



Towards Early Detection of Oak Wilt in
Maine: Lessons Learned from Oak Wilt
Training in Minnesota and Wisconsin

What is Oak Wilt?

- A vascular (systemic) wilt fungus lethal to red oaks (similar to Dutch elm disease in elms). Can kill a mature oak tree within a month.
- Caused by the fungus, *Bretziella fagacearum* (Until recently was *Ceratocystis fagacearum*).
- Oak Wilt and the causal fungus were first described in Wisconsin in the early 1940s
- A lot of speculation about the origin of the oak wilt fungus and how it came to be a significant pathogen of red oaks in North America.

Current Oak Wilt Disease Distribution



Oak Wilt

Ceratocystis fagacearum (Bretz) J. Hunt

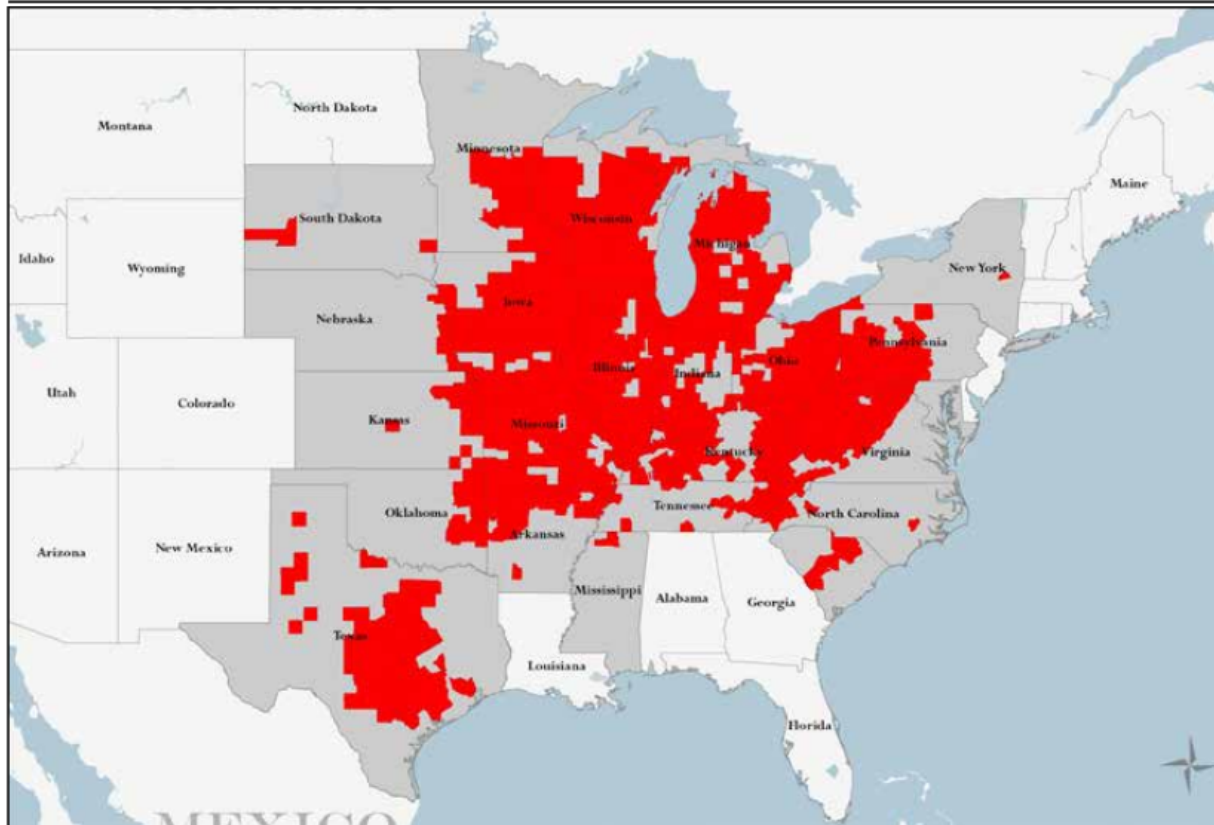


Photo Credit: Dave French

State level report County level observation

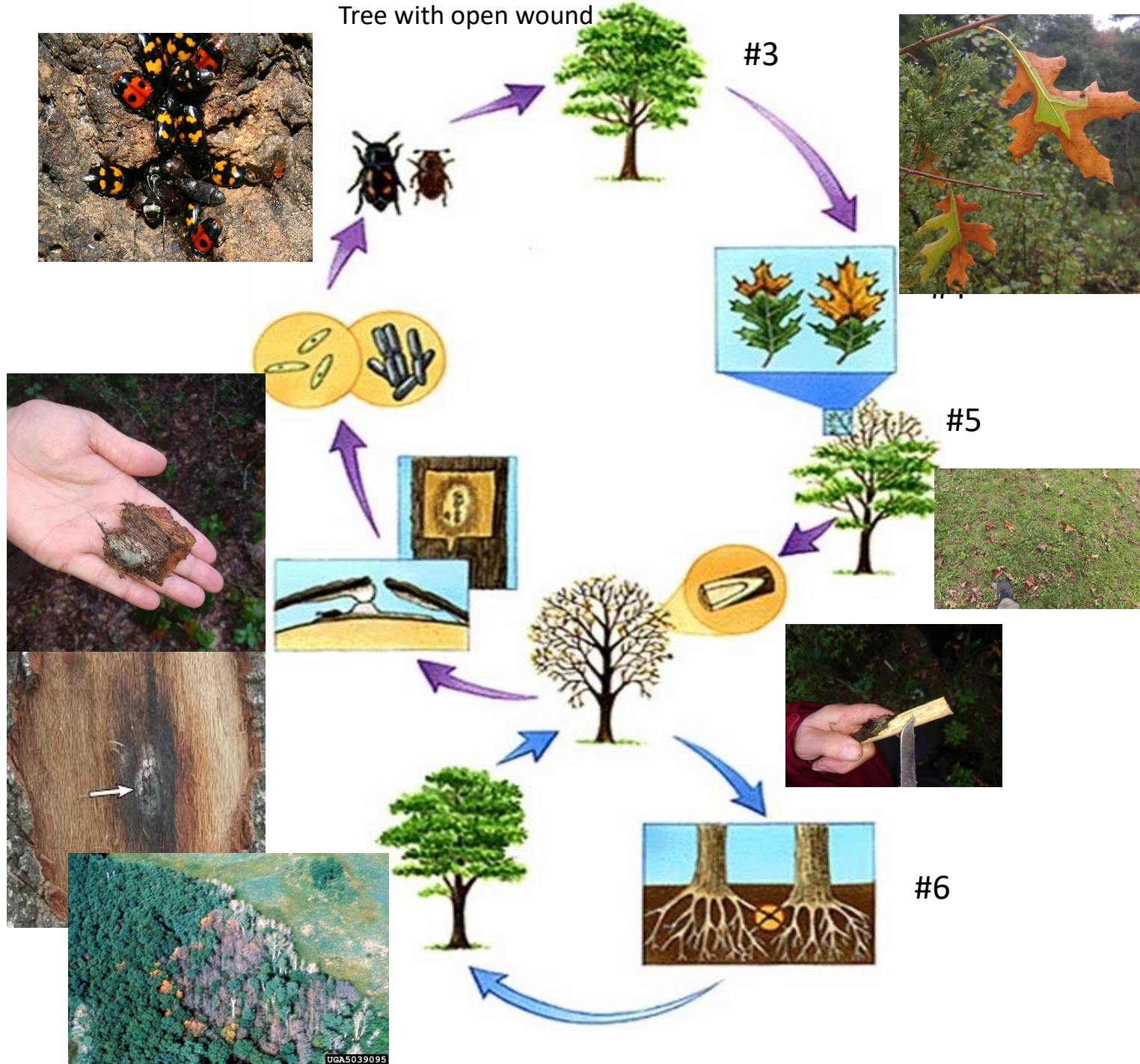
Date created: 27 March 2019

The Alien Forest Pest Explorer maintains spatial and biological information for 89 non-indigenous pests to the United States forests. Some of these pests are widely known, but a great number of them are obscure and relatively unknown. Because of this disparity, information for this site is generated from a variety of sources and depicts a geographic range at the county scale. For some of the regulated forest pests, we collect data from Forest Health Protection (FHP) and its partner's Insect and Disease Survey (IDS) Dataset. For the other pests, information is annually updated using peer-reviewed articles, gray literature, museum specimens and communications with experts. We strive to generate maps that reflect the best of our current knowledge for each species; however, a degree of error is inherent in all maps. The maps are distributed "AS-IS" without warranties of any kind, either expressed or implied, including but not limited to warranties of suitability to a particular purpose or use. The Forest Service and its partners shall not be held responsible for missing or inaccurate data. An accuracy assessment has not been completed for this dataset. Maps and data may be updated without notice.

