



Department of
Environmental
Conservation

NEW YORK STATE OAK WILT MANAGEMENT PLAN

DIVISION OF LANDS AND FORESTS OAK WILT RESPONSE

2019

Andrew M. Cuomo, Governor | Basil Seggos, Commissioner



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Molly Hassett – Response and Management Coordinator, NYSDEC Division of Lands and Forests, Bureau of Invasive Species and Ecosystem Health, molly.hassett@dec.ny.gov

Kelsey McLaughlin – Oak Wilt Assistant Area Commander – Operations, NYSDEC Division of Lands and Forests, Bureau of Invasive Species and Ecosystem Health, kelsey.mclaughlin@dec.ny.gov

Rob Cole – Oak Wilt Area Commander, NYSDEC Division of Lands and Forests, Bureau of Invasive Species and Ecosystem Health, robert.cole@dec.ny.gov

Executive Summary

The New York State Department of Environmental Conservation (DEC) Division of Lands and Forests (DLF) has continued to eradicate or control oak wilt, a fungal disease that affects oak trees, since it was first detected in Glenville, NY in 2008. To prevent oak wilt from spreading in New York, DLF's Bureau of Invasive Species and Ecosystem Health has created a Statewide Management Plan to outline oak wilt detection and treatment methods.

Eradication of oak wilt infections is possible when the disease is detected early and a management response is rapidly implemented (Wilson 2005). Potentially infected trees are detected through a variety of survey activities, including aerial survey, ground survey, and public reporting. For the best success in eradicating the disease, DLF uses several management techniques, including targeted removal and root graft disruption. When eradication is not possible, and the goal is to control oak wilt, only infected trees will be removed. Additional management activities may occur based on site conditions.

New York's oak wilt management techniques are based on research by the U.S. Forest Service (USFS), as well as universities in states where the disease is more prevalent. In Minnesota, studies have demonstrated that root graft disruption stops the belowground spread of the oak wilt fungus on >80 percent of sites when used with other management techniques such as targeted removals (Juzwik et al. 2010).

DLF staff are conducting research to better determine how oak wilt behaves in New York. A photo monitoring study has been developed to capture the progression of oak wilt symptoms. Sap and bark beetle trapping to determine the population densities of different species at specific times of year and the effects of temperature on those populations, will help in confirming the high-risk period for disease spread through these insects. DLF staff will continue to collaborate with USFS pathologists and university researchers to exchange research results and new information about the disease.

In addition, DLF staff continue to increase public awareness of oak wilt by conducting outreach on the symptoms of the disease, how to report it, and ways to prevent its spread, including pruning oaks at the right time of year and following the New York State firewood regulation.

Background

Oak wilt was first identified in Wisconsin in 1942 (Wilson and Lester 2002) and has caused extensive damage in several upper Midwest states and Texas. In Texas, where the disease has been established for years, it has caused hundreds of millions of dollars in economic losses (Wilson and Lester 2002). If this fungus spreads throughout New York, where oaks are associated with \$55 million of income for private landowners annually (Crawford 2016) and account for 20 percent of the state's log production (Crawford 2014), economic losses would be substantial. In addition, landowners, municipalities, and utilities would be burdened with the costs of removing infected trees from rights of way and other areas where they would pose a hazard.

Oak wilt is caused by *Bretziella fagacearum*, a fungus that develops in the xylem (water-carrying cells) of trees. The fungus blocks the flow of water through the tree, causing the leaves to wilt and fall off, killing the tree. All oaks are susceptible to the fungus, but red group oaks (with pointed leaf tips) can die within one to six weeks while white group oaks (with rounded leaf tips) may take years to succumb.

Transmission of oak wilt occurs in two ways: above ground by beetles; and below ground through root grafts (connected tree roots). Fungal spore mats (reproductive structures) form just under the bark of infected red group oaks the year after they are infected. Sap beetles that are attracted to the sweet smell

emitted by spore mats and to fresh, sap-oozing tree wounds—such as those caused by pruning—and bark beetles that feed on dead and dying trees can pick up fungal spores as they crawl around and then carry the spores to uninfected trees, sometimes miles away. Once an oak is infected, the fungus can spread to other trees through root grafts. Infected firewood and other wood materials also pose a threat because they can harbor the fungus and/or beetles that can spread the disease.

