

Current Plant Problems and their Management

Practical Guidelines for the Industry

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NYSTLA 2015 Professional Turf & Landscape Conference & Trade Show

Yonkers, NY

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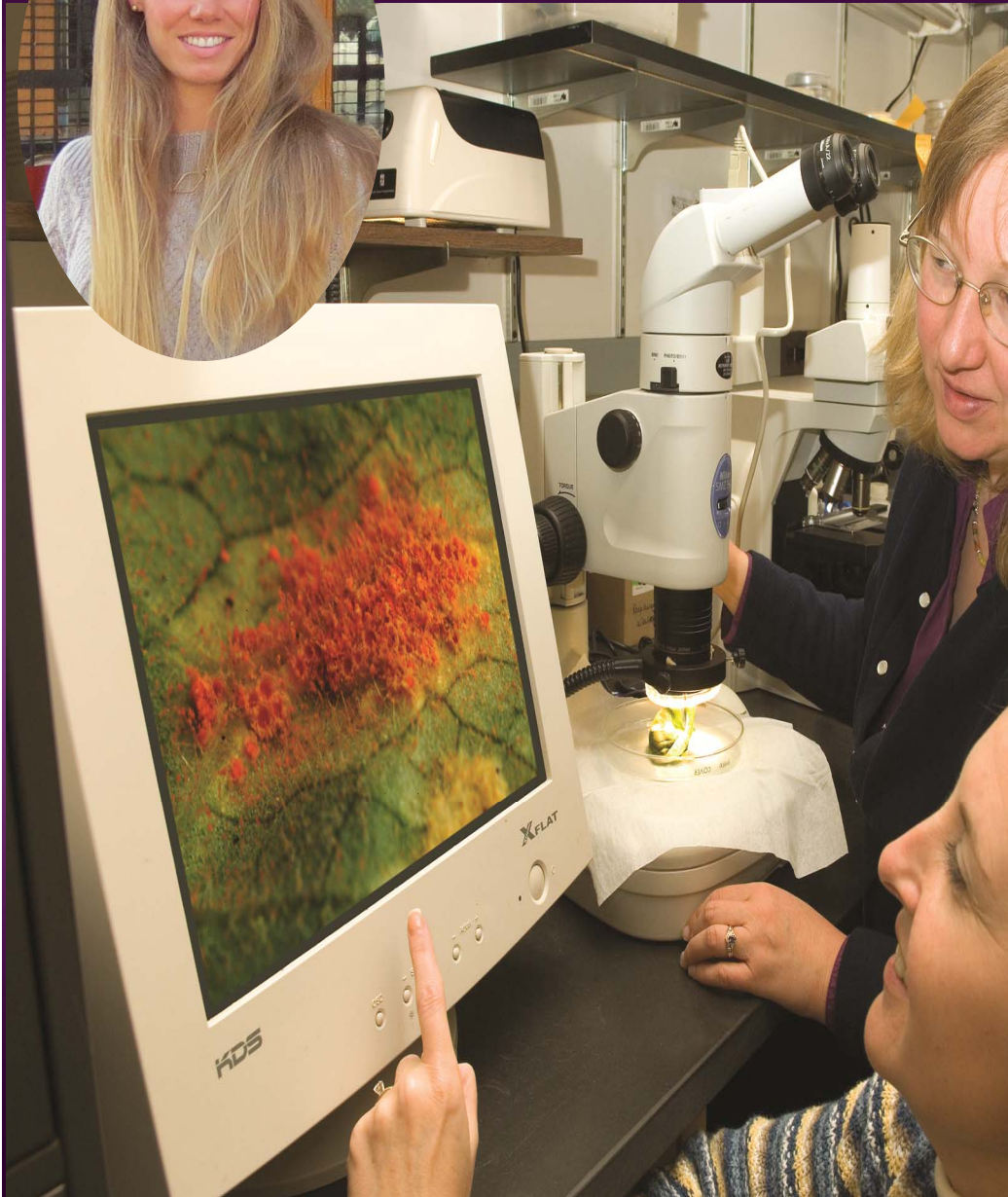


Cornell University
Department of Plant Pathology
and Plant-Microbe Biology



**Cornell University
Plant Disease Diagnostic Clinic
(PDDC)**

Cornell University PDDC staff



The Cornell University PDDC was established in 1971 to provide a central location for plant problem sample submissions and record keeping

The clinic offers testing services on all types of plant pathogens to include fungi, bacteria, viruses, nematodes and phytoplasmas

Karen Snover-Clift became the diagnostician in 1998 and Sandra Jensen in 2004, Tricia Allen became our technician in 2014.

Types of Samples Processed by the PDDC

The PDDC receives samples from extension educators, homeowners, golf course managers, growers, and other green industry members. We refer to these as “routine”

We also serve as the plant disease diagnostic facility for NYS Department of Agriculture & Markets. For NYSDAM and other state and federal agencies we process “regulatory” or “survey” samples

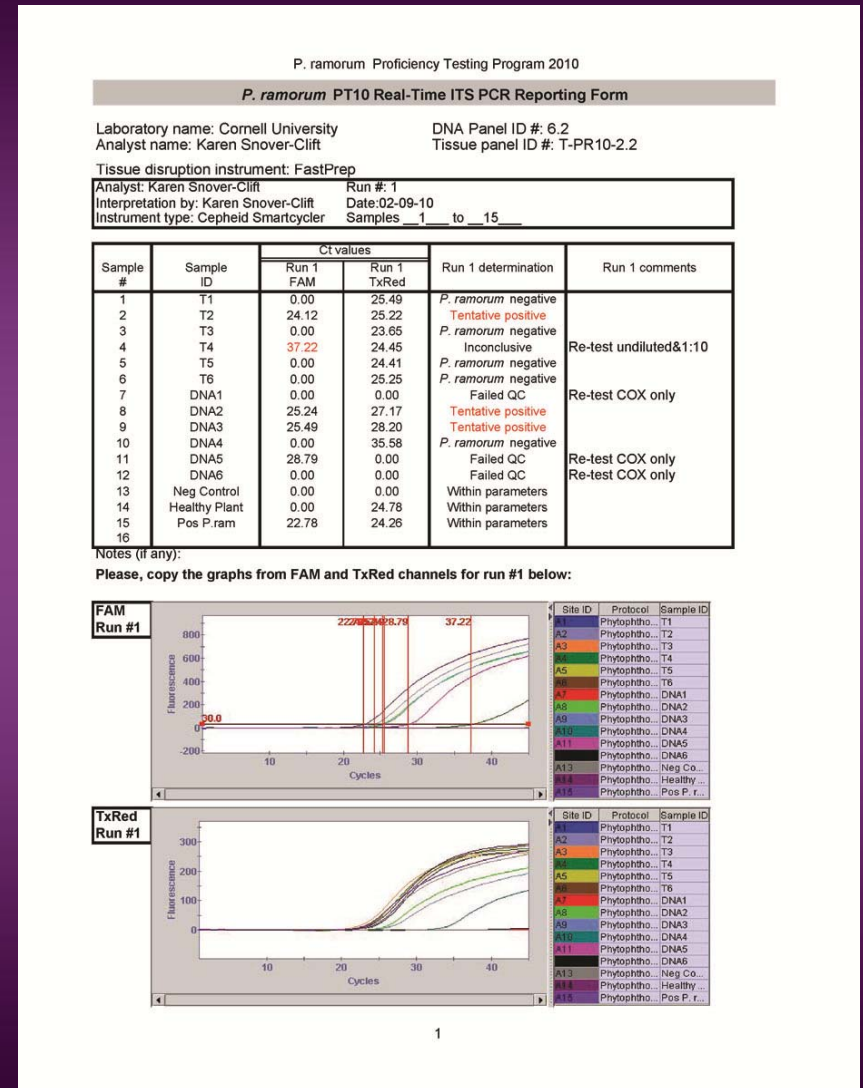
In 2015, we processed 701 routine and 385 *Phytophthora ramorum* trace forward and survey samples =
807 total



PDDC Staff are NPPLAP Certified

The PDDC has gained National Plant Protection Laboratory Accreditation Program (NPPLAP) certification for processing *Phytophthora ramorum* samples since 2006 and must complete a proficiency panel each year

Staff members also have leadership roles in the development of the NPDN STAR-D program that is designed to follow ISO-17025 standards and will be required for all NPDN laboratories to ensure that all meet certain standards



2014 Notable Clinic Quandaries

Was there a new spruce disease this year?

