. Each agency may decide whether to invest its resources to support action taken by MIFPC.

B. Maintain Active Communications with Partners in Other States.

Maintain communications with other state and national forest health officials, plant regulatory officials, and researchers to facilitate information exchange about invasive forest pest monitoring, impacts, regulations, and management.

C. Maintain Active Communications with Stakeholders.

1. A contact list of stakeholders, representing public, private and industry interests will be maintained by MIFPC officers.
2. Maintain additional pest-specific lists of stakeholders as part of pest action plans described below.
3. Provide stakeholders with timely updates on MIFPC activities and the status of invasive forest pests.
4. Convene periodic meetings to provide open forums for stakeholders and MIFPC members to exchange information and concerns about invasive forest pests. Meetings will be held annually, if sufficient stakeholder interest exists.
5. MIFPC will make representatives available to meet with the Missouri Forest Resources Advisory Council (MOFRAC) as needed to exchange information and gather stakeholder input about invasive forest pests.

D. Legal Authority

The following agencies have, by law, the responsibility and authority to manage an invasive forest pest introduction.

- Missouri Department of Agriculture
 - Missouri Revised Statutes, Chapter 263

- U.S. Department of Agriculture, APHIS, Plant Protection and Quarantine.
 - Agricultural Bioterrorism Protection Act of 2002 (Public Law 107-188)
 - Plant Protection Act of 2000 (Public Law 106-224; June 20, 2000)
 - Federal Plant Protection Regulations (Title 7 Code of Federal Regulations 300–399)
- U.S. Department of Agriculture, Forest Service, State and Private Forestry, Forest Health Protection.
 - Cooperative Forestry Assistance Act of 1978, Forest Health Protection (Section 8).
- Affected local government(s) at sites of invasive pest infestations.
- State agencies on public lands they manage (e.g., Missouri Department of Conservation and Missouri Department of Natural Resources).
- Federal agencies on public lands they manage (e.g., U.S. Department of Agriculture Forest Service; U.S. Army Corps of Engineers; U.S. Department of the Interior National Park Service and Fish and Wildlife Service).

E. Agency roles and responsibilities for major partners in MIFPC include, but are not limited to those listed within this section. Some actions in following sections of the Plan indicate lead agencies for that action in brackets []. Actions without specific agency identification are the responsibility of MIFPC as a whole.

1. **Missouri Department of Agriculture (MDA)** is the lead State agency responsible for preventing the introduction and spread of harmful plant pests, such as insects and diseases, into and within Missouri.
 - a) Provide monitoring and detection for plant pests of regulatory concern as funding allows, follow-up inspections on reported suspect invasive species, pest identification and assessments of invasive pests.
 - b) Inspect Missouri nurseries to ascertain whether they are infested or infected with plant pests and take appropriate mitigation actions.
 - c) Notify and coordinate activities with the appropriate local, state and federal agencies and other appropriate organizations related to program responsibilities and this Plan.
 - d) Confirm identification of samples and suspect organisms. Forward to appropriate national identifiers when necessary.
 - e) Cooperate with other MIFPC members to develop specific messages and coordinate communication of invasive species information to the public, media, cooperators and affected industries.
 - f) Implement and maintain appropriate state interior and exterior quarantines.
 - g) Review and coordinate pest control activities to ensure compliance with federal, state and local laws.
 - h) Condemn and seize materials when appropriate.
 - i) Oversee destruction of infested or potentially infested materials or vectors when appropriate.

