



PORTLAND PARKS & RECREATION

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Urban Forestry Elm Report

Background, Findings, & Recommendations

October 2021

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Cover Photo: American Elm in the North Park Blocks.

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Background

Dutch elm disease (DED) is a lethal, highly communicable disease affecting many members of the genus *Ulmus*, caused by the fungal pathogens *Ophiostoma ulmi* and *Ophiostoma novo-ulmi*. These fungi invade the vascular tissue of elms and prohibit water movement in the tree. An infected elm tree can die within weeks of showing the first symptoms of DED.

Dutch elm disease was first discovered in Europe in 1918, but the causal fungus was not identified until 1922 in the Netherlands. It was given the name Dutch elm disease in honor of the Dutch scientists who isolated the fungus, Bea Schwarz and Christine Buisman. The origin of DED is hypothesized to be in Asia and Asian elm species such as *U. parvifolia* and *U. pumila* are known to be resistant to DED.

In 1930, DED appeared in Ohio, reaching the US via shipping crates made of infected elm wood. The disease hit the east coast hard, causing widespread elm fatalities. By 1972, the European bark beetle, the primary DED vector, was found in all but four states. The first case of DED in Oregon was discovered in 1973 in Ontario, likely transmitted from Boise, Idaho, along the I-84 corridor. A single case was discovered in Portland's Overlook Park in 1977. The elm was quickly removed, leaving no further outbreaks of DED in western Oregon until 1986, when a dual outbreak occurred in Eugene and Portland. This second case of DED in Portland was discovered at East Burnside St & Cesar E Chavez Blvd. Since then, Urban Forestry's elm monitoring program has worked to keep the spread of DED under control throughout the city.

There are three ways the DED fungus spreads: bark beetles, root grafting, and human activity. Both the native elm bark beetle, *Hylurgopinus rufipes*, and the smaller European elm bark beetle, *Scolytus multistriatus*, are DED vectors. Elm bark beetles breed and overwinter under the bark of dead or declining elms. In infected trees, spores of the DED fungus stick to the backs of bark beetles and are transported to new elms when beetles emerge in the spring and fly off to feed on healthy elms. The fungus spreads most rapidly through root grafts, which form between trees growing close together. Human activity, such as transporting elm wood infested with bark beetles, also spreads the disease.

The fungus kills trees by invading and occluding the infected tree's xylem (vascular tissue), preventing water conduction and ultimately resulting in death. Visual symptoms of DED include localized leaf wilt and browning (termed *flagging*) and sapwood discoloration (termed *streaking*).

Infection can be prevented with commercial fungicides. There are several fungicides currently on the market, the most commonly used being Arbotect. The fungicides vary in their application systems and price ranges, but their mechanisms are similar. Fungicides help prevent DED infection by disabling fungal spores when infected beetles feed on an elm. Fungicides are not 100 percent effective at preventing DED. However, a dedicated community with clear goals can take steps to slow the spread of DED in affected urban environments.

Portland's Elm Strategy

On June 10, 1987, Portland City Council passed Ordinance No. 159750, declaring Dutch elm disease-infected trees a nuisance and declaring a state of emergency for Portland's elm canopy. The ordinance specifies that it is unlawful for elm trees infected with DED to remain on any lot or parcel of land in the city. In 2011, City Council codified this ordinance under Title 11 Trees, which was then implemented in January 2015. In line with this ordinance, Urban Forestry has an aggressive, five-pronged approach to prevent DED and contain elms that are already infected. With approximately 2,500 susceptible elms throughout the city, DED would have a catastrophic impact on Portland's urban forest if allowed to progress unchecked.

Monitoring

To help ensure healthy elm populations, each summer Urban Forestry hires an elm monitor to inspect and assess elm trees on public and private property, across the city. The elm monitor looks for the visual symptoms of Dutch elm disease, such as flagging. The monitor samples—or directs the Urban Forestry crew to sample—elm trees that show possible DED symptoms. When a sample shows symptoms of DED, such as streaking, it is sent to the Oregon State University Plant Pathology Clinic for cultivation and identification. If the lab culture is identified as the Dutch elm disease fungus, steps are taken to remove the tree. Elms that do not present signs of DED, but decline over the season, are reviewed by Urban Forestry to determine if the tree should be removed.

Removal

Rapid removal is important to decrease the probability of spread to adjacent trees via root grafts. In addition, swift removal of infected elms will eliminate a local source of elm bark beetles by removing the elm prior to beetle emergence. At one time, Urban Forestry removed DED-infected elms in the public right-of-way at no cost to adjacent property owners. As of July 1st, 2017, Urban Forestry's policy became consistent with Portland's Tree Code regarding the responsibility of adjacent property owner maintenance of street trees. As with all other street tree issues, the adjacent property owner is responsible for the removal of DED-infected trees in the associated right-of-way. Urban Forestry continues to provide free sampling for all elms exhibiting DED symptoms. For DED-infected elms on private property, the property owner is required to remove the tree within 30 days of notification, at their own expense. After removal, stumps must be ground to prevent infection via root grafts, and the property owner must also replant.

Sanitation

All elm wood must be disposed of in a controlled manner by chipping, de-barking, or burying so as not to provide habitat for, and reduce the sources of, elm bark beetles. All tools in contact with infected elm trees are disinfected before and after use to prevent contamination with fungal spores. Portland also observes a moratorium on pruning elms between April 15th and October 15th each year. Bark beetles are active during the spring

and summer months and are attracted to open wound sites left by pruning or injury. Deadwood pruning is conducted during the winter months to reduce sites that could harbor bark beetles.