We received many calls from arborists and county extension educators about declining and damaged spruce... mainly blue spruce but others too.

Asked for samples and found **no obvious cause**.

Found some spider mite and spruce bud scale damage...

Images courtesy of Sandra Jensen, Cornell University



Was there a new spruce disease this year?

Also found some Stigmina and Rhizosphaera needle blights; even the elusive SNEED (Sudden Needle Drop).

Also considered Cytospora canker and Weir's cushion rust but could not confirm since not the time of year when can find evidence on new year's needles...

Images courtesy of Sandra Jensen, Cornell University



Was there a new spruce disease this year?

Learned that diagnosticians from surrounding states were also hearing about similar problems with no luck determining the root cause.

Hope, if it continues, to get a sample submission at the right time to find the pathogen or to determine an abiotic factor that is causing the damage.



Images courtesy of PDDC Sample Submission, Cornell University

Was there a new English walnut disease?

Almost same scenario to the spruce issue...we received many calls from, in this case, homeowners and county extension educators about declining and damaged English walnut.

A few samples from at least 3 locations around the state...**no obvious cause found.**



Image courtesy of Rick Rakoce

Significant Pathogens

Oak Wilt, caused by
Ceratocystis fagacearum

Oak Wilt: *Ceratocystis fagacearum*

Oak wilt is a disease caused by the fungus *Ceratocystis fagacearum*. The fungus grows in the water-conducting vessels of the tree causing the vessels to plug which prevents water transport and causes the eventual death of the tree.

Image courtesy of George Hudler, Cornell University



Diseased trees typically start to wilt in June or July and may wilt completely in as little as three weeks. Leaves on infected trees typically show marginal “scorch” but other pathogens and environmental problems also cause scorch, so this symptom alone is not diagnostic.

What Tree Species are Susceptible?

All species of oak are susceptible to oak wilt to some degree, but those belonging to the red oak group such as northern red oak, black oak, and pin oak are much more likely to die soon after they contract the disease. White and bur oaks are more resistant to the disease (but they are not immune) and may survive for many years after infection, losing just a few branches each year.



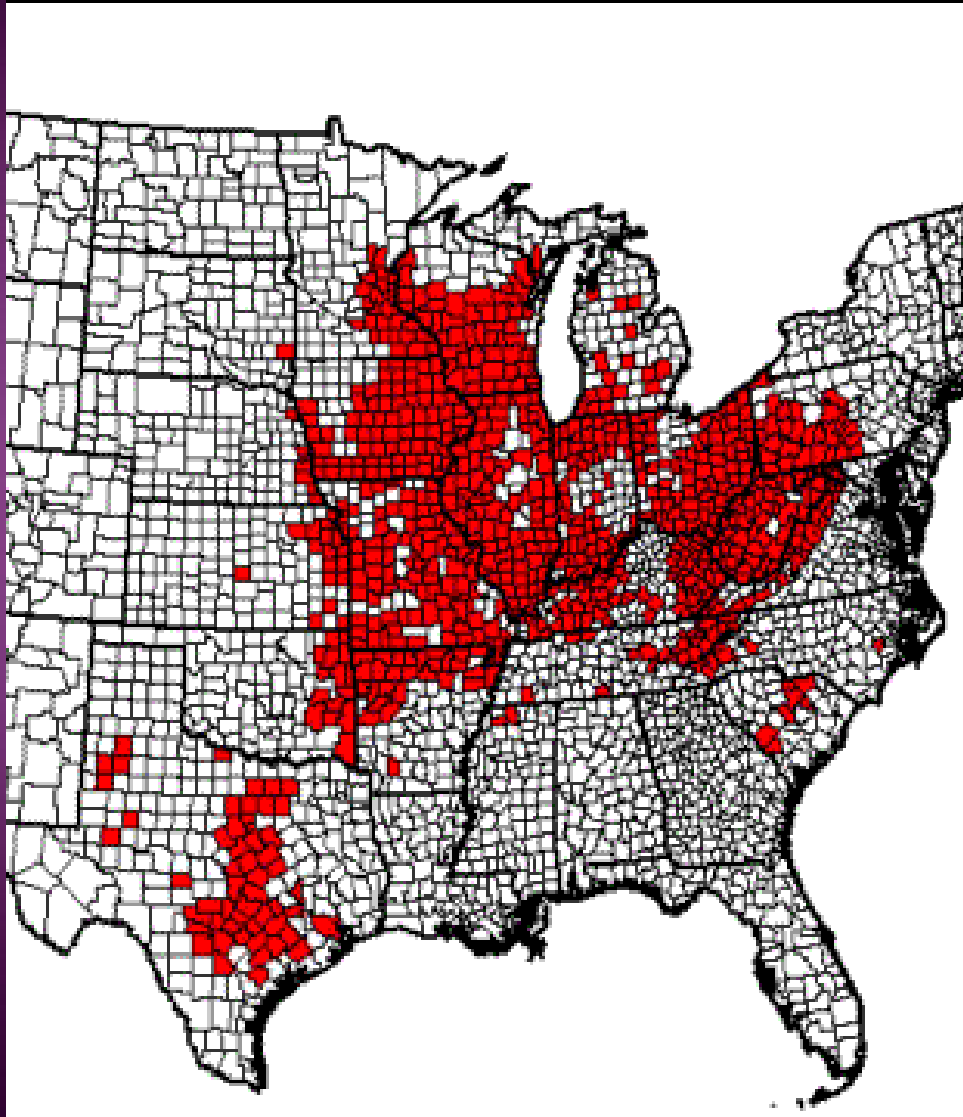
Red oak typically have pointed lobes.

VS.



White oak typically have rounded lobes.

Where did it come from?



The disease was first described in the US in Wisconsin in 1944, however, the origin is not known.

It has been commonly found throughout the Midwest, Mid-Atlantic states and in Texas but not identified in New York until 2008.

In 2008, it was found in a small area in Schenectady County and eradicated.

Oak Wilt Symptoms

As a diseased tree nears death, the fungus produces sterile tissue on the inner bark and outer wood of the tree. As these pads expand, they split the bark open, creating a 3-8 inch long fissure that is barely noticeable to untrained observers. At the same time a “mycelial mat” forms around the pressure pads. It produces a sweet odor reminiscent of rotting fruit.

Image courtesy of George Hudler, Cornell University



2008 Find

A quarantine area was established containing three zones. Helicopters were used to survey the oak trees in the quarantine area. Within each zone, multiple symptomatic trees were identified. A cutting plan was created based on the observations made. The plan can be seen in the images above.

Symptomatic trees found in yards and in the woods were marked with orange paint to indicate that they should be removed.

