National Response Framework for Thousand Cankers Disease (TCD) on Walnut



US Forest Service, Animal Plant Health Inspection Service, National Association of State Foresters, and the National Plant Board

2011

Forward

Approval

This framework represents a combined national effort to address Thousand Cankers Disease (TCD) on Walnut. We, the undersigned, approve this document and its intent toward better management of this emerging insect/disease complex.

USDA Forest Service

USDA Animal Plant Health Inspection Service

National Plant Board

National Association of State Foresters

Executive Summary

Purpose

A newly discovered insect/disease complex called Thousand Cankers Disease (TCD) has been identified as a potential threat to the nation's walnut resource. This document contains information to guide state foresters, agriculture officials, and legislative staff on Thousand Cankers Disease (TCD) of walnut. It is intended to serve as a reference for land managers and government agencies currently dealing with this complex and states (as yet) not affected by TCD. It lays the foundation for prioritizing on-the-ground work, research, and resource needs. The implementation of specific activities outlined in the framework is flexible and based on the best available information at this time. Themes common to all framework elements include partnerships, collaboration, communication, and education. Success will be dependent on the ability to improve capacity, streamline procedural activities, and long-term commitment. This report outlines the US Department of Agriculture's (USDA) and its key partner's comprehensive framework to respond to TCD centering on five key elements:

- Prevention
- Detection/Monitoring
- Management
- Outreach/Education
- Research

The USDA Forest Service (State and Private Forestry, Forest Health Protection) has convened a group of subject matter experts from research, state, and federal agencies to emphasize the importance of this emerging insect/disease complex, and provide a basis for protecting the nation's walnut resource. The document is not a policy document, nor does it make any resource commitment, it simply brings together the best information available on the topic to inform land managers and other stakeholders. It also identifies current roles and responsibilities of the signatories; USDA's Forest Service and Animal and Plant Health Inspection Service, National Association of State Foresters, and the National Plant Board to better integrate our approach to managing TCD. These roles and responsibilities may be changed in the future as needed.

Significance

Thousand Cankers Disease results from the combined activity of the Walnut Twig Beetle, (*Pityophthoris juglandis* Blackman) tunneling through the bark and delivering a canker causing fungus (*Geosmithia morbida* sp. nov). Each feeding attempt by the twig beetles creates a new canker. Thousand Cankers Disease is now known to occur in AZ, CA, CO, ID, OR, NM, TN, UT, and WA. Impact to walnut resources from TCD is expected to be significant. Assessments to the lumber industry in states with walnut, such as Missouri, may reach $36 million and potentially as high as $9 million annually in Kansas. This does not include estimates for nut production, street-tree removal, tree replacements, and impacts to the native western black walnuts in riparian ecosystems. The walnut industry estimates annual purchases of 20 to 28 million pounds of black walnut nuts from various hulling stations in the Midwest, valued at over $4 to $6 million to local economies in the eastern US. Loss of black walnut will negatively impact nut producers, walnut exports, recreation, nursery stock production, and wildlife habitat. Other species within the family of Juglandaceae have shown varying susceptibility to TCD, and may also be at risk.

Prevention

States have the primary authority to address plant health issues through their Departments of Agriculture, Forestry, and Natural Resources, which have resources and technical expertise to properly respond to TCD. An effort to connect and engage these state agencies early is vital to prevent further spread of this disease in a coordinated manner. Chain-of-custody, rapid diagnostics, and notification are important steps to effectively confirm and mitigate the extent of the TCD outbreak. Once TCD is positively identified in a state, the State Secretary of Agriculture and the State Forester should be notified and appropriate staff(s) engaged, response measures identified, and actions implemented. In all cases, states have the 'lead' regulatory responsibility, as directed by the Office of their State Plant Regulatory Official (SPRO). Media press releases should be handled by the

SPRO and a consistent message regarding TCD should be communicated to the public as soon as possible.