DEC works to detect potentially infected trees through aerial survey, ground survey, and public reporting. When a surveyor determines a tree is likely infected, a sample is taken and sent to the Cornell Plant Disease Diagnostic Clinic for testing. Areas that have at least one sample-confirmed infected tree within the past six years are called infection centers (an infection center includes all infected trees within a half mile of each other). DLF will determine if an infection center is a good candidate for eradication depending on its characteristics, such as its proximity to and the number of nearby infection centers. If eradication is not possible, DEC removes infected trees and works to control the spread of oak wilt.

New York's first oak wilt infection was reported in Glenville in 2008. Since then, oak wilt has been confirmed in Brooklyn, Islip, Riverhead, Southold, Canandaigua, and most recently in South Bristol (See Appendix A, Figure 1).

Oak Wilt Response

The goal of DLF's Oak Wilt Response Plan is to prevent, detect, and manage oak wilt in New York to protect native habitats and rare ecosystems. The Response Plan includes the following strategies:

1. Detect symptomatic oak trees;
2. Collect and test samples from potentially infected oaks;
3. Establish regulatory areas;
4. Identify and conduct oak wilt management activities;
5. Inform the public about oak wilt and how to prevent its spread; and
6. Conduct research to guide management decisions.

To effectively manage the response to oak wilt, DLF established an Incident Command Structure in the affected DEC regions to apply consistent implementation of the response, delineate roles and responsibilities, and effectively disseminate information. An additional Area Command was established in Central Office (Albany, NY) to provide financial, planning, operational, and communication support (See Appendix B, Figure 2).

Strategy 1 – Detect Symptomatic Oak Trees

Monitoring and surveying efforts will continue at infection sites until no additional oak wilt infections are detected for at least five years.

Aerial surveys

DLF staff conduct yearly statewide aerial survey flights at an altitude of 1200 feet to monitor for a variety of native and invasive pests and diseases, including oak wilt. Surveys specifically for oak wilt are conducted in helicopters at an altitude of approximately 300 feet. These more-focused aerial surveys look for expansions

within two miles of known infection sites and new infections in nearby high-risk areas with large oak populations. Flights are done in mid-July and early September, when oak wilt symptoms are more easily distinguished from healthy, green, non-infected oaks.

Ground surveys

Symptomatic trees mapped during aerial flights will be visited by ground surveyors to check for alternative causes for the symptoms identified, and to determine the need for oak wilt testing.

Ground surveys will also be used to:

- Monitor trees adjacent to where infected trees were removed in areas targeted for management or eradication;
- Look for symptomatic trees in neighborhoods with infection sites;
- Look for symptomatic trees along roads in high-risk areas within and outside of protective zones/quarantine districts (see Strategy 3); and
- Check symptomatic trees reported by the public.

Reports from the public

The public is encouraged to report trees displaying oak wilt symptoms between June and October to DEC by calling the Forest Health information line at 1-866-650-0652 or emailing foresthealth@dec.ny.gov. Photos of the symptomatic leaves and/or trees are requested to help DLF staff determine if a site visit and ground survey are warranted. Public meetings and stakeholder trainings will be used to provide information on the symptoms of oak wilt.

Strategy 2 – Collect and Test Samples from Potentially Infected Oaks

DLF staff will collect samples from potentially infected trees during the growing season, primarily in the summer months. DLF sends samples to the Cornell Plant Disease Diagnostic Clinic in Ithaca, NY, to be tested for the oak wilt fungus using culturing, PCR analysis, and DNA sequencing. Samples may be sent for testing by the public, environmental organizations, and others, but any samples that test positive for oak wilt will require a second sampling by DLF or the New York State Department of Agriculture and Markets (NYSDAM) for confirmation. If oak wilt is confirmed, DLF will implement management tactics to eradicate or control oak wilt. Both response options will include establishing a protective zone and a quarantine district.

Strategy 3 – Establish Regulatory Areas

Quarantine districts will be established in areas with confirmed oak wilt infection sites to prevent potentially infected material from moving out of the regulated area, limiting the chance for the disease to spread. Restrictions include:

- Oak wood and firewood (less than 29 inches long) of any species may not be moved out of a quarantine district from April 1 to July 31.
 - Non-oak wood must be in large, identifiable pieces (greater than 29 inches long) in order to leave a quarantine district.
- Oak wood and firewood of any species may be moved from August 1 to March 31 with a limited transportation permit issued by DLF.
- Oak nursery stock more than two years old may not be moved without a permit issued by NYSDAM's Division of Plant Industry.

