

INSECTS, DISEASE, AND INVASIVE PLANTS – Connecting the Dots

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An Introduction

'Forest health' is a description of the overall condition and vigor of trees in the Urban Forest. There are many factors that affect forest health and that affect the trees ability to tolerate stress. Natural factors play a part including weather, animal depredation, and human-induced activities (site conditions). Generally, forest health issues are in two categories: native and non-native. Native insects and pathogens help recycle trees by breaking them down to simpler organic compounds that are usually beneficial. Some non-native insects, diseases, and plants can devastate whole or multiple tree species and healthy trees are compromised. Invasive species are non-native species that likely cause economic or environmental harm or impact human health. Proper urban forest and tree care plays a critical role in defending against these pests to improve and sustain a healthy community forest. Management to protect our forests from these threats may include methods to prevent, eradicate, manage or restore impacted sites. Practices could include maintaining species diversity, monitoring, slowing spread, treatment, mechanical removal and/or chemical treatment of invasive trees and plants, and reforestation.

This urban forest health chapter will focus on all non-native pest and disease in Iowa, a few emerging non-native pests in other parts of the country, native pests and diseases, and invasive plants. The degree to which trees in Des Moines may be impacted depends on the current geographic range of the insect or disease, and whether Des Moines has a significant population of tree species impacted by that insect or disease. Each of the pests and diseases include common name and scientific name, hosts, location if present in Iowa, management solutions, and a brief description. The invasive plants section includes a listing with the common name, scientific name and abundance. For plants noted by the District Forester in Polk and/or Warren Counties, a map with frequency is shown, an ID description, and management techniques. Weather and climate change as topics are not included but can be found in other chapters of this master plan.

Non-Native Pests and Diseases in Iowa

Butternut Canker, Scientific Name: *Ophiognomonia clavignenti-juglandacearum* – Host: Butternut (0% of Des Moines street and park trees. There are likely some butternut in Des Moines, but they are not currently recorded on the tree inventory). Found: statewide Management Solution: Remove affected branches if whole tree isn't affected yet, preserve genetics of those not being affected

Butternut canker is found throughout Iowa but is largely concentrated in the Eastern half of Iowa where butternuts occur. The disease is fatal to native non hybrid butternuts.



Figure 1: Example of canker found on butternut trees Image: Mike Ostry / USDA Forest Service, Bugwood.org

Dutch Elm Disease, Scientific Name: *Ophiostoma ulmi* or *Ophiostoma novo-ulmi* - Host: Elm (1% of Des Moines street and park trees), Found: statewide Management Solution: Removal of affected trees, species diversity, treatment

Dutch elm disease was introduced to North America in the 1930's and began killing millions of native elm trees. Dutch elm disease has been identified in all of Iowa's counties, and it's estimated that just over 95 percent of the urban elm trees have succumbed to this disease.

The fungus is native to Asia and was introduced to Europe shortly after World War I. From Europe, it traveled to North America in the 1930's in crates made from infected elm logs. The disease quickly infected elms across the United States since our native elms did not have natural resistance to the introduced pathogen.

Emerald Ash Borer, Scientific Name: *Agrilus planipennis* – Host: All Ash (*Fraxinus*) species (10% of Des Moines street and park trees. In 2015 ash represented 14% of street and park trees, but this number has been reduced through a proactive removal program to prevent massive numbers of standing dead ash trees in the future). Found: Polk and Warren Counties. Management Solution: Increase diversity, preserving genetics of those not affected, treatment or removal of ash

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The Emerald Ash Borer (EAB) is native to Asia, and was introduced in the United States near Detroit in the 1990's. EAB kills all ash species by burrowing under the bark and eating the growth (cambium) layers of the trees. EAB has been found capable of killing every species and size of ash tree in neighborhoods or woodlands. Ash is one of the most abundant native tree species in North America and has been a preferred and heavily planted landscape tree in yards and other urban areas. Managing urban ash trees with an advancing emerald ash borer will require resources for inventory, outreach, monitoring, treatment or tree removal, and tree replacement. With ash representing one of the top genera this pest will have a large impact for both homeowners and the City.

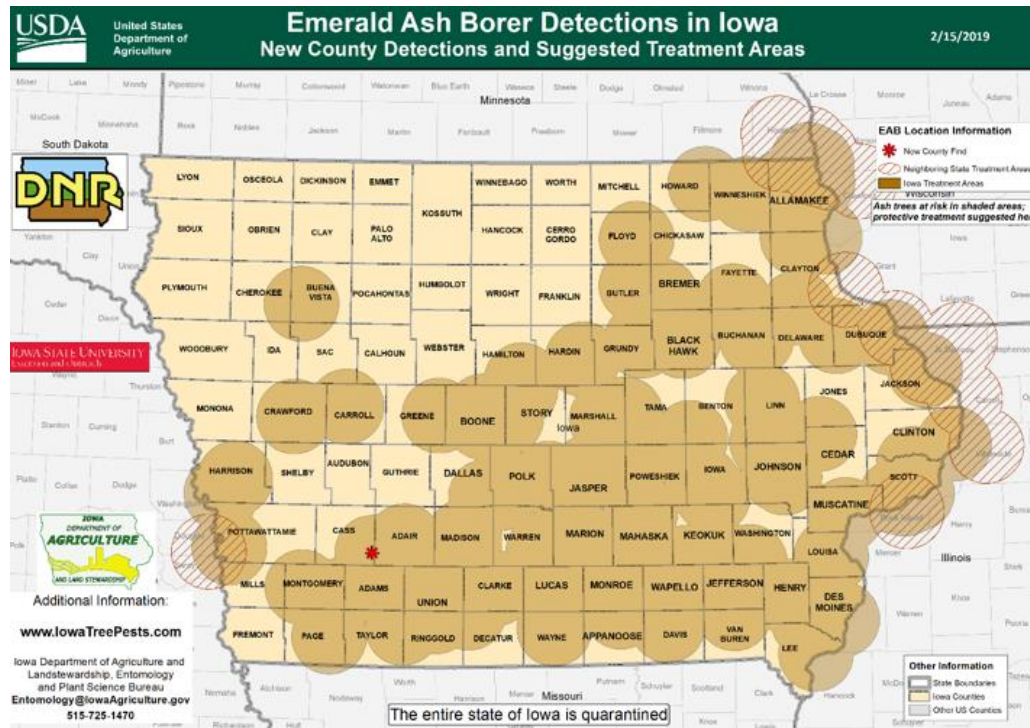


Figure 2: Locations of the emerald ash borer infestations, as of November 2018. Please note that the entire State of Iowa is now quarantined for EAB. The brown circles around each infestation represent a 15 miles radius to assist landowners in making decisions about when to treat ash trees

Des Moines has been conducting a robust EAB Management Plan since 2014. It includes treatment of the healthiest ash trees in 2015 and again in 2017, and removal of others. At present there are no plans to continue treatment of ash, opting instead for complete removal of the species and re-planting with diverse species.