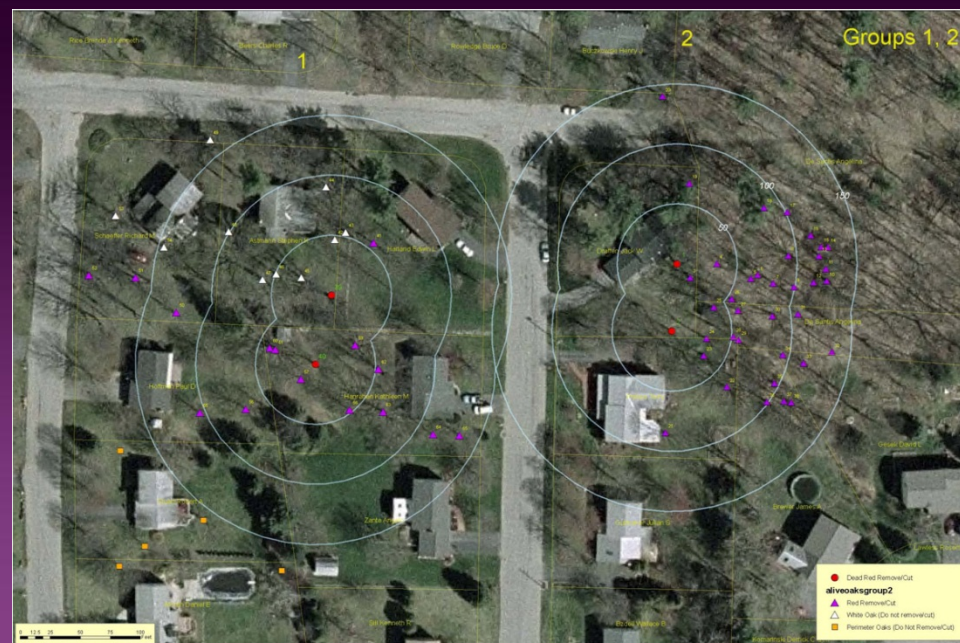
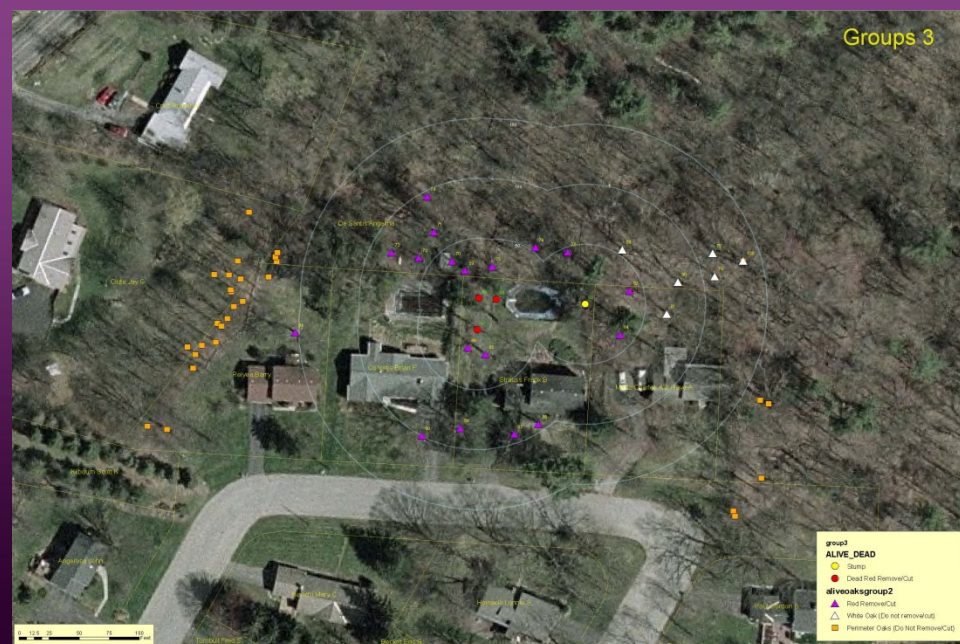


Image courtesy of NYSDAM



2008 Find

Tree crews removed the trees. The trees were cut up or chipped and sent to a burn facility to be destroyed.

Additionally, trenches were cut into some areas to break root graphs that could allow the pathogen direct access to new hosts.



Oak Wilt: Before and After



Image courtesy of NYSDAM

2008-2013

No additional sample surveys were conducted. We received some suspect samples from time to time.

In 2013, we received a red oak sample that was labelled by the submitter as a bacterial leaf scorch, *Xylella fastidiosa*, suspect.



Image courtesy of NYSDAM

Our diagnostician, called the submitter for more information and learned that the tree was one of two that remained on site in the neighborhood of the 2008 finding...so she requested additional tissue so she could determine if the oak wilt pathogen was present or not..

Confirmed for a second time in 2013

Tissue from the re-submitted material appeared to be slightly discolored and isolation attempts were made and allowed to grow for two weeks.

The fungus on the plates appeared to be morphologically identical to the oak wilt pathogen.

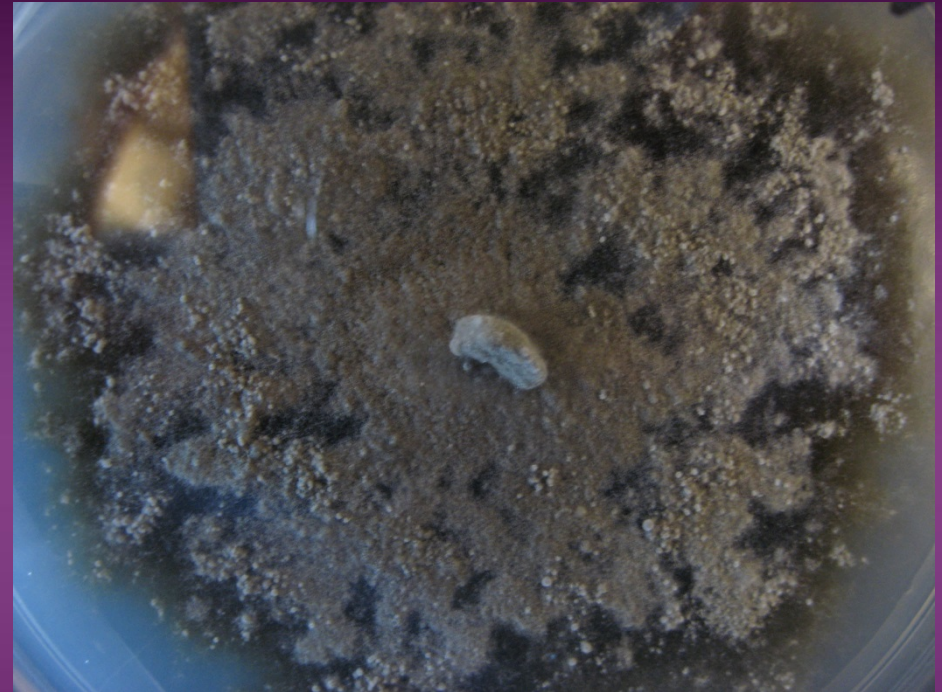


Image courtesy of Sandra Jensen, Cornell University

DNA was extracted from the cultures and forwarded to experts at Iowa State for molecular analysis. The isolates were confirmed to be *Ceratocystis fagacearum*, the oak wilt pathogen.

Specialty Crops Block Grant

Three objectives to this project...

1. Collect visual observation of symptoms on red oaks at potentially favorable sites for the establishment of oak wilt infections,
2. Determine if symptomatic samples contain the pathogen that causes oak wilt, *Ceratocystis fagacearum*,
3. and determine if newly developed PCR identification techniques will provided consistent results from pure cultures and directly from plant material.



Image courtesy of Steven Katovich, USDA Forest Service



Cornell University
Department of Plant Pathology
and Plant-Microbe Biology

**Thousand Cankers, caused by
*Geosmithia morbosa***

Thousand Cankers, *Geosmithia morbida*

- The disease may be present for 10 years or more before visual symptoms appear. The first symptoms are flagging of the branches. Once seen, the symptoms increase in severity quickly
- The disease is vectored by the walnut twig beetle, for early detection, look for entry and exit holes
- Major concerns over this pathogen becoming established in the native population of black walnut



Thousand Cankers, *Geosmithia morbida*

- Dr. Ned Tisserat of Colorado State University started investigating substantial mortality of black walnut trees in the Boulder and Colorado Springs area in 2004
- The decline was actually first observed by others around 2001 and the decline could have started as early as the 1990s
- The first published reports of dieback of black walnut is from New Mexico in 2002



