The Morton Arboretum®

THE CHAMPION of TREES

2020

Chicago Region Tree Census Report

County Data and Change Analysis

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Summary

Understanding a forest's structure, function, and value can facilitate management decisions that will improve human health and environmental quality. Accordingly, an assessment of forest properties in the seven-county Chicago region was performed in 2020. This report provides the county-level results of the 2020 tree census for the following counties: Cook (not including the city of Chicago), DuPage, Kane, Kendall, Lake, McHenry, and Will.

Data from field plots were analyzed using the i-Tree Eco (version 6.0.20) developed by the USDA Forest Service, Northern Research Station. The numbers in the report are extrapolated estimates for each county based upon a carefully designed statistical sampling and analysis. Applying models to a complex and heterogeneous environment is challenging, hence these numbers should be considered as best estimates of the comprehensive values. The Arboretum hopes that these estimates can serve as the foundation to understand and incorporate the value of the regional forest into priority setting and management decision processes to enhance environmental quality and community livability.

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Notes:
Ton: short ton (US) (2,000 lbs)
Monetary values $ are reported in US dollars.
Pollution removal and avoided runoff estimates are reported for trees and shrubs.
All other ecosystem service estimates are reported for trees.
Tree and shrub canopy cover is estimated by using i-Tree Canopy Tool with 1000 randomized points.

Benefit Prices used by i-Tree Eco:
- Electricity $ (USD)/kWh: 0.13 (Eco default value: 0.13 for 2018)
- Fuels $ (USD)/Therm: 0.85 (Eco default value: 0.85 for 2018)
- Carbon $ (USD)/ton: 170.55 (Eco default value: 170.55 for 2020)
- Avoided runoff $ (USD)/gallon: 0.0089 (Eco default value: 0.0089 for 2004)

Cook County (not including the city of Chicago) (199 plots)

Number of trees: 44,590,000

Tree and shrub cover: 30%

Most common species of trees (stem count): European buckthorn, juniper spp., American elm

Percentage of trees less than 6 inches (15.2 cm) diameter: 73.5%

Pollution removal: 5,100 tons/year ($45.9 million/year)

Carbon storage: 5,500,000 tons ($936 million)

Carbon sequestration: 150,000 tons ($25.6 million/year)

Oxygen production: 180,400 tons/year

Avoided runoff: 407,500,000 cubic feet/year ($27.2 million/year)

Building energy savings: $13.5 million/year

Structural values: $12.9 billion

SPECIES NAME	PERCENT POPULATION	PERCENT LEAF AREA
European buckthorn	33.1	10.8
Juniper spp.	5	1.3
American elm	4.2	6.4
Black cherry	3.9	2.6
Boxelder	3.6	2.9
Eastern cottonwood	3.3	13.2
Tree of heaven	3	3
Eastern red oak	2.7	5.3
Silver maple	2	7.2
Norway maple	1	7.7

Table 1: Top 10 species ranked by stem count in suburban Cook County, shown with the percentage of the population and percentage of leaf area.

DuPage County (191 plots)

Number of trees: 19,760,000

Tree and shrub cover: 31%

Most common species of trees (stem count): European buckthorn, European alder, Amur honeysuckle

Percentage of trees less than 6 inches (15.2 cm) diameter: 76.2%

Pollution removal: 2,200 tons/year ($19.8 million/year)

Carbon storage: 2,200,000 tons ($380 million)

Carbon sequestration: 63,600 tons ($10.9 million/year)

Oxygen production: 57,520 tons/year

Avoided runoff: 174,700,000 cubic feet/year ($11.7 million/year)

Building energy savings: $476,000/year

Structural values: $5.8 billion

SPECIES NAME	PERCENT POPULATION	PERCENT LEAF AREA
European buckthorn	37.7	9.3
European alder	10.5	2.1
Amur honeysuckle	5.1	1.6
Black cherry	4.4	8.3
Boxelder	3.9	6
American elm	1.6	3.6
Eastern white pine	1.5	2.8
Silver maple	1.4	10.8
Norway maple	1.3	4.8
Black walnut	0.6	6.1

Table 2: Top 10 species ranked by stem count in DuPage County, shown with the percentage of the population and percentage of leaf area.

Number of trees: 8,596,000

Tree and shrub cover: 21%

Most common species of trees (stem count): European buckthorn, boxelder, black cherry

Percentage of trees less than 6 inches (15.2 cm) diameter: 63.8%

Pollution removal: 1,300 tons/year ($11.8 million/year)

Carbon storage: 1,600,000 tons ($265 million)

Carbon sequestration: 40,900 tons ($7 million/year)

Oxygen production: 20,600 tons/year

Avoided runoff: 102,700,000 cubic feet/year ($6.9 million/year)

Building energy savings: $3.4 million/year

Structural values: $3.8 billion

SPECIES NAME	PERCENT POPULATION	PERCENT LEAF AREA
European buckthorn	15	2.4
Boxelder	13.7	5.5
Black cherry	6.8	3
Willow spp.	5.4	2.4
Mulberry spp.	5.3	4.1
White mulberry	4.8	4.6
Black walnut	4.5	10.1
Silver maple	2.2	10.1
Bur oak	1.9	8.8
Eastern cottonwood	1.6	6.1

Table 3: Top 10 species ranked by stem count in Kane County, shown with the percentage of the population and percentage of leaf area.