Gypsy Moth, Scientific Name: *Lymantria dispar* – Found: Eastern Iowa Counties, 2018. Hosts: Hardwoods (96% of Des Moines street and park trees). Management Solution: tree management to promote the growth of healthy trees, tree species diversity, monitoring, mating disruption or chemical control

Gypsy Moth is a European insect species introduced in Boston, MA in 1869 as an experiment to help provide silk for the textile industry. This exotic insect continues to spread west from that introduction site and defoliate native forests. Gypsy moth has repeatedly been captured in Iowa, but the population

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level has effectively been controlled through trapping and mating disruption. Feeding damage has not occurred to Iowa’s trees.

During the 2018 trapping season, 1778 male moths were captured. Three areas will be delimiting trapped (trapped in zones) in 2019 to determine whether Iowa has an isolated early infestation. There are three treatment blocks identified for 2019 using mating disruption. The treatment block totals 12,712 polygon acres.

The 2018 Btk (*Bacillus thuringiensis var. kustaki*, a naturally occurring pest control product) treatment in Jackson County was successful with only a single trap with two male moths. No egg masses were found during the fall survey. A small portion of the Btk block was included in the 2019 mating disruption treatment to ensure gypsy moth is eradicated.

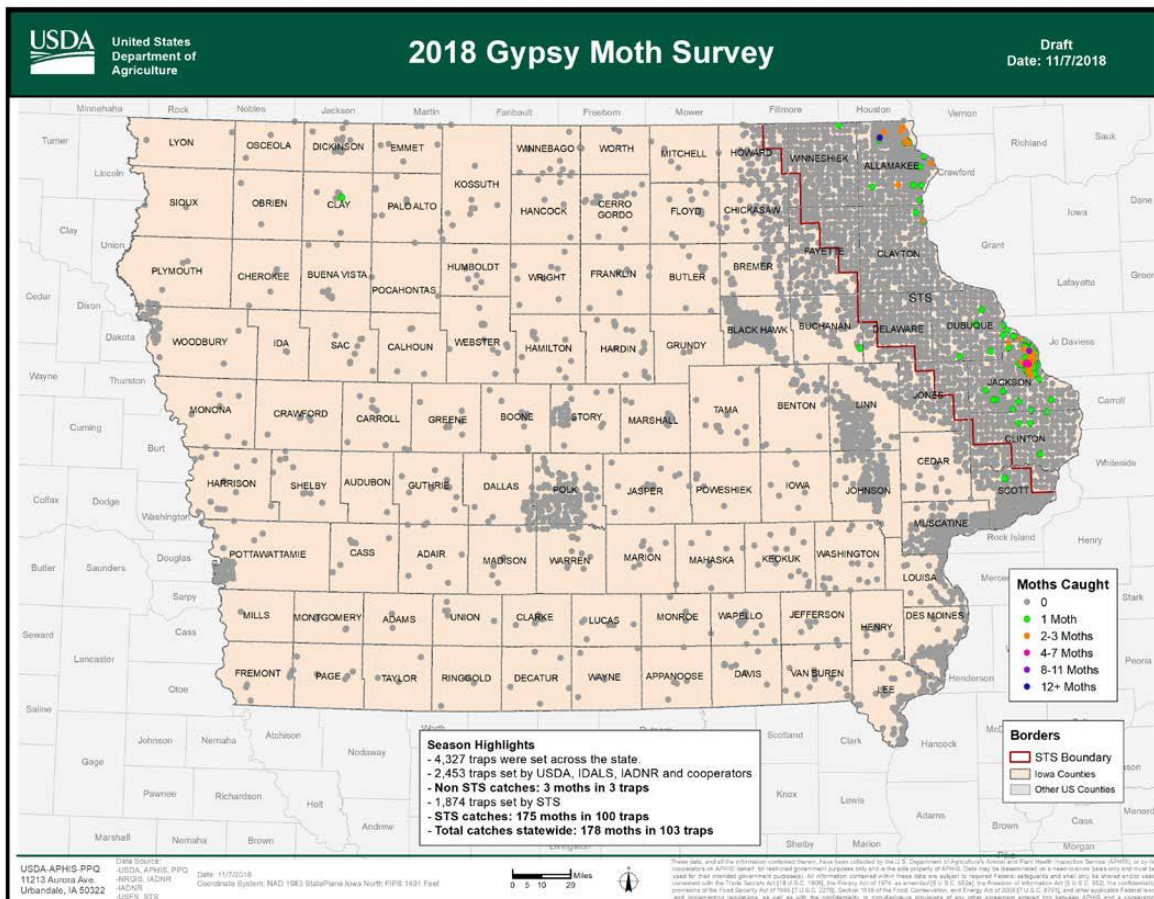


Figure 3: The map above details the locations of all the gypsy moth traps and the number of moths captured in them during the 2018-trapping season. The total male moth capture was 178 male moths. (Image: Mark Hollister, PPQ).

White Pine Blister Rust, Scientific Name: *Cronartium ribicola*, Found: outside of Polk County. Host: white pine (2% of Des Moines street and park trees). Management Solution: removal of alternate hosts, removal of branches with cankers, fungicide

White pine blister rust has been identified in Iowa and is a pest that can occur throughout the native white pine range in Iowa. No additional funds were available to conduct survey work. No suspect samples were submitted to DNR or the ISU Plant Diagnostic Clinic. No other survey work was conducted

for white pine blister rust.

USDA  **White Pine Blister Rust**
Cronartium ribicola J.C. Fischer

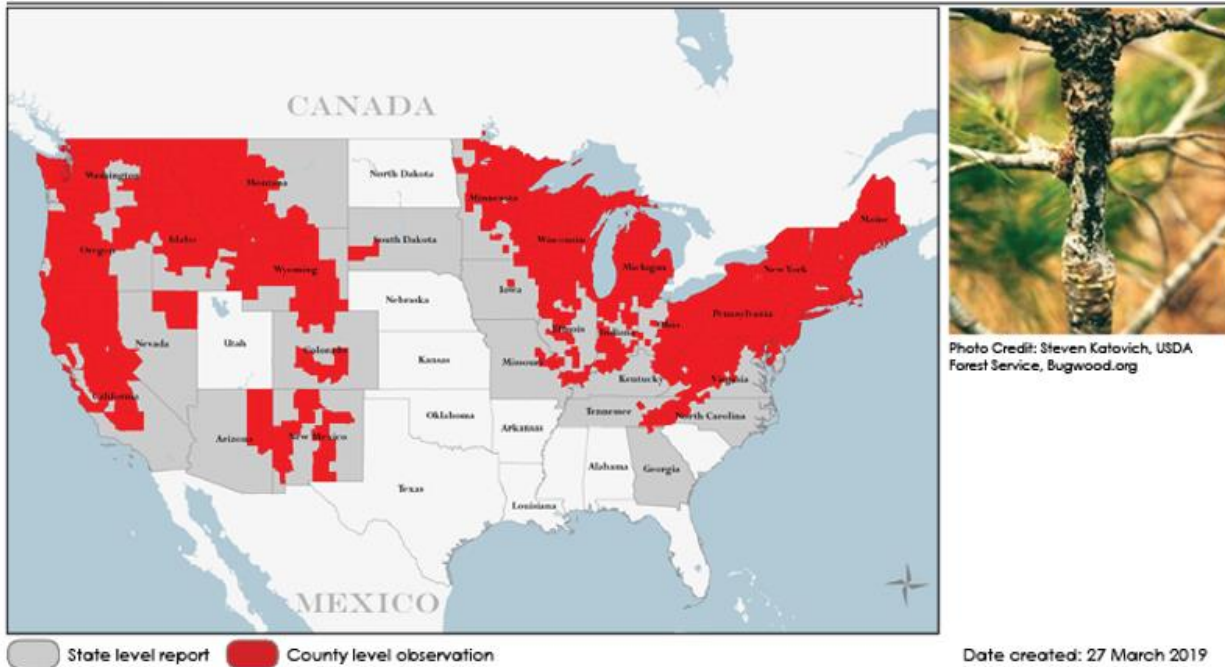


Figure 4: The range map for known areas of white pine blister rust

Pine Shoot Beetle, Scientific Name: *Tomicus piniperda*, Found: Dubuque and Scott Counties.
Host: all pines (3% of Des Moines street and park trees). Management Solution: sanitation, insecticide