Thousand Cankers, *Geosmithia morbida*

K.L. Snover-Clift



Thousand Cankers, *Geosmithia morbida*



June 2008



September 2008

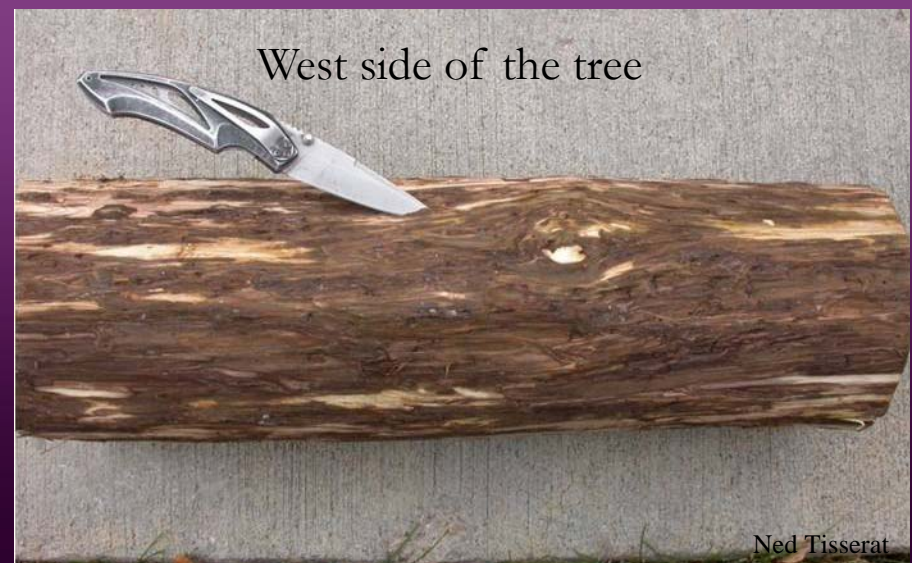


June 2009

Ned Tisserat

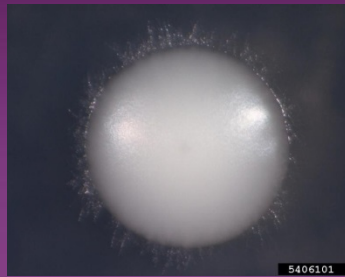
Thousand Cankers, *Geosmithia morbida*

- Thousand Cankers was named by Dr. Tisserat of because of the numerous cankers found beneath the bark
- The number of cankers can vary depending on which side you are looking at...often the west side of the tree has more cankers than the east side
- Cankers coalesce over time causing branch dieback and eventual death of the tree
- Cankers restricted to the Phloem and Bark and initially do not extend into the Cambium

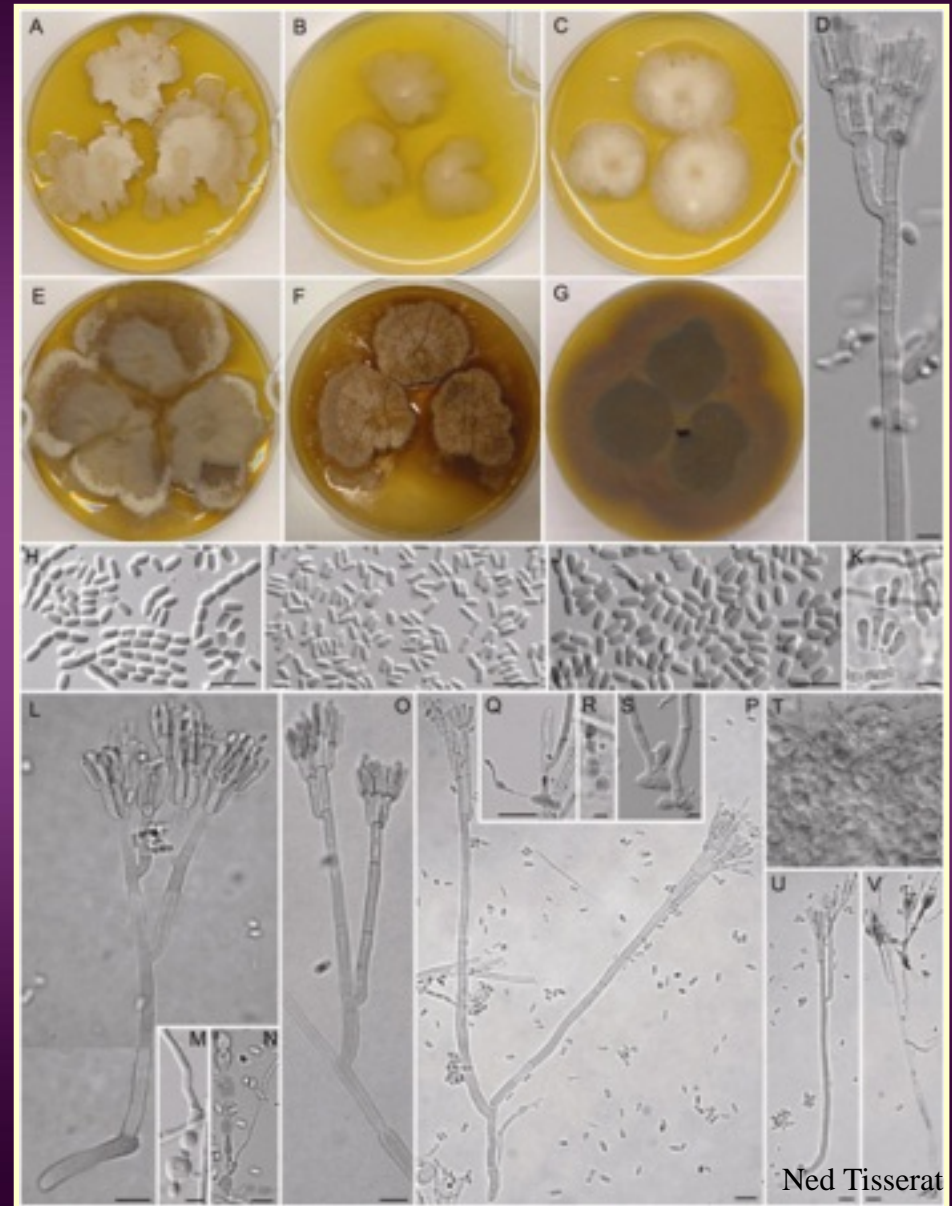


The pathogen, *Geosmithia morbida*

- The pathogen in culture has many forms and can appear white to gray to brown and also has a yeast phase.



- The fungus has a similar appearance of another very common fungal contaminant and at first was not identified as the causal agent.
- Evidence suggests that the fungus is a native fungus that likes warm climates.



The Walnut Twig Beetle, *Pityophthorus juglandis*

- The Twig Beetle are tiny beetles that are difficult to see with the naked eye
- The beetles presence in a tree will most likely occur for many years prior to the tree displaying damage symptoms



Picture by Jim LaBonte,
OR Dept. Agriculture



K.L. Snover-Clift



K.L. Snover-Clift

The Walnut Twig Beetle, *Pityophthorus juglandis*



K.L. Snover-Clift

The Walnut Twig Beetle, *Pityophthorus juglandis*,
entrance and exit holes



K.L.Snover-Clift

The Walnut Twig Beetle, *Pityophthorus juglandis*

- The Twig Beetle carries the fungus on its body from host to host.
- Entomologists are suggesting the beetle has “jumped” hosts and has been spread throughout the western states due to people moving firewood from the southwest northward.
- Many beetles can be in a small space. For example, in the two logs shown here that are approximately 18 inches long and 5 ½ inches in diameter, there are **~23, 040 beetles**.



Whitney Crenshaw



Whitney Crenshaw

The Walnut Twig Beetle, *Pityophthorus juglandis*, galleries

- It's best to search for the cankers in greater than 1 inch thick diameter twigs.
- The Twig Beetle will most likely attack trees mid-April through mid-September but at the recent conference they warned us that any warm period can allow for a release of adults.
- The researchers stress that symptoms of Thousand Cankers develop following **sustained introductions and inoculations** of the pathogen from the twig beetles.