Inoculation

Urban Forestry inoculates approximately 140 elms per year with the fungicide Arbotect (Thiabendazole hypophosphite). Significant elms in Portland's parks and public spaces are targeted and put into a three-year treatment rotation. Though Urban Forestry must permit and approve inoculations in the public right-of-way, the cost, coordination, and execution of neighborhood inoculations rests entirely on the property owners and their private contractor of choice.

Education and Outreach

The elm monitor serves as a liaison between Urban Forestry and the community. In this capacity, the elm monitor offers homeowners and neighbors educational resources to increase public awareness of Dutch elm disease. Working with community groups is also an important way to support neighborhood engagement and stewardship of elms. Continuing to build relationships with neighbors in areas that infrequently lose elms to DED also eases the acceptance of the removal process when it does occur.



Elm flagging at Eastmoreland Golf Course.

2021 Dutch Elm Disease Findings

To capture the scope of the elm protection program's monitoring efforts, all elm removals that were initiated by monitoring efforts are captured in this report, even though not all removed elms tested positive for Dutch elm disease. This is consistent with historic elm reports. However, terminology referring to removals has been updated to better reflect the scope of the program.

A total of 36 elms were removed due to elm monitoring efforts in 2021. Of these, only 13 elms were removed due to testing positive for DED. The remaining elms were removed due to showing classic DED symptoms while being adjacent to DED-positive elms, or due to conditions that deemed the tree dead or dying. With an average of 39 DED removals per year since 1977, Portland experienced a slightly below average number of elm removals in 2021 (Figure 1).

Geographic extent

Historically, Portland was divided into five geographic sectors: North, Northeast, Southeast, Northwest, and Southwest Portland. Beginning in 2020, City Council designated a sixth sector: South Portland. This year, five of Portland's sextants were impacted by elm removals. Although DED loss has been documented in the South Portland area in the past (when considered Southwest Portland), no DED removals occurred in this newly designated sextant in 2021 as well as in North and Northwest Portland. Of note, there were three neighborhoods impacted with elm removals this year which hadn't seen removals for three or more previous years Alameda in Northeast, had one DED-suspected removal, the Southwest Hills neighborhood had one confirmed DED removal, and Sunnyside in Southeast had two DED confirmed removals. .

Altogether, Southeast Portland lost 18 elms to Dutch elm disease, nine elm trees confirmed DED-positive and nine to DED-suspected decline (Appendix A, B). This sextant typically has the greatest number of elm removals and 2021 resulted in one less the previous year's total of ten.

- The Eastmoreland neighborhood, a historical DED hotspot, had five removals directly attributed to DED (Appendix E).
- The Hosford-Abernathy Neighborhood District, which includes Ladd's Addition, home to many mature elms, had two DED-positive elms removed. (Appendix D).
- In Sellwood-Moreland, a single positive case of DED resulted in removal, similar to 2020.
- The Sunnyside neighborhood had one DED confirmed removal.
- Nine additional elms were removed in Southeast Portland due to DED-suspected decline.

Southwest Portland lost one elm attributable to a DED confirmation, a much lower figure to the nine removed in 2019 and 2018. Additionally, six more elms were removed due to DED-suspected decline.

- Southwest Hills was home to the sole DED-positive elm in in the Southwest sextant.
- Six additional elms were removed in Southwest Portland due to DED- suspected decline in the neighborhoods of Goose Hollow (2), Downtown (3), and South Portland (1).
- One elm along SW 1st Ave in a known DED hotspot was removed due to DED-suspected decline. An adjacent tree at same property was removed in 2020 due to confirmed DED.

Three DED-positive removals this year in Northeast Portland continues a downward trend of fewer removals year after year, as ten removals occurred in 2020 and 13 in 2019. Six more elms were removed due to DED-suspected decline.

- Wilshire Park in the Beaumont-Wilshire neighborhood experienced the removal of a park elm due to DED. The park had lost an elm to DED as recently as 2019.
- The Alameda neighborhood saw one removal, the first DED removal since 2018.
- Laurelhurst, another known hotspot, had only one DED confirmed elm.
- Six elms suspected of DED-suspected decline were removed in Northeast Portland in the neighborhoods of Grant Park, King and Laurelhurst, each with two.

Historical averages

The number of elms removed in 2021 is low compared to the last decade of elm removals (Figure 1). Portland's elm mortality rate remains low and relatively stable. Most of this year's elm removals occurred in Southeast neighborhoods, Northeast neighborhoods, consistent with past trends (Figure 2).

- Since DED appeared in the city in 1977, a total of 1,468 elm trees have been removed in Portland due to elm monitoring efforts (Appendix C).
- Assuming that the elm population was about 3,700 in 1986, around 40 percent of the elm population has been removed, an average of approximately 1 percent of the elm population annually.
- A majority of the elms removed in Portland are replanted with hybrid elms that are resistant to DED.