Kendall County (183 plots)

Number of trees: 2,991,000

Tree and shrub cover: 5.3%

Most common species of trees (stem count): mulberry spp., black walnut, bur oak

Percentage of trees less than 6 inches (15.2 cm) diameter: 58.7%

Pollution removal: 395.2 tons/year ($3.6 million/year)

Carbon storage: 436,900 tons ($74.5 million)

Carbon sequestration: 13,000 tons ($2.2 million/year)

Oxygen production: 18,400 tons/year

Avoided runoff: 31,600,000 cubic feet/year ($2.1 million/year)

Building energy savings: $1.4 million/year

Structural values: $905 million

SPECIES NAME	PERCENT POPULATION	PERCENT LEAF AREA
Mulberry spp.	12	7.3
Black walnut	6.6	9.8
Bur oak	5.5	6.8
Boxelder	5	4.4
Eastern white pine	4.8	7.1
White mulberry	4.5	3.9
Black cherry	4.4	3.1
Apple spp.	3.7	3.8
Black locust	3.2	3.7
American elm	2.8	6.6

Table 4: Top 10 species ranked by stem count in Kendall County, shown with the percentage of the population and percentage of leaf area.

Number of trees: 44,730,000

Tree and shrub cover: 35%

Most common species of trees (stem count): European buckthorn, staghorn sumac, boxelder

Percentage of trees less than 6 inches (15.2 cm) diameter: 80.9%

Pollution removal: 3,700 tons/year ($31.4 million/year)

Carbon storage: 4,500,000 tons ($770 million)

Carbon sequestration: 110,600 tons ($18.9 million/year)

Oxygen production: 165,100 tons/year

Avoided runoff: 292,300,000 cubic feet/year ($19.5 million/year)

Building energy savings: $10.1 million/year

Structural values: $8.2 billion

SPECIES NAME	PERCENT POPULATION	PERCENT LEAF AREA
European buckthorn	52.2	17.3
Staghorn sumac	3.6	0.5
Boxelder	3.5	9.8
Eastern cottonwood	3.5	5.7
Shagbark hickory	2.3	2.8
Black walnut	2.2	4.9
Black cherry	2	2.5
Northern red oak	1.9	10.7
White oak	1	4.5
Silver maple	0.7	5.8

Table 5: Top 10 species ranked by stem count in Lake County, shown with the percentage of the population and percentage of leaf area.

McHenry County (185 plots)

Number of trees: 24,890,000

Tree and shrub cover: 18%

Most common species of trees (stem count): European buckthorn, black cherry, bush honeysuckle spp.

Percentage of trees less than 6 inches (15.2 cm) diameter: 75.5%

Pollution removal: 3,000 tons/year ($25.9 million/year)

Carbon storage: 3.5 million tons ($594 million)

Carbon sequestration: 78,000 tons ($13.3 million/year)

Oxygen production: 135,600 tons/year

Avoided runoff: 243,400,000 cubic feet/year ($16.3 million/year)

Building energy savings: $2.2 million/year

Structural values: $5.8 billion

SPECIES NAME	PERCENT POPULATION	PERCENT LEAF AREA
European buckthorn	40.9	8.8
Black cherry	6.1	5.2
Bush honeysuckle spp.	5.3	0.7
Boxelder	4.7	12.4
Black walnut	3.8	9.6
Siberian elm	3.4	3.3
Shagbark hickory	2.8	2.7
Silver maple	2.4	16.2
Bur oak	1.6	5.9
Eastern cottonwood	1.3	4.1

Table 6: Top 10 species ranked by stem count in McHenry County, shown with the percentage of the population and percentage of leaf area.

Number of trees: 21,590,000

Tree and shrub cover: 17%

Most common species of trees (stem count): European buckthorn, Amur honeysuckle, sugar maple

Percentage of trees less than 6 inches (15.2 cm) diameter: 72%

Pollution removal: 2,800 tons/year ($23.5 million/year)

Carbon storage: 2.5 million tons ($424 million)

Carbon sequestration: 72,500 tons ($12.4 million/year)

Oxygen production: 71,400 tons/year

Avoided runoff: 222 million cubic feet/year ($14.8 million/year)

Building energy savings: $10 million/year

Structural values: $5.8 billion

SPECIES NAME	PERCENT POPULATION	PERCENT LEAF AREA
European buckthorn	13.9	4
Amur honeysuckle	12.2	1.9
Sugar maple	9.6	7.9
Black locust	7	14
Green ash	6.2	0.6
American elm	6	7.3
Black cherry	3.1	4
Black walnut	3	8.1
Eastern cottonwood	1.5	5.6
Siberian elm	0.9	5.5

Table 7: Top 10 species ranked by stem count in Will County, shown with the percentage of the population and percentage of leaf area.

Variation of forest structure and composition by county

The Chicago region is the third-largest metropolitan region in the United States. This region includes an estimated 2,565,760 acres with over 9 million residents in 284 municipalities. The region has a diverse landscape ranging from the highly urbanized Chicago to predominantly residential areas of the surrounding suburban Lake, DuPage, and Cook counties, and agricultural land in Will, Kendall, Kane, and McHenry counties.

Land use

The structure of forest resources changes significantly across the Chicago region. Variations in tree and shrub cover within the city of Chicago and the seven counties are evident and differ among land use classifications. Land use categories used in this study are: agricultural, commercial/industrial, institutional, open space, residential, transportation/utility, and water/wetlands. A breakdown of the land use distribution in each county is plotted in Figure 1.

In general, the suburban counties with a greater percentage of residential and open space land use (including private hunting clubs, campgrounds, forest and grassland, wetlands and open water such as lakes and rivers) have larger amounts of and a higher percentage of leaf area. Lake County, suburban Cook County, and DuPage County, which are predominantly residential and open space, have the greatest percentages of tree and shrub cover.

Counties with a high percentage of agricultural land and the city of Chicago with a large area of commercial, transportation, and institutional land use generally have fewer trees. The counties with the lowest percentage of tree and shrub cover are Kane (21%), McHenry (18%), Will (17%), and Kendall (11%) counties, which are predominantly agricultural.