Detection/Monitoring

To date, TCD has been confined to urban settings and its impact to the native forest is unknown. At present there are no traps to effectively detect walnut twig beetles (the vector of this disease), though research suggests that there are chemical attractants produced by males and females that could be used to formulate lures and improve captures. Visual delimit surveys should be conducted as soon as TCD is confirmed and detection surveys implemented in un-infested states. Local, state, and regional sampling should be handled as determined through collaboration between affected parties. Samples should be submitted to diagnostic labs that have proper permits for accepting plant pests. State plant diagnostic labs and those associated with the National Plant Diagnostic Network (NPDN) need to be informed of any established protocols for proper identification of TCD. Location, setting, host type, date, and other site/tree characteristics must be included with sample submission to properly evaluate suspected trees and follow-up efforts if needed.

Management

Currently our ability to manage TCD on walnut is limited, but methods to limit the spread of the disease offer promising results. A vigorous program to identify walnuts showing early symptoms and subsequent removal may slow-the-spread of TCD if implemented early during a sanitation project. The bark and wood from TCD-infected trees should be destroyed or kiln-dried to prevent further spread of walnut twig beetles. Several states have established quarantines to prevent the movement of certain walnut products, and with the new find in Tennessee, more states are soon to follow. These emergency measures regulate the movement of unprocessed walnut wood material into states that have established quarantines. However, most states allow transport of wood that has been milled to remove all bark as finished products and nuts as this mitigates vectoring of the disease. It is critical that the walnut twig beetle and associated fungus not be allowed

to spread to un-infested areas if possible. Management decisions will be science-based and where information is lacking, appropriate research activities identified to develop technology and/or scientific information for TCD.

Outreach/Education

All agencies and affected groups have shared responsibility to develop outreach and education opportunities in response to TCD. The US Forest Service has developed a Pest Alert (NA-PR-02-10) to advance timely information on TCD. In addition, the US Forest Service is working with partners to develop diagnostic keys for use in identifying the walnut twig beetle in its Early Detection and Rapid Response (EDRR) program. Colorado State University continues to provide key informative materials and training sessions for the diagnosis of TCD. Web-based materials need further development to best unify and link all information on TCD, such as is done for emerald ash borer (www.emeraldashborer.info).

Research

Critical research on aspects of the life history, biology, and behavior of the insect and pathogen associated with TCD are needed to inform and improve management. Priority research needs include:

- The characterization of the aggregation pheromone of walnut twig beetle for a reliable trap for detection.
- The development of a risk-based map using Geographical Information Systems (GIS) and Forest Inventory and Analysis (FIA) data to focus the detection effort on where the pest is most likely to migrate.
- Evaluation of cultural methodologies on survival of the insect and the pathogen after debarking and kiln drying or other treatments.
- Efficacy testing of systemic insecticides and fungicides as protectants on high-value walnut.
- Long-term research on spread rates, beetle/fungal origins, their interactions, biological control, and host resistance to help improve integrated control efforts.

I. Introduction

Thousand cankers disease of walnut (TCD) is a recently recognized insect/disease complex that occurs on certain walnuts in the Juglandaceae family. It has been found in eight states in the West and, as of July 2010, confirmed in Tennessee. The disease is a result of the combined activity of the walnut twig beetle (WTB), *Pityophthorus juglandis*, and a canker producing fungus, *Geosmithia morbida*. The first published occurrence of black walnut mortality attributed to TCD was in the Española Valley in northern New Mexico in 2001. Walnut twig beetles were implicated; however, drought was considered the primary cause of the dieback. City trees in several Colorado communities such as Boulder, Colorado Springs, and Westminster experienced black walnut mortality in early 2000. Again walnut twig beetles were collected and thought to be associated. However, beetle presence alone did not account for walnut mortality. It was only when a previously undescribed *Geosmithia* fungus was demonstrated as the causal agent in 2008, that the disease complex was fully understood. In July 2010, the walnut twig beetle and *G. morbida* were confirmed in Knoxville, TN. This is a highly significant discovery since it represents the first report of TCD within the native range of eastern black walnut. The infestation in the Knoxville area is considered extensive, suggesting the disease has been present there for possibly 15-20 years. Prior to 2000, walnut twig beetle had never been associated with *Juglans* mortality. In most areas where the die-offs of black walnut have occurred, drought was always suspected as the cause of the decline and death of trees, with the beetle as a secondary pest. However, when walnut twig beetle and *G. morbida* are present and mortality occurs in the absence of drought, this would suggest an alternate underlying cause – TCD.