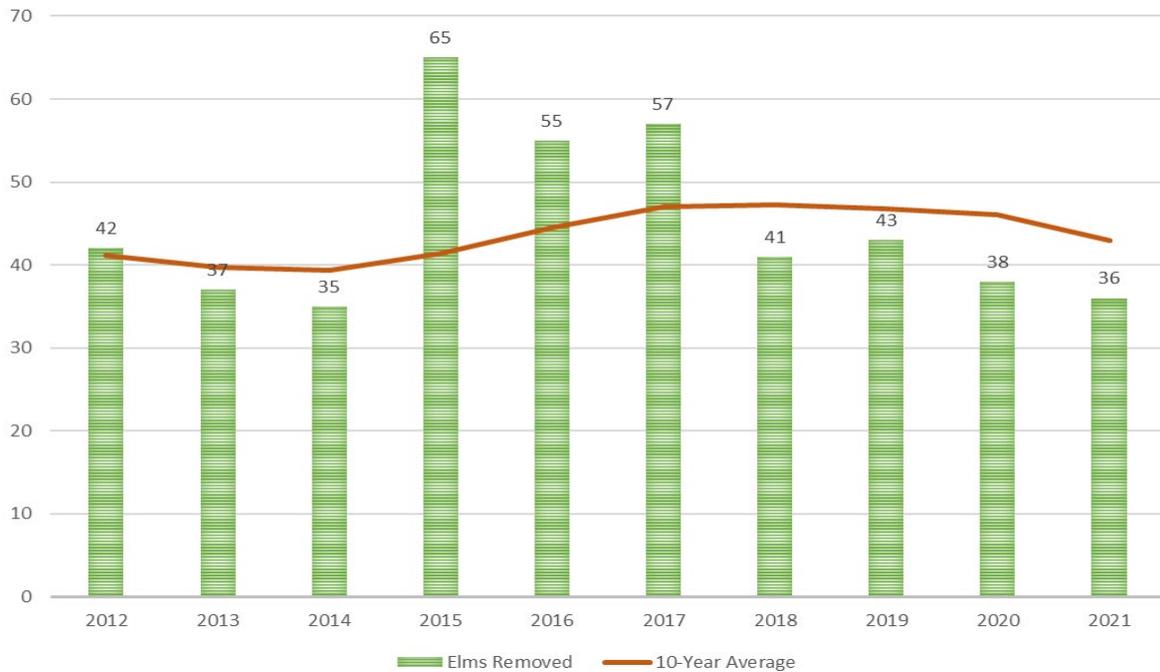


Figure 1: Number of elms removed annually due to monitoring efforts (2012-2021)

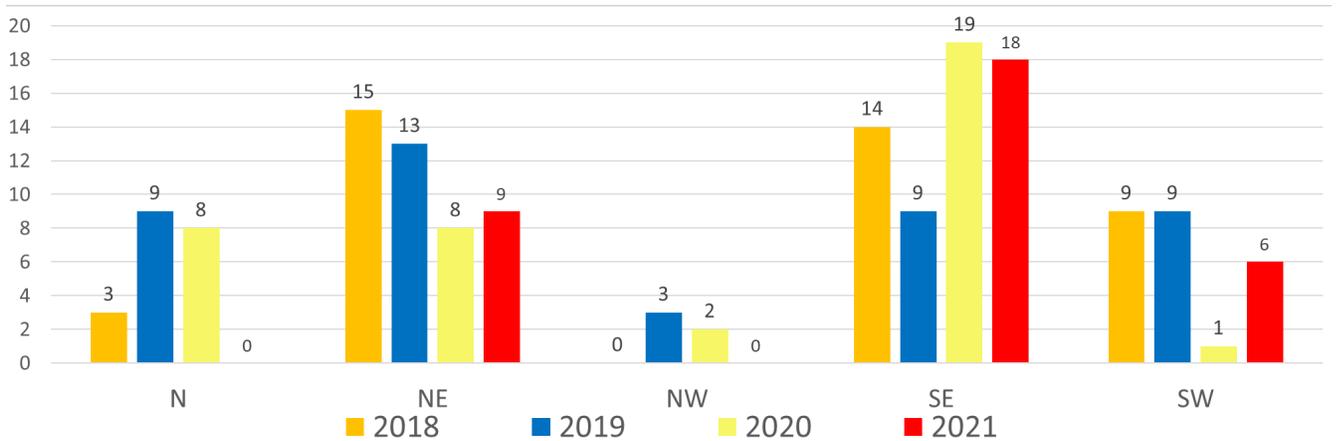


Figure 2: Number of elms removed each year due to DED monitoring per city sector over the last ten years (2018-2021)

Testing

Urban Forestry sent 54 samples to the Oregon State University Plant Pathology Clinic to be tested for DED. Samples were only sent to the lab when streaking was found under the bark of examined branches.

- Thirteen samples came back positive for the DED fungus (*Ophiostoma ulmi*), for a positive rate of 24 percent.
- Though many samples came back negative, ten DED-negative elms were ultimately removed due to the condition of the trees as dead or dying.
- Additionally, nine elms were removed without the possibility of DED testing due to a lack of live woody tissue to sample for testing or homeowner-initiated removal applications for DED-suspected elms.

Removals

Urban Forestry crews remove elms in public parks that test positive for DED or have DED-like symptoms and are in severe decline. Most of the elms removed during 2021, 13 DED-positive and 23 in DED-suspected decline, were in the 30.1-40-inch DBH range which is consistent with previous years' trends (Figure 3 and 4). Right-of-way elms that tested DED-positive, or fit the City's criteria for dead, dying, or dangerous, were required to be removed by the adjacent property owner.

- Urban Forestry crews removed one tree on park property, a DED-positive elm in Wilshire Park.
- At Duniway Elementary School in Eastmoreland, a Portland Public School, two elms were removed from the property along SE Lambert St.
- Adjacent property owners removed ten DED-positive elms in the right-of-way, and a total of twenty-three elms in the right-of-way were removed for DED-suspected decline after they were determined to be dead, dying, or dangerous.