- j) Enlist the aid of the Missouri Highway Patrol to monitor and report movement of potentially regulated articles, when needed and as provided by Missouri Revised Statutes, Section 263.145.
 - k) Provide or assist with the procurement of funding for survey, outreach, monitoring and containment when appropriate.
 - l) Provide pest management expertise and advice to all cooperators and the public.
2. **USDA, APHIS, Plant Protection and Quarantine (PPQ)** is the lead Federal agency responding to a harmful plant pest introduction of Federal interest.
- a) Assist in all response activities including quarantine, evaluation, identification, disposal, disinfection, epidemiology, trace-backs and trace-forwards, permitting, inspection, transportation control systems, survey activities and assessment.
 - b) Collect, collate, analyze and disseminate technical and logistical information and distribute to field staff and cooperators.
 - c) Cooperate with other MIFPC members to develop specific messages and coordinate communication of invasive species information to the public, media, cooperators and affected industries.
 - d) Define training requirements for temporary employees or support agencies involved in response operations. Training may consist of survey, sampling, diagnostic and regulatory procedures.
 - e) Implement and maintain appropriate federal quarantines.
 - f) Cooperate in the determination of an emergency response and assist in defining the regulated area(s).
 - g) Allocate funding for compensation to the owner of destroyed products, when appropriate, if an “Extraordinary Emergency” is declared by the U.S. Secretary of Agriculture.
 - h) When available, distribute necessary funding to support emergency program activities.
 - i) Utilize Investigative and Enforcement Services (IES) as necessary to respond to violations of state or federal regulations.
 - j) Consult with State and local authorities regarding response operations.
3. **Missouri Department of Conservation (MDC)** is the lead State agency responsible for providing forest management information and technical forestry assistance to the people of Missouri and for protecting and managing Missouri’s forests for long-term resource health and sustainability.
- a) Provide forest management expertise and advice to private landowners, communities, forest products and tree care industries, consulting foresters and the general public.
 - b) Provide information and assistance to Missouri communities in planning community preparedness and response to invasive forest pests.
 - c) Provide technical information to MIFPC members and stakeholders regarding pest biology, management options and economic impacts on forest resources.
 - d) Manage forests on MDC lands to mitigate the impacts of invasive forest pests.

- e) Cooperate with other MIFPC members to develop specific messages and coordinate communication of invasive species information to the public, media, cooperators and affected industries.
 - f) Provide liaison with the USDA Forest Service, National Association of State Foresters and Northeastern Area Association of State Foresters through the Missouri State Forester to request further assistance and funding.
 - g) Assist in monitoring, detection, follow-up inspections on reported suspect invasive species, identification and assessment of invasive forest pests.
 - h) Assist with containment, restoration and mitigation activities.
 - i) Serve as the liaison (Missouri State Forester) to the Missouri Forest Resources Advisory Council.
4. **Missouri Department of Natural Resources (MDNR)** is the State agency responsible for environmental quality, waste disposal, energy, emergency response to environmental events, operation and management of State Parks and historic sites, and protecting natural resources in Missouri.
- a) Develop programs to reduce the likelihood of introduction of invasive forest pests to State Parks and Historic Sites.
 - b) Cooperate with other MIFPC members to develop specific messages and coordinate communication of invasive species information to the public, media, cooperators and affected industries.
 - c) Cooperate with detection and delimit surveys, regulatory activities and containment efforts, when appropriate, at State Parks and Historic Sites.
5. **University of Missouri Extension (MU Extension)** contributes to the mission of the state's land grant university by making science-based knowledge accessible to the people of Missouri.
- a) Provide information and educational opportunities to increase awareness of invasive forest pests among the public.
 - b) Cooperate with other MIFPC members to develop specific messages and coordinate communication of invasive species information to the public, media, cooperators and affected industries.
 - c) Provide resources and local contacts to the public for invasive species information through Extension staff and offices throughout the state.
 - d) Assist in monitoring, detection and identification of invasive forest pests through the services of the Plant Diagnostic Clinic.
 - e) Provide liaison with volunteer organizations (e.g., Master Gardeners, Master Naturalists) and green industry groups.
5. **USDA Forest Service, State and Private Forestry, Forest Health Protection (FHP)** assists in the detection, evaluation, monitoring and management of invasive forest pests on all forest ownerships.
- a) Assist other agencies in identifying and prioritizing which invasive species to control and effectively implementing management plans to minimize their impact and spread.

- b) Provide forest pest management expertise to the National Forests and other federal land management agencies.
- c) Cooperate with the Missouri State Forester in the State's forest pest management activities on non-federal lands.
- d) Cooperate with other MIFPC members to develop specific messages and coordinate communication of invasive species information to the public, media, cooperators and affected industries.
- e) Provide education and outreach materials to increase public awareness of invasive forest pests.
- f) Provide technical expertise to cooperating agencies during response to an invasive forest pest introduction.
- g) Provide funding for survey and response efforts, when appropriate.