Please cite this map as follows: USDA Forest Service, Northern Research Station and Forest Health Protection. "Alien Forest Pest Explorer - species map." Database last updated 25 March 2019. <<https://www.nrs.fs.fed.us/tools/afpe/maps/>> (access date).

Oak wilt life cycle basics:

- Primarily spread by sap-feeding beetles (Nitidulidae). #1
 - Some evidence suggests possible spread by other types of beetles.
- Beetles are attracted to the sweet smell of the fungus's spore-producing structures. #2
- Beetles vector spores of the fungus that causes oak wilt to wounds on otherwise healthy trees. #3
- Leaf symptoms occur on infected areas. #4
- Wilt symptoms spread throughout crown. Summer leaf drop. #5
- The oak wilt fungus can be spread to neighboring oak trees via root grafts creating pockets of mortality. #6
- Infected trees form the sweet smelling, spore-producing fungal pegs that again attract beetles and the cycle continues...
- Red oak-group oaks** (like northern red oak or pin oak) are severely affected and die within a year, while white oak-group oaks (like white oak or bur oak) can persist several years after infection, and act as a 'reservoir for disease'.



General oak wilt precautions

- Do not prune your oak trees during the growing season.
 - All fresh wounds on oak trees are attractive to the beetles that spread the oak wilt fungus.
- Keep an eye on the oaks in your area.
 - Report all incidences of wilting oak branches or whole trees wilting/dying
 - Report all incidences of early/summer defoliation of oak trees
 - Report any suspect trees to the Maine Forest Service Insect and Disease Lab

aaron.bergdahl@maine.gov

207-287-3008

Leaf Symptoms: discoloration and mottling but not always wilt symptoms early on in the infection. Notice variation in symptoms among leaves.



Oak wilt mortality pocket. Crown symptoms can appear June through September.





Staining of xylem may not be visible early on in infection and may not develop until infected trees are in advanced stages of oak wilt disease.

Fungal pressure pegs form, generating pressure that creates cracks in the bark. The fungal pegs produce spores and a sweet smell that attracts the beetle vectors of the disease.