Pine shoot beetle attacks new growth, stunting growth. pine shoot beetle was identified September 18, 2006 and all counties in Iowa were quarantined for pine shoot beetle. Since the entire state is quarantined, no further monitoring has been required.

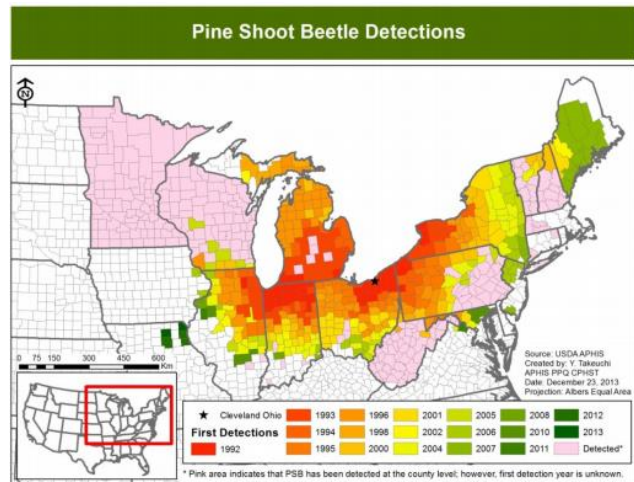


Figure 5: The map above shows the quarantined areas for pine shoot beetle. (Image: by USDA-APHIS-PPQ)

Emerging Non-Native Pests and Diseases outside of Iowa

Asian long-horned beetle, Scientific Name: *Anoplophora glabripennis* – Host: Maple, horsechestnut/buckeye, willow, elm, birch, and sycamore (25% of Des Moines street and park trees). Management Solution: Tree species diversity, tree removal in known areas

Asian Longhorned Beetle (ALB) is an exotic pest native to China. The larva of this beetle kills trees by tunneling through the tree, which girdles stems and branches. ALB most likely traveled to the United States inside wood packaging materials from China and has been intercepted at various ports of entry and warehouses throughout the country. Maple, the beetle’s host of choice, is a tree extremely common in urban settings. An infestation of ALB would be devastating for the City of Des Moines with maple being a top genus of trees. Des Moines currently does not have any maple on its Recommended Species list. Though maple continues to be a popular selection for homeowners, the City Forester has elected to disallow maple trees on new development sites for two reasons. First, maple already represents 17% of all street and park trees. This is not a good metric, since diversification of species to limit the effect of insects and disease would suggest that 10% of a genus is a better number. Second, with ALB presenting a potential future challenge, and with maple being its number one preferred host tree, it seems prudent to limit the planting of this tree. ALB has devastated most communities it has been found in, however with monitoring ALB can be detected early and eradicated.



Figure 6: Adult Asian long-horned Beetle (Image: Dennis Haugen, USDA Forest Service, Bugwood.org).



Figure 7b: Adult Asian long-horned Beetle damage includes chewed round depressions in the bark of a tree, pencil-sized, perfectly round tree exit holes, excessive sawdust (frass) buildup near tree bases, and unseasonable yellowed or drooping leaves (Image: USDA Forest Service/aphis/resources).

Oak Wilt, Scientific Name: *Ceratocystis fagacearum* – Found: Statewide including Polk and Warren Counties. Host: all oak spp (13% of Des Moines street and park trees). Management Solution: prune oaks in winter only, paint cuts when branches must be pruned outside of winter dormant season, tree removal, root trenching between infected and healthy trees, fungicide treatment

Oak wilt (*Ceratocystis fagacearum*) is a fungus that has caused the mortality of thousands of oaks. This disease is spread in two primary methods: First through root grafts of ‘like oak’ species; and second,

over land via a species of nitidulid beetles that contact the oak wilt fungus fruiting pressure pad. These beetles then spread and infect other trees some distance away. In Iowa, the spread of oak wilt through root grafts is slow and isolated due to heavy clay soils that minimize root grafts in natural stands.

