State of Kansas
Thousand Cankers Disease of Walnut
Strategic Plan

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Cover images: Large – walnut tree with TCD branch death in late stage, M. Mielke US Forest Service. Small – a branch shaved of bark revealing longitudinal dark cankers with some nuptial chambers in Colorado, M. Kennelly KSU.

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Kansas Thousand Cankers Disease Strategic Plan

I. INTRODUCTION

Thousand Cankers Disease is a pest complex that is caused by the walnut twig beetle *(Pityophthorus juglandis)* and an associated fungus *(Geosmithia morbida)*. Two species of walnut, Black walnut *(Juglans nigra)* and Little Walnut (*Juglans microcarpa*), are native to Kansas (Figure 1). Black walnut can be found statewide in either urban settings or in native stands. Little walnut is confined to south central and southwestern Kansas along the Oklahoma border. Both walnuts are susceptible to the disease and black walnut is considered highly susceptible (Tisserat et al., 2009).

A. HISTORY

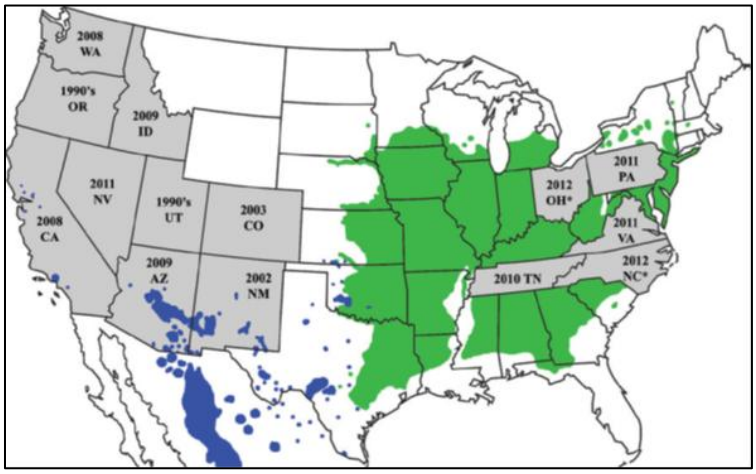

Figure 1. The native range of *J. nigra* (green) and four western black walnuts species (blue) including *J. microcarpa* and reports of TCD or WTB in states in gray. Maryland was positive in 2013 for WTB and not shown on the map as gray. Seybold et al. USDA Forest Service NA-PR-02-10 revised 2-2013

The walnut twig beetle (WTB) is native to North America; its native range in the southwest U.S. appears to coincide largely with the distribution of Arizona walnut (*J. major*), the likely original native host (Cranshaw and Tisserat, 2008). Records from California suggest that the WTB may be native to that state also; *P. juglandis* was described from specimens collected in California on *J. nigra* (Bright and Stark, 1973) and *J. californica* (Bright, 1981), both of which are susceptible to thousand cankers disease. The first published record of a cluster of black walnut mortality associated with the walnut twig beetle was in the Espanola Valley of New Mexico where large numbers of mature black walnut died in 2001 (Cranshaw and Tisserat, 2008). Similar widespread decline also occurred about this time in the Boise, Idaho area where the insect was first confirmed present in 2003 (Cranshaw and Tisserat, 2008).

Black walnut mortality and the walnut twig beetle have been noted in several Front Range communities in Colorado since 2004 and in most infested cities the majority of black walnut has since died. *P. juglandis* has been recorded from Oregon (Portland) since 1997, has been widely captured in funnel traps in The Dalles since 2004, and is suspected of being associated with recent widespread death of black walnut and black walnut hybrids in the Willamette Valley of Oregon (Cranshaw and Tisserat, 2008).

Prior to these recent reports, WTB was not associated with any significant *Juglans* mortality. In most areas where the die-offs of black walnut have occurred, drought was originally suspected as the cause of the decline and death of trees, with the beetle considered as a secondary pest.

In 2010, the *G. morbida* fungus and the WTB were discovered in the eastern United States for the first time. Tennessee was reported in 2010 in the Knoxville area and then nearby states of Virginia (2011), Pennsylvania (2011), and Ohio (2013) reported the disease complex within a couple of years. These reports were then followed by North Carolina (2012), the country of Italy (2013, Monticchio et al) and Maryland in 2013 for the walnut twig beetle (personnel communication, D. Bean, MDA).

As of the date of this document, neither the walnut twig beetle nor *G. morbida* has been found within the state of Kansas. The disease complex has been annually surveyed beginning in 2009 by Kansas Department of Agriculture and the Kansas Forest Service with collaboration from Kansas State University. In 2010, an external quarantine was enacted by Kansas Department of Agriculture. In 2012, an aggregation lure for the walnut twig beetle became available and utilized for detection of the vector insect.

Publications relative to TCD are available online including pest alerts by Colorado State University http://www.ppdl.purdue.edu/PPDL/pubs/walnutthousandcankersdisease.pdf; and the USDA Forest Service http://na.fs.fed.us/pubs/palerts/cankers_disease/thousand_cankers_disease_low_res.pdf.

B. BIOLOGY

The walnut twig beetle *Pityophthorus juglandis* is the only *Pityophthorus* species that has been associated with both *Juglans* and *Geosmithia*, and can be readily distinguished from other members of the genus by several physical features that include size, color, frons shape and setae, ridges on pronotum, and orientation of elytra declivity (Seybold). Adult beetles are very small (1.5 to 2.0 mm long or about 1/16 in) and are reddish brown in color. This species is a typical-looking bark beetle. It can be distinguished from other members of the genus by the four to six concentric ridges on the upper surface of the pronotum (the shield-like cover behind and over the head). Like most bark beetles, the larvae are white, C shaped, and found in the phloem. For this species, the egg galleries created by the adults are horizontal (across the grain) and the larval galleries tend to be vertical (along the grain) (Seybold, et al., 2010) (see Fig. 2).

Figure 2. Beetle entry and exit holes in branches in Colorado, a diagnostic clue to TCD. Megan Kennelly, KSU

On *J. nigra* WTB prefers to colonize the underside of branches and prefers branches larger than 3 cm (1 in) in diameter (Tisserat, 2010). Numerous beetle entry and exit holes can be seen on dead and dying branches (Figure 2). Tunneling sometimes occurs in trunks (Cranshaw and Tisserat, 2008). It also prefers the warmer (more sun-exposure) side of the tree (Cranshaw and Tisserat, 2008).

Recent studies conducted on *J. hindsii* in California have revealed that male beetles colonize newly cut branches in 4-9 days and are joined quickly by female beetles. Brood

galleries are then created, often several per female. Both sexes contribute to an aggregation pheromone that attracts both sexes to infested branches (Seybold et al., 2009).

The adult beetle winters within cavities excavated in the bark of the trunk. Adults resume activity by late April in Colorado. Many adults fly to nearby branches to mate and initiate new tunnels for egg galleries; some may remain in the trunk and expand overwintering tunnels. During beetle tunneling the *Geosmithia morbida* fungus is introduced as fungal spores that tend to be carried on the mouthparts of the WTB. Ultimately a nuptial chamber is produced from which one or more radiating egg galleries are excavated. Each gallery contains 7-25 eggs. (Lambdin, 2013) Larvae develop just under the bark and then enter the bark to pupate (Cranshaw and Tisserat, 2008). Larval development takes 6-8 weeks to complete. Females can be expected to produce 50-100 offspring each (Lambdin, 2013) There are generally two overlapping generations per season in Colorado. Adult beetles can be observed flying from mid-April to late October in Boulder (Cranshaw and Tisserat 2008; Cranshaw 2008). The adult WTB is estimated to fly one to two miles per season (USDA APHIS PPQ NPAG-Archives, 2008).