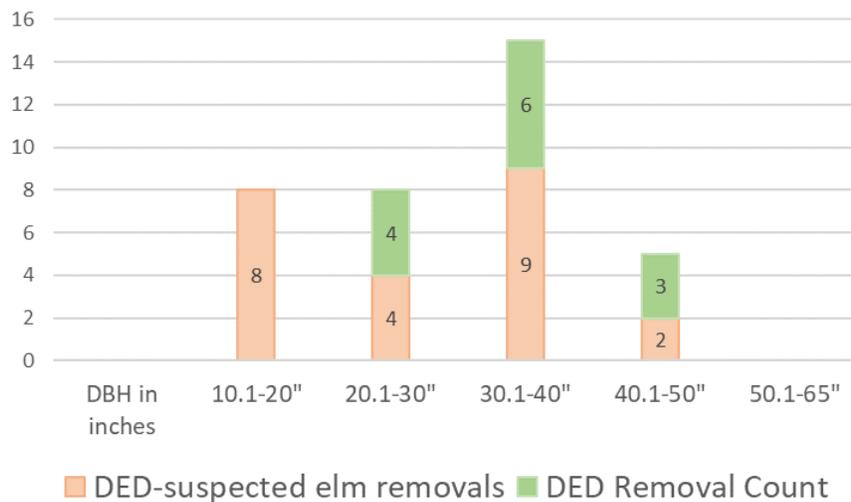


Figure 3: Number of elms removed due to monitoring efforts by DBH size class, in inches (2021)

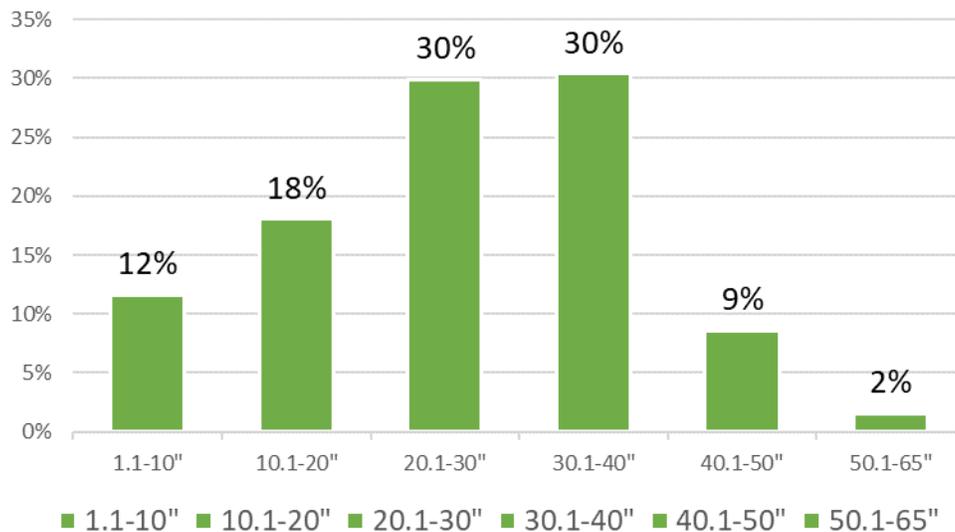


Figure 4: Percent of elms removed due to monitoring efforts by DBH size class, in inches (1991-2021)

Elm Inoculations

Urban Forestry inoculated 119 elms in ten locations with the Arbotect macroinjection technique in the summer of 2021 (Table 1). This is in keeping with the three-year rotation of inoculation. Additionally, other private community members inoculated their elms contracting with various local tree care providers.

Table 1: Location and number of elms treated with Arbotect (Thiabendazole) fungicide in 2021 by Urban Forestry

Location	Number of Elms
Burrell Elm @ YMCA	1
Eastmoreland Golf Course	18
Normandale Park	9
Plaza Blocks	20
Wallace Park	18
North Park Block 5	10
South Park Block 6	11
South Park Block 7	11
South Park Block 8	11
Right-of-way Heritage Trees	10
Total	119

Outreach

The elm monitor talked with many homeowners about their elms, as well as several neighbors about the DED activity in their neighborhood. It was standard practice to knock on the door of any property being sampled when the elm monitor did the initial inspection. This helped residents prepare for activity around their elm(s) and the potential for removal. In several instances, the removal posting initiated conversations with residents about DED in their neighborhood, and Urban Forestry's policy to post a sign on the condemned elms seems to contribute well to raising public awareness of the disease.



Example of signage posted prior to elm removal

Elm Inventory

In 2016, Urban Forestry completed a multi-year update of the elm inventory. The prior inventory had not been updated since 2001. An inventory of elms increases the efficiency of elm monitoring as well as enhances accuracy in data and reports. It also ensures that DED monitoring is thorough and complete. Data sources for the updated inventory include Portland's Street Tree Inventory and data collected by the elm monitor on Park property trees (2014) and private property trees (2015-2016). The resulting database is updated as elms get sampled, removed, or planted.



Elm inventoried by volunteers during Portland's street tree inventory in 2016

The elm inventory, as of 2021, consists of 4,956 total elms, approximately half of which are resistant cultivars and species (Table 2).

Table 2: Elm inventory species composition (2021)

DED Susceptible Species		DED Resistant Species	
American	2,418	Hybrid	2,054
Camperdown	74	Siberian	298
Other susceptible	71	Other non-susceptible	41
Total	2,563	52%	2,393
			48%

The updated elm inventory reveals interesting distribution patterns in the size/age class of elms and resistance to DED. The population of DED-resistant elms is comprised mostly of smaller-sized trees, between 0-3 inches DBH (Figure 5). This pattern is likely driven by the continuous addition, via planting, of young DED-resistant elm cultivars. This contrasts with the size class distribution of DED-susceptible elms, in which majority of elms are older, large size trees (Figure 6).