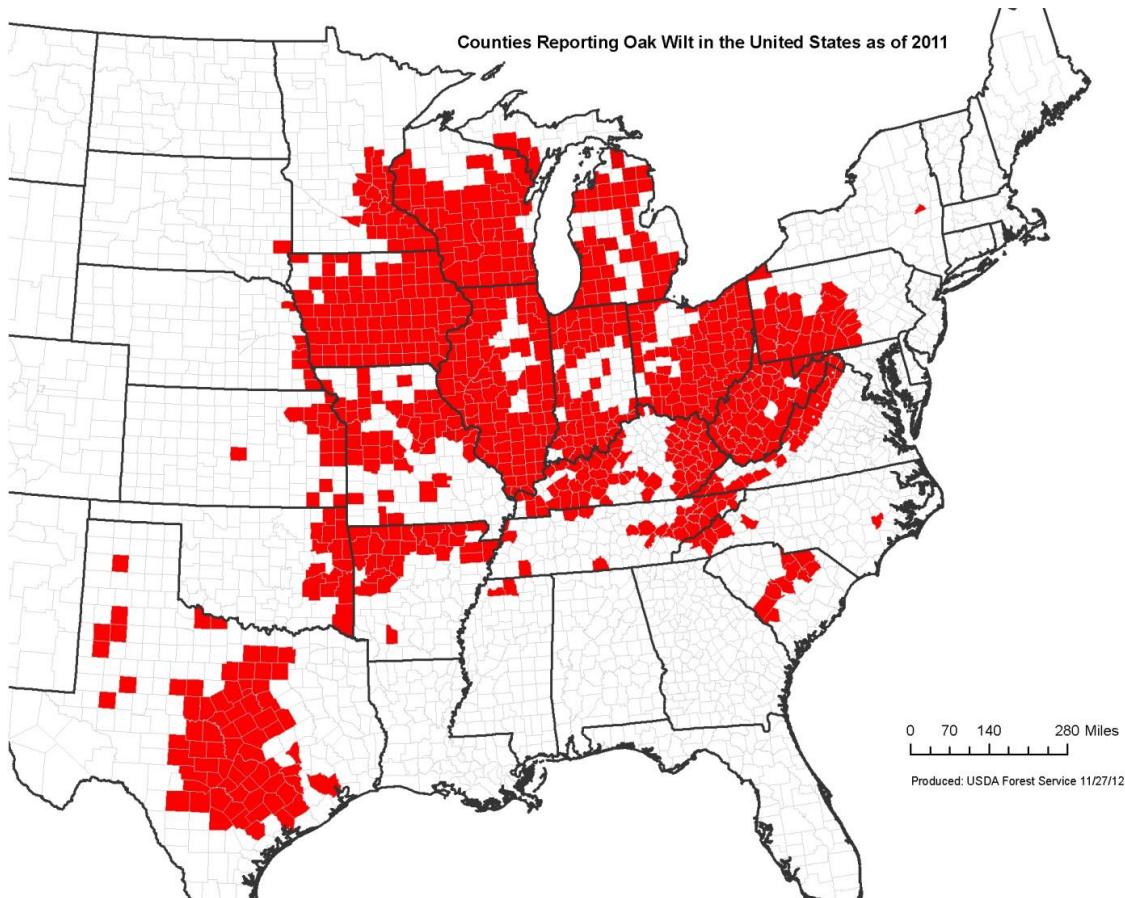


Figure 8: The map above details the counties in Iowa with confirmed oak wilt. Oak wilt may be present in the non-red counties but has not been confirmed by the ISU Diagnostic Clinic. (Image: Quinn Chavez, USFS).

However, twenty- to thirty-year old pure red oak plantations have been virtually wiped out by oak wilt via root grafting. Overland spread is a more serious concern in Iowa because it creates new scattered oak wilt infection centers or “pockets” some distance away from the original source. Currently, the most common control recommendation is to cut the root grafts with a trencher or vibratory plow to a depth of three to five feet and then remove the infected trees. Oak wilt will continue to be monitored through aerial flights, ground checks, and reports from landowners. This disease is of particular concern in Iowa because of the prevalence of oak-hickory forest.

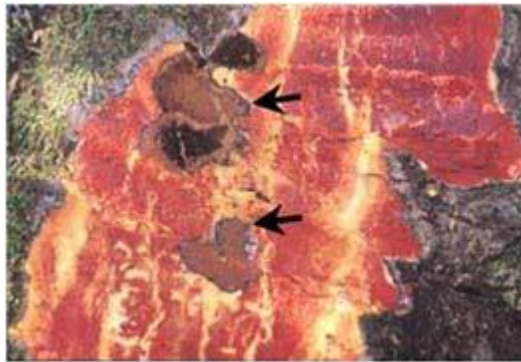
Sudden Oak Death, Scientific Name: *Phytophthora ramorum* – Found: Potentially shipped to Iowa on nursery plants from out of state but not yet found. Host: All oaks (13% of Des Moines street and park trees). Management Solution: preventing spread, monitoring

Sudden oak death was first found in the 1990s and kills some oak species. It was first introduced in the US to California. Iowa did not receive any notice of “trace forward” of suspected sudden oak death in

2018, meaning that no potentially infected plant material had been shipped to Iowa. Stream baiting, to test for sudden oak death was not conducted in 2018 and was not planned for 2019.



Ooze bleeds from a canker on an infected oak.



Black zone lines are found under diseased bark in oak.

Figure 9: Two examples of the oozing canker found on an infected tree. The black lines under the bark are also symptomatic of sudden oak death. (Images: Joseph O'Brien, USDA Forest Service Pest Alert, and Bugwood.org)

Thousand Cankers Disease, Scientific Name: *Pityophthorus juglandis* and *Geosmithia morbida* –Host: Walnut (2% of Des Moines street and park trees). Management Solution: maintaining healthy trees, monitoring

Since the 1990's, black walnut has been dying in Western U.S. The deaths are caused by a walnut twig beetle (*Pityophthorus juglandis*) that carries a fungus (*Geosmithia morbida*) which is spread as the beetle tunnels through tree tissues. The insect disease complex had been named thousand cankers disease (TCD). The introduction of TCD into Iowa would have disastrous effects economically to the wood industry in the state and the rest of the nation. Iowa has the third largest volume (979 million board feet) of saw log size black walnut in the world. Some experts believe that TCD has the potential to decimate black walnut in the same way Dutch elm disease, emerald ash borer and chestnut blight have destroyed their respective hosts.

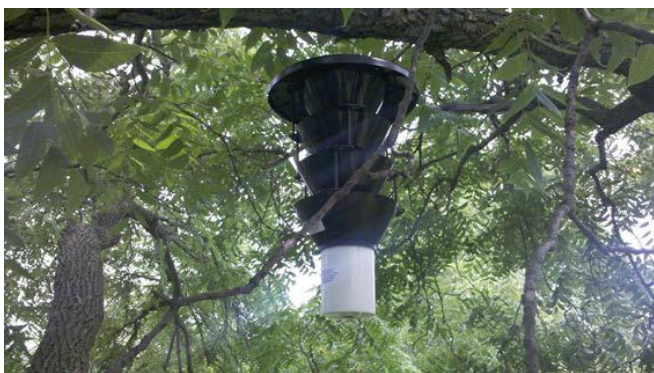


Figure 10: One of the Lindgren funnel traps that were used in conjunction with the walnut twig beetle pheromone. The traps were placed at sawmills, communities, and campgrounds. (Image: Shane Donegan, DNR)

Native Pests and Diseases

Armillaria Root Disease, Scientific Name: *Armillaria spp.* – Host: Hardwoods and Conifers (100% of Des Moines street and park trees). Found: Polk and Warren Counties. Management Solution: maintaining healthy trees

Armillaria root disease is a common disease. The crown symptoms consist of branch dieback and crown thinning. The fungus produces a mycelial fan in recently killed trees just underneath the inner bark that



Figure 11: *Armillaria* rhizomorphs under the bark. (Image: Robert L. Anderson, USDA Forest Service, Bugwood.org).

often has a strong “mushroom” odor. The most common signs are the rhizomorphs that are produced just under the bark, and sometimes just on the bark surface. The rhizomorphs look like “shoestring”, which is why this fungus is sometimes called the shoestring fungi.

Bur Oak Blight, Scientific Name: *Tubakia iowensis* – Host: Bur oak and Swamp White Oak (8% of Des Moines street and park trees). Found: in Polk and Warren Counties. Management Solution: trees species diversity, fungicide treatment



Bur oak blight has been recognized in Central Iowa for only the last 13 years. However, it is suspected that the fungus that causes the disease has probably been here much longer. Theories on why bur oak blight has increased include: a shift in climate temperatures, more frequent rain events, older mature trees might be more susceptible, and that trees are more susceptible on sites that have a history of grazing or construction. The disease causes severe decline and mortality. Spring season chemical injections with propiconazole (Alamo) seem to control bur oak blight. However, some chemical burning (phytotoxic effects of the chemical) does occur. This control method works well in urban settings. Currently, control measures have not been identified for woodland trees.

Figure 12: An example of bur oak leaves infected with *Tubakia* spp. Photo by Christine Engelbrecht.