IV. READINESS

Objective: Assess potential threats of invasive forest insects and diseases and prepare responses to those threats.

A. Assess threats to Missouri's forest resources.

1. Monitor the status of introductions, infestations and the spread of invasive forest pests in the U.S. by maintaining communications with other state and national forest health and plant regulatory officials. [Leads: MDA, MDC, PPQ]
2. Assess the risk of damage by invasive forest pests. [Leads: MDA, MDC, PPQ]
 - a) Gather current knowledge on impacts of invasive forest pest species.
 - b) Assess the risk in Missouri of forest, environmental and economic damage for known invasive forest pest species (e.g., compile data for the Missouri Pests of Concern List for the USDA Cooperative Agricultural Pest Survey program).
 - c) Identify and evaluate pathways of introduction into Missouri for major groups (e.g., wood borers) and known species of invasive forest pests.

B. Develop Action Plans for individual invasive forest pest species.

1. This plan, the *Missouri Invasive Forest Pest Plan*, provides the framework of agency roles and responsibilities and major readiness and response activities that are common to most invasive forest pest threats in Missouri. *Action Plans* will be developed to provide more detailed information for individual invasive forest pest species and will be subordinate and complementary to the Missouri Invasive Forest Pest Plan.
2. MIFPC will annually assess the need for Action Plans to be developed or revised for individual invasive pest species based on the risk of introduction, potential impacts in Missouri, and current state of knowledge about pest biology, monitoring and management. MIFPC will select one of its members to lead the development or revision of each Action Plan as needed (Pest Coordinator).

3. Each Action Plan will address the following topics:
 - a) Purpose of the plan
 - b) The pest's relevance to Missouri's forest resources.
 - c) Outreach efforts
 - d) Monitoring and reporting procedures
 - e) Response to detection
 - f) General management guidelines, if available
 - g) List of stakeholders
 - h) Date of completion or revision of the document
4. Provide opportunities for stakeholders to submit input during development of Action Plans.
5. Provide opportunities for review of Action Plans by other staff of agencies represented in MIFPC.
6. An Action Plan will be a dynamic document that will be revised periodically by MIFPC as new pest information or technology is developed. [Leads: Pest Coordinators]
 - a) Original and revised versions of an Action Plan will be accepted for implementation by consensus of MIFPC members.
 - b) The State Entomologist (Missouri Department of Agriculture) will maintain a file of current versions of the Action Plans.
7. Distribute completed or revised Action Plans to stakeholders as they become available.

C. Promote readiness among local governments and other stakeholders.

Educate municipalities and other stakeholders about invasive forest pest threats and assist in developing readiness plans [Lead: MDC].

V. OUTREACH PROGRAM

Objectives: Communicate with stakeholders and the public about invasive forest pest threats and response activities.

A. Develop outreach campaigns.

1. Identify key messages and target audiences common to multiple invasive forest pests. [Leads: MIFPC Outreach Coordinators]
2. Develop outreach campaigns to educate about major pathways of pest introduction, such as firewood movement. [Leads: MIFPC Outreach Coordinators]
3. Develop outreach campaigns to educate about individual invasive forest pests based on outreach objectives and stakeholders as identified in Action Plans. [Leads: MIFPC Outreach Coordinators]

B. Establish a coordinated approach for communicating with media and stakeholders.

1. Identify key contacts in MIFPC as sources of current information for the media. [Leads: MIFPC Outreach Coordinators]
2. Develop a system for coordinating outreach messages among agencies. [Leads: MIFPC Outreach Coordinators]

VI. RISK REDUCTION

Objective: Promote actions to be taken by government agencies, industries and the public to reduce risks of introduction and establishment of invasive forest pests.

A. Educate the public and professionals to reduce risk of pest introduction.

1. Raise awareness among the public, industries and municipalities about risks and regulations associated with potential pathways of introduction of invasive forest pests.
2. Educate law enforcement agencies (Missouri State Highway Patrol, Missouri Sheriffs' Association, local police departments and associations, and enforcement branches of other agencies) regarding existing regulations. [Leads: MDA and PPQ]

B. Promote resource management actions that reduce risk of pest introduction and establishment.

1. Promote sound management practices for invasive forest pests by government agencies and stakeholders.
 - a) Develop policy recommendations for government agencies to reduce invasive pest risks due to firewood movement.
 - b) Develop recommendations for best management practices for invasive forest pests by industries, forest and land managers, municipalities and recreational interests.
2. Promote tree planting selections that contribute to a diverse and sustainable urban forest. [Lead: MDC]
 - a) Educate municipalities and the green industry about diversity in tree planting and risk reduction.
 - b) Assist local governments in tree assessments and inventories to guide tree planting and management decisions.