A single generation has been observed to be completed in less than two months. Yellow sticky trap sampling in Boulder, Colorado found adult beetles to be present from mid-April through early October, when sampling was discontinued. Peak adult captures occurred from mid-July through late August. These data suggest that two or more generations may be produced annually, which may increasingly overlap later in the growing season (Cranshaw and Tisserat, 2008). WTB populations in trees can reach levels of 30 per square inch; a single black walnut tree may produce tens of thousands of beetles (Cranshaw 2010).

There are a number of bark beetles (Coleoptera: Curculionidae: Scolytinae) that have the potential to serve as alternate vectors of *Geosmithia* conidia (Newton and Fowler, 2009). For instance *Pityophthorus lautus* is known to attack black walnut (*Juglans nigra*) in its native range (Wood 1982).

Cankers, caused by *Geosmithia morbida*, initially develop around the nuptial chambers of the walnut twig beetle in small twigs, branches and even the trunk (see cover page). Cankers expand rapidly and develop more expansively lengthwise than circumferentially along the stem. On thick barked branches, cankers may at first be localized in outer bark tissue and extend into the cambium only after extensive bark discoloration has occurred. Eventually multiple cankers coalesce on twigs and branches, resulting in branch dieback (cover page). The number of cankers that are formed on branches and the trunk is enormous; hence the name thousand cankers to describe the disease (Cranshaw and Tisserat, 2008) (see Fig. 3). Unlike other canker disease in which one or few large cankers girdle the tree or branch, with TCD it is the combined effects of numerous small cankers that collectively damages and causes a dieback eventually killing the tree. A dark amber stain may form on the bark surface in association with the cankers. Other *Geosmithia* species are associates of bark beetles of hardwood and conifer trees but have not previously been reported as pathogens of *Juglans* or fungal associates of *P. juglandis*.

Pathway analysis and potential mechanisms of spread: Risks and pathways to Kansas walnuts

The USDA APHIS (2009) pathway assessment on *Geosmithia sp. and Pityophthorus juglandis* movement from the western portion of the nation into the eastern United States characterized the approach rate of potential TCD pathways. The long-distance dissemination pathways included raw timber (veneer quality logs, saw logs, burls, and stumps), firewood, wood packaging material (WPM),

nursery stock, scion wood for grafting, and natural spread. For Kansas, firewood and untreated logs were of concern.

The distribution along major commerce routes in western states suggested that movement of thousand cankers disease and its vector may be human assisted (Newton and Fowler, 2009). This observation also was made in Tennessee and Virginia with their discoveries (GPDN webinars, 2013). Therefore it is important in Kansas that population centers and transportation corridors be monitored because of association with human movement of walnut materials and location in the native range of black walnut. Population centers (>40,000) include Kansas City Metro area of Johnson, Wyandotte, Douglas, Leavenworth, and Miami Counties, the I-70 corridor from Kansas City to Junction City, and Wichita and surrounding communities including Hutchinson.

For Kansas the proximity to Colorado is a real concern. The main transportation corridor of Interstate 70 that connects Kansas City in the east to Denver, Colorado allows easy access into Kansas for much of Colorado. In addition, four other major highways and corresponding rail funnel commodity transportation eastward from Colorado into Kansas. These highway and rail corridors provide a direct entrance of commercial commodities into the eastern half of Kansas but also for private movement of walnut articles including raw wood for wood working and firewood.

Figure 3. Map of Kansas showing in red, major vehicular and rail corridors from Colorado into the eastern half of Kansas where black walnut is native. J. Appel, KDA

Many residents of one state have either homes or family or friends residing in the other state. Therefore the unintentional introduction of TCD with raw wood is a special concern to Kansas as a tree felled in Colorado could easily be moved into the eastern two thirds of Kansas by residents who do not understand or are aware of the risks and consequences of their actions. A large geographical area of Kansas where walnuts are present in either the urban landscape or in riparian areas present a likely host situation where the pathogen, vector, and host would come together. Undoubtedly, this possibility of pest introduction by residents or either Kansas or Colorado is a great risk to introducing TCD into Kansas walnuts stands.

Figure 4. A TCD walnut log hidden in an alley of Denver observed during a training event in 2009, J. Appel KDA

Other concerns from Colorado and states both in western and now eastern United States, include frequent campers from infested states into the Kansas campgrounds associated with federal reservoirs that have walnut populations. Firewood is the concern here with campers hauling their own firewood and the wood carrying walnut twig beetles that may escape to nearby walnuts.

Kansas is fortunate that the eastern Colorado high plain has a lack of native stands of walnuts. This area extends about a third of the way through much of western Kansas. The closest location in

Colorado to Kansas is the Rocky Ford area west of Lamar, (Tisserat, 2013). This natural barrier of lack of hosts allows for a controllable buffer area where surveys and mitigation efforts may be successful towards TCD. Colorado municipalities, forestry, and extension educators have been pro-active in informing the public of the potential for spread of the disease by raw wood.

It is important to keep in mind that though the disease was not reported in Tennessee until 2010, current evidence suggests that it had been already present for 10-20 years (Huan, TDA). Drought and other symptoms, and lack of awareness of TCD may have masked TCD from being readily detected in Tennessee. The subsequent discovery of TCD in other states of eastern United States from 2011 to 2014 further indicate that the disease has been present for some time in eastern US. It is therefore important for Kansas to be vigilant in efforts to educate the public on the risks of moving raw walnut wood and to early detection surveys.

Figure 5. A walnut tree in Tennessee that authorities believed to have the disease for over 10 years. G. Haun, TDA Action Plan.

C. VALUES AT RISK

According to *Kansas' Forest Resources, 2012*, the most recent published inventory of USDA [Forest Service, Northern Research Station, Forest Inventory Analysis (FIA)] there is an estimated 429.7 million board feet of black walnut sawtimber and 209.7 million cubic feet of black walnut in Kansas rural areas. *Kansas Forests 2010* report estimated 8,772,000 black walnut trees in Kansas classified as "growing stock". In addition to these numbers, riparian forests, shelterbelts, windbreaks and isolated trees that don't meet the FIA definition for forestland add another 960,131 black walnut trees to the mix. Additionally there is an estimate 1.7 million black walnut trees located in cities and towns with about 28,181 providing value as street and park trees (Sources: Great Plains Initiative Inventory and KS Community Forest Inventories).

Black walnut is the most commercially valuable tree species in Kansas adding millions of dollars annually to the Kansas economy through the sales of veneer, gun stock, lumber, cabinets, furniture, and nut products. The wood is easily worked, durable, retains finish well, has a highly marketable appearance, and a long-standing reputation with consumers as being highly desirable. Final products made of walnut include furniture, cabinets, interior trim, wood carvings, and gun stocks. Nuts from walnut have a variety of uses from food products to polishing compound. Black walnut hulls are used for flavoring and health food extract for a variety of skin and intestinal ailments.

Black walnut is a relatively important species for wildlife, mostly for its nutritious nut meat. Wildlife species that consume the nuts are generally rodents such as squirrels and mice. These species are expected to be moderately to severely affected should black walnut be lost from the landscape.