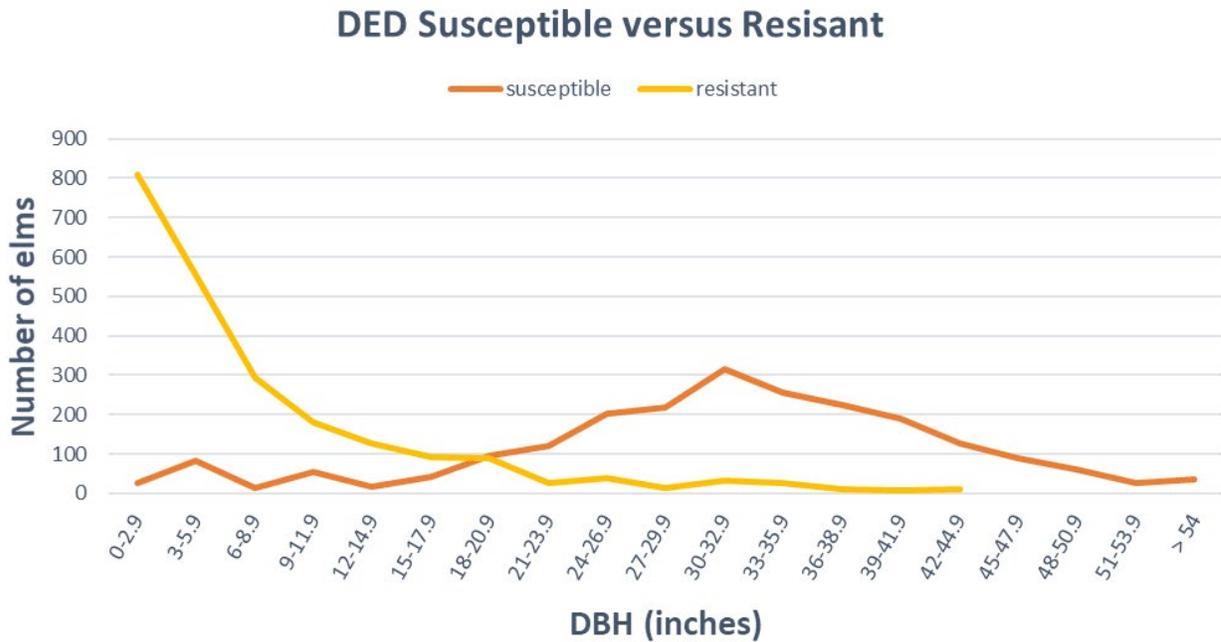


Figure 5: Size class distribution of DED-susceptible elms versus DED-resistant elms

As noted previously, the loss of elms in 2021 was relatively low, at approximately 0.79 percent elms lost per year (Figure 6). Though the most recent elm loss is slightly lower than one percent, there is not a clear downward trend in the percentage of elms removed per year. There does appear to be a spatial component to elm losses and removals (Appendices C, D, E). In neighborhoods with high concentrations of elms (Appendices D, E), elm removals appear to progress along the same blocks from one year to the next. The majority of all elm species, approximately 69 percent, are located in the public right-of-way (Figure 7).

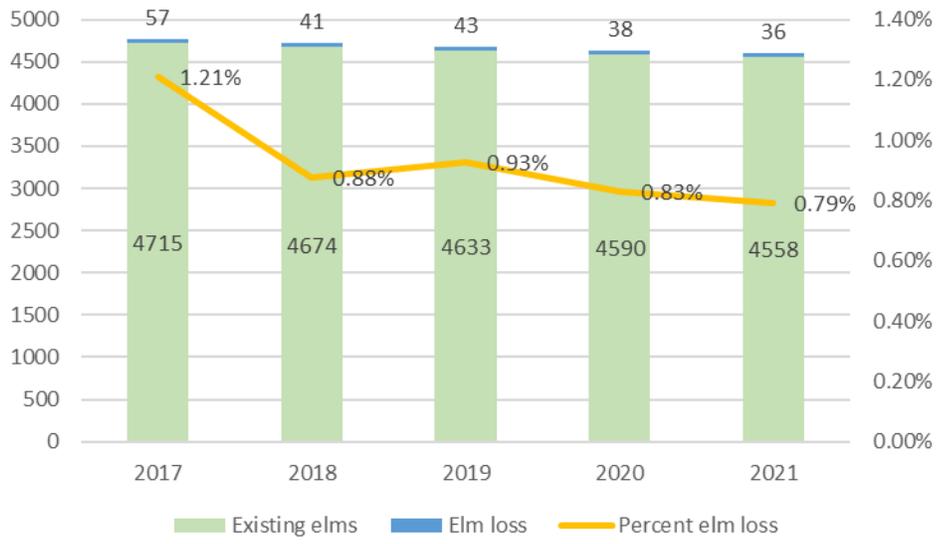


Figure 6: Elm population and loss 2017-2021

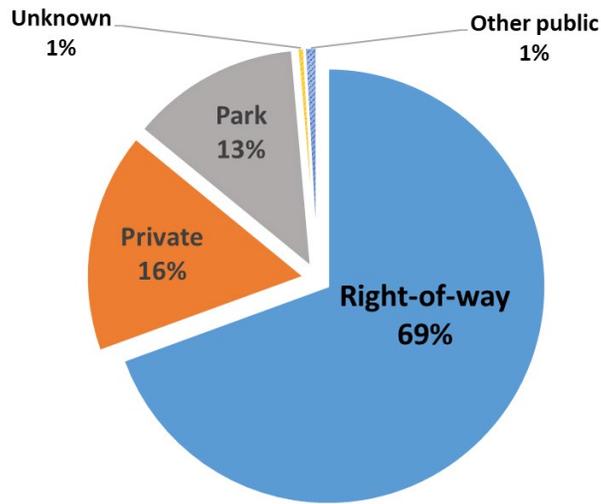


Figure 7: Proportion of elm population by property type (N=4905)

Program Challenges & Recommendations

Through the efforts of Urban Forestry's DED management program, the annual loss of elms remains steady at around one percent. Nonetheless, the continued output of resources to maintain these trees requires continued evaluation. The following challenges and recommendations should be considered as the program moves forward.