Whitney Crenshaw

Thousand Cankers Disease-Extensive Damage

- The Black Walnuts in Colorado Springs were wiped out by 2008 and over 2000 trees in the Denver-Boulder area were dead...leaving very few survivors.
- Reports from Oregon indicate a much slower progression of damage possibly due to different host presence... hybrids, larger trees, different weather.
- Fear is spread of these damaged trees as firewood and to be used by hobbyists living far away...with their hitchhikers...people are just not aware of the potential damage that can be done by moving this wood!



Ned Tisserat

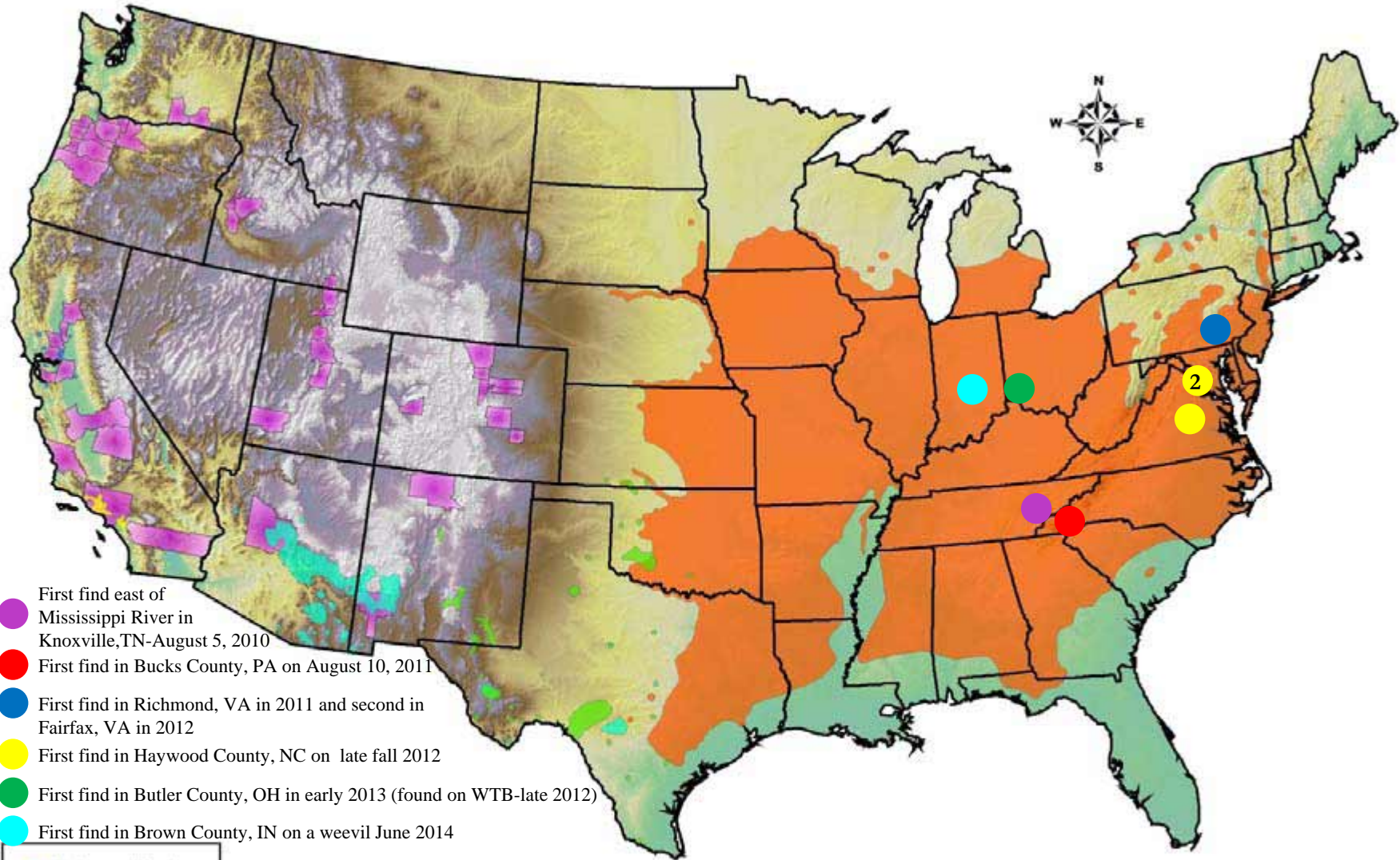


Ned Tisserat



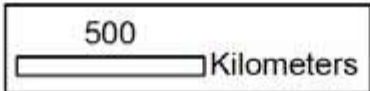
Whitney Crenshaw

U.S. Native Walnut Distributions and TCD Affected Counties



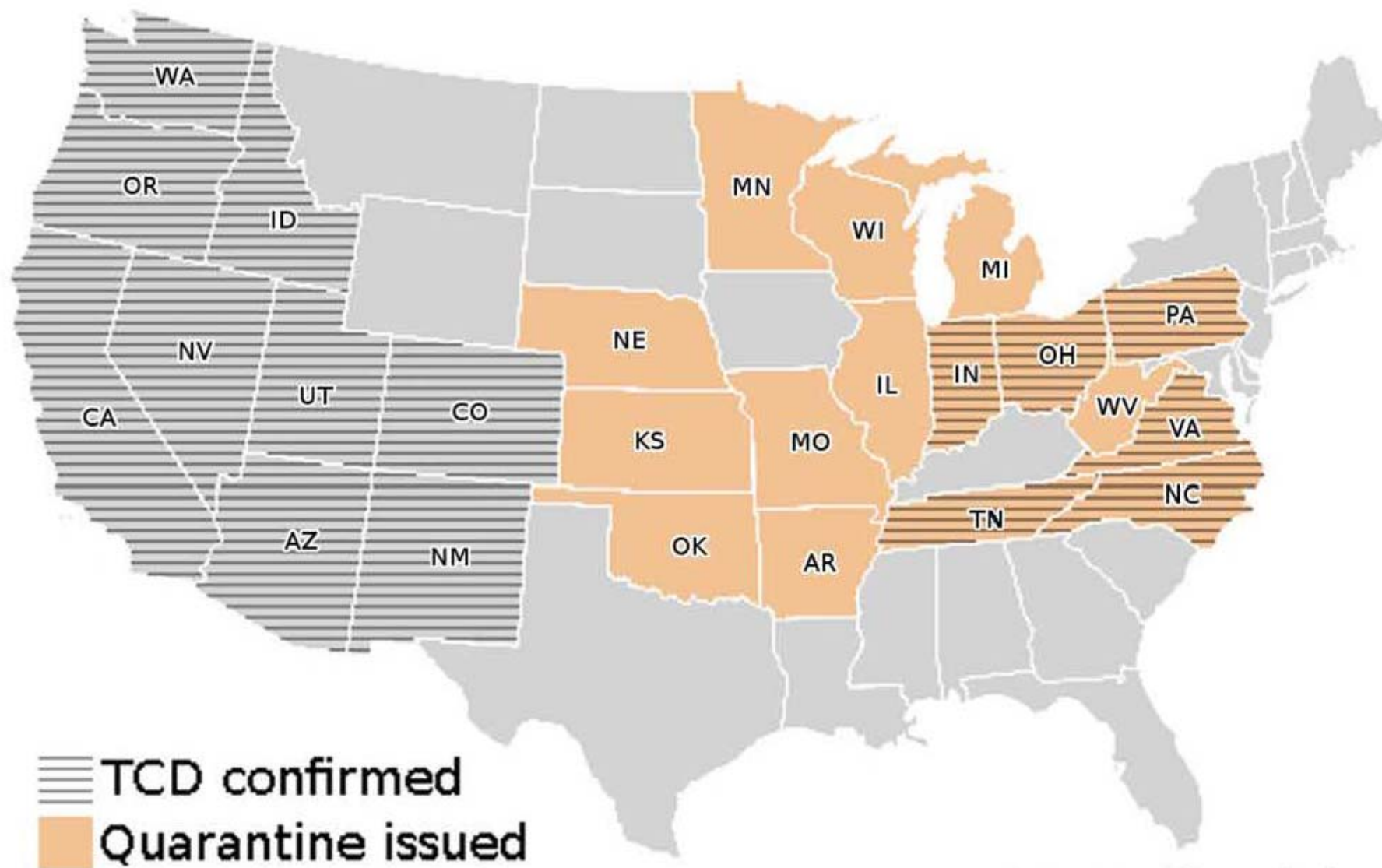
- First find east of Mississippi River in Knoxville, TN- August 5, 2010
- First find in Bucks County, PA on August 10, 2011
- First find in Richmond, VA in 2011 and second in Fairfax, VA in 2012
- First find in Haywood County, NC on late fall 2012
- First find in Butler County, OH in early 2013 (found on WTB-late 2012)
- First find in Brown County, IN on a weevil June 2014