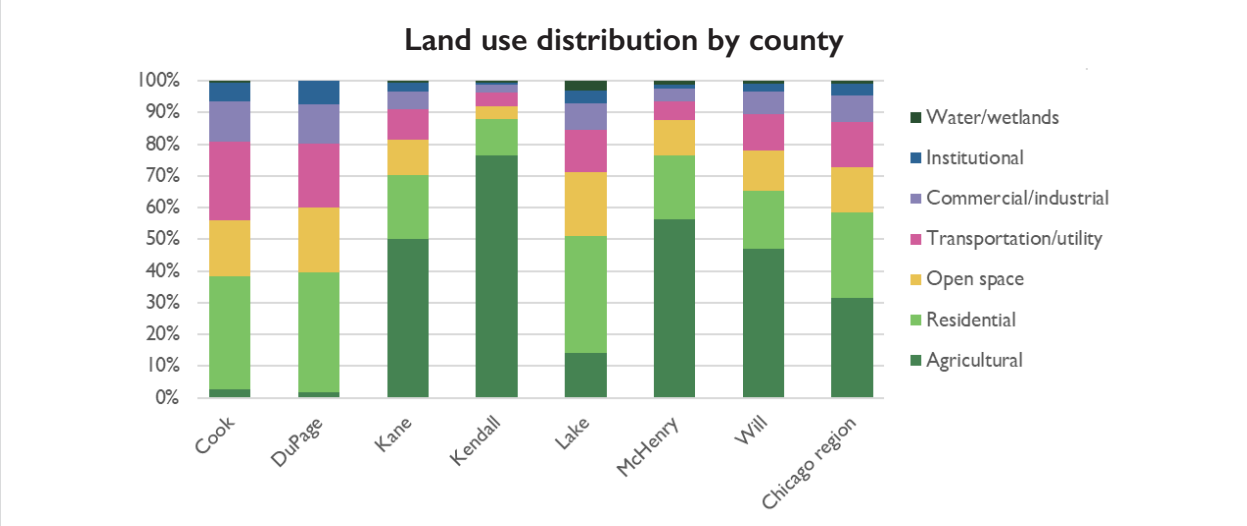


Figure 1: Percent of area occupied by different land use categories, Chicago region, based on data from 2015. (Cook County data does not include the data from the city of Chicago.)

Number of trees

The entire region has an estimated 172,297,000 trees (stem count), a 12% increase from 157,142,000 in 2010 (Kua *et al.*, 2021). The seven-county region has an estimated 168,300,000 trees. The highest tree density occurs in the suburban counties: Lake (149 trees/ac), suburban Cook (97 trees/ac), and DuPage (82 trees/ac) (Table 8 and Figure 2).

NUMBER OF TREES VS. LEAF AREA

When assessing a forest, although stem count is a useful metric, it should not be used alone. Canopy size or total leaf area should also be taken into consideration. Benefits such as air quality improvement, reduction of energy consumptions, stormwater mitigation, carbon storage, and carbon sequestration are closely linked to a healthy tree canopy.

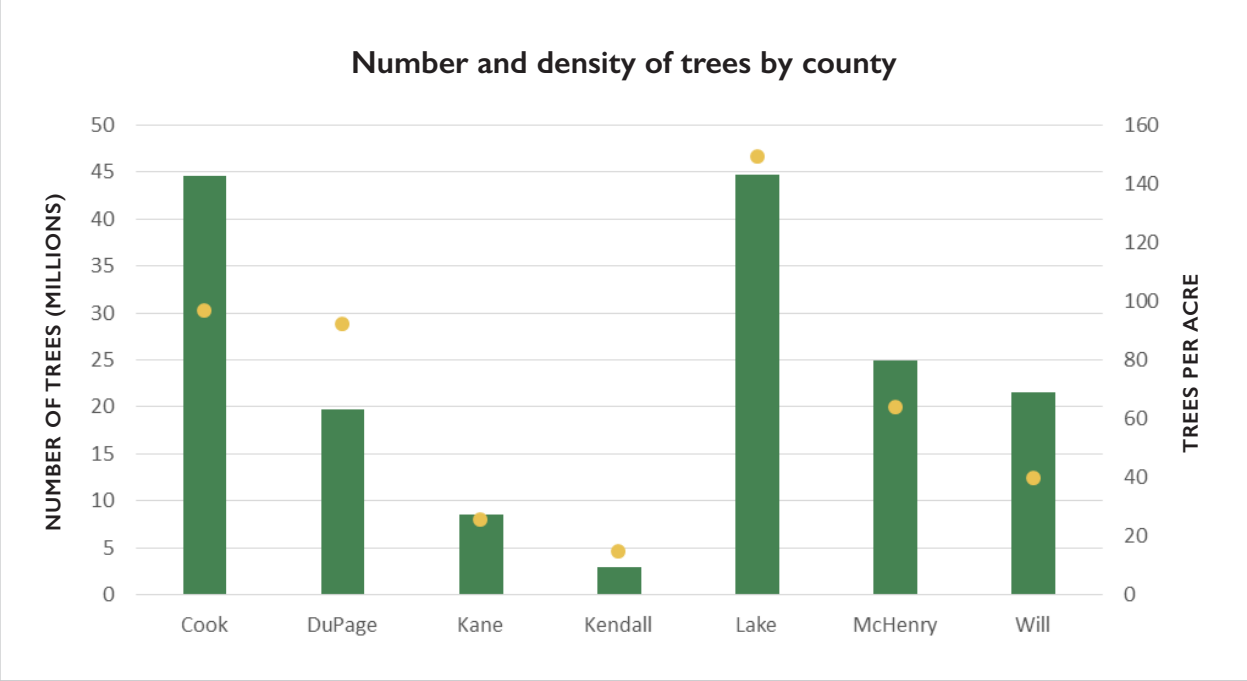


Figure 2: Number of trees and tree density by area, Chicago region, 2020. Counties with extensive agricultural areas have lower tree densities. The number of trees (in millions) is illustrated by green bars (keyed to the left vertical axis), whereas the yellow dots represent the number of trees per acre (keyed to the right vertical axis). (Cook County data does not include the data from the city of Chicago).