Policy & Equity of Services

In 2017, as a result of a budget realignment, Urban Forestry discontinued removing DED-positive elms from the public right-of-way, shifting this responsibility to the adjacent property owner, in compliance with City Code Title 11, Trees. Funding previously used for these removals is now used for crucial maintenance of Heritage Trees and park trees across the city, allowing for a more equitable distribution of park tree maintenance activities. An additional important outcome of this funding shift has been greater staff capacity and resources for swift removal of DED-positive elms in public parks, thereby decreasing opportunity for DED spread.

- Continuing to fund and support maintenance of park and Heritage elms across the city is essential for DED management and highly recommended.
- Incorporating DED management into a more comprehensive pest and pathogen program, to more broadly address pests and pathogens that are current or imminent threats to trees distributed in parks *across* the city, is also highly recommended.

Prevention

Inoculation of DED-susceptible elms in parks and those designated as Heritage elms occurs on a three-year cycle using the fungicide Arbotect.

- The long-term effectiveness of this fungicide in protecting an elm from DED, along with phytotoxic effects or stresses incurred upon the tree, should be scientifically evaluated.
- Using Urban Forestry data, the survival rate of inoculated elms in Portland should be evaluated.

Another preventative tool is the elm pruning moratorium. The goal of this measure is to prevent the spread of the DED fungus through attraction of elm bark beetles to pruning sites when during the height of beetle activity.

- The current elm pruning moratorium is static, from April 15th to October 15th each year; however, this schedule does not account for annual shifts on beetle emergence or activity as a result of climate change. As such, it is recommended to track degree days annually, and adjust the pruning moratorium accordingly.

- Outreach and education on the importance of proactive deadwood pruning in the winter should be provided for community members responsible for elms.

A multi-year elm inventory was completed in 2016, providing important information on location, type, age, class, and condition of elms on private and public property.

- Future elm monitors should consider tracking how DED symptoms occur on infected elms, as this may reveal how DED spreads among elm trees in different parts of the city.
- Monitoring the success of newly planted DED-resistant elms will help inform future planting efforts to ensure that the most successful cultivars are chosen.

Testing

This year saw a marked drop in Dutch elm disease positive lab tests. It is worth acknowledging that many negative tests prompted concern and future consideration shall be made to quality control of crew-collected samples of viable tissue for lab submissions. The Oregon State University Plant Clinic has been the partner of Urban Forestry for testing for years. A discussion with the director of the clinic, Melodie Putnam, sought to address the sampling issues. Ultimately, it is the belief that severe weather events, in this case extreme summer heat, are believed to be a contributing factor, with Putnam stating: "I think the main reason there were so few confirmations is not because the trees were free of the disease, but because the pathogen was not detectable because of how the extreme hot weather influences where the pathogen can be found in the trees."

In light of the initial discovery of negative results, crews were given refresher training to identify elm streaking in live tissue samples and all submitted samples were quality checked for streaking and viability. After the resampling of seven elms of concern in which the trees continued to display a DED-symptomatic decline of flagging, desiccation, and defoliation in the canopy, lab tests only found two results were positive. The remaining five trees were unable to be considered for removal as hazard trees at the time elm monitoring season ended for 2021.

In total, around a dozen or more elms with observed DED symptoms remain standing and are to be considered for early testing/removal in the Spring of 2022.

Appendices

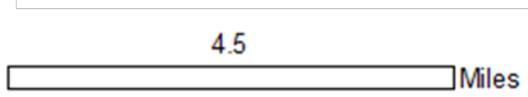
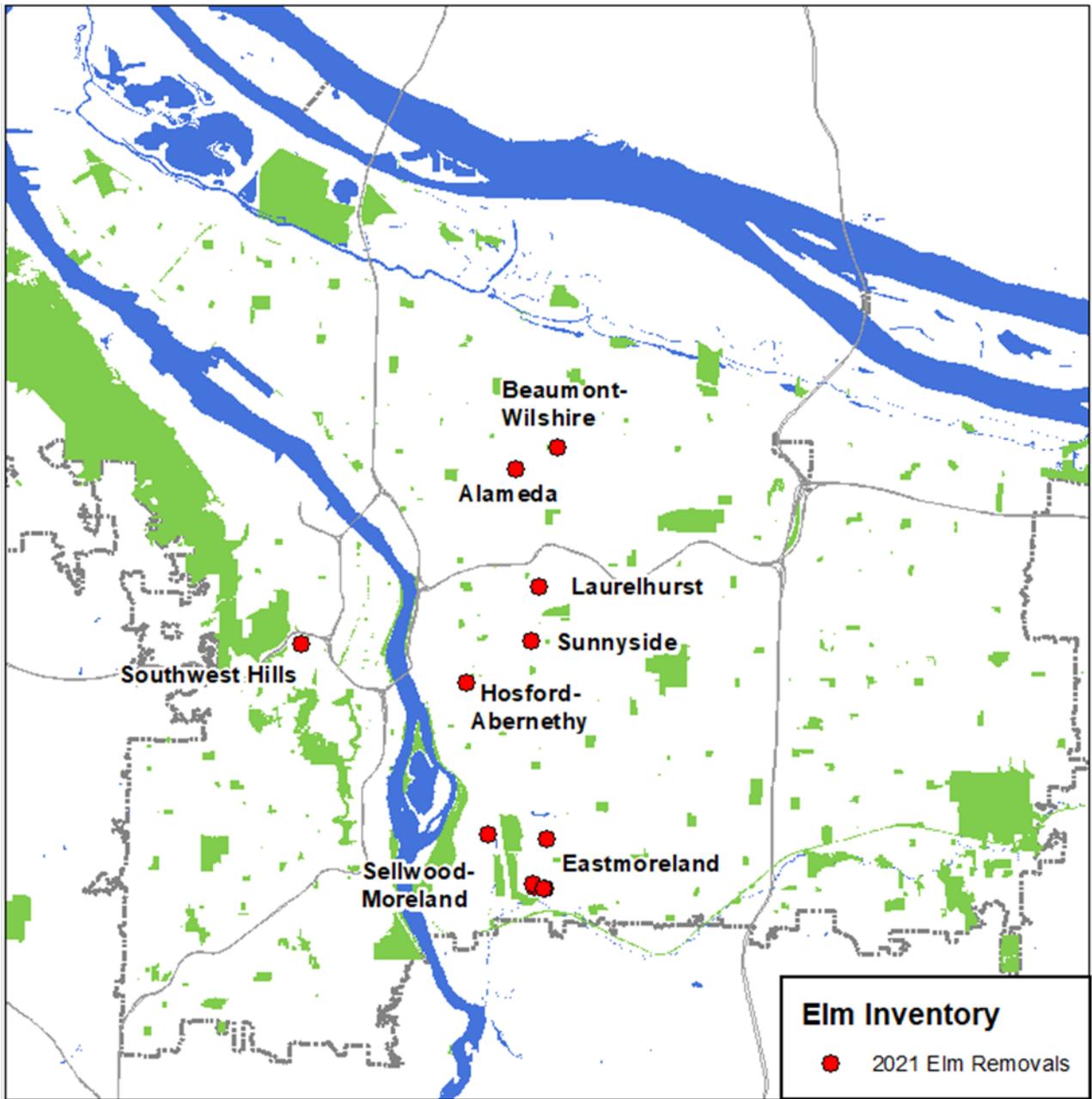