The following criteria will be used to determine the extent of a quarantine district:

- When there is only one infection center per town, DLF will establish a neighborhood quarantine district (approximately a .5 mile radius from the infected tree).
- When there would be two or more quarantine districts per town, DLF will establish a town quarantine district.
 - Infection centers require separate quarantine districts if there is more than a mile between the infected trees.
 - The infection center must fall within the town for a quarantine district to count toward the town's total quarantine districts.
- A county quarantine district will be established when there would be quarantine districts in four or more towns.

DLF will also consider the square mileage of the infection site and treatment area, the length of time that has passed since an infected tree was detected in an infection center, and the size of the associated town or county when determining the type of quarantine district that will be established. Quarantine district designations will be adjusted as needed or lifted entirely after oak wilt has been successfully eradicated.

Strategy 4 – Identify and Conduct Oak Wilt Management Activities

Protective zones are used internally to identify where management activities will be conducted to either eradicate or control oak wilt, and often share a boundary with quarantine districts. In counties where there are fewer than four infection centers, DLF will work to eradicate the disease. In counties where there are four or more infection centers, the possibility of eradication is less likely, so the goal will be control. As of January 2019, the Brooklyn,

Canandaigua, South Bristol, and Glenville infection centers will be managed for eradication, and the Suffolk County infection centers will be controlled.

Site management plan

Local spread of oak wilt is dependent on characteristics specific to each location, so regardless of the type of management, each infection center will have a site management

plan. The site management plan identifies soil type, root graft distance, tree density, utilities, and other factors that need to be considered when planning management activities. These factors help determine if a buffer of healthy trees should be removed, if root disruption will be used, and if replanting is necessary. Any trees removed for management are chipped, incinerated, or treated to prevent them from spreading oak wilt.

Table 1. Root grafting distances, based on a 99% confidence level (Bruhn et al., 1992)			
Combined DBH* (in.)	Inter tree root graft distances (feet) for soil types		
	Sandy soil (ft)	Loamy sand soil (ft)	Sandy loam/loam soil (ft)
2	5.1	4.1	2.9
4	10.2	8.1	6.0
6	15.3	12.2	8.9
8	20.4	16.3	11.8
10	25.5	20.3	14.8
12	30.6	24.4	17.7
14	35.7	28.5	20.6
16	40.8	32.5	23.7
18	46.0	36.6	26.6
20	51.1	40.6	29.5
22	56.2	44.7	32.5
24	61.3	48.8	35.5
26	66.4	52.8	38.5
28	71.5	56.9	41.4
30	76.6	61	44.3
32	81.7	65	47.4
34	86.8	69.1	50.3
36	91.9	73.2	53.2
38	97.0	77.2	56.2
40	102.1	81.3	59.1
42	107.2	85.4	62.0
44	112.3	89.4	65.1
46	117.4	93.5	68.0
48	122.5	97.5	70.9
50	127.6	101.6	74.0

*Combined DBH: Diameter at breast height of an infected oak tree and a nearby oak it may be root-grafted to

Eradication activities

All infected trees will be removed, as well as any potentially infected oak trees within the root graft zone (the distance within which an infected oak's roots may graft with those of nearby oaks), unless otherwise noted in the site management plan. The extent of a root graft zone varies by tree size and soil type (Table 1, page 5). All stumps will be treated with herbicide to kill the root system quickly and prevent new growth. They will be monitored for at least one growing season to verify that the roots have died, and if the stumps resprout, herbicide will be reapplied.

DLF may remove additional uninfected trees outside of the root graft zone to create a buffer to ensure all trees potentially infected with oak wilt are removed. Some factors that may warrant the establishment of a buffer are: sandy soils, a high number of infected trees, and inability to use root graft disruption.

Root graft disruption is a management technique that severs root connections between non-symptomatic oaks within the root graft zone and neighboring oaks outside of the root graft zone to further prevent underground transmission of the fungus (Figure 3). The use of root graft disruptions can reduce the number of trees that need to be removed but depends on site conditions, as they are difficult to establish in rocky soils or urban and suburban settings where houses, roads, fences, and other structures are present. When they are established, one or two disruption lines are cut four to five feet deep along the root graft zone boundary using trenching equipment, cutting tools, etc. In addition to severing roots, a root graft barrier, such as heavy landscape fabric, is often installed to help prevent the severed roots from growing back into infected soils. When root graft disruption is conducted, it is done before infected trees are removed from the root graft zone. The cutting of infected trees can trigger rapid fungus movement through the roots, so it is important to have a trench in place to prevent the spread of the disease.