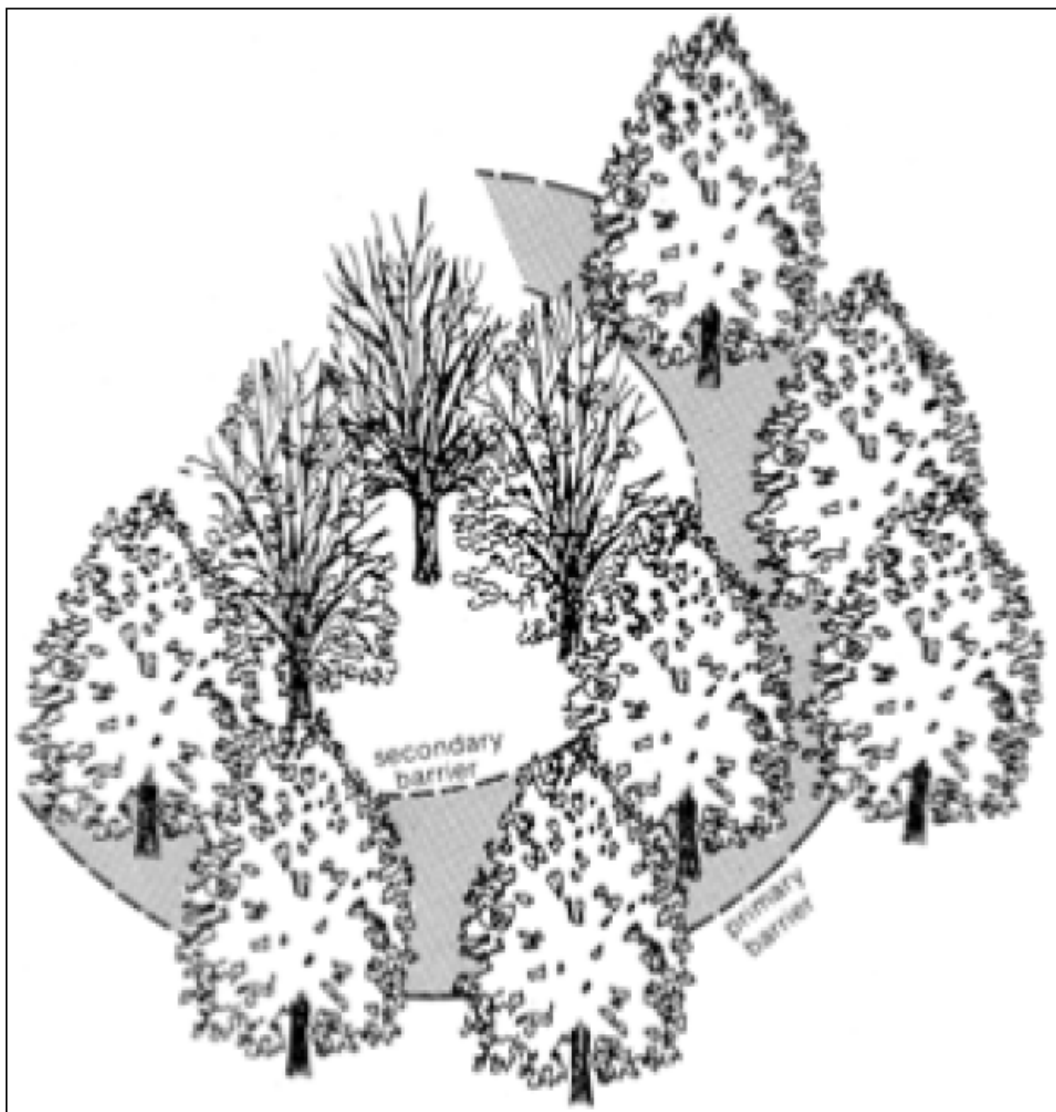


Treatment options: Vibratory plow to break root grafts, preventing underground spread. Plow cuts a 5-foot-deep trench around infected trees.