Importance

Black walnuts, *Juglans nigra* is an economically and ecologically valuable resource in the north central region, the central hardwood region, and throughout most of the rest of the eastern deciduous forest of the United States (Fig. 1). Black walnut lumber demands a high price in the market and is currently exported to 67 countries producing $41M in annual sales. Walnuts occur naturally and are also planted for timber production, nut

production, wildlife habitat, riparian buffers, native woodland restoration, wind breaks, watershed protection, erosion control, and conservation. Black walnut is also widely

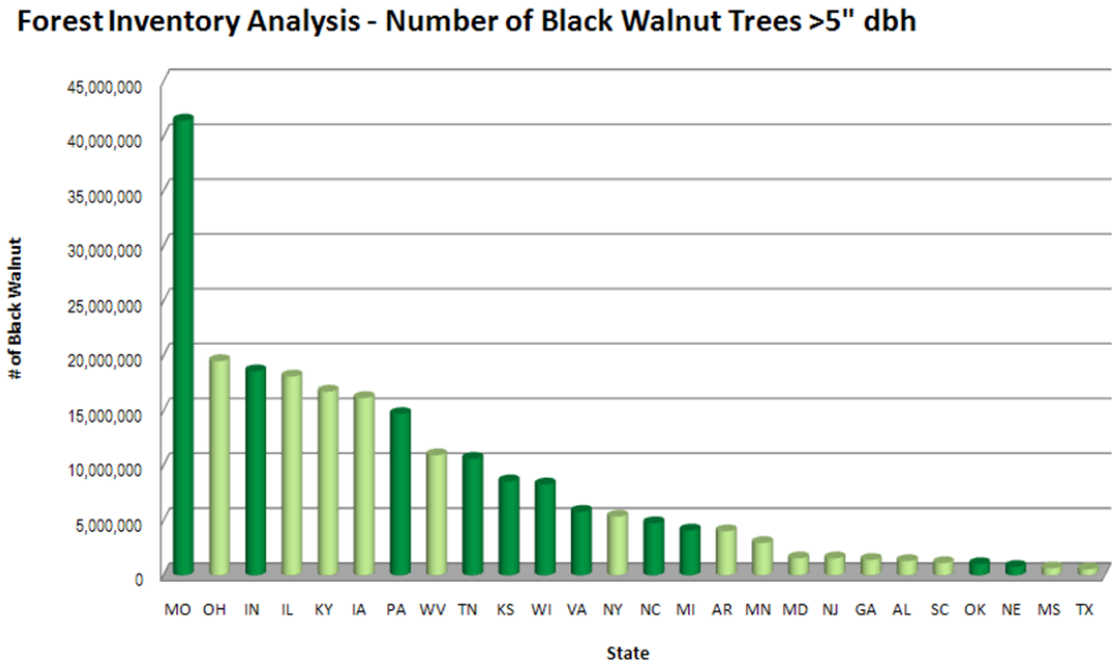

Figure 1. Forest Inventory Analysis (FIA) data showing states and number of black walnut > 5" dbh in forests. Note: dark green depicts states that have enacted emergency quarantine regulations in 2011. J. Van Sambeek, US Forest Service.

planted in the cities and rural areas of the western US and provides important shade and other amenity values. Loss of black walnut due to TCD would negatively impact timber harvesting (very high value per thousand board feet), furniture manufacturing (high value as veneer log), nut production, recreation, nursery stock production, landowners (removal of trees may be costly), and ecosystems (especially wildlife). Other species within the Juglandaceae have shown varying susceptibility to TCD and may also be at risk.

II. Biology & Background

Adult walnut twig beetles have been shown to carry spores of *G. morbida* and the fungus colonizes the cork cambium and phloem in and around the galleries of the beetles. As the adults exit, they pick up spores that create new infections when the beetles tunnel into branches and trunks of walnut to produce new egg galleries or overwintering galleries. The combined activity of both the walnut twig beetle and *G. morbida* cause repeated cankers to form over time. The name of the disease is aptly described as 'death by a