Control activities

When the goal is only to control an infection site, all infected trees are removed, and the stumps are treated with herbicide. Additional management activities, such as the removal of root grafted trees, establishment of a buffer, or root graft disruption, may be implemented on a case-by-case basis. Activities not included in DLF's site management plans that landowners choose to do on their own will be at the landowners' expense.

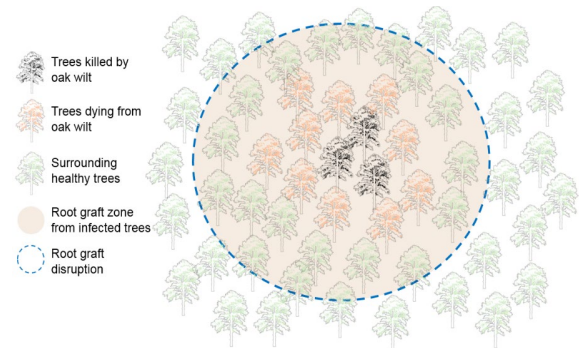


Figure 3. Diagram of root graft zone and root graft disruption in relation to infected and surrounding trees

Replanting

Landowners that have oaks removed from their property may receive a two-inch-diameter tree for replanting and can choose from a variety of non-oak species. Oak trees should not be planted in infection centers due to the possibility of infection via root grafts.

Strategy 5 – Inform the Public About Oak Wilt and How to Prevent Its Spread

DLF staff will conduct outreach on ways to prevent the spread of oak wilt, including pruning oak trees at the right time of year and following the New York State firewood regulation.

Oaks should not be pruned from April through July, when the insects that transmit the oak wilt fungus are most active (Table 2, page 7, adapted from Juzwik et al., 2018). If oaks are pruned or damaged during this time, paint

should immediately be applied to pruning wounds, stump surfaces of felled trees, and any other damaged areas. This creates a barrier that prevents spores, carried to the tree by insects, from getting into the wounds. Caution should also be used during August and September, when new infections are less likely, but still possible. Cuts or wounds should still be

immediately covered with paint. Education efforts for pruning best management practices will be focused on landowners, arborists, loggers, and landscapers. Staff will present at professional meetings, provide trainings and workshops, and create outreach materials, such as handouts and billboards, to disseminate this information.

Table 2. Risk of oak wilt fungus spread by sap beetles and advisory comments by time of year (adapted from Juzwik et al., 2018)

Time of year	Risk of insect spread	Advisory notes
April–July	High	Don't wound, prune, or fell oaks during this time. Immediately cover any unavoidable wounds with paint or shellac.
August–September	Low	Depending on weather conditions and insect populations, infections are less likely. Immediately cover pruning wounds, stump surfaces of felled trees, and other wounds with paint.
October–March	Safe	Fungal pathogens and insect vectors are inactive.

Note: March was originally considered part of the high-risk time frame but was adjusted to “Safe” after trapping and research determined there was no risk of spread from beetles.

Oak wilt is widely believed to have been introduced to New York through the movement of infected firewood. Moving untreated firewood can unintentionally move oak wilt spore mats, and therefore the disease, to new areas. DEC's firewood regulation states that untreated firewood cannot enter New York from any other state and New York-grown, untreated firewood cannot be moved more than 50 miles from its origin or source. The additional restrictions of the quarantine districts further protect against oak wilt spreading from known infection sites.

Strategy 6 – Conduct Research to Guide Management Decisions

Symptom monitoring

Even though oak wilt has been discovered in several locations across New York, the progression of the disease has not been documented. To capture the visual symptoms as they appear, DLF will take photographs throughout the growing season of trees near control sites that have a high probability of

becoming infected. Photos will be taken of the same trees from the same angles on a biweekly basis. These photos will then be combined to create a time lapse of the changes that occur, if any. This will help DLF's Oak Wilt Response Team better understand when and where (on the tree) infected oaks begin showing symptoms, which will help improve detection efforts.

Beetle trapping

In the central United States, sap beetles (Coleoptera: Nitidulidae) have been the primary insects that transport the oak wilt fungus, and oak bark beetles (*Pseudopityophthorus minutissimus*) have been identified as a minor vector. The activity of these beetles in New York had not been well documented until DLF staff began their trapping program in 2017. Funnel traps are deployed from April through September to determine which beetle species are present and when they are most active. Knowing the diversity and seasonal distribution of insects that may transport oak wilt will help guide future management decisions and education.