An Economic Loss Associated with the Introduction of TCD of Black Walnut to Kansas publication projects over $160 million loss (2010 dollars) into the future should TCD be introduced to Kansas. This includes $9.7 million in wood products, $65.2 million in urban street and park trees, and $605,000 loss in nut production, along with other future dollar projections.

II. Purpose of Strategic Plan

The Kansas Thousand Cankers Strategic Plan (KTCSP) has four goals to protect and sustain both *Juglans* species within the state and associated industries. The four goals and subsequent strategies should be developed around the following assessments:

- The disease complex appears to develop and spread slowly. Thousand Cankers is often mistaken for drought decline. TCD does not move naturally large distances because of limitations of vector insect flight of a mile or two during a season.
- Walnut is found in almost every community in Kansas and common to woodlands in the eastern two thirds of Kansas. The highest populations of walnut are often found in extreme eastern Kansas.
- Because walnut has value as firewood, lumber, and a desirable woodworking material, raw walnut wood is at high risk of being moved by human activities.
- Walnut has a food source value in the nut both to humans and to animals. The tree is an important component of the urban forest in Kansas communities and improves the life of residents and reduces cost of drainage, heating and cooling, and other aspects of a canopy tree in the urban setting.
- The closest infestation of Thousand Cankers is in Colorado and firewood and other walnut articles that are moved into or through the state from this western neighbor is of great concern. Campers, logging and woodworking industries, and residents of Kansas who either own property in Colorado or who have some connection may bring infested wood into the state.

The ***first goal*** is safeguarding Kansas walnut resources by preventing introductions into the state associated with raw wood articles. The Thousand Cankers Quarantine of 2010 and 2014 revision are an important part of achieving this goal. Outreach is an important component of a successful quarantine.

The ***second goal*** is provide an early detection network based upon pathway analysis and risk considerations.

The ***third goal*** is to address a response plan if the disease was found in the state with considerations regarding either eradicating the disease complex or minimizing the spread of the disease in a timely manner.

The ***fourth goal*** is export commodity assurance by providing a system to ensure pest freedom requirements placed on Kansas produced commodities by domestic and foreign importers is maintained to allow movement of those commodities.

The KTCSP is intended to follow guidelines established in the National Framework for Thousand Cankers Disease developed by the USDA Forest Service, State and Private Forestry, Plant Protection Program of KDA, and the TCD Strategic Group.

III. General Readiness

Objective: To prevent introduction, limit the spread, reduce risk, minimize impact, respond effectively to TCD and to use partnerships for maintaining overall health and sustainability of Kansas urban and native forests.

A. Establish a network of agencies and organizations to assess and address TCD concerns as the Thousand Canker Disease Strategic Team. The Team will draft annually a work plan for the calendar year and be responsible for advising, advocating, and leading in the implementation of the plan to meet the four stated goals.

1. **Strategic Team** – The team serves as the lead group in planning and coordinating annually all TCD prevention and response activities. The team is composed of the following members but not limited to them. The team will meet a minimum of two times during the calendar year to develop and implement an annual Strategic Plan.

- KDA Plant Protection and Weed Control Program Manager (co-chair)
- KDA Plant Pathologist
- KDA Entomologist
- KFS State Forester (co-chair)
- KFS Community and Rural Foresters
- KFS Forest Pest Specialist
- KSU State Extension Forester
- KSU Plant Pathologist
- KSU Plant Disease Diagnostician
- KSU Entomologist
- Kansas Walnut Council representative
- Various Public Information officers
- KDA legal counsel

Specific activities to accomplish the objectives include:

- TCD detection surveys
- Develop a common survey method and reporting system

- Store and manage data in one accessible database
- Conduct investigations on reported and or suspect detections
- Identify pathways of introduction and other risk factors
- Communicate and coordinate with appropriate local, state, federal agencies, general public, and industry activities regarding the KTCSP
- Confirm identification or provide specimens to appropriate authorities for taxonomic identification
- Review and advice the legal authorities regarding TCD issues.
- Develop a communications team
- Work with local government authorities

B. Agency Roles and Responsibilities for major partners in the Thousand Cankers Disease Strategic Team include, but are not limited to the following:

1. **Department of Agriculture, Plant Protection and Weed Control Program** is the lead State agency responsible for preventing the introduction and spread of harmful plant pests, such as insects and diseases, into and within Kansas. KDA by law has the responsibility and authority to manage plant pest introduction in the state of Kansas. It is also the lead state agency responding to any type of harmful plant pest introduction.

Prevention Activities

- Provide surveillance and detection, follow-up inspections on reported suspects
- Notify and coordinate activities with the appropriate local, state, and federal agencies and private organizations related to program responsibilities and this Plan.
- Confirm identification of samples and suspect organisms.
- Implement and maintain appropriate state quarantines.
- Review and coordinate pest control activities to ensure compliance with federal, state, and local laws.
- Seize and destroy materials when warranted.
- Oversee destruction of infested or potentially infested materials or vectors.
- Provide or assist with the procurement of funding for survey, outreach, monitoring, and containment when appropriate.
- Provide pest management expertise and advice to all cooperators (including nursery operators) and the public.
- Implement compliance agreements for the movement of regulatory articles related to the TCD quarantine.
- Monitor compliance
- Cooperate with other Strategic team members to develop specific messages.
- Coordinate communication of invasive species information to stakeholders.

Response Activities for an Infested County or Area

- Assist in all response activities including quarantine, evaluation, identification, disposal, disinfection, epidemiology, trace-backs and trace- forwards, permitting, inspection, transportation control systems, and survey activities.
- Collect, collate, analyze, and disseminate technical and logistical information and distribute to field staff and cooperators.
- Cooperate with other members of the TCD Strategic Team to develop specific messages and coordinate communication of invasive species information to the public, media, cooperators, and affected industries.
- Define training requirements for those involved in response operations. Training may consist of survey, sampling, diagnostic, and regulatory procedures.
- Cooperate in the declaration of the emergency area and assist in defining the emergency area and control of quarantined zones.
- Acquire necessary funding to support emergency program activities.
- Consult with State and local authorities regarding response operations.
- Maintain compliance with out of state external quarantines regarding walnut articles.
- Advocate restrictions based on Kansas pest surveillance date and internal regulations.

2. **Kansas Forest Service, Kansas State University** is the lead state agency responsible for providing forest and urban forest management information and technical forestry assistance to the people of Kansas and protecting and managing Kansas forests for long-term resource sustainability through the implementation of the Kansas Forest Action Plan (http://www.kansasforests.org/about/about.shtml).

- Provide forest management expertise and advice to private landowners, communities, forest products and tree care industries, consulting foresters, and the general public.
- Provide information and assistance to Kansas communities in planning community preparedness and response to TCD and other invasive forest species.
- Lead in partnership with other agencies, develop specific messages and coordinate communication of invasive species information to the public, media, cooperators, and affected industries.
- Provide liaison with the USDA Forest Service, National Association of State Foresters, and Council of Western State Foresters through the Kansas State Forester to request further assistance and funding.
- Assist in surveillance, detection, follow-up inspections on reported suspect sightings (identification, assessment, and monitoring).
- Assist with containment, restoration, and mitigation activities.