■	<i>Juglans californica</i>
■	<i>Juglans hindsii</i>
■	<i>Juglans major</i>
■	<i>Juglans microcarpa</i>
■	<i>Juglans nigra</i>
■	Affected County



Sources: Alston, 2008; Cranshaw and Tisserat, 2008; Little, 1971; Murray, 2009; Pizzo, 2009; Pscheidt, 2009; Seybold, 2009; Tisserat, 2009; UI CALS, 2009;
 Created By: Glenn Fowler and Leslie Newton
 USDA-APHIS-PPQ-CPHST-PERAL
 NAD 83 Albers Equal Area Conic
 October 7, 2009

Distribution of Thousand Cankers Disease as of August 29, 2014



Source: www.thousandcankers.com

Tennessee

Thousand Cankers Disease

Quarantine and Buffer Regulated Areas



Thousand Cankers Disease Quarantined Areas

Anderson, Blount, Jefferson, Knox, Loudon, Morgan, Rhea, Sevier and Union counties.

Citizens in these counties cannot move walnut tree products and hardwood firewood outside the quarantined counties.



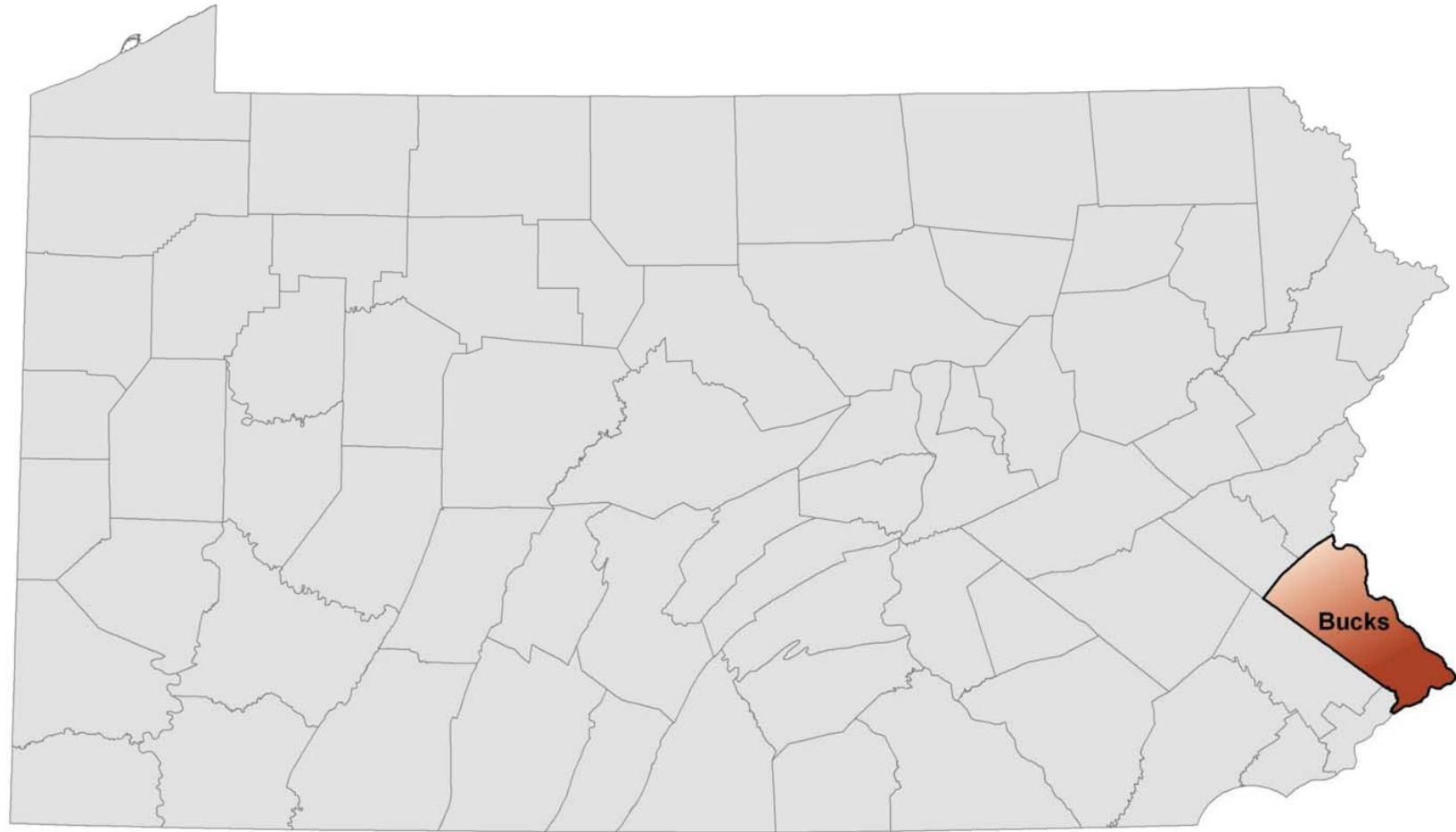
Thousand Cankers Disease Buffer Regulated Areas

Bledsoe, Bradley, Campbell, Claiborne, Cocke, Cumberland, Fentress, Grainger, Greene, Hamblen, Hamilton, Marion, McMinn, Meigs, Monroe, Polk, Roane, Scott and Sequatchie counties.

Citizens in buffer counties/areas can move walnut tree products and hardwood firewood within buffer counties, but not outside. Product can also be moved into a quarantine county, but not taken back out.



Pennsylvania Department of Agriculture Map of Counties Quarantined for Thousand Cankers Disease as of August 10, 2011