AREA	NUMBER OF TREES	AREA (ACRES)	TREES PER ACRE
Cook	44,590,000	462,000	97
DuPage	19,764,000	215,000	92
Kane	8,596,000	335,000	26
Kendall	2,991,000	206,000	15
Lake	44,726,000	300,000	149
McHenry	24,894,000	391,000	64
Will	21,592,000	544,000	40

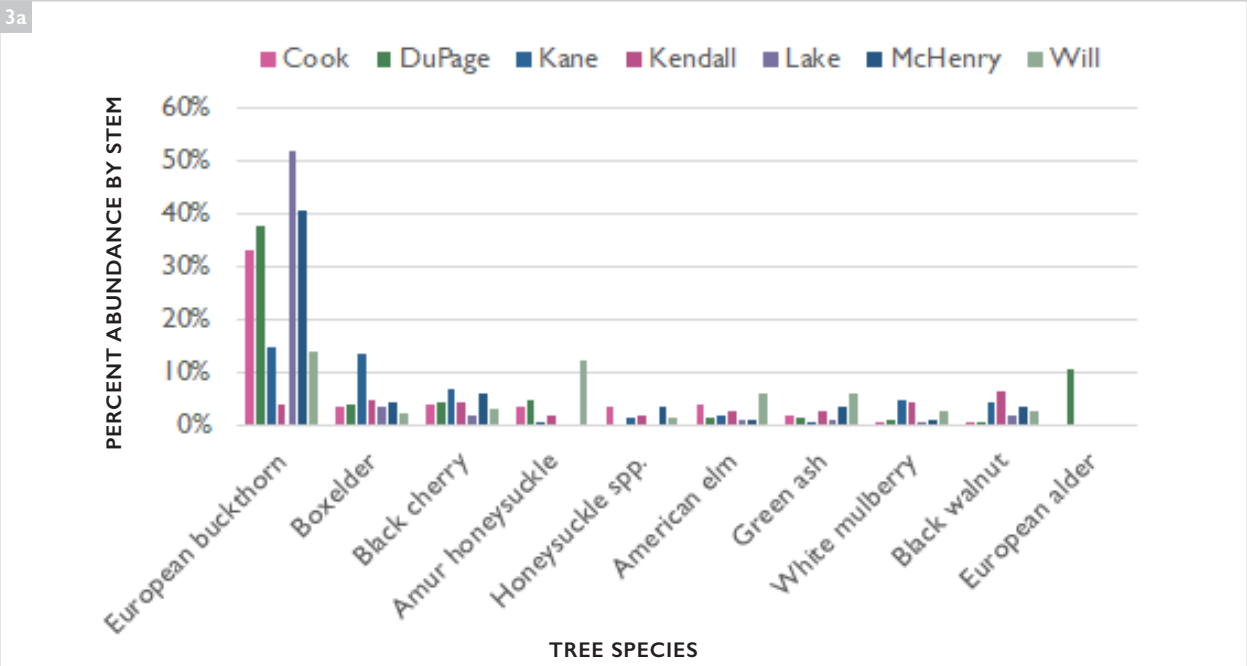
Table 8: Total number of trees, acreage, and average number of trees per acre in each of the seven counties of the Chicago region. (Cook County data does not include the data from the city of Chicago.)

Forest composition and structure

In the 2020 tree census, 194 different tree species were recorded in the seven-county region, with 103 species in the city of Chicago. Of the 194 species, 37% are native to Illinois. Since these numbers were determined using the inventory of species in the sample plots, the diversity of the regional forest might actually be higher. Across the region, the number of tree species (an indicator of forest diversity) is generally highest for residential land use, followed by open space.

> In the 2020 tree census, 194 different tree species were recorded in the seven-county region, with 103 species in the city of Chicago.

Distribution of the common tree species in different counties was plotted in Figure 3 (stem count) and Figure 4 (leaf area). Although stem count is a useful metric in this assessment, it should not be used alone. Canopy size or total leaf area should also be taken into consideration, since many of the benefits that trees provide are directly related to the amount of healthy leaf surface area on the plant.