thousand cankers' or TCD (Fig. 2). The association between the pathogen and the beetle is well established and considered diagnostic when both beetle and fungus are present. Cankers often extend considerably beyond the beetle galleries, reaching more than 3 cm in length in susceptible hosts such as black walnut. Cankers develop in phloem tissues formed by the cork cambium in as little as a month. Cankers formed are not the typical 'target-shape' type, as those observed with *Nectria* canker, and occur only superficially beneath the bark. During late stages of TCD, a dark amber stain often forms on the outer bark surface in association with the cankers. As cankers expand and coalesce, the tree is unable to store and move nutrients, thereby starving the host. As trees decline, more bark beetles are attracted to infest the bark, producing more cankers, eventually moving down from the crown to the trunk overwhelming and killing the tree. This progression may take 10-12 years to fully reach the main stem. Leaf yellowing and dieback is first restricted to single branches, giving way to larger portions of the crown as the disease progresses. Severity of the complex varies across walnut type and growing region.

Figure 2. Multiple main stem cankers on black walnut. B. Moltzan, US Forest Service

Current distribution

Historically, walnut twig beetles were collected in native Arizona walnut, *Juglans major* in Arizona and New Mexico, as well as with California black walnut, *Juglans californica.* Observations in Arizona and New Mexico suggest that walnut twig beetle restricts its damage primarily to shaded or weakened branches and twigs in the upper crown. However, expansion of the beetle's range to black walnut planted outside its native range in urban landscapes in the West appears to have taken place in the last 20 years. On black walnut, beetle activity is more aggressive than on native western walnuts leading to tree decline and eventual mortality. Thousand cankers disease has been confirmed in eight western states that have been surveyed (AZ, CA, CO, ID, NM, OR, UT, WA) and as of

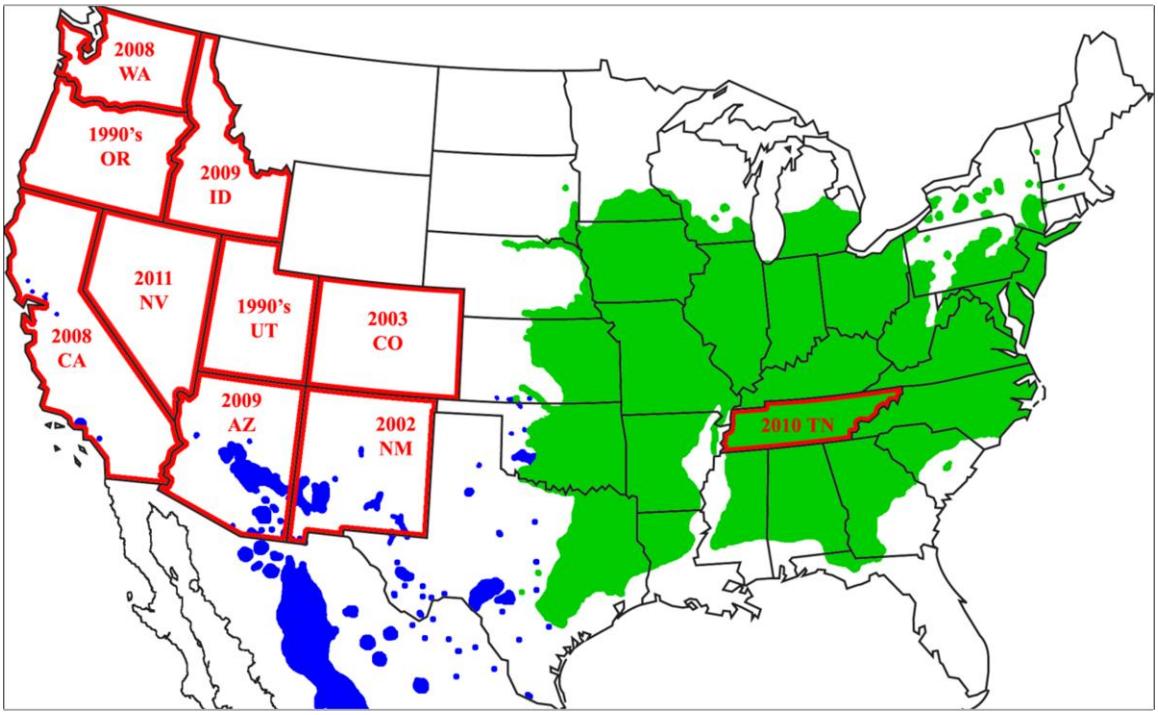

***Figure 3. States with confirmed Thousand Cankers Disease (TCD) as of May 2011. Green area indicates native black walnut range, blue indicates known distribution of Arizona walnut. S. Seybold and A. Graves, US Forest Service* .(*TCD has since been confirmed in VA and PA summer of 2011)**