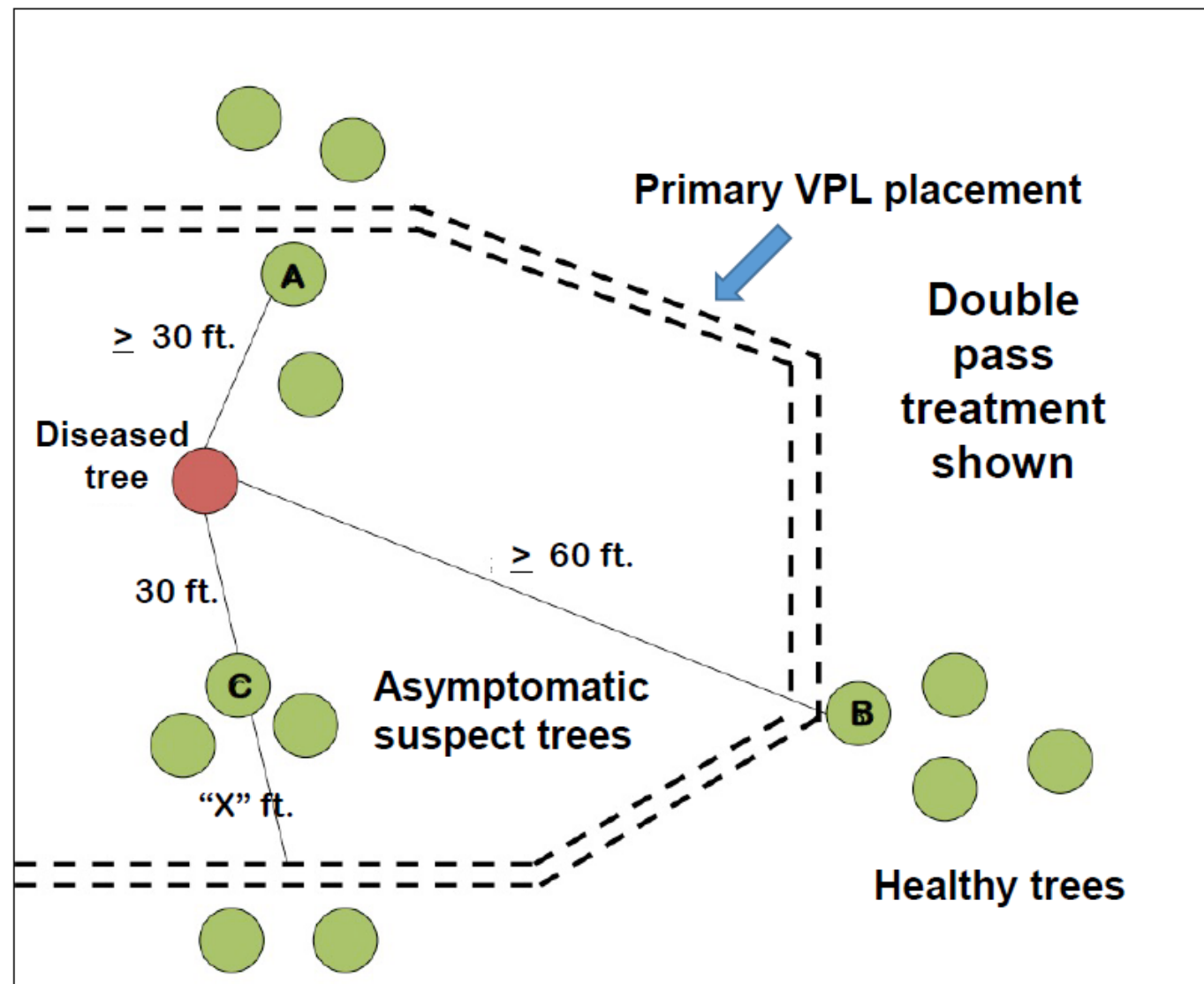
Original “Rule of Thumb” Model

For placing root graft barriers to stop below-ground spread of oak wilt fungus (French & Stienstra, 1978)



Expert User Modification of “Rule of Thumb” Model

For placing vibratory plow treatment lines in current MITPPC-funded project. (P. Kujawa modification)