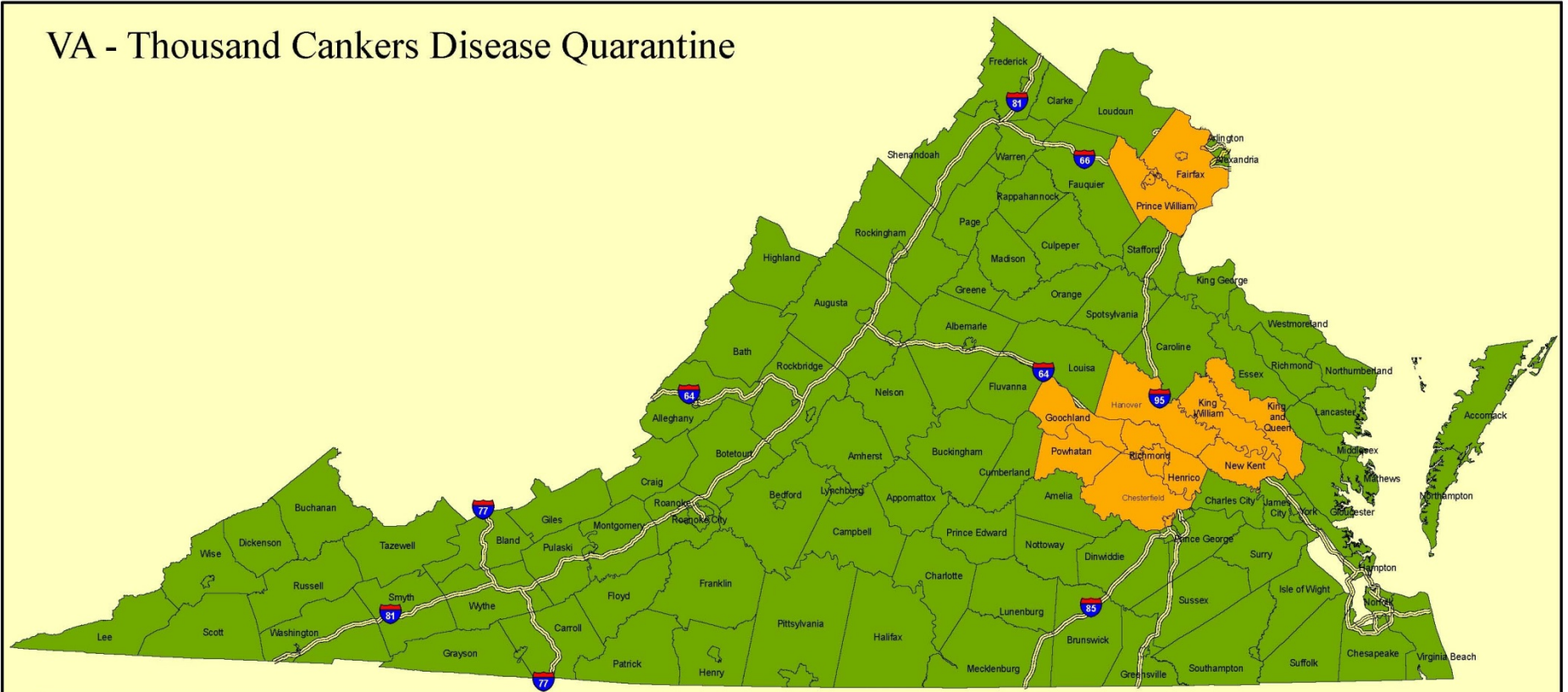


TCD Quarantined County

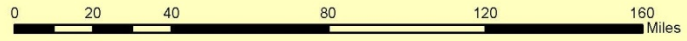


Non-Quarantined County

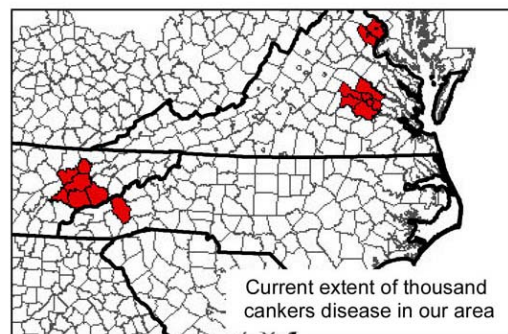
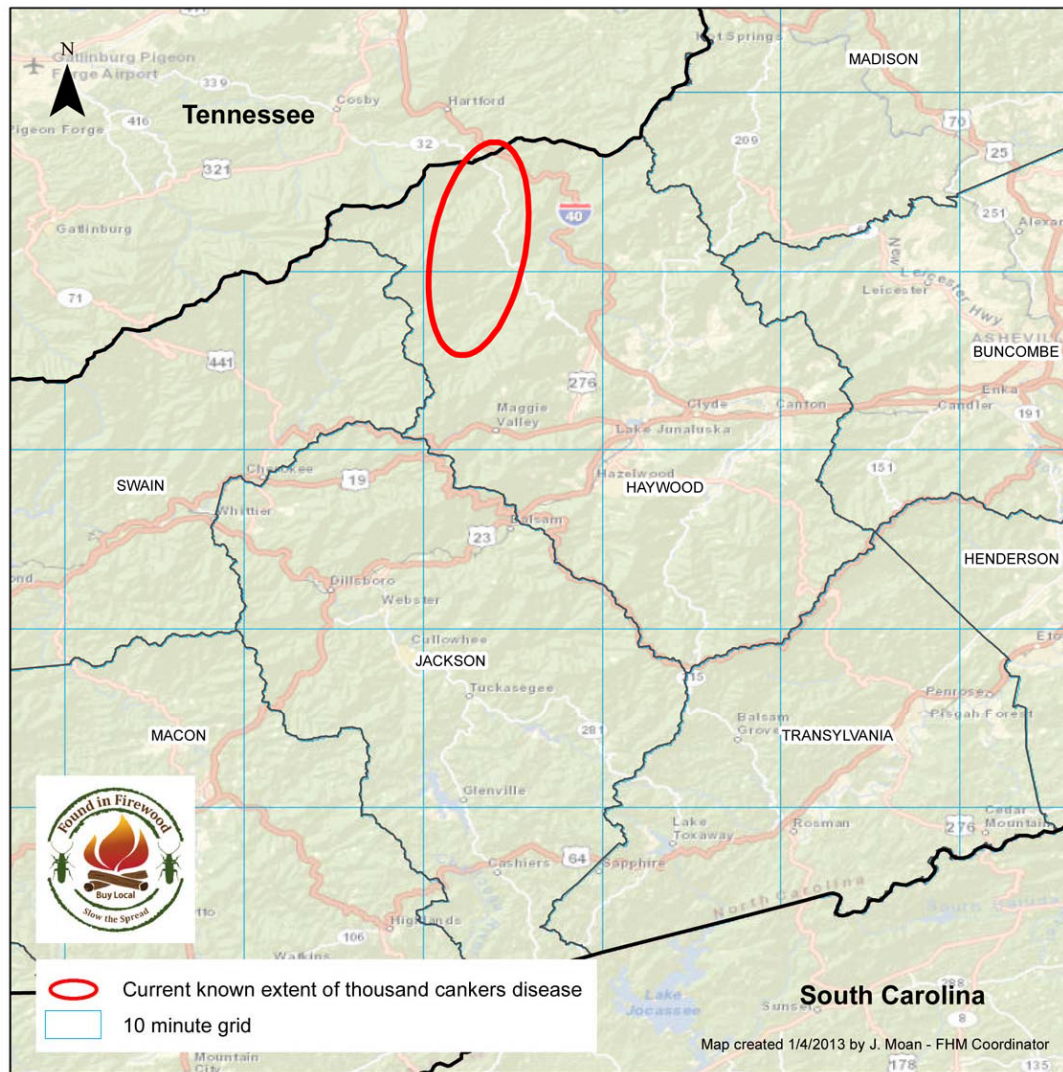
VA - Thousand Cankers Disease Quarantine



Quarantined Localities		
Counties		Cities
Chesterfield	King William	Colonial Heights
Fairfax	New Kent	Fairfax
Goochland	King and Queen	Falls Church
Hanover		Manassas
Henrico		Manassas Park
Powhatan		Richmond
Prince William		



Fairfax County Urban Forest Management- 12/03/2012



Current Known Distribution of Thousand Cankers Disease in North Carolina

Thousand cankers disease poses a serious threat to walnut trees in the eastern United States. This disease is spread by the walnut twig beetle, which is native to the southwestern United States. Host trees generally die 2-3 years after initial symptoms are noticed.

Susceptible plants in North Carolina are black walnut and butternut. Non-native trees in the *Juglans* genus may also be affected. This disease can be moved to new locations in woody material from infested trees.





THE COLUMBUS DISPATCH



**Bleeding Canker on
Horsechestnut, caused by
Pseudomonas syringae pv. *aesculi***

Bleeding Canker, *Pseudomonas syringae* pv. *aesculi*

- Bleeding cankers have been found on horse chestnuts for many years and were known to be caused by *Phytophthora* spp. but at some point the samples were no longer producing this pathogen
- Timeframe: Early 2000s when began isolating the bacterium in the United Kingdom
- Found in UK, the Netherlands, Belgium, France and Germany
- A survey done in the UK in 2007 indicated that 49% of the trees they looked at were infected



United Kingdom Forestry Commission

Bleeding Canker, *Pseudomonas syringae* pv. *aesculi*

Mainly infects the white flowering horse chestnut, *Aesculus hippocastanum* and the red flowering, *Aesculus x carnea*. The cultivar 'Baumanii' is extremely susceptible.