Alternative Management Strategies

Soil treatment

Soils from a site with oak wilt can be treated with fumigation or solarization to try to remove the oak wilt fungus. During fumigation, infected soils are treated with fungicides in a gaseous form. Soil solarization involves trapping the sun's radiant energy using clear plastic to heat infected soils to high temperatures, which kills the fungus. Both techniques result in a significant amount of soil disturbance, which is not usually preferred by urban and suburban landowners. For this reason, DLF has not implemented soil treatments and has instead prohibited the planting of oak within the root graft zone.

Fungicide

The literature on oak wilt and the effectiveness of fungicides is not definitive. Some studies have shown that they may be effective in treating and preventing oak wilt in some species of oaks, while other studies have shown that fungicides only mask the symptoms. Since masking the symptoms makes detection more difficult and potentially delays treatment, DLF has chosen not to use this management technique until its effectiveness is clearer.

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Appendix A

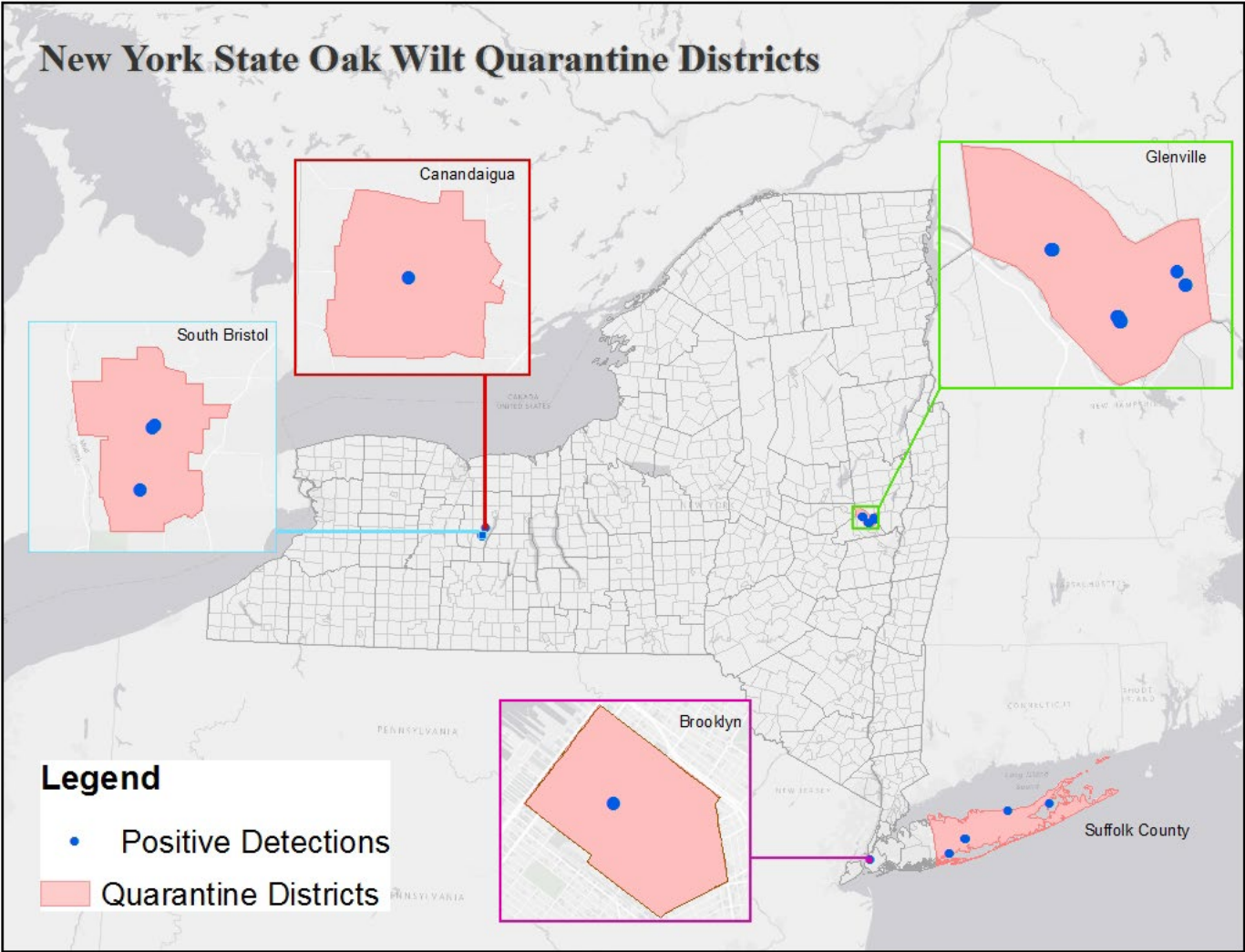


Figure 1. Map showing oak wilt detections and quarantine districts in New York

Appendix B

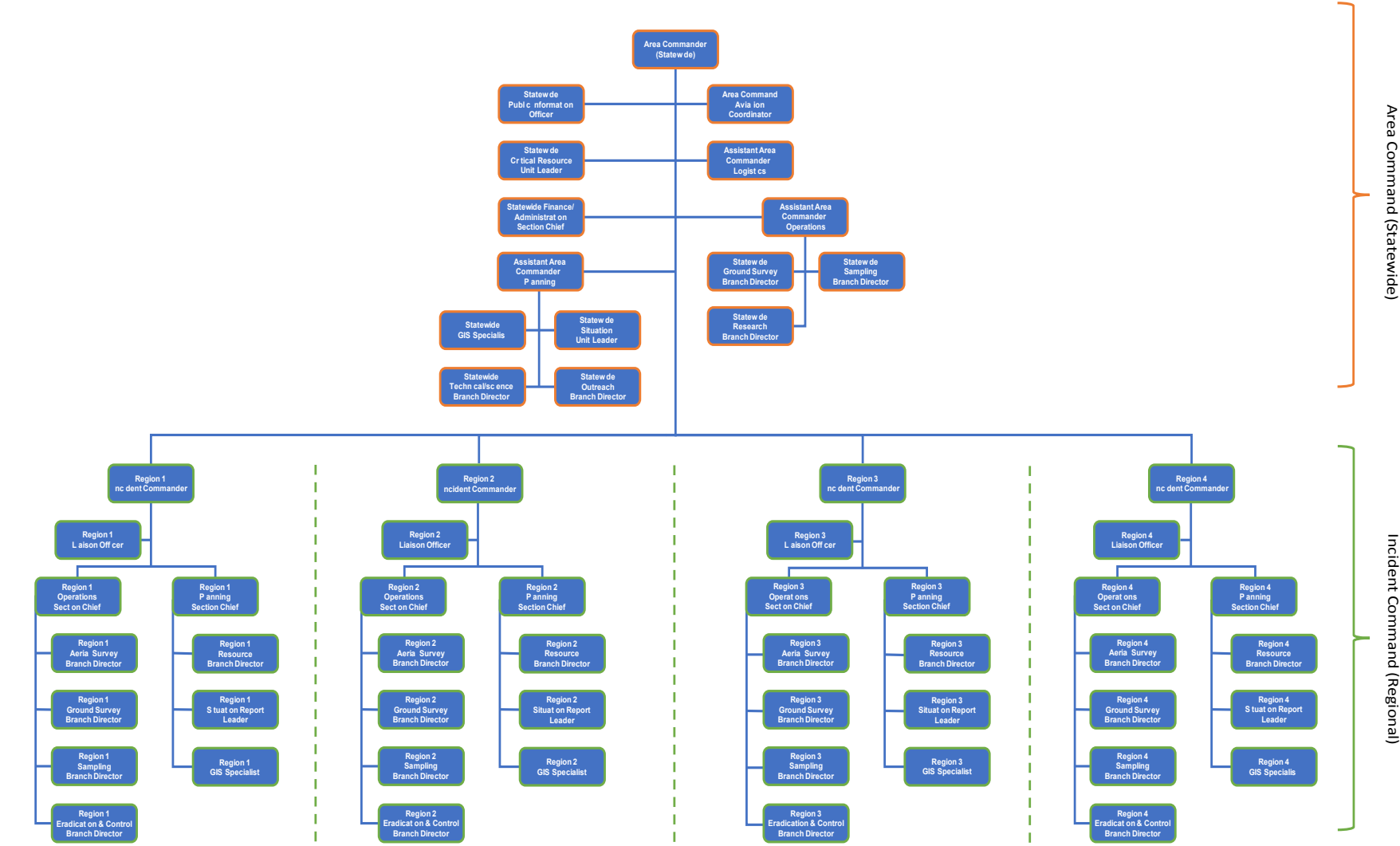


Figure 2. The Area Command System used for oak wilt response in 2019



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