Forest Tent Caterpillar, Scientific Name: *Malacosoma disstria*
 – Found: Allamakee, Winneshiek, Howard, Chickasaw, Fayette, Clayton, and Delaware. Host: Hardwoods (96% of Des Moines street and park trees). Management Solution: egg mass removal, larvae removal, tree bands, insecticide

Forest tent caterpillar is the most common and destructive tent caterpillar in the United States. In many areas, short-duration outbreaks result in intense defoliation. Defoliation can result in reduced tree growth, top-kill, tree mortality, and impairment of aesthetic values. During years when forest tent caterpillars are abundant, they reduce foliage and can become a hazard for automotive traffic, trains, and pedestrians.



Figure 13: The picture above shows forest tent caterpillars on the main stem of a young tree. (Image: Robert Honeywell, DNR).



Lucas and Van Buren Counties.
Host: Conifers (4% of Des Moines street and park trees).
Management Solution: reduce wounding, change thinning practices, species diversity

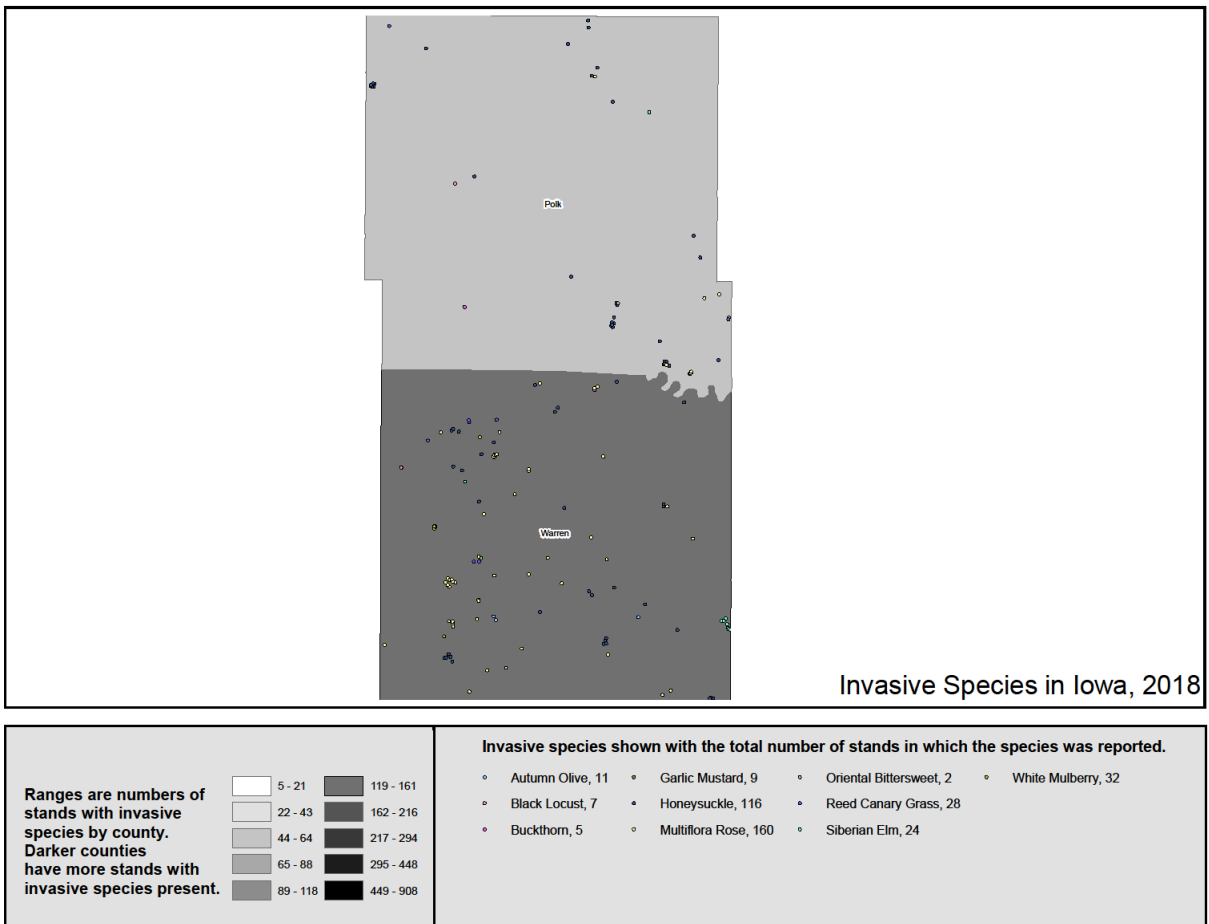
Heterobasidion root disease has been identified in Iowa and is a pest that can occur throughout Iowa on pines or red cedar. Historically it has been reported on jack pine in Stephens State Forest.

Figure 14: Example of Heterobasidion root disease. (Image: William Jacobi, Colorado State University, Bugwood.org)

Invasive Plants

Invasive species are non-native to an ecosystem and are likely to cause economic or environmental harm to humans, crops, livestock or natural plant and animal communities. These invasive and exotic plants out-compete native forest species, diminish fisheries and wildlife habitat, reduce water quality, reduce economic returns from forest management and tourism and threaten long-term forest sustainability and biodiversity. These non-native plants have several advantages over competing native plants, including prolific seed production, shade tolerance, earlier production of leaves in the spring and maintenance of leaves longer in the fall. All of these traits give invasive plants a competitive advantage over native tree seedlings and native understory plants. This in turn leads to a reduction in both plant diversity and availability of suitable habitat for a variety of wildlife species.

The local District Forester has recorded invasive plants in databases after visiting private landowners and municipal park forests as part of creating stewardship plans. The figure below shows the list of invasive plants that have been observed during landowner site visits. Although this is not a systematic survey, it is the best available information at the county level.



Known Invasive Plants in Iowa 2018

- Key: NP= Not Present- Not known to exist in Iowa
 I= Isolated- the species is infrequent, not commonly seen
 LA= Locally Abundant- the species is present but is not in the majority of the counties
 W= Widespread- commonly seen in the majority of counties in large or small population

Bold and underlined – Noted in Polk or Warren Counties

Species	Common Name	Abundance
Abutilon theophrasti	Velvetleaf	W
Ailanthus altissima	tree-of-heaven	W
<u>Alliaria petiolata</u>	<u>garlic mustard</u>	<u>W</u>
<u>Berberis thunbergii</u>	<u>Japanese barberry</u>	W
Bromus tectorum	cheatgrass	W
Butomus umbellatus	flowering rush	I
Carduus acanthoides	plumeless thistle	I
Carduus nutans	Musk thistle	W