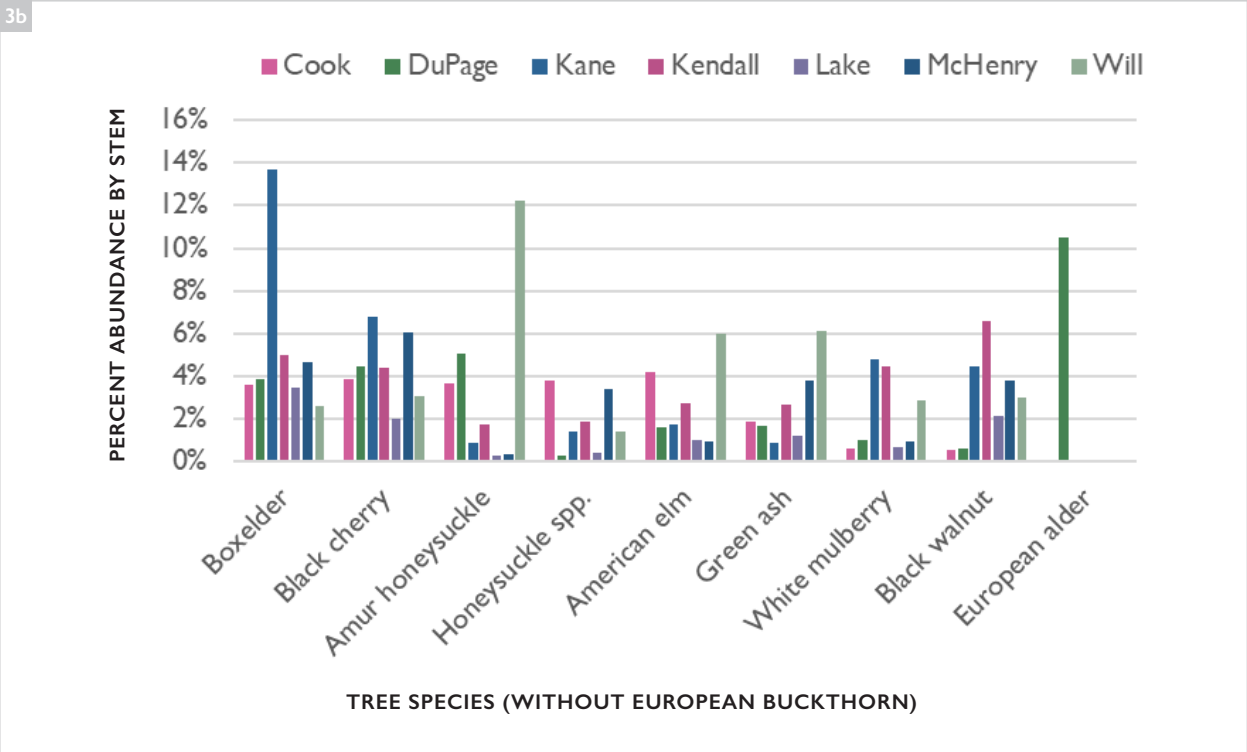


Figure 3: Species composition variations by stem count: distribution of the common tree species in different counties (3a). The second graph (3b) is plotted without European buckthorn to better visualize the abundance of the other tree species. As the most common tree species in many counties, buckthorn's high abundance dwarfs the abundance of other species. For actual estimated numbers, please refer to the appendix section in this report. (Cook County data does not include the data from the city of Chicago).

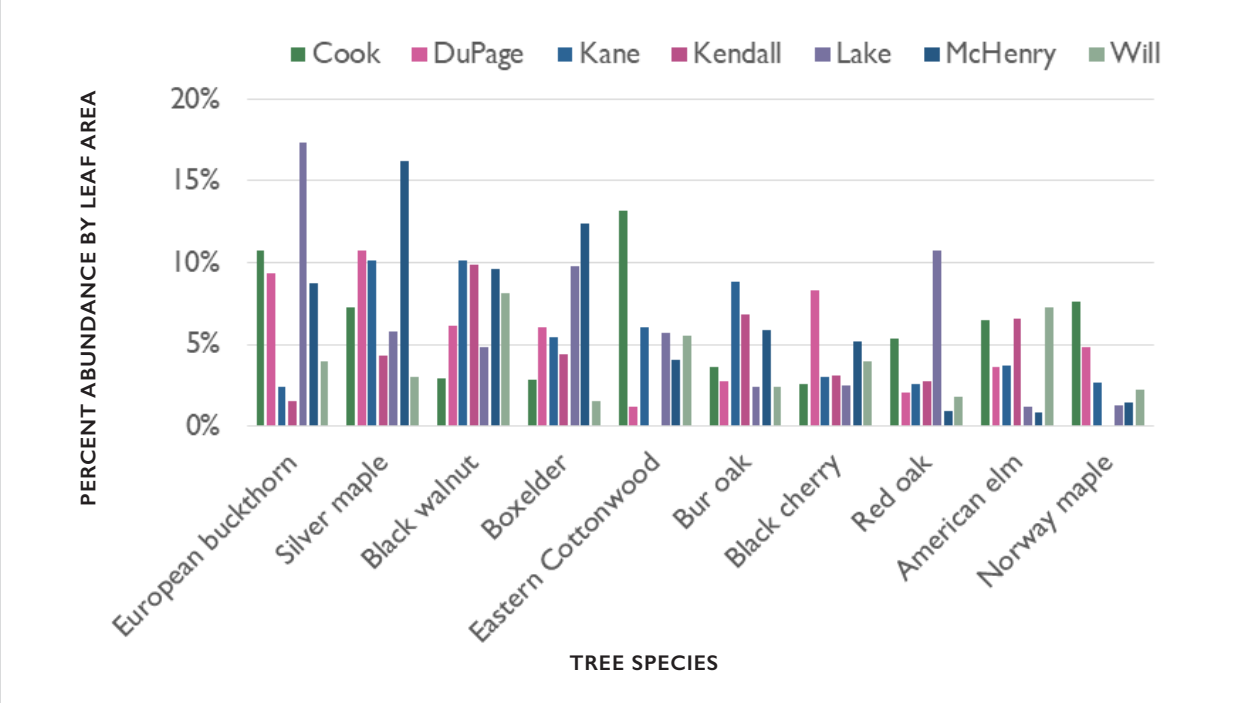


Figure 4: Species composition variations by leaf area: distribution of the common tree species in different counties. When leaf areas are assessed, the important keystone tree species with large canopy volume such as the maples and oaks become more prominent in the distribution. (Cook County data does not include the data from the city of Chicago).