A large elm in Eastmoreland with flagging in the canopy, a typical sign of Dutch elm disease.

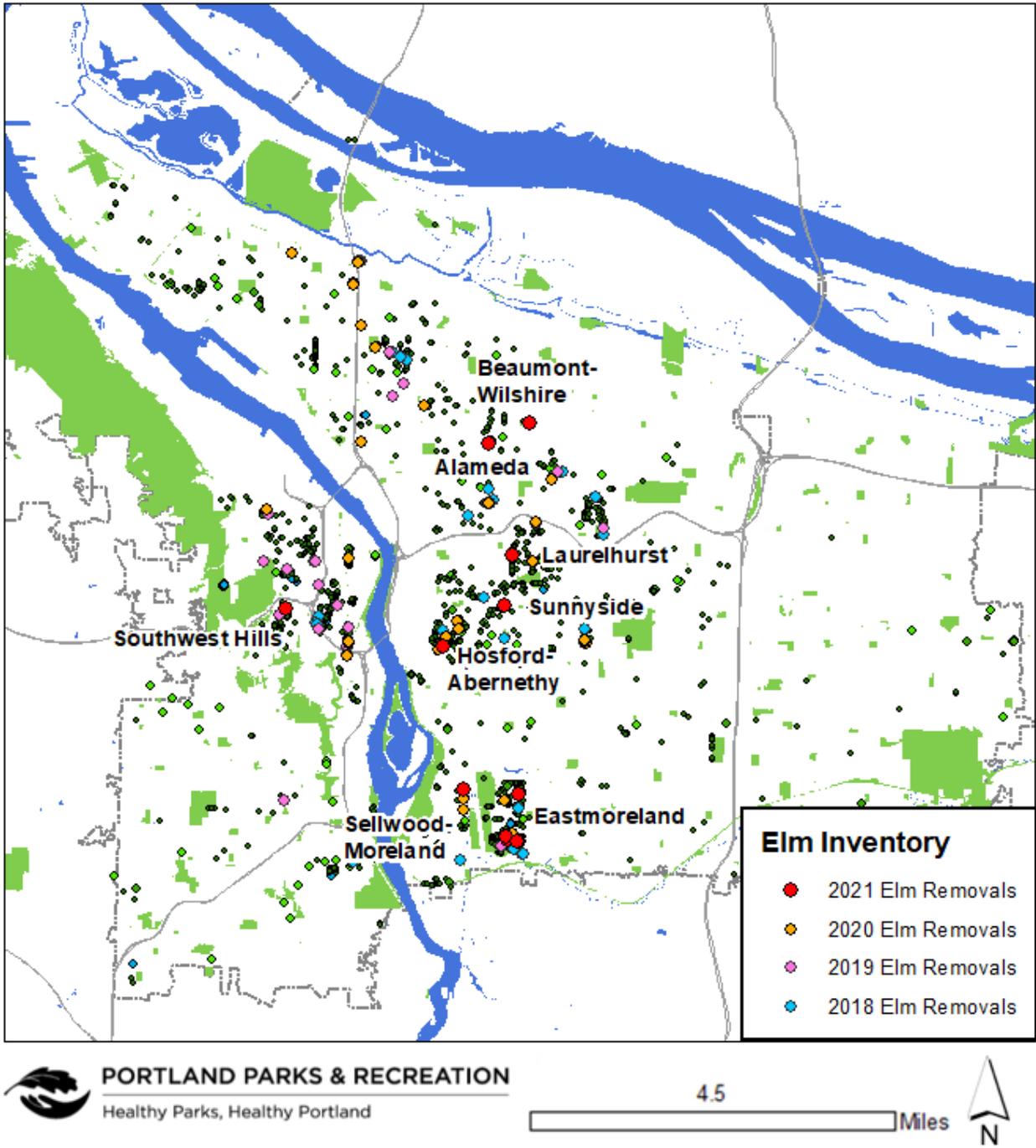
Appendix A: Location and ownership of DED-positive elms removed in 2021