July 2010, in Knoxville, TN on landscape trees in urban settings (Fig. 3). The TN infection has likely been present for 10-20 years. Whether this has occurred through natural dispersal events or by human transport of twig beetle infested walnut products is not known. New state records of walnut twig beetle have been reported in western state surveys, such as Oregon (1997), Idaho (2003), and Washington (2008), and now Tennessee (2010); all of these coincide with black walnut dieback.

III. Roles and Responsibilities

The USDA Forest Service (State and Private Forestry, Forest Health Protection) has convened a group of subject matter experts from research, state, and federal agencies to emphasize the importance of this emerging insect/disease complex, and provide a basis for protecting the nation's walnut resource. The document is not a policy document, nor does it make any resource commitment. It simply brings together the best information available on the topic to inform land managers and other stakeholders. It also identifies current roles and responsibilities of the signatories; USDA's Forest Service and Animal and Plant Health Inspection Service, National Association of State Foresters, and the

National Plant Board to better integrate our approach to managing TCD. These roles and responsibilities may be changed in the future as needed. The USDA Animal Plant Health Inspection Service (APHIS) has the regulatory authority on all pests coming to the nation's borders and the interstate movement of regulated pests. State Departments of Agriculture have the primary regulating authority into and within state boundaries and typically State Forestry Departments work to manage the forest resources, by working closely with landowners. To develop this framework, representatives were assigned in groups or teams to connect federal, state agencies, universities, and organizations involved with TCD (See Appendix A). All stakeholders have shared roles and responsibilities to develop contingency plans by working together to detect TCD as early as possible and acting quickly to reduce further movement outside the infected areas. Resources should be allocated to sustain the TCD effort start to finish, including surveys, research, and follow up as necessary. Raising TCD awareness through outreach and education must be stream-lined across all groups for consistency. All stakeholders should promote training to inform and prepare forest health professionals to recognize TCD. Currently, states with significant walnut resource at risk are working independently to survey and regulate the movement of walnut. Better collaboration and communication across the range of walnut should be undertaken even if a state is not presently affected. States with TCD should share lessons learned and experience gathered to improve overall TCD preparedness. For example, the Tennessee Department of Agriculture has taken steps to both quarantine confirmed counties and regulate those counties adjacent to the current outbreak. Further, they are working with adjacent states and beyond, offering demonstrations within TCD infected areas to improve overall regional surveys for this disease.

Administrative preparedness

States have the authorities to address plant health issues through their Departments of Agriculture, Forestry, and Natural Resources. Achievable actions agreed upon by local, state, and federal agencies should be implemented quickly. In all cases, states will have the 'lead' regulatory responsibility to respond to TCD as directed by the Office of their State Plant Regulatory Official (SPRO). Each agency should educate internal stake-holders and promote a common approach, as well as identify resources and needs. It is

essential to assess human and technical resources available among partner agencies (e.g. survey personnel, delimiting personnel, diagnostic personnel, foresters) and acquire their commitments for TCD response including funding for specific readiness activities.

Technical readiness

Each agency should ensure that policy decisions, actions, and education initiatives are guided by the best available science developed from recent government and university research. Our knowledge of TCD is limited, given its recent discovery. To provide better management options for TCD, further research is needed on the target species to expose weaknesses in their natural life cycles. As research is completed, it will be important to prioritize needs and to transfer this new technology quickly to forest health professionals, foresters, consulting extension specialists, arborists, master gardeners, and the walnut industry. The research community has already established short-term and long-term goals to address trap and survey tool development, best management tools, basic TCD biology, and host plant resistance. Multiple agency support of these science-based objectives should improve TCD preparedness.