3. Kansas State University

K-State Research and Extension provides outreach/education to stakeholder groups who could be affected by TCD. The Department of Plant Pathology, including the Plant Disease Diagnostic Clinic, and the Department of Entomology, including the Insect Diagnostic Lab, provide education and diagnostic support to landowners and others, often via a local county or district extension educator based in the community. KSU will work with KDA and KFS to:

- Diagnose suspect samples of *G. morbida* and *P. juglandis*
- Assist in surveillance, detections, and follow-up of at risks and suspect tree sites
- Develop and deliver educational materials (print, online, in-person seminars, etc) related to TCD

C. Facilitate Inquiries and Reporting of Suspect Infestations

- Educate the general public to submit inquiries and suspect infestation reports to Kansas Department of Agriculture or Kansas Forest Service professionals to allow pre-screening for appropriate tree species and insect group. See reporting process details in Appendix C.

- Educate natural resource professionals (e.g. arborists, municipal foresters, nursery managers, federal land managers, and KSU extension agents) to submit inquiries and suspect infestation (Appendix C)

- Inquiries and reports of suspect TCD or WTB infestations are to be submitted to one of the following agencies. Personnel from the following agencies will inspect the suspected walnut tree(s) and identify the specimen(s): Kansas Department of Agriculture Plant Protection Staff, Kansas Forest Service Foresters, Kansas State University's Horticultural Plant Pathologist or GPDN Diagnosticians.

- If a specimen is collected by either official survey or by the public (see 3 above) and suspected to be thousand cankers, the specimen will be sent to the Great Plains Diagnostic Laboratory at Kansas State University for confirmation. In the case of walnut twig beetle, official survey specimens will be sent for evaluation by the KDA entomologist and then if suspects are found will follow national USDA Forest Service protocol guidelines for official identification confirmation. In the case of samples from the public, those samples may both be screened by the entomologists at Kansas State University and then conferred with the KDA entomologist or by KDA entomologist alone. Insect sample suspects will then be sent on for official confirmation per national protocol guidelines if they are believed to be *P. juglandis*. Voucher specimens will be kept by KDA when the number of sampled insect numbers allow.

- In the event of a positive confirmation of either Thousand Cankers disease or the Walnut Twig Beetle, the Kansas Department of Agriculture is to be notified within 72 hours of confirmation and then the Strategic Team will release a joint statement

regarding the positive find. The Kansas Department of Agriculture with the help of local authorities will take immediate regulatory action to stabilize the site of infestation minimizing any further spread. The Strategic Team will meet at the earliest convenience to develop and implement a mitigation program.

IV. Reduction of Infestation Risk

Objective: Identify all major pathways of TCD and WTB introduction and ensure actions are taken to reduce infestations as soon as possible.

A. Assess Risk of Infestation and Monitoring

1. Assess introduction sites based upon potential introduction events, transportation corridors, walnut populations, and human population centers.
2. Conduct annual surveys of introduction sites and walnut populations.
    a) Higher Risk sites include those of high transportation traffic, firewood vendors and locations that handle walnut articles such as warehouses, campgrounds, sawmills, and woodworking locations.

B. Reduce Risk of Spread

1. Raise public awareness about risks and regulations of moving infested wood.
    a) Install educational posters at public and private campgrounds and highway rest areas.
    b) Deploy educational billboards or bridge banners on major highway that enter into the state particularly in western Kansas and around Kansas City and Wichita, the major urban centers in Kansas.
    c) Develop and employ a variety of educational tools (e.g., media releases, billboards, public service announcements).
    d) Educate firewood dealers and buyers on the benefits of buying and selling locally produced firewood in Kansas.
    e) Educate the public and implement (1) “Don’t move out of state firewood”, (2) “Use local sources of firewood”, (3) “If you have already brought firewood from home, don’t move it, burn it” firewood policy in private and public campgrounds (4) dispose of yard waste properly.
    f) Educate state and national camping, recreational vehicle associations, and other organizations about the risks of spreading disease and insects involved with transporting firewood.
    g) Reach out to primary and secondary wood processors through landowner, industry, and professional associations.
    h) Identify and educate conservation groups or agencies, municipalities, live plant dealers about the importance of knowing the source of black walnut nursery stock.

i) Monitor sources of mail and internet sales of walnut and educate out of state dealers about risks and regulations.
j) Coordinate survey and outreach with federal land managers at reservoirs, military installations, tribal lands, and other federal areas.

2. Educate law enforcement agencies (Kansas State Highway Patrol, Kansas Sheriff's Association, and local Police Departments and Associations) regarding regulations.

3. Promote planting selections that contribute to a diverse and sustainable urban forest.

V. Detection and Monitoring

Objective: To detect TCD and WTB introductions promptly and improve the probability of containing an infestation.

A. Survey high-risk black walnut populations to detect the presence of TCD

1. Continue state surveys of areas with high risk of TCD introduction.
2. Annually plan and review TCD survey activities.
3. Communicate survey results to stakeholders and the media by media releases and/or informational website.

B. Educate the public and professionals to aid in rapid identification of an infestation.

Provide TCD training and outreach to natural resource professionals including, naturalists, landscapers, consulting foresters, arborists, nursery personnel, land managers, and other plant industry workers.

2. Educate the general public about TCD.
   a) Obtain or develop educational materials for the general public.
   b) Pursue opportunities for speaking, publishing, and exhibiting educational material.

3. Recruit and enable volunteer observers.
   a) Promote awareness with media releases and public appeals for help in scouting.
   b) Obtain/prepare kits and training to support volunteer observers by individuals and groups (e.g. Master Gardeners, Naturalists, County Conservation Districts).

C. Coordinate State and National information to address professional and public inquiries for Kansas and foster cooperation and communication.

1. Coordinate with Thousand Cankers Disease interest groups to add Kansas information to their web site.

VI. Response to Infestations

Objective: To contain and manage TCD infestations such that the potential for new outbreaks is minimized and walnut articles outside of infested area are eligible for commerce. Prescribed treatments conform to the Integrated Pest Management concept described in Appendix H.

The Strategic Team, with cooperation of affected local government(s) will implement coordinated efforts to contain the infestation according to current policies and scientific information.

A. Plan and implement containment action.

1. Coordinate response with affected local governments and other entities.
   a) Meet to discuss and determine the preliminary plan of action.
   b) Schedule an emergency meeting with cooperators (e.g. regulated industries, city and county governments, utility companies, recreational areas, and others).
   c) Release accurate information to the media.
   d) Develop common methods of survey, sampling, investigation and reporting.

2. Organize and conduct an intensive core and delimiting survey to determine the infestation boundaries.
   a) Locate and assess as many walnut trees as possible within 2 miles of a positive find of TCD activity. Survey will be conducted within a reasonable time frame.
   b) Initiate an expanded survey if additional TCD infested trees are detected.
   c) Focus surveys on counties closest to known infested area for containment and commerce considerations.

3. Initiate regulatory and control activities as necessary.
   a) Administer provisional internal quarantine established by KDA consistent with Kansas External TCD Quarantine of 2010 amended in 2014. Emergency rules will be issued describing the quarantined area and regulated articles.
   b) Determine if removal of potential host trees is appropriate.
   c) Develop compliance agreements with stakeholders to restrict movement from TCD -infested (regulated) areas.
   d) The smallest political subdivision that can be quarantined for TCD is an entire county.
   e) Conduct trace back and trace forward investigations for walnut articles of the infested area. If an intentional introduction or breach of TCD quarantine is suspected, the appropriate law enforcement agency will be notified and advised of the situation.
   f) Develop a chain of custody and reporting system for samples

4. Dispose of wood debris in cooperation with local governments.

a) Establish processing facilities in the quarantine zone(s) to efficiently handle walnut debris and reclaim useable products as practical.
b) Market mitigated reclaimed wood products.