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<u>Celastrus orbiculatus</u>	<u>Oriental bittersweet</u>	LA
Centaurea maculosa/beibersteinii	spotted knapweed	LA
Centaurea repens	Russian knapweed	I
Centaurea solstitialis	yellow star thistle	I
Cirsium arvense	Canada thistle	W
Cirsium spp.	thistle	W
Cirsium vulgare	bull thistle	W
Conium maculatum	poison hemlock	I
Coronilla varia	crown vetch	W
Daucus carota	Queen Anne’s lace	W
Dipsacus fullonum/sylvestris	common teasel	I
Dipsacus laciniatus	cutleaf teasel	I
Dipsacus sativus	Indian teasel	NP
Elaeagnus angustifolia	Russian olive	I
<u>Elaeagnus umbellate</u>	<u>autumn olive</u>	LA
Euonymus alatus	burning bush	LA
Euphorbia esula	leafy spurge	W
Fallopia japonica	Japanese knotweed	LA
Frangula alnus/Rhamnus frangula	glossy buckthorn	I
Heracleum mantegazzianum	giant hogweed	NP
Hesperis matronalis	dame’s rocket	W
Humulus japonicus	Japanese hop	LA
Lespedeza cuneata	Sericea lespedeza	I
Ligustrum japonicum	Japanese privet	NP
Ligustrum obtusifolium	blunt-leaved or border privet	I
Ligustrum sinense	Chinese privet	NP
Ligustrum vulgare	common or European privet	I
Lonicera fragrantissima	fragrant honeysuckle	NP
Lonicera japonica	Japanese honeysuckle	LA
<u>Lonicera maackii</u>	<u>Amur honeysuckle</u>	W
Lonicera standishii	Standish’s honeysuckle	NP
<u>Lonicera tatarica</u>	<u>Tatarian honeysuckle</u>	W
Lonicera x bella	Bell’s honeysuckle	I
Lonicera xylosteum	European fly honeysuckle	NP
Lythrum salicaria	purple loosestrife	W
<u>Morus alba</u>	<u>white mulberry</u>	W
Pastinaca sativa	wild parsnip	W
Potamogeton crispus	Curly-leaf pondweed	I
Pueraria montana	kudzu	I
<u>Rhamnus cathartica</u>	<u>common buckthorn</u>	W
<u>Rosa multiflora</u>	<u>multiflora rose</u>	W
Tamarix spp.	salt cedar	I

Autumn Olive (*Eleagnus umbellata*) - Bushy plant up to 20 feet tall. Oblong leaves are silver on undersides. Stems have silver tint and thorns. Fruit is red at maturity. Must grow three years before producing fruit. Flowers: Appear in May, after first leaves are produced. Find abundant, tiny flowers in leaf axils. They are fragrant, silvery yellow, tubular and 1/2-inch-long. Bark: As shrub ages, bark splits and cracks starting at base and working up. Fruits: First appear silver, then red at maturity. Produces up to 6 pounds of fruit a year. Leaves: 1-inch-wide and oblong, with smooth but wavy edges, dark green to grayish-green with silver and white dotted undersides. Arranged alternately on stems. Appear in early spring, before native vegetation. Management Techniques: Stump treat—cut stump in July and immediately treat with 12.5% Triclopyr solution formulated for use with surfactant or penetrant per the label.



Figure 15: Bugwood.org/Leslie J. Mehrhoff, Univ. of Connecticut



Figure 16: Bugwood.org/ Paul Wray, Iowa State Univ.

Black Locust (*Robinia pseudoacacia*)- A deciduous tree native to the mid-southern U.S. but spreading and becoming invasive nationwide. Trees grow from 40 to 100 feet tall. Trees grow upright in forests but develop an open growth form in open areas. The bark of black locust is light brown, rough, and becomes very furrowed with age. Leaves: Pinnately compound with 7 to 21 small, round leaflets per leaf. Leaflets are 1.5 inches long. A pair of long, stipular spines is found at the base of most leaves. Flowers: Occurs in spring, when showy, fragrant, white to yellow flowers develop

in 8-inch-long clusters. Fruit: Smooth, thin seed pod 2 to 4 inches long.

Management Techniques: Stump treat - cut stumps in July and immediately treat with 6.25% glyphosate solution or with 12.5% Triclopyr solution formulated for use with surfactant or penetrant per the label.

Glossy Buckthorn (*Frangula alnus/Rhamnus frangula*)- A small tree or tall shrub. Brown-gray bark with light colored lenticels. Yellow sapwood. Heartwood pink to orange. Terminal buds shaped like a deer hoof, in pairs with a thorn between buds. Pea-sized fruits have laxative effect on birds. Seeds viable up to 3 years. Leaves: Common—simple, opposite, ovate with minute teeth on margins. Dark green with shiny topsides. Veins curve towards leaf tip. Twigs have sharp spikes at tips. Glossy—alternate, untoothed with hairy undersides. Veins first extend straight, then curve towards tip. No spikes present on twigs. Terminal Buds: Common—not hairy. Glossy—hairy. Flowers: Common—Fragrant, small, green-yellow flower cluster near end of stems in leaf axils. Bloom May to June. Each flower contains 4 petals. Glossy—pale yellow flowers contain 5 petals. Blooms late May until first frost. Fruit: Common—female plant fruits. Fruit are clustered, black and pea sized and shaped. Ripe August to September and can stay on plant through winter. Glossy—both male and female plants fruit. Progressively ripen from red to dark purple. Management Techniques: Basal bark spray—apply a 25% triclopyr solution plus a penetrant once to plant base between May and November. Stump Treat—cut stump in July, immediately treat with 20% glyphosate solution or 25% Triclopyr solution.



Figure 17: Bugwood.org/ photo by Rob Routledge



Figure 18: Bugwood.org/Daniel Herms, The Ohio State Univ

Garlic Mustard- White flowers with four petals; plant parts have garlic-like odor when crushed. Young plants resemble creeping Charlie or violets. First-year plants: Seedlings appear late spring to early summer, and throughout growing season as scattered individuals or dense ground layer. Rounded, heart-shaped leaves with scalloped edges form low rosettes that stay green through winter. Second-year plants: April into June, rosettes become more robust and send up flowering stalks with triangular to heart-shaped, coarsely toothed leaves. Stems 1' to 3' tall. Clusters of small, white, four petaled flowers at stem tip. Seed pods form soon after flowering. Green, thin, elongated pods enlarge and turn grayish-brown. Seeds shed mid-summer. Plants die. Management Techniques: Prescribed burn—April to May to control large areas of

newly emerging seedlings. Hand pulling—All season long, place in garbage bags for landfill—do not compost to prevent spread. Herbicide—Spray directly with 1% to 2% glyphosate from late fall until early spring.

Bush Honeysuckle- Deciduous shrub. Older stems hollow with tubular flowers that range from white, yellow, pink or red. Flowers produced in pairs along stem at base of leaves. Both species have egg-shaped leaves oppositely arranged on stem. Fruits are many-seeded berries ranging from red, orange or black. It creates dense thickets, inhibiting desirable plant growth.

Morrow’s Honeysuckle (*Lonicera morrowii*): Grows up to 7 feet tall, 2- to 3-inch long leaves hairy on underside. Flowers white to cream. Fruit is orange to red when ripe.

Amur Honeysuckle (*Lonicera maackii*): Grows up to 15 feet high. White to yellow flowers May through June. Red berries in September. Management Techniques: Basal bark spray—Apply a 25% triclopyr solution plus a penetrant once to base of plant between May and November. Stump Treat—cut stump in July, immediately treat with 20% glyphosate solution or 25% Triclopyr solution.