IV. Detection & Monitoring

Detection and monitoring programs should be implemented in states with a significant walnut resource. The first step in detection is to determine walnuts at risk by utilizing existing city tree inventories, locating walnut veneer and saw mills, and intensively managed stands of walnut. Evaluating symptomatic trees with thinning crowns and leaf yellowing should be done in mid-summer with special attention given to the upper canopy of suspected disease trees. Samples should be processed through diagnostic labs that have appropriate APHIS permits and expertise to validate the TCD identification. Appropriate state diagnostic, NPDN labs, and other plant clinics need to be informed of any established protocols for identification of TCD. Additionally, laboratories should be made aware of the number of samples expected, to avoid unnecessary delays in diagnosis. If a laboratory is at maximum capacity it can work

Figure 4. Walnut Twig Beetle in gallery just beneath the bark B. Moltzan, US Forest Service.

through the SPRO, APHIS, FS, and NPDN to reroute overflow TCD samples to another laboratory. The presence of live walnut twig beetles (Fig. 4) and culturing of *G. morbida* (Fig. 5) from canker margins will constitute positive confirmation of TCD by an official diagnostic lab. Improved methods to detect walnut twig beetles by developing traps and lures are currently being explored by APHIS and the FS and should eventually enhance our ability to detect early stages of TCD. At a minimum, efforts should be made to provide state Cooperative Agricultural Pest Survey (CAPS) coordinators with this information to track county level positive or negative finds. States with confirmed TCD should consider establishing a grid of standard plots to provide a measure for rate of spread and guide prioritization efforts to slow TCD spread. Permanent plots will be established in different geographic regions and include different *Juglans* hosts. The US Forest Service has developed a standardized survey instrument and is establishing a central database to track on-going TCD survey results.

V. Management

Figure 5. Geosmithia morbida cause of TCD. N. Tisserat, CSU.

Management of TCD should be focused in two areas: 1) the urban landscape that targets individual trees (i.e. city streets, tree farms, or walnut plantations), and 2) forested areas where walnut occurs naturally. Preventing movement of wood out of a local area is critical for containing TCD. Given the importance of walnut, quarantines must balance ecological and economic concerns prior to application. Emergency measures determined by states can be implemented to regulate unprocessed walnut wood material and yet allow transport of wood that has been milled to remove all bark and wood in finished products. Since localized loss of walnut to homeowners is of immediate concern in terms of containing TCD, recommendations on steps to prevent movement of the wood out of the area are keys to containment.

Risk Reduction

Risk reduction involves implementing methods to prevent the spread of TCD to new areas. Local governments and other entities should coordinate response efforts and

establish meetings with stakeholders to discuss and determine the initial plan of action. This was undertaken in part during the first, **Thousand Cankers Disease of Black Walnut National Conference** held in St. Louis, MO on November 3-4, 2009. The meeting was hosted by the Missouri Departments of Agriculture and Conservation with over 145 participants from 24 states, and Washington, DC. Subsequent to the conference, and in light of the TCD find in TN, a number of local and state authorities have scheduled emergency meetings with cooperators from industry, city, county governments, recreation areas, and others to develop response plans. Specific containment actions have followed, and are focused on initiating regulatory and control activities. States that have implemented emergency quarantines for TCD include; IN, KS, MI, MO, NC, NE, OK, TN, and WI. States such as TN and NC have organized and conducted delimit and detection surveys, respectively, to determine TCD boundaries. All black walnut within a ½ mile (0.8 km) of a positive TCD find were to be evaluated within a reasonable time frame. After its discovery in Knox County TN, an Incident Command System (ICS) was adopted by the TN Department of Agriculture similar to that used for emerald ash borer surveys. Implementation of the ICS allowed for expansion of the survey area to include 19 counties, which resulted in four additional counties confirmed with TCD. Several states have put forth proposals to seek legislative support to cover costs associated with TCD survey and management. States will continue to augment readiness funding through partnerships with stakeholders.

Urban Settings

When TCD is established in an urban area (Fig. 6), efforts should be made to slow its natural spread and prevent human-assisted spread (e.g. via firewood or veneer logs). Plans for urban areas need to be developed directly with municipalities, city foresters, tree boards, and others with an interest in urban forest health. Such plans should include methods to map and track diseased trees and

Figure 6. Thousand Cankers Disease (TCD) in urban landscape. B. Moltzan, US Forest Service.