B. Communicate information about response.

1. Provide accurate information and updates to the media.
2. Provide accurate information to affected residents.
   a. Prepare information for customizing and distributing to affected area immediately after infestation is found.
   b. Cooperate with local governments to host local resident/landowner meetings to share information as soon as possible after an infestation is found.
3. Communicate with public and industry professionals to foster cooperation and maximize effective response.
4. Communicate with other State Regulatory officials about infestation if found in Kansas and containment activities.

VII. Mitigation of Potential Impacts

Objective: To develop processes and resources for mitigating potential impacts in the event of the establishment of TCD populations.

A. Response for urban forests

1. Develop TCD Response Plan for Urban Forests.
   a) Distribute draft plan to stakeholders for review. See Appendix F.
   b) Team agrees to implementation of the plan.
   c) Educate internal stakeholders within cooperating agencies to promote common approach to plan implementation and data collection.

2. Identify resources and needs.
   a) Evaluate human and technical resources required to effectively monitor for TCD and respond to introductions.
   b) Assess human and technical resources available among partner agencies (e.g. survey personnel, delimiting personnel, tree climbers) and acquire commitments for their participation.
   c) Identify sources of funding for readiness activities.

3. Educate the media to ensure accuracy of information
   a) Identify key contacts as sources of current information.
   b) Develop a system among core members for coordinating messages among agencies and providing expedited communications.
   c) Develop a media strategy to publicize the final Action Plan.

4. Explore wood waste utilization opportunities with the forest products industries to reclaim walnut material to its highest possible use in the event a large volume of infected material becomes available.

B. Response for rural forests

1. Develop recommendations for silvicultural response

2. Distribute guidelines to appropriate stakeholders.

3. Evaluate and encourage local market utilization.

C. Technical Readiness – Ensure that policy decisions, actions, and education initiatives are guided by the best current science.

1. Review and distribute to stakeholders recommendations for remedial control actions developed from recent government and university research.

2. Transfer technology to field foresters, consulting foresters, arborists, extension and nursery professional as it becomes available.

D. Administration Readiness – Ensure that current, relevant, and achievable policies are in place that allow the actions described in this plan to occur quickly and unencumbered.

1. Assist communities in developing local response plans.

2. Conduct training programs for local government staff.

3. Develop and distribute relevant information (print media, web, public service announcements, etc.) for homeowners.

4. Provide updated information on TCD management techniques to arborists, landscape professionals, utility companies, and other green industry personnel through publication and periodic workshops.

5. Explore opportunities for potential reforestation programs.

E. Seek legislative support to cover cost associated with TCD management.

1. Invite active participation by the Governor's representative.

2. Advocate for matching funds at state and federal levels to assist local government(s) in mitigation and recovery efforts.

3. Advocate for readiness funding from stakeholders.

4. Invite active participation by the general public from interested owners of black walnut trees.

F. Develop research infrastructure and project outputs

1. Secure funding for research.

2. Learn more about the biology of TCD

3. Develop strategies for mitigation of quarantine regulated items.

4. Develop an economic impact assessment of TCD in Kansas.

5. Develop effective trapping and detection methods.

6. Learn what the likely pathways for TCD spread are and how to mitigate them.

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APPENDIX A – Kansas TCD Action Team and Partners

Collaborators

Kansas Department of Agriculture Plant Protection and Weed Control Program (Co Chair: Program Manager)
Kansas Forest Service (Co Chair: State Forester)
Kansas State University, Department of Plant Pathology
Kansas State University, Department of Entomology
Kansas State University, Horticulture, Forestry, and Recreation Resources Department
Kansas State University, Research and Extension
Kansas Walnut Council

Stakeholders

Municipalities
Commercial Campgrounds
Conservation Districts
The Nature Conservancy
Walnut Council
Kansas Wildlife, Parks, and Tourism
USDA Farm Service Agency
US Army, Corps of Engineers
US Department of Interior, Bureau of Reclamation

APPENDIX B - Legal Authorities

The following agencies have, by law, the responsibility and authority to manage plant pest introduction:

- Kansas Department of Agriculture

  Kansas Walnut Thousands Canker Quarantine, July 2010

  Kansas Plant Pest and Agriculture Commodity Certification Act 2012 K.S.A. 2 -2112 through 2-2141 and K.A.R.4-15-4 through K.A.R. 4-15-10

  Kansas Criminal Code: K.S.A. 21-3419, K.S.A. 21-3436, K.S.A 21-4221, and K.S.A. 4222

  Emergency Preparedness for Disasters: K.S.A. 48-924

  Kansas Tree and Shrubbery Law 2008 K.S.A 12-3201 through K.S.A. 3207

- Affected local government(s) at sites of infestation.

  Kansas Tree and Shrubbery Law 2008

  Various local nuisance laws

APPENDIX C - Reporting Suspect Thousand Cankers Disease Infestation

Reporting Process:

General public:

1. Suspect TCD infestations may be reported by calling 785.862.2180. Phone number change coming with KDA move Provide name, location, phone number, date and site/tree characteristics and symptoms.

2. A representative of the Kansas Department of Agriculture Plant Protection Program will contact the caller and arrange for a site visit. If the walnut tree is suspect, samples will be collected for analysis.

KDA, KFS, KSU:

1. Inquiries should be investigated as soon as practical. A site report should be made of the visit if the investigator believes that TCD of WTB may be involved and samples are taken.

2. Samples will be double bagged at the collection site, frozen for a minimum of 48 hours, triple bagged, and shipped to the appropriate lab for analysis. A custody form (Appendix J) should accompany the sample. The diagnostic laboratory personnel should be notified of the sample before arriving.

APPENDIX D – Best Management Practices

Management options are currently limited since this newly emerging insect/disease complex has only been recently described (2008). A vigorous program to identify black walnuts showing early symptoms and their subsequent removal may slow-the-spread of TCD within an affected community if implemented early (Cranshaw 2009).

Urban

The wood from TCD-infected trees should be removed as soon as possible to prevent further spread of walnut twig beetles. Chipping is considered the best management approach, although some twig beetles may survive this treatment on larger fragments. The chipping process will likely make host material unsuitable in a much shorter time (i.e., months) rather than leaving whole logs (i.e., years) on site. The wood may be buried or held in a secure location isolated from areas where TCD is not present. (Cranshaw, 2009)

Forest

Preemptive harvesting of black walnut is not recommended except to contain a known infestation. Walnut in forest settings has not been observed to have TCD. This is possibly because of the problems of observing and detecting TCD in a forest location rather than any inherent resistance that forest walnut trees may have. There is every reason to believe that walnut in a forest setting is susceptible to TCD. Woodland walnut trees near known infestations should be monitored for TCD. When TCD occurs in forest walnut trees they should be removed with an appropriate harvest scheme such as a sanitation cut. All walnut trees in the stand or property should be harvested to insure that trees harboring TCD are not left behind. Walnut tree tops should be left in the woods. Walnut logs should be separated from other logs when loaded for hauling. Walnut logs in a quarantined county cannot be taken outside the quarantined counties. Walnut logs in a buffer county cannot be moved outside the regulated counties.