VII. MONITORING

Objective: Maintain monitoring activities to detect and assess invasive forest pest threats and enhance the ability to respond to an introduction.

A. Conduct surveys for invasive pests posing significant threats to Missouri's forest resources.

1. Maintain multi-agency collaboration to plan and conduct surveys for invasive forest pests, as determined by monitoring needs and available funding. [Leads: MDA, MDC, PPQ]
2. Conduct surveys using established protocols when available or protocols based on the best science currently available. [Leads: MDA, MDC, PPQ]
3. Annually review survey activities and assess current and future monitoring needs. [Leads: MDA, MDC, PPQ]

B. Educate professionals and the public.

1. Provide basic information to natural resource professionals, green industries and the public about recognizing invasive forest pests and how to report when suspects are found.
2. Provide training opportunities for natural resource professionals, green industries and other target audiences most likely to play key roles in invasive pest detection.

C. Identify pest introductions.

1. Reporting of invasive forest pest suspects by the general public and natural resource professionals should follow procedures outlined in Appendix B.
2. Reports of invasive forest pest suspects will be initially evaluated by professional staff at state and federal agencies receiving the reports. Suspect reports of significant invasive forest pests will be forwarded immediately to the State Entomologist (MDA) and the State Plant Health Director (USDA APHIS PPQ).
3. The State Entomologist (MDA), in consultation with the State Plant Health Director (USDA APHIS PPQ), will provide the official identification of suspect organisms or submit specimens to a national identifier, when appropriate.

D. Communicate information about detections.

1. Confirmation of an invasive pest identification will be provided by the State Entomologist (MDA) in a timely manner to the members of MIFPC.
2. Inform the media and general public about detection of a new invasive forest pest in Missouri. [Lead: MDA]
 - a) MDA is responsible for official announcements about detections of invasive plant pests in Missouri.
 - b) Announcements about pests that require a regulatory response will be made first by MDA, prior to announcements by other agencies.
 - c) Announcements will be coordinated with outreach personnel of other MIFPC member agencies to enhance distribution of information.

3. The MIFPC Chairperson will inform stakeholders of new detections of invasive forest pests, following announcement by MDA.

VIII. RESPONSE TO DETECTION OF AN INVASIVE FOREST PEST

Objective: Ensure coordinated, science-based responses to new detections of invasive forest pest introductions.

A. Determine required response following detection.

1. The level of state response to invasive forest pest detections will vary among pest species and will be determined by the state and federal agency members of MIFPC having regulatory or natural resource management responsibilities, with consultation of other members of MIFPC. [Leads: MDA, MDC, PPQ]
2. Determination of the level of state response will be based on several factors including the following (not in priority order):
 - a) Assessment of the potential threat to forest resources (Section IV-A).
 - b) Economic importance of the affected host resource.
 - c) Status of a new detection (established pest vs. intercepted pest not known to be established).
 - d) Current biological and ecological knowledge about the pest.
 - e) Known distribution of the pest within Missouri and within the United States.
 - f) Available pest detection and management technology.
 - g) Existing state or federal regulations.
 - h) Inclusion of detected pest on more than one list of pests of concern, for example, lists developed through USDA programs such as the Cooperative Agricultural Pest Survey and New Pest Advisory Group.
 - i) Availability of fiscal and personnel resources.
3. Responses will be further defined by Action Plans developed for individual pests.
4. If an unknown forest pest is detected causing significant forest damage, MIFPC will take immediate steps to identify the organism and assess the threat by consulting appropriate organism specialists and searching scientific literature, as needed.

B. Plan and implement initial response.

1. MIFPC will meet in a timely manner following the first detection in Missouri of a major invasive forest pest to coordinate initial response activities.
2. A major invasive forest pest is defined as a non-native insect or disease pest of trees that has the potential to cause extirpation of its host plant or other significant ecological or economic damage.