Figure 19: Bugwood.org/Richard Gardner, UMES



Figure 20: Bugwood.org/Rob Routledge, Sault College

Multiflora Rose- Dense shrub grows up to 15 feet tall. Produces small white flowers in May or June. Small red fruit mature in August and can remain through winter. Stems contain thorns. Petioles have feathery stipules. Leaves: Pinnately compound, alternate with 5 to 11 leaflets. Leaflets toothed, with smooth top and hairy underside. Fringed petioles distinguish it from other roses. Flowers: Usually 1 inch wide, contain 5 petals, white in color, and form a panicle. Clusters bloom May and June. Fruit: Small, hard, round, red berries form clusters in August. Berries can remain on the plant through winter. Eaten by birds and animals. Stems: Arching, woody stems contain curved thorns. Stems can grow up to 13 feet long, but typically bend groundward at 6 feet. Upon reaching ground, they can take root. Seeds: Each plant produces up to 500,000 seeds per year—viable in soil up to 20 years. Management Techniques: Hand pulling—spring remove entire plant and root system and place in garbage bags for landfill—do not compost to prevent spread. Herbicide— Treat cut stumps with a 50% Triclopyr solution or foliar spray with a 2% Triclopyr solution with a surfactant.

Oriental Bittersweet- Climbing vine with round, glossy, finely toothed leaves. Green or yellow fruits grow at leaf axils along stem and reveal red-orange berries later in fall. Young Vines: Grow vertically and wrap around each other for support to reach sunlight. Vines on Trees: Wrap around tree as they grow towards sky. Upon reaching canopy they start growing back to ground. Weight of vines eventually pulls down entire tree. Leaves: Glossy, rounded, finely toothed and alternately arranged along stem. Berries: When female matures, spherical green to yellow fruits split open to reveal three red-orange fleshy arils that contain seeds. Flowers: Clusters of small greenish flowers emerge from leaf axils. Prolific seed numbers. Management



Figure 21: Bugwood.org/Leslie J. Mehrhoff, Univ. of Connecticut

Techniques: Basal bark spray—Apply a 25% triclopyr solution plus a penetrant once to base of plant between May and November. Mowing—mow area and treat resprouts with 2% Triclopyr solution.



Figure 22: Bugwood.org/Jamie Nielsen Univ. of Alaska, Fairbanks

Reed Canary Grass- Grows 2 to 6 feet tall, and occasionally reaches 9 feet. Produces green to purple flowers. Leaves are long, narrow and rough on both sides. Leaves: Alternately growing leaves are wide, have a flat blade (erect through the majority of the plant's life), are gradually tapered and have a rough texture on top and bottom. Leaves measure 3-1/2 to 10 inches long and 1/4 to 3/4 inches wide. Flowers: Dense terminal clusters. Over the summer, branches of flower heads open up. As plant goes to seed, branches fold up again. Flower colors green to purple, turning beige in late summer and fall. Stem: Bluish green, round, hairless and stand erect. Unique characteristic is a stiff 1/2-inch ligule at base of leaves. Management Techniques: Hand Pull—In spring, pull young plants before seeds are produced. Herbicide—two treatments of

5% glyphosate solution foliar spray to leaves using a sprayer before native vegetation begins to grow. Prescribed burn the area 4-5 years in a row post-herbicide treatment.



Siberian Elm- A deciduous tree that grows up to 70 feet tall. Round, open crown with slender, spreading branches. Produces pale green flowers in early spring. Flowers: Petal-less flowers emerge in spring, before leaves begin to unfold. Flowers are pale green and come in clusters of 2 to 5 blossoms. Fruit: Thin, flat and in clusters. Each fruit contains one seed, spread easily by wind. Seeds are egg-shaped and smooth. Bark: Gray to brown in color. Becomes furrowed with light colored spots when mature. Leaves: Small, simple, and alternate. Dark green and smooth on the topsides, pale and fuzzy on undersides and rarely more than 2 inches long. Elliptical in shape and singly toothed. Fall color is yellow. Management Techniques: Stump treat—cut stump in July and immediately treat with 25% glyphosate solution or with 12.5% Triclopyr solution. Basal bark—20% triclopyr and 80% surfactant or penetrant per the label.

Figure 23: Bugwood.org/
John M. Randall, The
Conservancy

White Mulberry- Small deciduous tree with low branches and wide spreading crown. Roots are a distinctive, obnoxious orange, a color lightly reflected in its ridged, brown bark. Leaves: A glossy sheen is obvious on the upper surface of its variably lobed leaves. White mulberry flowers are green-yellow and occur in dense spikes. Fruit: The aggregate fruits, which ripen from May to August, turn from green to white to red to black. Fruit is relished by wildlife, which spread white mulberry to new locations. Can also spread through root sprouting. Management Techniques: Stump treat—cut stump in July and immediately treat with 20% glyphosate solution or with 20% Triclopyr solution. Basal bark—20% triclopyr and 80% surfactant or penetrant per the label.



Figure 24: Bugwood.org/ Ohio State Weed Lab

Wildlife Depredation

Where wildlife populations are high, browsing can impact individual trees and the species composition of our community forests. Browsing has a profound impact on the establishment of regeneration, the density of hardwood seedlings and the presence of understory plants. Additionally, wildlife can also impact vegetation by moving parasites and invasive plant seeds. Selective browsing can lead to a reduction in forest biodiversity, which can then lead to a change in habitat which all wildlife needs.

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The list below is created to show how many of each tree species may be at risk from various pests

Species information from **TreeKeeper8** inventory software used by the City to inventory trees

CDM residents can access <https://desmoinesia.mytreekeeper.com/> to find trees on their street

Species (Scientific)	Species (Common)	QTY	Common Diseases	# At Risk for Diseases
<i>Acer buergerianum</i>	maple, trident	20	ALB(Asian Long-Horned Beetle)Anthracnose	(summary of # at risk)
<i>Acer campestre</i>	maple, hedge	1	ALB, Anthracnose	
<i>Acer griseum</i>	maple, paperbark	5	ALB, Anthracnose	# At Risk for ALB
<i>Acer miyabei</i>	maple, Miyabe	13	ALB, Anthracnose	16,520
<i>Acer negundo</i>	boxelder	118	ALB, Anthracnose	# At Risk for Anthracnose
<i>Acer nigrum</i>	maple, black	21	ALB, Anthracnose	22,672
<i>Acer palmatum</i>	maple, Japanese	41	ALB, JB(Japanese Beetles), Anthracnose	# At Risk for JB
<i>Acer platanoides</i>	maple, Norway	2,244	ALB, JB, Anthracnose	11,471
<i>Acer pseudoplatanus</i>	maple, sycamore	2	ALB, Anthracnose	# At Risk for Witches Broom
<i>Acer rubrum</i>	maple, red	1,219	ALB, Anthracnose	3,329
<i>Acer saccharinum</i>	maple, silver	1,113	ALB, Anthracnose	# At Risk for EAB
<i>Acer saccharum</i>	maple, sugar	2,005	ALB, Anthracnose	4,150
<i>Acer spp.</i>	maple, spp.	12	ALB, Anthracnose	
<i>Acer tataricum</i>	maple, Tatarian	64	ALB, Anthracnose	# At Risk for Oak Wilt
<i>Acer tataricum ginnala</i>	maple, Amur	125	ALB, Anthracnose	6,295