inventory healthy trees within the urban area. Local communities need to establish protocols for removal and proper handling of infected trees, as well as conduct public education efforts on the nature of the threat. Further, all stakeholders will need to explore wood-waste utilization opportunities with forest products industries and other partners to reclaim walnut material in the event large volumes of material become available. Sanitation chipping can make wood too small to support the beetle and may be one of the best ways to treat wood from TCD-affected areas. However, removal of infested trees as recommended for control of Dutch Elm Disease (DED), may only have a modest effect on TCD due to the long lag time (years) between when trees are initially infested and when the disease is finally diagnosed. During this lag period, beetles are likely to spread within a TCD-infested area inhibiting effective containment. Commonly used bark beetle insecticides (e.g., carbaryl, various pyrethroids) may have utility on high value walnut trees. However, coverage may prove too costly to maintain due to the extended period that adult beetles are active and the extensive areas of trees that are colonized. Colonization of the bark by *G. morbida* may continue even if adult beetles or larvae are killed by the insecticide.

Forest Areas

Management of TCD once established in forested areas will depend on early detection and development of effective silvicultural prescriptions. Existing data from the FS Forest Inventory and Analysis (FIA) program may provide target areas to set up delimiting surveys. These FIA plots are considered a coarse snapshot of walnut condition collected over many growing seasons (Fig. 7). Multiple ownerships will be challenging as unique management goals and desired outcomes are brought to the table. Concerned stakeholders will need to consider how these forests should be managed in the absence of TCD. Currently, the impact to the native walnut tree species needs further study.

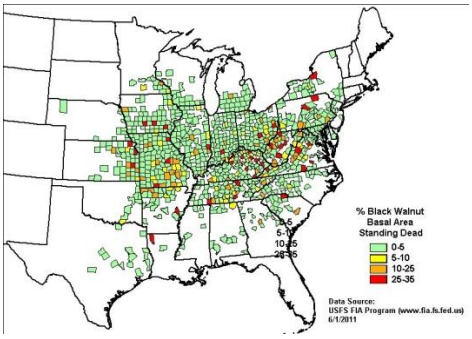

Figure 7. Forest Inventory and Analysis (FIA) as percent basal area of black walnut shown as standing dead trees 2011. J. Steinman, US Forest Service.

Ultimately, landscape management strategies for TCD must incorporate prevention, available treatment, restoration, and conservation into an overall program.

VI. Outreach and Education

All stakeholders involved in the TCD management effort should inform the media to assist them in providing accurate information on TCD to the general public. Many states with significant walnut resources are already providing science-based information and regular updates with links to their state websites. To expedite communications, most state agriculture and forestry departments have key contacts to coordinate official press releases. More information alerting the public about human transport of infested walnut can enhance awareness among woodworkers who may seek to buy walnut from infected areas for use in the Midwest. In 2008, 2009, and 2010, experts in identifying TCD conducted workshops in affected communities in CO and now in TN. In order to increase early detection of TCD, a pool of local experts should be broadened to include federal and state forest health specialists, professional foresters, extension specialists, master gardeners, arborists, woodworkers, and walnut producers. Standardized materials are needed to teach identification of symptomatic trees and proper sampling technique; methods of culture and identification of *G. morbida*; and how to identify the walnut twig beetle. Risk maps will improve the focus of TCD detection surveys.

National Plant Diagnostic Network (NPDN)

The National Plant Diagnostic Network (NPDN) consists as a consortium of plant diagnostic laboratories working through Land Grant Universities, federal agencies, state departments of agriculture, and other stakeholders. The specific purpose of the NPDN is to provide a nationwide network of public agricultural institutions with a cohesive, distributed system to quickly detect high consequence pests and pathogens that have been introduced into agricultural and natural ecosystems, identify them, and immediately report them to appropriate responders and decision makers. The NPDN will collect, compile, and disseminate training materials for outreach and education in coordination with University of California, Colorado State University, US Geological Survey, state foresters, cooperative extension, private foresters, and master gardeners, as well as others.

The NPDN can also utilize the National Registry of First Detectors when new detections occur. The NPDN analysts will collaborate with others and use epidemiological tools to map and understand sample submission and chain-of-custody. Information release is vital and established lines of communication must be followed to make sure the regulatory, diagnostic, forestry communities are starting from a valid point of reference when TCD is detected.