3. Coordinate response with affected local, state and federal agencies and other stakeholder organizations. [Lead: MDA]
4. Review the Missouri Invasive Forest Pest Plan and address Incident Command System practices and support structures when appropriate for major invasive forest pests. [Leads: MDA and PPQ]
 - a) Based on the determined level of response (VIII-A), elements of the Incident Command System will be incorporated and scaled according to the situation, with MDA and USDA APHIS PPQ officials as Unified Commanders.
 - b) Designate individuals or agencies responsible for local response functions.
5. Review and update the Action Plan for the detected species, or assign a group to develop a plan if needed. [Leads: MIFPC Chair and Pest Coordinator]
6. Assess geographical distribution of a major invasive forest pest species following initial detection in Missouri and, when appropriate, for successive detections. [Lead: MDA]
 - a) The extent, timing, methods and necessity of assessments will be determined by MDA, in consultation with PPQ, MDC and other MIFPC members, and will be based on current knowledge of the biology, potential forest impacts, available detection technology and known distribution of other populations of that pest species.
 - b) Assessment activities will be coordinated by MDA, in consultation with PPQ, MDC and other agency members of MIFPC.

C. Initiate regulatory activities as necessary.

1. Seek input from stakeholders and assess impacts on businesses in proposed regulated areas prior to establishing state interior quarantines. [Lead: MDA]
2. Following detection of an established population of a major pest of quarantine significance, an emergency quarantine will be established by MDA consistent with Missouri Revised Statutes, Chapter 263. Emergency rules will be issued describing the quarantined area and regulated articles. For federally regulated pests, USDA APHIS PPQ, in communication with MDA, will establish a federal quarantine. [Leads: MDA and PPQ]
3. Develop compliance agreements with stakeholders, under authority of specific state or federal quarantines, to control movement of regulated articles. [Leads: MDA and PPQ]
4. Cooperate with prosecutors to enforce Missouri Plant Law Quarantines. Missouri Revised Statutes, Section 263.180 states that a violation of the Missouri Plant Law is a class A misdemeanor. [Lead: MDA]

D. Determine and implement initial pest management strategy.

1. Determine potential pest management strategies (eradication, suppression, slowing the spread, no action, or other) for each recently detected invasive forest pest.

- a) Determination of potential management options will be based on: 1) the best science available, 2) current knowledge of ecological, technological, economic and social feasibility of management options and 3) experience of agencies in other states.
 - b) Selection of a management strategy to implement is dependent on the ability to accurately determine the presence and geographical distribution of an invasive pest. Newly detected invasive pests are often established over large areas with ill-defined boundaries at the time of detection due to lack of adequate detection technology.
 - c) Selection of a management strategy is further dependent on the availability of funding and the cost-effectiveness of potential management strategies.
 - d) Eradication of a widespread invasive pest often is not feasible, but management efforts that slow the rate of range expansion and lessen the impacts on forest resources may be beneficial in some cases.
2. Implement appropriate pest management strategy based on the best science available. [Lead: MDA]
- a) Develop and coordinate strategies for suppression or eradication of regulated invasive forest pests, when such actions are appropriate.
 - b) Strategies employed within the state will vary among pests, but may include some of the following components:
 - i. Collection points for processing or destruction of regulated materials.
 - ii. Destruction of potentially infested or infected plant material.
 - iii. Chemical treatments to suppress pest populations.
 - iv. Biological control strategies to suppress pest populations.
 - v. Outreach campaign with a goal of reducing the rate of spread of an invasive pest.
 - vi. No active control measures, when current science-based knowledge indicates controls are biologically ineffective or unnecessary, or are not cost effective.

E. Communicate information about response.

1. Inform the media and general public about implementation of quarantines and other response activities for major invasive forest pests in Missouri. [Lead: MDA]
 - a) MDA is responsible for official announcements about quarantines and regulatory activities relating to invasive plant pests in Missouri.
 - b) Announcements will be coordinated with outreach personnel of other MIFPC member agencies to enhance distribution of information and uniformity of messages.
2. The State Entomologist (MDA) or that person's designee will inform stakeholders of the implementation of quarantines for invasive forest pests immediately following release of an official announcement.
3. Provide accurate information to affected residents, communities and industries to foster cooperation and maximize effective response.