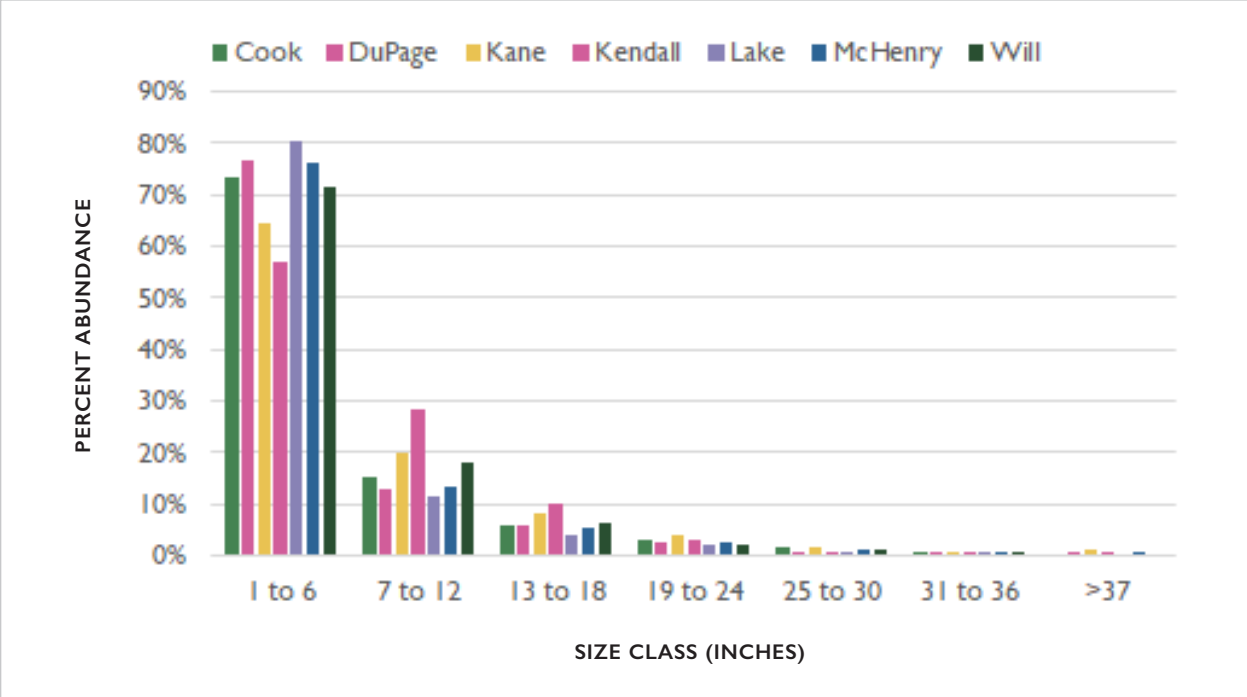


Figure 5: Size class distribution in the seven counties. Small trees dominate every county in the region. (Cook County data does not include the data from the city of Chicago).

Comparison between 2010 and 2020

Comparing the species composition between 2010 and 2020, two major trends emerged: European buckthorn has increased significantly and the region has lost the majority of its ash trees.

Figures 6 through 12 illustrate how the tree population and leaf area have changed during the past decade in each county. Figure 13 (page 19) shows the comparison of ash tree population.

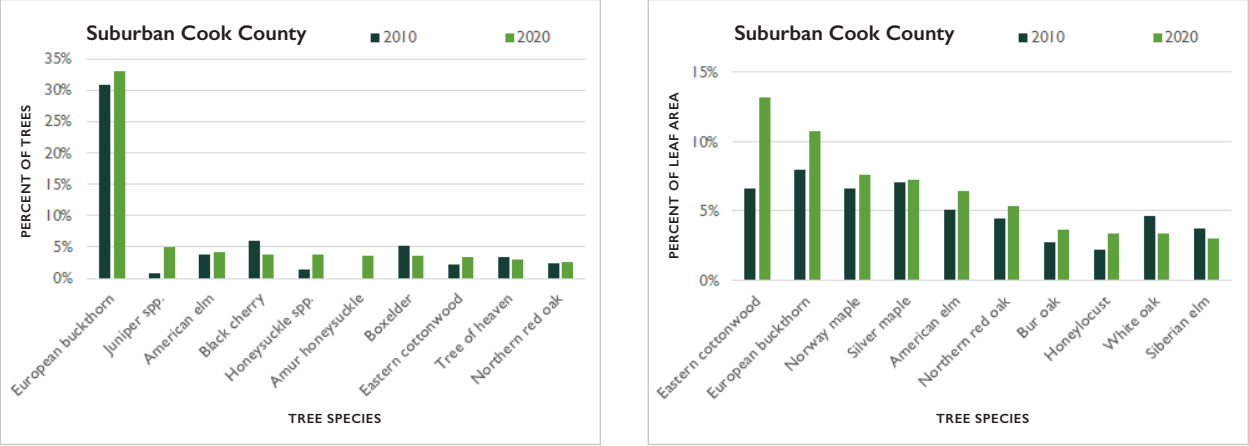


Figure 6: Changes of the top 10 species in tree population and leaf area percentages, Suburban Cook County. (Cook County data does not include the data from the city of Chicago.)

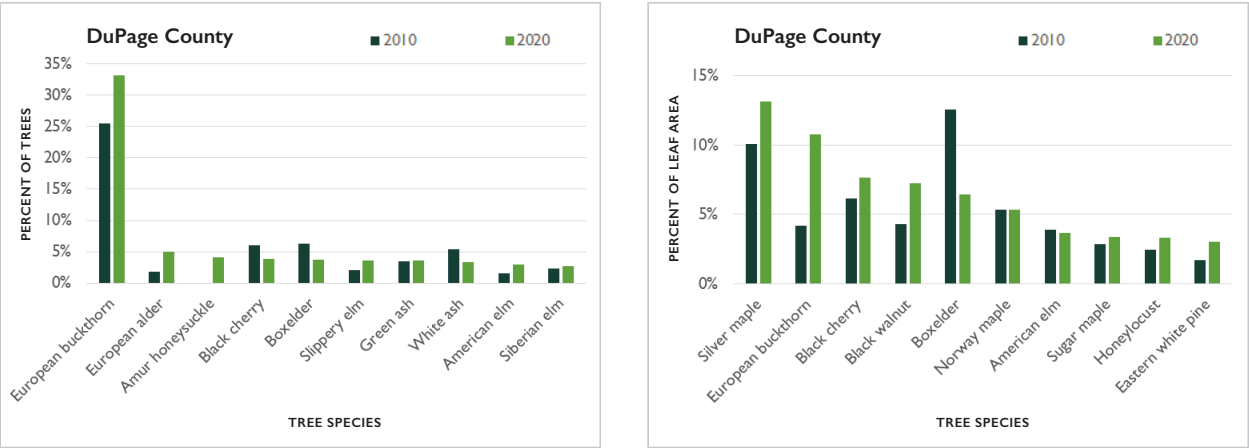
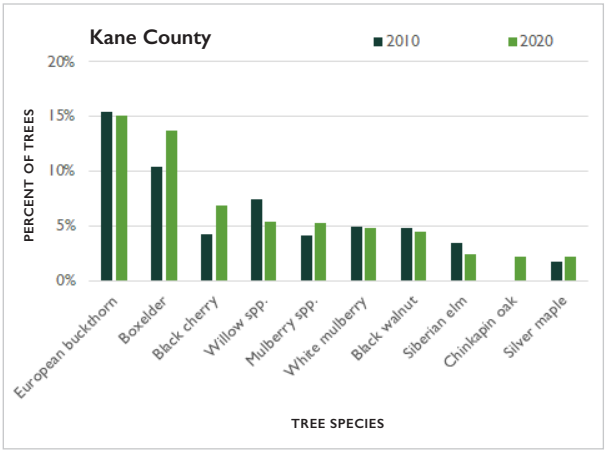


Figure 7: Changes of the top 10 species in tree population and leaf area percentages, DuPage County.