Wood Using Industry

Since early 2010 several states have established quarantines that prevent the movement of certain walnut products. These measures regulate raw walnut wood material with bark intact, although details may differ regarding accepted means of disinfestations. Most do allow transport of wood that has been milled to remove all bark and wood that had been incorporated into finished products. Also, nuts do not harbor walnut twig beetles and are not regulated by quarantines. These management limitations make it extremely critical that the walnut twig beetle and associated fungus not be allowed to spread from infested areas. (Cranshaw, 2009)

APPENDIX E – An Urban Forest Response Plan Template (excerpts from *A Proposed Action Plan for TCD Management in Urban Forests* – W. Cranshaw, edited by J. Appel, KDA)

1. Identify the location of all *Juglans* species within the area.

2. Identify the location of all TCD-symptomatic trees.
Trees suspected of TCD should be confirmed by examining limbs for presence of the cankers and/or beetle presence. Culture of *Geosmithia morbida* or the presence of walnut twig beetle can be used for positive identification.

Note: Verification of the disease by culturing is not necessary if the walnut twig beetle is observed in the wood after initial TCD confirmation. The assumption is that all beetles are infested with *Geosmithia*; therefore beetle infested bark will contain the fungus. Remember that flagging on walnut, the earliest diagnostic symptom of TCD, may be caused by squirrel damage, other physical limb injuries, flat headed borers, or canker disease other than *Geosmithia*.

3. Inform all owners of *Juglans* sp. trees of the nature of thousand cankers disease. In particular, educate tree owners of the importance of handling infective wood to prevent spread to new locations.

4. Establish a means to properly handle and store/destroy infective wood.

5. Decide on an action plan.
If the disease is widespread and Juglans plantings occur throughout the municipality, there is little opportunity to affect the course of the disease via directed tree removals. Education and proper handling of TCD-infective wood should be the primary focus. When TCD is present in isolated pockets within a community then containment can be considered as having potential value in slowing spread. Tree removal should focus on these sites, eliminating all Juglans that can reasonably be suspected of containing infective walnut twig beetles. Establishment of a *Juglans*-free barrier between the TCD site and areas of healthy trees not already colonized by walnut twig beetle may substantially retard spread. Education and proper handling of TCD infective wood should be emphasized.

TCD - Prevention: The Best Strategy

Prevention of TCD establishment in a community is the only means to effectively manage this disease. This no longer is an option where TCD is already present. If the disease can be contained, most importantly by restricting beetle-containing wood or bark, then the ultimate course of Thousand Cankers Disease may be limited to the destruction of walnut trees within communities where the disease has already become established.

Since Thousand Cankers Disease has become established within the native range of this tree the results could be a catastrophic - possibly even leading to the functional extermination of this species in the manner that Chestnut blight or Dutch elm disease destroyed American chestnut and American elm, respectively. Prevention of spread by preventing the movement of TCD infective walnut wood is critical to the protection and future survival of *Juglans nigra* (black walnut) in North America.

APPENDIX F - TCD Treatments in Urban Forests

(excerpts from *A Proposed Action Plan for TCD Management in Urban Forests* – W. Cranshaw)

Arborists have made attempts to manage this disease, primarily involving use of various bark applied sprays (e.g., permethrin, bifenthrin) or soil drench systemic insecticides (e.g., imidacloprid) to kill the walnut twig beetle (*Pityophthorus juglandis*). The walnut twig beetle is the vector of *Geosmithia morbida*, the fungal associate that produces bark cankers that most define the course of TCD infections. These beetle-targeted insecticide applications have apparently had only limited effectiveness and, at best, have been able only to slow the TCD progress.

Sanitation has also been considered for TCD management. The effectiveness of sanitation for managing some shade tree diseases is well illustrated with Dutch elm disease (DED), a devastating disease of American elm (*Ulmus americana*) that similarly involves a pathogenic fungus (*Ophiostoma novo-ulmi*) and a bark beetle vector (*Scolytus multistriatus*; probably *Scolytus schevyrewii*). Indeed, the adoption of sanitation and other management practices for DED was a key event in the development modern urban forestry.

Epidemiology - Thousand Cankers Disease/Involvement of the pathogen

Geosmithia morbida is restricted to the phloem and outer tree bark (and later the cambium) producing localized cankers.

Role of Root Grafts

Root graft transmission does not occur.

Association of the Pathogen with the Beetle Vector

Geosmithia morbida is consistently associated with the walnut twig beetle. It is a very common and perhaps invariable fungal associate of walnut twig beetles. It is possible that the two organisms have a mutual association, as occurs with some bark beetles.

Speed of Symptom Development

Symptoms develop from the cumulative effects of multiple canker production, resulting from very large numbers of individual inoculations by *G. morbida*-carrying walnut twig beetles. External symptoms of infection, e.g., flagging, will not occur until sufficient numbers of cankers have been present to produce girdling.

The speed at which walnut trees are killed is still unknown and will depend on many factors, notably the number of infective beetles initiating infections as well as host susceptibility to *G.morbida.* However, if plantings are originally colonized by only small numbers of walnut twig beetles, it may take a very long time (i.e., more than 3-4 years), before sufficient numbers of cankers have developed to produce external symptoms. However, trees usually are dead within 2-3 years after symptoms such as branch wilting or dieback are observed.

Overwintering of Beetle Vectors

The overwintering habits of the walnut twig beetle need more attention. Presently, we believe beetles overwinter primarily as adults in cavities excavated in outer bark. These overwintering chambers may be in the same tree within which the beetle developed or may be a nearby walnut tree.

Survival in Cut Wood

Freshly cut wood is highly attractive to and can support development of walnut twig beetles. Successful larval development will require wood of sufficient moisture and drying ultimately will make wood unsuitable. However, because of the small size of the beetles, development may occur in small pockets within drying logs. It is possible that under conditions where drying is slow, logs may remain suitable for breeding for 2 or even 3 years after felling.

Debarking may kill some developing larvae. However, bark may contain live adult beetles. Chipping likely will kill most beetles, but some small pieces of wood with bark intact remain after chipping that can support surviving walnut twig beetles and allow successful development of some larvae.

Role of Bark-Sprayed Insecticides

Trunk/branch sprays applied in a manner typically used for bark beetle control do not appear to be effective in preventing TCD-progress. The large number of walnut twig beetles present over an extended period (May-September) and the large areas of the tree that may be attacked are all significant impediments to effective coverage.

It is possible that late summer trunk sprays directed at beetles seeking overwintering shelter in the trunk may be useful in reducing populations. This may have some value in slowing TCD development and spread. However, this method has not been demonstrated.

Role of Systemic Insecticides

The value of systemic insecticides in TCD management has not been well evaluated. Limited observations indicate that imidacloprid (i.e., Merit, Marathon, Touchstone, etc.) is ineffective after symptoms have developed. Anecdotal accounts suggest that disease progress may be slowed by imidacloprid if applications are made before extensive cankers have been formed. However, it is unlikely that systemic insecticides can prevent TCD. Successful inoculations of *G. morbida* likely can occur even if the walnut twig beetle is subsequently killed. Cankers resulting from infection will produce pockets within the tree where future movement of systemic insecticides will be limited, allowing some successful development of twig beetles at these sites. These areas under the bark where beetles will be protected from systemic insecticides will increase with time as cankers expand and new cankers are initiated. It is possible that the more water soluble insecticide dinotefuran (Safari) may provide improved coverage. However, it has not been evaluated.