Outreach materials

The US Forest Service has developed a Pest Alert (NA-PR-02-10) to advance timely information on TCD. In addition, the FS is working with partners to develop diagnostic keys for use in identifying the walnut twig beetle in its Early Detection and Rapid Response (EDRR) program. Colorado State University continues to provide key informative materials and training sessions for the diagnosis of TCD. Many states are preparing TCD information 'packets' for distribution to affected areas. Two FS Forest Insect and Disease Leaflets (FIDL) are being developed, one for the walnut twig beetle specifically, and the other for the fungus *G. morbida* and the disease. These outreach and education materials should be produced in sufficient quantities and well distributed, and kept current as web based documents for quick updating as needed (Appendix B).

Website

A single, reliable, up-to-date website is needed to unify and link all current information on TCD, similar to the emerald ash borer website (www.emeraldashborer.info). In addition, it may be possible to develop an early detection reporting system website like that created to track mile-a-minute vine (http://www.hort.uconn.edu/mam/). To be effective and up-to-date these efforts require constant feedback and may be costly. All stakeholders should work together to expedite information transfer on TCD.

VII. Research

Expanded knowledge about the life history, biology, and behavior of the walnut twig beetle and *G. morbida* associated with TCD are critical needs for the early detection and

the development of applied management techniques for dealing with this disease. Research will need to encompass fundamental areas of study such as; chemical ecology, developmental biology, and host plant resistance, as well as applied areas such as trap and survey tool development, best management practices, and integrated pest management. With better trapping tools, surveys should improve our understanding of where and how much TCD is occurring in a given area. By validating cultural, chemical, and biological control methods for TCD, it may be possible to protect high value walnut trees. The development of robust screening tools will help to define potential host resistance mechanisms. Understanding all aspects of disease progression, life cycles, risk to the resource should be included as long-term research strategies. Finally, other insects that attack walnut trees should be evaluated as potential TCD vectors.

Figure 8. Trap surveys conducted at UC Davis. B. Moltzan, US Forest Service.

VIII. Conclusions

Figure 9. Colorado State University Extension conducting a TCD Training in Boulder, CO 2010. N. Tisserat, CSU.

The purpose of this document is to alert and inform state foresters, agriculture officials, and legislative staff on this emerging insect/disease complex and its potential impact to the nations walnut resource. The National Response Framework for Thousand Cankers Disease (TCD) on Walnut seeks to establish a foundation for prioritizing on-the-ground work, research, and resource needs. The implementation of specific activities outlined in this framework is flexible and based on the best available information at this time. All stakeholders have shared roles and responsibilities to develop contingency plans by working together to detect TCD as early as possible to reduce further movement outside the infected areas. Ultimately, landscape management strategies for TCD must incorporate prevention, available treatment, restoration, and conservation into an overall program. As our understanding of TCD improves, it will be important to monitor progress to make sure appropriate corrections to this TCD framework are adapted to improve management in the future.

Appendix A

Executive Group – Establishes outline and oversees the Technical Working Group.

Technical Working Group – Serves to lead and coordinate TCD readiness and provide an overview of current science in the framework.

Technical Review Team – Provides comment on the framework.

External Review Team – Includes FHP Director's impacted by TCD.

Communication Team – Outreach professionals who deliver a consistent message and provide information to help agencies and organizations tasked with pest management decisions.

Executive Team

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Appendix B

Links:

National Association of State Foresters (NASF)
http://stateforesters.org/

National Plant Board (NPB)
http://nationalplantboard.org/

National Association of State Departments of Agriculture (NASDA)
http://www.nasda.org/

National Plant Diagnostic Network (NPDN)
http://www.npdn.org/

Walnut Council
http://www.walnutcouncil.org/

Resources:

Colorado State University Extension
http://www.colostate.edu/Depts/bspm/extension%20and%20outreach/thousand%20cankers.html

UC Davis IPM Online
http://www.ipm.ucdavis.edu/EXOTIC/thousandcankers.html

Tennessee Department of Agriculture
http://tn.gov/agriculture/regulatory/tcd.html

Walnut Twig Beetle diagnostics
http://caps.ceris.purdue.edu/webfm_send/853

Forest Service, Northeastern Area (NA) Pest Alert
http://www.na.fs.fed.us/pubs/detail.cfm?id=5225

APHIS TCD Pathway Assessment
http://mda.mo.gov/plants/pdf/tc_pathwayanalysis.pdf