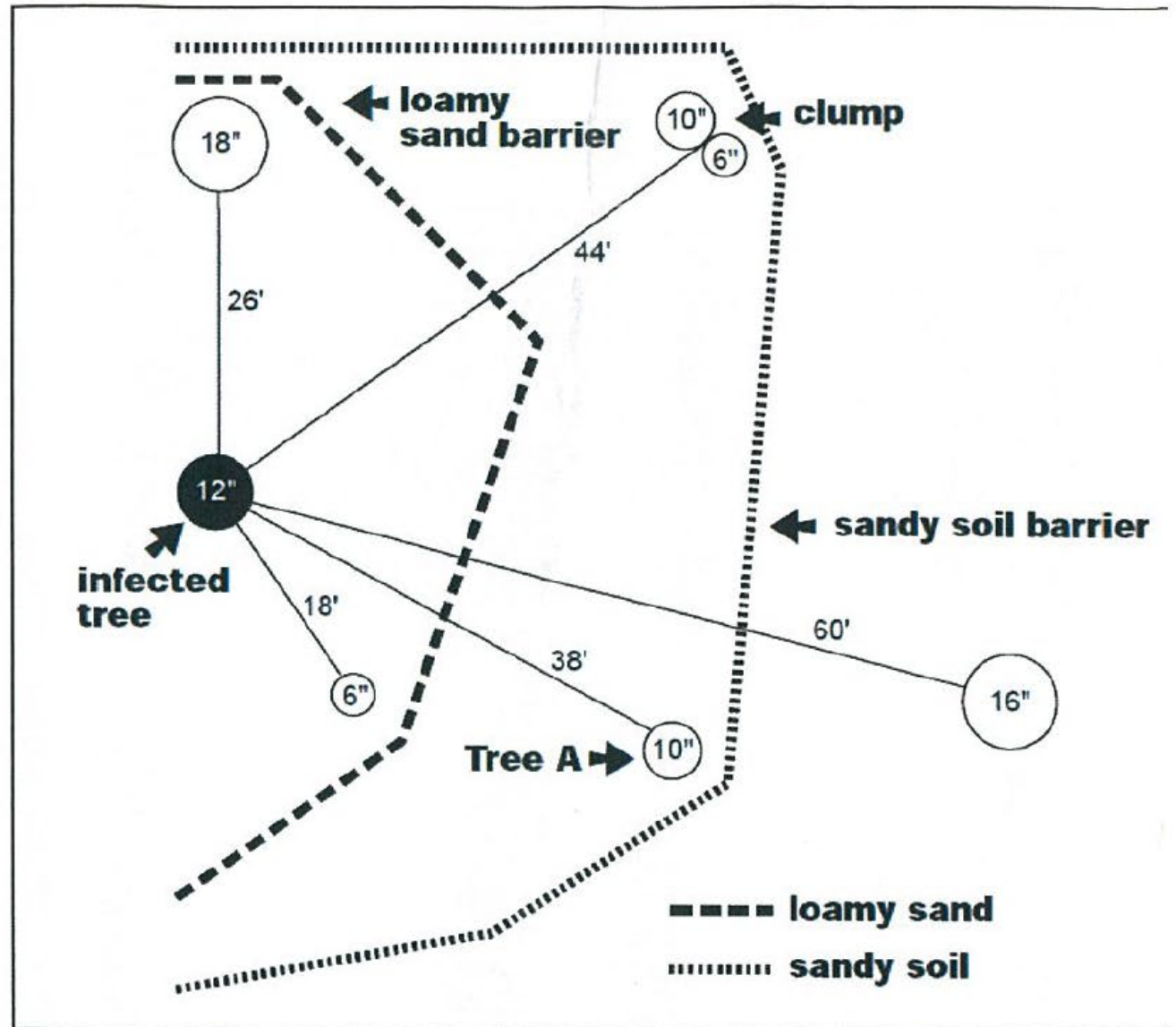




Treatment options:
Girdling trees
around infection
centers to prevent
fungal peg
formation (spore
production) and
application of
herbicide to kill as
much living tissue
as possible (the oak
wilt fungus requires
living tissue to
survive and persist
on a site).

Girdle Herbicide Treatment

Combined DBH (inches)	Inter-tree Distance	
	(distance in feet) loamy sand	(distance in feet) sandy
2	3.1	3.9
4	6.2	7.8
6	9.3	11.6
8	12.4	15.5
10	15.4	19.4
12	18.5	23.3
14	21.6	27.2
16	24.7	31.0
18	27.8	34.9
20	30.9	38.8
22	34.0	42.7
24	37.1	46.6
26	40.2	50.4
28	43.2	54.3
30	46.3	58.2
32	49.4	62.1
34	52.5	66.0
36	55.6	69.8
38	58.7	73.7
40	61.8	77.6
42	64.9	81.5
44	68.0	85.4
46	71.1	89.3
48	74.1	93.1



Bruhn and Heyd, 1992

What I learned about oak wilt during the 2019 Training in MN and WI.

- The symptoms are highly variable and seem to differ geographically.
 - Staining may not be seen until later stages of the disease.
- Leaf symptoms are highly variable.
- Time frame for infection and crown symptoms is much longer than I originally thought, spanning from late May through September.
- The disease is highly virulent and can kill mature trees in a month, but infections can also span a few years.
- The disease can persist on a site living on live roots underground for as much as 5 years after management, so frequent follow-ups are crucial to successful management.
- Any size/age of oak tree can be affected.

What I learned about oak wilt during the 2019 Training in MN and WI.

- Management via vibratory plow is expensive (the plow itself, transporting it, operating it, maintenance), but was used in park areas where the public would not tolerate cutting trees/losing high-value trees.
- Management by killing trees within the vicinity of an infected area via girdling and herbicide is effective but results in cutting a considerable amount of trees. This seems to be the most practical and effective way to directly manage the disease and protect oak trees in nearby areas.

Oak Wilt: Cause for Concern



Oak Wilt

- Much is still being learned about oak wilt and how to effectively manage it.
- Please contact me with any questions about the oak wilt fungus and its management.

Aaron Bergdahl
Forest Pathologist
Maine Forest Service
90 Blossom Lane
Deering Building, Room 201
168 SHS
Augusta, ME 04333
aaron.bergdahl@maine.gov
Office: 207-287-3008