Pesticide labeling restrictions will be an important limitation to the use of systemic insecticides in most walnuts. Any pesticide (insecticide, fungicide) considered in TCD management may need to comply with use restrictions of walnuts grown for nut-crops. At present, there are food crop tolerances for imidacloprid in walnut meat, as this insecticide (Provado formulation) is used in commercial nut production. Dinotefuran has no established tolerance for walnut meat and no formulations are labeled for this crop.

The Role of Sanitation in TCD Management

For urban forestry, sanitation will have a modest role in management of thousand cankers disease. This is largely due to two factors: 1) the long lag time between tree infestation and TCD symptom expression, allowing undetected local spread; and 2) the consistent association of the pathogen with essentially all bark beetles. Because of this, once TCD has become established in a city, eradication is unlikely; some slowing of spread is the best potential outcome.

Where black walnut trees within a city occur in contiguous plantings, elimination of TCD symptomatic trees will have minimal effects. Nearby non-symptomatic trees can be assumed to very likely also be infested whenever a TCD-symptomatic tree is detected. Although tree removal will result in some removal of infective walnut twig beetles within the cut tree, these will constitute only a portion of those already present among the plantings, perhaps only a small portion. Elimination of these beetles through tree removal will likely only modestly slow the course of disease development in remaining nearby trees, probably by only a couple of years at most.
Sanitation may be most effective if plantings of black walnut within the city are widely separated, by several city blocks at a minimum. If it is assumed that normally the beetles disperse short distances, then removal of all TCD infected trees, symptomatic or not, may provide local TCD-eradication within an isolated pocket of black walnuts. If infective walnut twig beetles have not already spread beyond this area, TCD spread to more distant uninfected plantings of walnut may be substantially slowed.

Also extremely important in TCD-containment is the proper handling of TCD-infective wood. Recently cut trees that showed TCD symptoms likely will contain many thousands of walnut twig beetles. If this infective wood is moved in a manner that these beetles can invade new, healthy stands of walnut, new pockets of TCD will develop and ultimately destroy these plantings. As bark-on walnut wood may support development of walnut twig beetles until thoroughly dried, beetle-containing wood must be either destroyed or isolated. De-barked, kiln-dried wood has not been shown to be suitable for WTB re-colonization after treatment and de-regulation.

Chipping will largely achieve beetle destruction, but not completely, so that chipped TCD-infected wood should also be handled with care. (During warm periods, active beetles potentially may even disperse from cut wood as it is moved from the site. Therefore, care should be given in routing trucks hauling TCD-infective wood to avoid areas of healthy, uninfected walnut.)

Because of the very high value of black walnut logs, salvage often will be attempted. If logs cut from TCD-infective trees are recovered, they should be handled in a manner that prevents beetle dispersal until the wood no long supports further walnut twig beetle development. Until sufficiently dried (2, perhaps 3 years under normal conditions) they should be isolated. Isolation can be achieved largely by stockpiling wood in a site that is distant from healthy walnuts, particularly walnuts located downwind. Storage of logs in buildings can achieve beetle containment. Tarping logs with clear plastic also may contain beetles within logs. Tarping to achieve solarization also would likely be a means to kill developing beetles.

Reference:
Cranshaw, Whitney, Thousand Cankers Disease Management in Urban Forestry - Draft. 2009.

APPENDIX G – TCD Rural Forest Response Plan

There are many unknowns about managing forestland for preventing and treatment of TCD. Utilizing the best science in practical and economic methods is perhaps the best guiding principle.

It will be important for those in the forest industry to follow quarantine guidelines to prevent spread of TCD. And to insure that walnut products from Kansas can be trusted to be free of TCD.

With the widespread presence of black walnut in Kansas forests, it is assumed that walnut is present in most woodlots and forests. Deep, moist, well drained soils are typical of where black walnut is found. It is often found as single trees or in groups of scattered walnuts intermixed with other species.

Information and Education – owners of forestland and woodlots should be informed of the threat of TCD. The latest research and location of TCD should be disseminated to forest owners and managers. Forest industry must be kept abreast of changes in quarantine areas and product treatments.

Detection and Monitoring – known infestations will become the center of detection activity. Nearby forests having black walnut will be examined for TCD symptoms. Examinations may begin with landowners or other non-professionals and escalate to site visits by foresters or others trained to take tree samples if the situation dictates. When infested trees are removed periodic monitoring of nearby forests is warranted.

Treatment – Preemptive harvesting of black walnut is not recommended except to contain a known infestation. Removal of infested black walnut, and potentially infested black walnut within the stand or on the same property is advised. Sanitation harvests, other partial harvests or clear-cuts are appropriate methods of treatment. Walnut tree tops should be left in the woods. Walnut logs should be separated from other logs when loaded for hauling. Walnut logs or products with bark intact in a quarantined county or buffer county cannot be taken outside the quarantine area. Walnut lumber in a quarantined county or buffer county cannot be taken outside the quarantine area unless certified to be TCD free.

It is not yet known if the removal of black walnut in an area would result in the demise of TCD in that vicinity. Logically the absence of a host would apparently result in the loss of the pest, however much is yet to be learned about TCD.

Because of the regenerative quality of black walnut, (seed reproduction, root and stump sprouts, etc.) it is likely that open areas will retain some element of black walnut in their stand composition. However, black walnut does not tolerate shade well so those stands that are partially harvested through a thinning scheme will likely lose most or all of their black walnut.

APPENDIX H – IPM Strategic Plan Principles

Although specific treatment for TCD is undetermined at this time, the Integrated Pest Management process should be used to guide the thousand cankers disease (TCD) management activities in Kansas.

Integrated pest management is a decision process that uses all available pest management strategies to economically control pests and weeds. IPM is a process of using the least invasive control method or combination of methods that will reduce the risk, created by both the pest and the treatment of the pest, to human health and the environment. IPM is a continual process of refining appropriate treatments based on the level of pest infestation and new information and technology.

Strategic Goals:

- Minimize damages caused by TCD (such as economic, aesthetic, public safety).
- Reduce negative ecological impacts resulting from TCD infestations.
- Minimize potential negative impacts of treatments used to manage TCD.

In the strategic plan implementation, actions are taken only after evaluating whether or not TCD poses a significant problem..

Injury Levels:

- Economic Injury Levels - Control measures should be implemented when damage is predicted to reach a level that is severe enough to cause a net economic loss.
- Environmental Injury Levels – The levels of damage at which TCD is expected to become a threat or cause harm to the environment or public safety.
- Aesthetic Injury Levels - Damage at which TCD is predicted to become a problem by negatively impacting vistas. Aesthetic injury levels are subjective and will vary depending on the situation.

Components of strategic response:

- Identify, monitor and evaluate TCD populations and damage along with other relevant factors.
- Determine injury levels and thresholds that trigger treatment.
- Select the least disruptive yet effective tactics.
- Time the appropriate treatments.
- Spot-treat for thousand cankers disease where appropriate.
- Evaluate the effectiveness of treatments to guide future treatments.
- Educate those involved with TCD control measures.

APPENDIX I – SITE INVESTIGATION SAMPLE FORM

Please see Kansas Department of Agriculture for an electronic version. KDA in addition has a photo documentation form not shown.

KANSAS DEPARTMENT OF AGRICULTURE

SITE VISIT REPORT

Event: Thousand Cankers and Walnut Twig Beetle

Date: **County of site visit:** **Arrival time:**

Address of business:

Name of business or resident:

Is the site visit the address of business? ☐ Yes ☐ No
If not, describe:

GPS location of site visit:

Description of site including situation, weather conditions surrounding visit, nearby fields or woodlands, structures visited, and other factors (you may provide a diagram on page 2):

Tasks performed:

Contacts made:

Trace back and trace forward: describe source of infected material and possible distribution of material in question (attach all documents)?