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<i>Acer truncatum x A. platanoides</i>	maple, Pacific Sunset	1	ALB, Anthracnose	# At Risk for Bur Oak Blight
<i>Acer x freemanii</i>	maple, Freeman	415	ALB, Anthracnose	1,445
<i>Aesculus glabra</i>	buckeye, Ohio	50	ALB	
<i>Aesculus hippocastanum</i>	horsechestnut	38	ALB, JB	# At Risk for DED
<i>Betula alleghaniensis</i>	birch, yellow	2	ALB	409
<i>Betula nigra</i>	birch, river	216	ALB	
<i>Betula papyrifera</i>	birch, paper	50	ALB	# At Risk for Rhizosphaera Needle Cast
<i>Betula pendula</i>	birch, European white	4	ALB	357
<i>Betula populifolia</i>	birch, gray	5	ALB, JB	
<i>Betula x</i>	birch, hybrid	1	ALB	
<i>Carya cordiformis</i>	hickory, bitternut	40	Anthracnose, Cankers, Witches Broom	# At Risk for TCD
<i>Carya ovata</i>	hickory, shagbark	183	Anthracnose, Cankers, Witches Broom	692
<i>Castanea mollissima</i>	chestnut, Chinese	7	Blight	# At Risk for Pine Wilt
<i>Catalpa speciosa</i>	catalpa, northern	198	Verticillium Wilt, Powdery Mildew	1,215
<i>Celtis occidentalis</i>	hackberry, common	3,005	Witches Broom	# At Risk for Swiss Needle Cast
<i>Cercidiphyllum japonicum</i>	Katsura tree	14	ALB	150
<i>Fraxinus americana</i>	ash, white	567	EAB(Emerald Ash Borer), ALB, Anthracnose	# At Risk for Apple Scab
<i>Fraxinus excelsior</i>	ash, European	1	EAB, ALB, Anthracnose	6,140

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<i>Fraxinus nigra</i>	ash, black	5	EAB, ALB, Anthracnose	
<i>Fraxinus pennsylvanica</i>	ash, green	3,575	EAB, ALB, Anthracnose	# At Risk for Fire Blight
<i>Fraxinus quadrangulata</i>	ash, blue	2	EAB, ALB, Anthracnose	1,014
<i>Gleditsia triacanthos</i>	honeylocust	105	Cankers, Root Collar Rot	# At Risk for Dothistroma Needle Blight
<i>Gleditsia triacanthos inermis</i>	honeylocust, thornless	2,324	Cankers, Root Collar Rot	913
<i>Juglans nigra</i>	walnut, black	690	TCD(Thousand Cankers Disease), JB, Anthracnose	# At Risk for Diplodia Tip Blight
<i>Juglans regia</i>	walnut, English	2	TCD, Anthracnose	913
<i>Koelreuteria paniculata</i>	goldenraintree	5	ALB	# At Risk for Root Collar Rot
<i>Malus spp.</i>	crabapple, flowering	5,126	JB, Apple Scab	2,429
<i>Picea pungens</i>	spruce, Colorado	357	Rhizosphaera Needle Cast	
<i>Pinus mugo</i>	pine, mugo	11	Pine Wilt	
<i>Pinus nigra</i>	pine, Austrian	149	Pine Wilt	
<i>Pinus resinosa</i>	pine, red	70	Pine Wilt	
<i>Pinus strobus</i>	pine, eastern white	913	Dothistroma Needle Blight, Pine Wilt, Diplodia Tip Blight and Canker	
<i>Pinus sylvestris</i>	pine, Scotch	72	Pine Wilt	
<i>Platanus occidentalis</i>	sycamore, American	1,167	ALB, Anthracnose	
<i>Platanus x acerifolia</i>	planetree, London	723	ALB, JB, Anthracnose	
<i>Populus alba</i>	poplar, white	12	ALB	
<i>Populus deltoides</i>	cottonwood, eastern	379	ALB	

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<i>Populus grandidentata</i>	aspen, bigtooth	28	ALB	
<i>Populus tremuloides</i>	aspen, quaking	11	ALB	
<i>Populus x</i>	poplar, hybrid	3	ALB	
<i>Prunus spp.</i>	cherry/plum, spp.	316	JB	
<i>Pseudotsuga menziesii</i>	Douglas fir	150	Swiss Needle Cast	
<i>Pyrus calleryana</i>	pear, callery	999	Apple Scab, Fire Blight	
<i>Pyrus communis</i>	pear, common	13	Apple Scab, Fire Blight	
<i>Pyrus kikusui</i>	pear, Asian	2	Apple Scab, Fire Blight	
<i>Quercus acutissima</i>	oak, sawtooth	38	Oak Wilt, Anthracnose	
<i>Quercus alba</i>	oak, white	803	Oak Wilt, Anthracnose	
<i>Quercus bicolor</i>	oak, swamp white	1,593	Oak Wilt, Anthracnose	
<i>Quercus coccinea</i>	oak, scarlet	53	Oak Wilt, Anthracnose	
<i>Quercus imbricaria</i>	oak, shingle	96	Oak Wilt, Anthracnose	
<i>Quercus macrocarpa</i>	oak, bur	1,445	Oak Wilt, Bur Oak Blight, Anthracnose	
<i>Quercus muehlenbergii</i>	oak, chinkapin	70	Oak Wilt, Anthracnose	
<i>Quercus palustris</i>	oak, pin	529	Oak Wilt, Anthracnose	
<i>Quercus robur</i>	oak, English	66	Oak Wilt, Anthracnose	
<i>Quercus rubra</i>	oak, northern red	1,576	Oak Wilt, Anthracnose	
<i>Quercus shumardii</i>	oak, Shumard	2	Oak Wilt, Anthracnose	
<i>Quercus velutina</i>	oak, black	21	Oak Wilt, Anthracnose	
<i>Quercus x</i>	oak, hybrid	3	Oak Wilt, Anthracnose	

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<i>Rhamnus frangula</i>	buckthorn, glossy	8	Invasive, Poisonous Fruit	
<i>Robinia pseudoacacia</i>	locust, black	101	Witches Broom	
<i>Salix discolor</i>	willow, pussy	9	ALB	
<i>Salix matsudana</i>	willow, corkscrew	4	ALB	
<i>Salix nigra</i>	willow, black	12	ALB	
<i>Salix spp</i>	willow spp	4	ALB	
<i>Sorbus spp.</i>	mountain ash, spp.	3	ALB	
<i>Tilia americana</i>	linden, American	359	JB, Anthracnose	
<i>Tilia cordata</i>	linden, littleleaf	1,836	JB	
<i>Tilia tomentosa</i>	linden, silver	73	JB	
<i>Ulmus americana</i>	elm, American	335	DED (Dutch Elm Disease), ALB, Anthracnose	
<i>Ulmus pumila</i>	elm, Siberian	799	ALB, Anthracnose	
<i>Ulmus rubra</i>	elm, slippery	66	DED,ALB, Anthracnose	
<i>Ulmus spp.</i>	elm, spp.	45	ALB, Anthracnose	
<i>Ulmus thomasii</i>	elm, rock	8	DED , ALB, Anthracnose	
<i>Ulmus x</i>	elm, hybrid	958	ALB, Anthracnose	