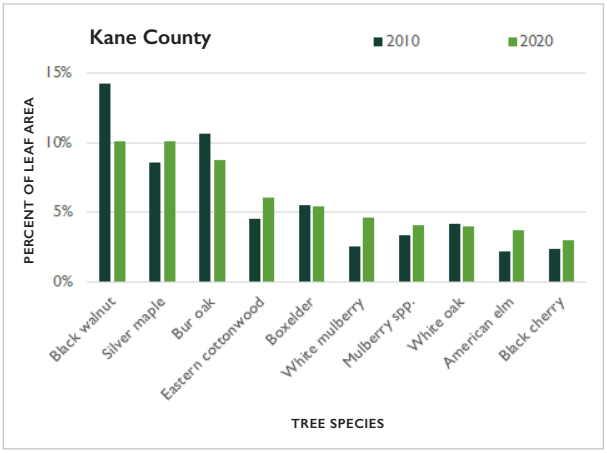
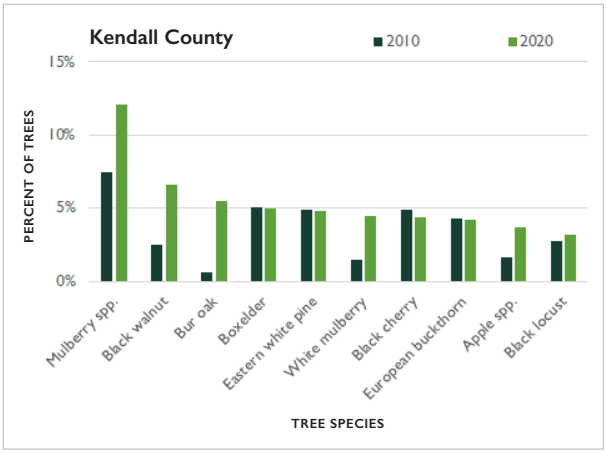


Figure 8: Changes of the top 10 species in tree population and leaf area percentages, Kane County.



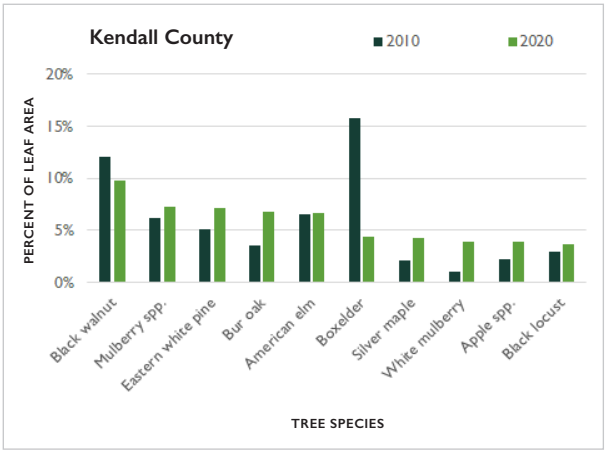
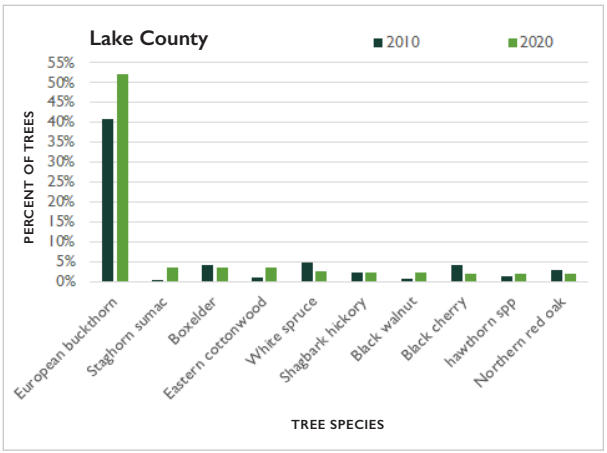


Figure 9: Changes of the top 10 species in tree population and leaf area percentages, Kendall County.



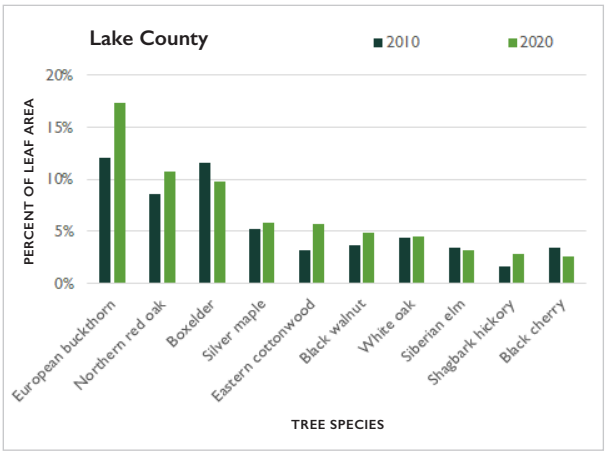
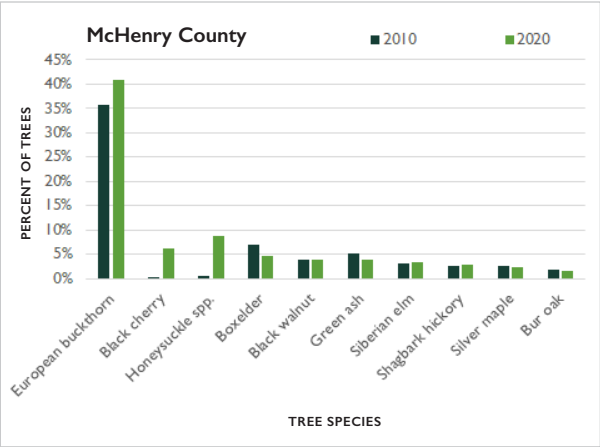


Figure 10: Changes of the top 10 species in tree population and leaf area percentages, Lake County.