- a) Government response activities.
- b) Actions homeowners, arborists, communities, utilities and others should take.
- c) How to report suspect infestations.

IX. MANAGEMENT OF ESTABLISHED POPULATIONS OF INVASIVE FOREST PESTS

Objective: Promote appropriate actions by government agencies, private industry and the public to manage established populations of invasive forest pests and mitigate impacts on forest resources.

1. Develop and distribute recommendations for invasive forest pest management based on the best science currently available. [Lead: MDC]
 - a) Compile information on invasive forest pest management in urban forests and distribute to homeowners, community groups, utilities, arborists, landscape professionals and other green industry personnel as appropriate.
 - b) Compile or develop silvicultural guidelines, as appropriate, for invasive forest pests affecting rural forests and distribute to foresters, forest managers and forest industry personnel.
2. Evaluate and encourage appropriate local market utilization of forest resources impacted by invasive forest pests. [Lead: MDC]
3. Evaluate and promote the use of biological control for management of invasive forest pests, when biological control tactics become available and are supported by science-based information. [Leads: MDA and MDC]

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Appendix A. Initial Members of the Missouri Invasive Forest Pest Council

Missouri Department of Agriculture (MDA)

Missouri Department of Conservation (MDC)

Missouri Department of Natural Resources (MDNR)

University of Missouri Extension (MU Extension)

U.S. Department of Agriculture, APHIS, Plant Protection & Quarantine (PPQ)

U.S. Department of Agriculture, Forest Service, Mark Twain National Forest (MTNF)

U.S. Department of Agriculture, Forest Service, State & Private Forestry (S&PF)

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)

Appendix B. Reporting Procedure for Invasive Forest Pest Suspects

The following reporting procedure should be used when a suspected invasive forest pest or site of invasive forest pest activity is observed.

1. Suspected invasive forest pests should be reported using the following procedures, with this exception:
 - a. Reports are NOT needed if the presence of that pest has already been officially documented in the county where the suspect was found.
 - b. Consult information from the Missouri Department of Agriculture for current status of invasive forest pests in Missouri: <http://mda.mo.gov/>
2. Document the location.
 - a. Record date and a description of the location. Include GPS coordinates, if available.
3. Photograph site and suspects, providing views of the following:
 - a. Entire tree and immediate surroundings.
 - b. A branch with leaves, to confirm identity of tree species.
 - c. Close-up views of damaged portions of tree, suspect insects, or other interesting features. Include object in the photo to give a size reference (ruler, coin, etc.)
4. Contact one of the following to report observations and receive further information.
 - a. General public contact points for MIFPC member agencies. Consult agency web sites for contact information of local offices and personnel.
 - i. Missouri Department of Conservation: <http://www.mdc.mo.gov/>
 - ii. Missouri Department of Agriculture: <http://mda.mo.gov/>
 - iii. University of Missouri Extension: <http://extension.missouri.edu/>
 - b. Web sites and telephone hotlines established for reporting invasive forest pests.
 - i. For more information refer to: <http://extension.missouri.edu/treepests/>
 - c. Contact points specified in Action Plans for individual invasive forest pests.

Appendix C. Public Input Summary

The draft Missouri Invasive Forest Pest Plan was available for public comment during August 22-September 22, 2014. The Missouri Invasive Forest Pest Council (MIFPC) received comments from 11 respondents. Several lengthy comments were received. MIFPC members carefully reviewed and considered these ideas as they finalized this document. A brief summary of public input themes, including how they were incorporated or why they were not, follows below.

MIFPC responses to themes and issues identified through the public comment period

Concerns about the style and technical level of the plan and the role of MIFPC that indicate readers' confusion about the purpose of the plan.

The purpose of the plan, as stated within the plan, is to establish a framework for coordination among the public agencies with responsibility to respond to invasive forest pest threats. The plan is applicable to all invasive forest insects and diseases. MIFPC itself is an advisory body and has no legal authority collectively. The legal authority for actions rests with each agency as described in the plan. Although the plan is freely available and can be instructive to all who are interested in the State's response to invasive pests, the intended primary audience is our forest resource partners and agencies that have responsibilities under the plan.