Location of 2021 DED Elms	Neighborhood	Property Type	# of Elms
Northeast Portland			
Wilshire Park	Beaumont-Wilshire	Park	1
410 NE 32 nd Ave	Laurelhurst	ROW	1
3507 NE 26 th Ave	Alameda	ROW	1
Total NE			3
Southeast Portland			
7715 SE 31 st Ave	Eastmoreland	ROW	1
1403 SE Birch St	Hosford-Abernethy	ROW	2
7700 SE Reed College Pl (Duniway Elementary School)	Eastmoreland	ROW	2
2105 SE Tolman St	Sellwood-Moreland	ROW	1
6230 SE 34 th Ave	Eastmoreland	ROW	1
7737 SE 32 nd Ave	Eastmoreland	ROW	1
1012-1016 SE 31 st Ave	Sunnyside	ROW	1
Total SE			9
Southwest			
2010 SW Carter	Southwest Hills	ROW	1
Total SW			1
Grand Total			13

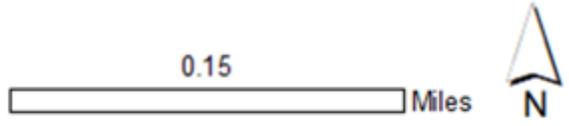
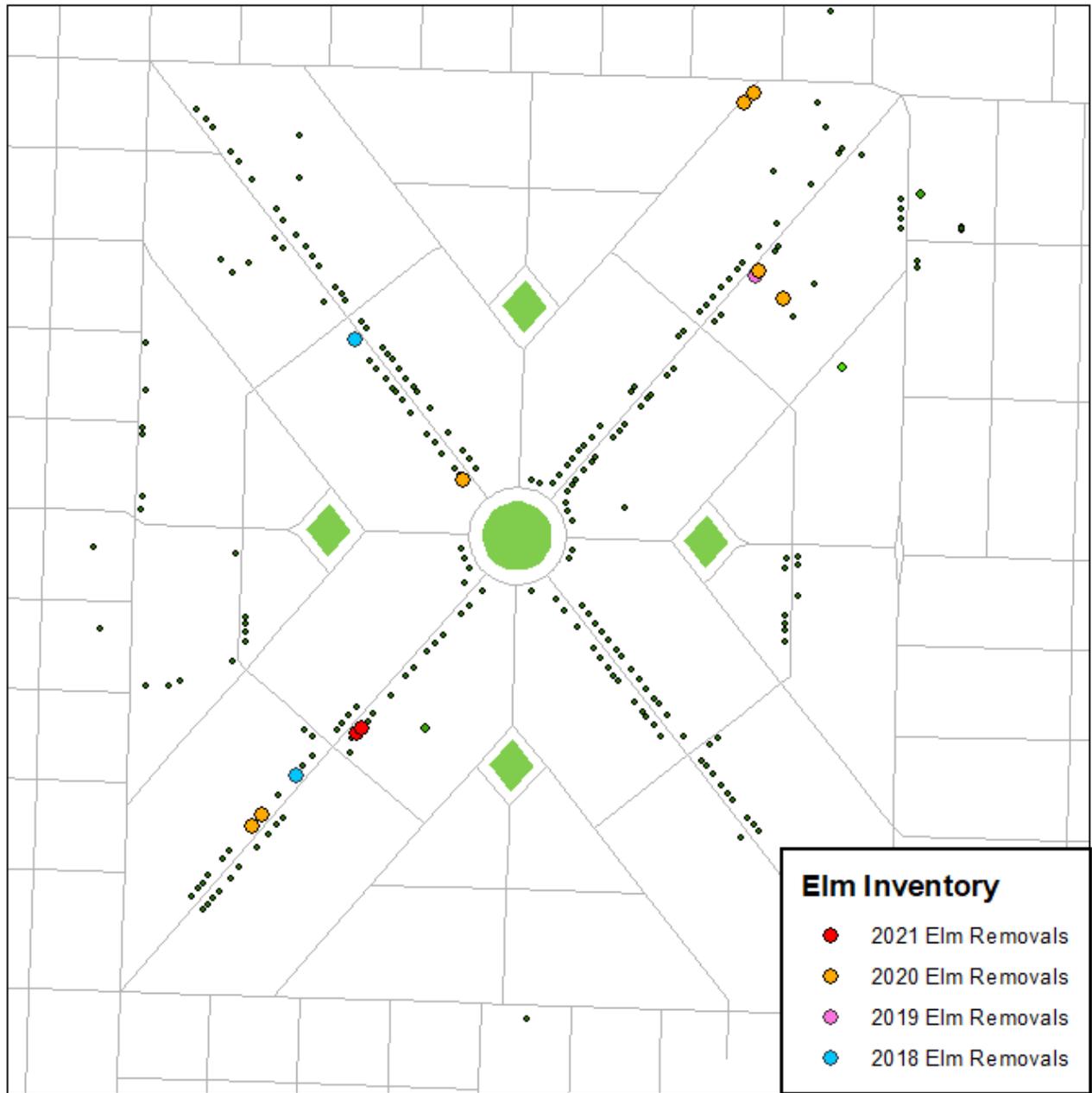
Appendix B: Map of DED-confirmed locations where elms were removed in 2021



Appendix C: Current inventory of DED-confirmed elm removals through 2021



Appendix D: Elm inventory of Ladd's Addition historic district (2021)



Appendix E: Elm inventory of Eastmoreland neighborhood (2021)