Symptoms appear as clear or dark or reddish-brown oozing liquid from lesions on the trunk and branches, hence the “bleeding canker”

- Lesions under the bark will show distinct margins but may coalesce which leads to the die off and visible crown symptoms are obvious



Bleeding Canker, *Pseudomonas syringae* pv. *aesculi*

Bleeding Bark Canker

- The oozing or bleeding increases significantly in warmer weather and what starts off as dark and clear often becomes a more rusty color and opaque
- If the conditions become very dry, the cankers may darken and become brittle and crusty
- The orange, crusty coloration is very unique for bleeding cankers, bleeding cankers caused by *Phytophthora* spp. often remain very black and wet looking



Bleeding Canker, *Pseudomonas syringae* pv. *aesculi*

Trees of all ages can become infected and those between 10-30 years of age at the time of infection will most likely die in 3-5 years

Research has shown that not all trees die from an infection, if the infection is minimal and the tree is otherwise healthy, only parts of the tree may die, however, if cankers become so abundant that they coalesce, then in most cases coalescing cankers fill the phloem, the tree becomes girdled and dies



**Rose Rosette Disease,
caused by Rose Rosette-associated
virus (RRaV)**

Rose Rosette Disease, Rose Rosette associated Virus

The cause of Rose Rosette Disease was in debate until just a couple of years ago, it was thought to be caused by either a virus or a phytoplasma.

Most believed it to be caused by a phytoplasma because the symptoms matched...loss of apical dominance (witches broomes), dwarfing, proliferation of thorns, stunting, distorted plant parts, discoloration.

Now known to be caused by a phytoplasma and transmitted by an eriophyid mite, *Phyllacoptes fructiphylus*. A molecular test has been developed to confirm.



5504993

Image courtesy of Dawn Dailey O'Brien



Rose Rosette Disease, Rose Rosette associated Virus

The disease is lethal to wild multiflora rose and to many cultivated varieties of rose.

Diagnosis can be difficult because the symptoms mimic other diseases, insect injury and abiotic disorders. Also early infections may present very mild symptoms and can be overlooked for years while present and spreading.

In 2013, the disease was confirmed in New York State after we learned of the availability of the PCR test. Dawn Dailey O'Brien collected a suspect sample from her home and we submitted it for testing. It was confirmed positive for both the mite and pathogen.



Image courtesy of John Hartman

Rose Rosette Disease, Rose Rosette associated Virus

Management is difficult!

Removal of infected plants at the earliest signs of infection will lessen overall damage to mass plantings. All parts of the plant must be removed including the entire root ball.

Other management includes purchasing initial and replacement stock from reliable sources, spacing plants so they do not touch each other, and controlling the eriophyid mite vector.



**Pine Wilt Nematode,
caused by *Bursaphelenchus xylophilis***

Pine Wilt: *Bursaphelenchus xylophilis*

Pine Wilt, caused by the pinewood nematode is vectored by pine sawyer beetles (*Monochamus* sp.).

Attacks mainly Scots Pine but also other exotic pines.

Not a lot of samples submitted for this type of analysis so it often goes unidentified and damage is blamed on other factors .

Image courtesy of L.D. Dwinell, USDA Forest Service



Image courtesy of Sandra Jensen





Image courtesy of USDA Forest Service-North Carolina Research Station

UGA1406274

UNIVERSITY



© University of Illinois Extension

Image courtesy of The Morton Arboretum



Boxwood Blight, caused by
Cylindrocladium pseudonaviculatum

Boxwood Blight: *Cylindrocladium pseudonaviculatum*



Known to cause damage on common boxwoods used in the landscape:
Common—*Buxus sempervirens*; English—*Buxus sempervirens*
'Suffruticosa'; Korean—*Buxus sinica* var. *insularis*; Littleleaf—*Buxus*
microphylla, Hybrids of *B. sempervirens* X *B. sinica* var. *insularis*
(Green Mountain, Green Gem, Chicagoland, etc)

Boxwood Blight: *Cylindrocladium psuedonaviculatum*



Boxwoods are becoming increasingly popular for creative plantings like this one at SeaWorld and in home landscapes.

Boxwood Blight: *Cylindrocladium pseudonaviculatum*



Boxwood Blight: *Cylindrocladium pseudonaviculatum*



Boxwood Blight: *Cylindrocladium pseudonaviculatum*



Boxwood Blight: *Cylindrocladium pseudonaviculatum*



Boxwood Blight: *Cylindrocladium pseudonaviculatum*



Boxwood Blight: *Cylindrocladium pseudonaviculatum*



Impatiens Downy Mildew,
caused by *Plasmopara obducens*

Impatiens Downy Mildew: *Plasmopara obducens*



Pittsburgh Post Gazette article on September 01, 2012..."Downy mildew on impatiens causes gardeners to lose patience"

Also whispers of issues from Saratoga Springs in 2009 and 2010...that now lead us to believe, they may have been on of the first sites to have an infection.



Impatiens Downy Mildew: *Plasmopara obducens*



garden impatiens (*Impatiens walleriana*)
garden balsam (*Impatiens balsamina*)

Impatiens Downy Mildew: *Plasmopara obducens*



Impatiens Downy Mildew: *Plasmopara obducens*





A. Windham image



July 1, 2012



September 15, 2012



September 15, 2012



October 11, 2012

Impatiens downy mildew
and other downy
mildews of concern...

and a few other issues...

Crouch Lab (USDA-ARS Beltsville)
very interested in isolates of these
pathogens

WANTED

DEAD, NOT ALIVE

Help us find
five fiendish foes!



**Impatiens
Downy Mildew**
(*Plasmopara obducens*)



**Rudbeckia
Downy Mildew**
(*Plasmopara halstedii*)



**Sunflower
Downy Mildew**
(*Plasmopara halstedii*)



Boxwood Blight
(*Calonectria pseudonaviculata*)



**Chrysanthemum
Brown Rust**
(*Puccinia chrysanthemii*)

Diseased samples are urgently needed!

These deadly pathogens are on a killing spree: destroying favorite garden plants across the United States. Scientists from numerous universities, governmental labs and industry have joined together in order to find solutions to these diseases. We need your help in locating them!

If you encounter any of these pathogens, please send samples to our central repository. Samples will be used for research of these diseases, and a portion will be permanently deposited in the U.S. National Fungus Collections in Beltsville, Maryland. It's a quick and easy way to help scientists combat these destructive plant pathogens.

To send samples, go to:
www.OrnamentalPathology.com

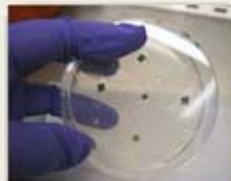


PDDC Website

Plant Disease Diagnostic Clinic

Address: <http://plantclinic.cornell.edu>

provides fast and accurate plant disease diagnosis and up-to-date pest control recommendations for anyone from home owners to commercial growers. Services include analysis of plant material and soil for bacterial, fungal, viral, and nematode pathogen.



The Clinic promotes a "Test, Don't Guess" attitude. This is because we feel that knowing the pest affecting your plants and crops prior to treatment is essential for the best chances of recovery. The "Test; Don't Guess" policy allows for the appropriate selection and efficient use of control methods.

When sending a sample to the laboratory please include a [Sample Submission Form](#). Please follow our [collection tips](#) when submitting samples! A sample that is improperly collected, packed, and/or shipped and arrives in poor shape is very difficult to diagnosis.



properly collected, packed and shipped.



Factsheets

Comprehensive collection of plant pest factsheets.



Under the Scope

Discover what diseases are coming into the Clinic when you join us to take a look Under the Scope.



Find an Expert

Have a question? Find the Cornell Cooperative Extension Office in your community.

Resources

- [Plant Lab Services](#)
- [Submission Form](#)
- [In-state Extension](#)
- [Out-of-state Extension](#)
- [Christmas Growers](#)
- [Master Gardeners](#)
- [NYS Fair 4H Project](#)
- [Insect Diagnostic Lab](#)
- [Nutrient Analysis Lab](#)
- [Agro-One Lab](#)
- [FIMS](#)
- [NPIRS](#)
- [PPPMB](#)
- [NPDN](#)

Thank you!

Any Questions?



Cornell University
Department of Plant Pathology
and Plant-Microbe Biology