Suggest several non-governmental organizations be added to MIFPC membership or procedures be established to provide more stakeholder involvement in response planning.

The purpose of MIFPC is to function as a coordinating body among the state and federal agencies with the responsibility to respond to forest pest threats. In lieu of membership, non-governmental organizations are provided other opportunities for participation in invasive forest pest response planning. The plan states that MIFPC will "provide opportunities for stakeholders to submit input during development of Action Plans" and "will provide stakeholders with timely updates on MIFPC activities and the status of invasive forest pests." The August-September 2014 public comment period, a December 2012 stakeholder meeting about the plan, and periodic email updates to stakeholders are examples of input opportunities and information sharing.

Organizations suggested by respondents have been added to the list of stakeholders that receive updates and from whom input will be sought during response planning for invasive forest pests. A section has been added to the plan that lists actions MIFPC will take to maintain active communications with stakeholders. MIFPC will hold periodic meetings to provide open forums for stakeholders and MIFPC members to exchange information and concerns about invasive forest pests. MIFPC representatives will be made available to report as needed to the Missouri Forest Resources Advisory Council (MOFRAC), an organization that represents many stakeholders with interests in Missouri's forest resources.

Suggest the plan should address the need to network with other states to keep current on the knowledge and experiences of others managing invasive forest pests.

MIFPC members have long maintained communications of this type as part of their standard operations. The plan states in the "Readiness" section that MIFPC members will maintain communications with other state and national forest health and plant regulatory officials to monitor the status of introductions, infestations and

spread of invasive forest pests in the U.S. An additional section has now been added to the “Cooperation” section to emphasize networking with professionals in other states.

Suggest that roles and responsibilities for University of Missouri Extension, a current MIFPC member, should be specifically added to the plan as has been done for other members.

Roles and responsibilities for MU Extension, including the Plant Diagnostic Clinic, have been added to the plan.

Concern that the plan does not give details about invasive pest regulations, quarantines, and law enforcement response to quarantine violations.

The plan states that the Missouri Department of Agriculture and USDA APHIS Plant Protection and Quarantine have the authorities to implement and maintain state and federal quarantines, respectively. All regulatory actions are under the purview of these two agencies. Statements have been added to the plan about potential penalties and actions by law enforcement agencies in response to quarantine violations. Further details are not described, because details vary with specific situations.

Suggest that the plan define the term “major invasive forest pests” for which various actions are indicated.

A definition of a major invasive forest pest has been added to the plan. A major invasive forest pest is a non-native insect or disease pest of trees that has the potential to cause extirpation of its host plant or other significant ecological or economic damage.

Suggest that one of the most important things MIFPC could do is provide information to land managers about detecting invasive pests.

Increased outreach to stakeholders and the general public is a high priority for MIFPC members. One example is the recently revised Missouri TreePests web site (<http://extension.missouri.edu/treepests>) that includes information on several invasive forest pests. Occasional email updates are sent to the MO Forest Health list maintained by MDC, which individuals can subscribe to at: <https://public.govdelivery.com/accounts/MODC/subscribers/new>. Many other outreach activities have been undertaken including training sessions, displays at fairs and conferences, and advertisements on radio, print and billboards.

Suggest that the outreach program in the plan should include a strategy to educate key members of the Missouri General Assembly, so they are ready to respond to emergency funding requests if major invasive pests are detected.

MIFPC member agencies do engage General Assembly members on a regular basis about matters relating to forests and other natural resources and will provide additional information as requested by the General Assembly. However, it is more properly the role of stakeholders to contact their legislators directly about potential funding concerns.

Suggest that the plan should include a budget along with a strategy to generate funds to support implementing the plan.

The Missouri Invasive Forest Pest Plan is a multi-agency document that outlines how state and federal agencies will cooperate over multiple years. A meaningful budget cannot be compiled that incorporates the efforts of all these agencies. MIFPC will assist with the procurement of funding for monitoring, outreach and containment when appropriate. MIFPC agencies have been active in the past in obtaining funding for monitoring and outreach efforts for the gypsy moth, emerald ash borer, thousand cankers disease of walnut, and other invasive forest pests.