Description of samples, digital images, etc.:

Status of sample(s):

Was an enforcement action taken? ☐ Yes ☐ No
Please describe.

Name of investigator and contact information:

Signature:

Go to page 2 for sample log and general instructions regarding site and visit:

This area reserved for additional information or recommendations for further investigation:

Sample Log:

Description of sample	Sample ID number	Units represented	Units affected	Unit description	Unit ID: lot, cultivar, bin, field # etc.	Suspect: yes or no	Comment
						YES	
						YES	
						YES	
						YES	
						YES	
						YES	
						YES	
						YES	
						YES	

DIAGRAM/MAP of SITE or UNITS SAMPLED

To investigator: Please fill out as sample log completely as possible. All material sampled must have information entered into the above table. Instructions below regarding conducting the site visit inspection.

General Instructions for site visit: Please regard this as a highly contagious disease and insect. All wood samples should be TRIPLE bagged and documented with custody/id form.

When: unknown

Where: unknown

Objective: To provide diagnosis of TCD and WTB and possible reg

Whom: Staff

Safety: Take upmost care with knives and saws, wear hard hat

Equipment: Knife, GPS unit, pole saw, bags, camera, clippers, handl

Investigation and sampling: Trees - look for symptoms of decline and flagging much like Dutch Elm Disease. Logs - look for very small insect holes 1/16

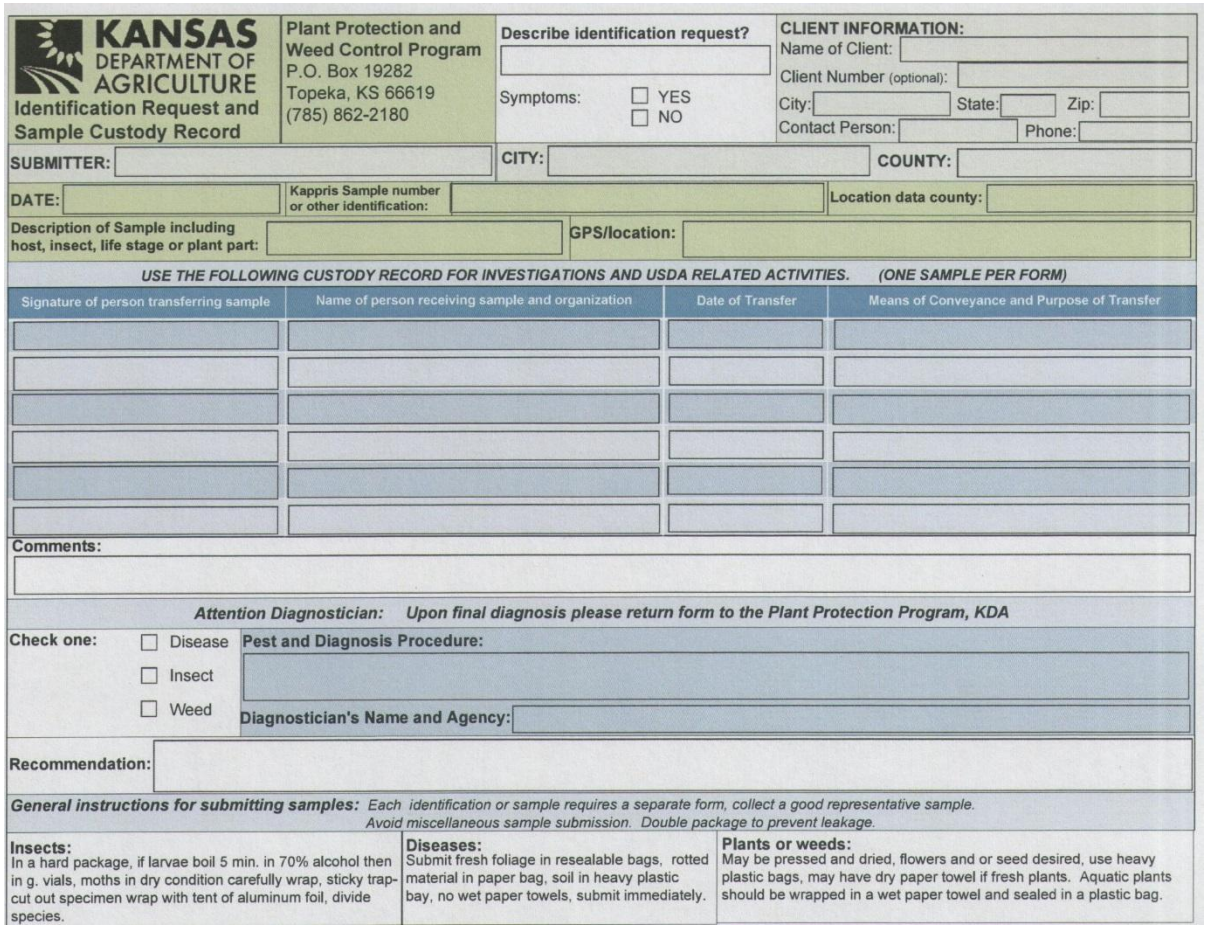
For more information contact: Jon Appel

Title: plant patholgist

ph. 785.564.0071

APPENDIX J: EXAMPLE OF SAMPLE CUSTODY FORM

Please see the Kansas Department of Agriculture for an electronic version. KDA personnel can use the custody report form generated by the RECS system. This form will be modified at a later date to reflect change in phone number and address for KDA.



KANSAS DEPARTMENT OF AGRICULTURE
Identification Request and Sample Custody Record

Plant Protection and Weed Control Program
P.O. Box 19282
Topeka, KS 66619
(785) 862-2180

Describe identification request?

Symptoms: ☐ YES ☐ NO

CLIENT INFORMATION:
Name of Client:
Client Number (optional):
City: State: Zip:
Contact Person: Phone:

SUBMITTER: CITY: COUNTY:

DATE: Kappris Sample number or other identification: Location data county:

Description of Sample including host, insect, life stage or plant part: GPS/location:

USE THE FOLLOWING CUSTODY RECORD FOR INVESTIGATIONS AND USDA RELATED ACTIVITIES. (ONE SAMPLE PER FORM)

Signature of person transferring sample	Name of person receiving sample and organization	Date of Transfer	Means of Conveyance and Purpose of Transfer

Comments:

Attention Diagnostician: Upon final diagnosis please return form to the Plant Protection Program, KDA

Check one: ☐ Disease ☐ Insect ☐ Weed

Pest and Diagnosis Procedure:

Diagnostician's Name and Agency:

Recommendation:

General instructions for submitting samples: *Each identification or sample requires a separate form, collect a good representative sample. Avoid miscellaneous sample submission. Double package to prevent leakage.*

Insects:
In a hard package, if larvae boil 5 min. in 70% alcohol then in g. vials, moths in dry condition carefully wrap, sticky trap-cut out specimen wrap with tent of aluminum foil, divide species.

Diseases:
Submit fresh foliage in resealable bags, rotted material in paper bag, soil in heavy plastic bay, no wet paper towels, submit immediately.

Plants or weeds:
May be pressed and dried, flowers and or seed desired, use heavy plastic bags, may have dry paper towel if fresh plants. Aquatic plants should be wrapped in a wet paper towel and sealed in a plastic bag.