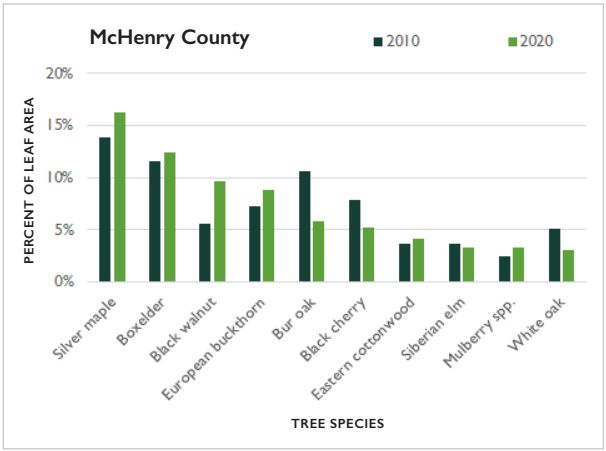
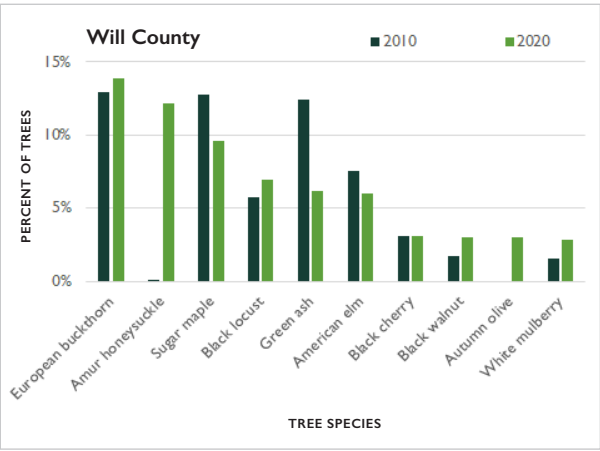


Figure 11: Changes of the top 10 species in tree population and leaf area percentages, McHenry County.



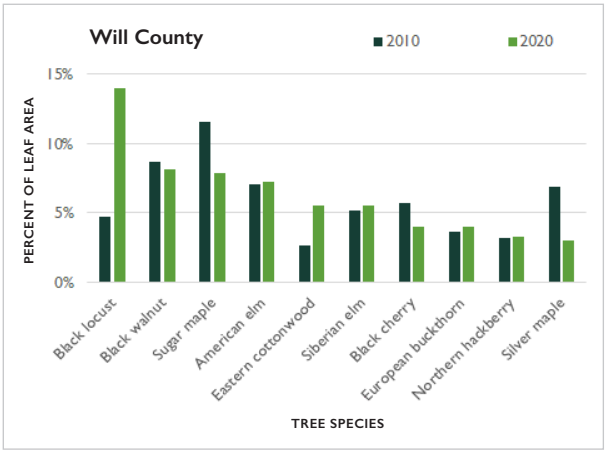


Figure 12: Changes of the top 10 species in tree population and leaf area percentages, Will County.

Invasive woody species

As seen in both 2010 and 2020 tree censuses, the regional forest continues to be dominated by exotic, invasive species—specifically European buckthorn and Amur honeysuckle (Nowak *et al*. 2013, Kua *et al*. 2021). Invasive plant species are often characterized by their vigor, acclimation, reproductive capacity, and lack of natural enemies. Invasives often thrive in areas of high disturbance and in harsh growing conditions. Factors such as lack of proper environmental management of transportation corridors, introduction of invasive landscaping plants in residential communities, connectivity of the region, and the highly disturbed conditions in urban and suburban settings can result in the proliferation of these species.

TREE SPECIES	Cook County	DuPage County	Kane County	Kendall County	Lake County	McHenry County	Will County
Norway maple		1%	1%		1%		
Tree of heaven	3%						
European alder		11%					
Autumn olive							3%
Bush honeysuckles	5%	5%				5%	12%
Mulberry spp., including white mulberry		1%	10%	17%		3%	2%
Callery pear				2%			
European buckthorn	33%	38%	15%	4%	52%	41%	14%
Black locust	1%			3%	1%		7%

Table 9: Estimated percentage of invasive woody species in the seven counties. The percentage is based on the tree species present in the i-Tree eco plots. European buckthorn is the most common species in all counties except for Kendall County. It accounts for greater than 30% of the tree population in Lake, McHenry, suburban Cook, and DuPage counties. (Cook County data does not include the data from the city of Chicago.) Empty boxes denote less than 1% of the species in the county population.

European buckthorn (*Rhamnus cathartica*)

Amur honeysuckle (*Lonicera maackii*)

Management practices such as removing these invasive woody species and replacing them with a diverse selection of woody plants can greatly benefit the health and sustainability of the regional forest.

Invasive species can greatly impact the biodiversity of a region by altering the forest structure and function. Management practices such as removing these invasive woody species and replacing them with a diverse selection of woody plants can greatly benefit the health and sustainability of the regional forest. The Healthy Hedges program (CRTI, n.d.), a collaborative initiative in the Chicago region meant to reduce the damage caused by invasive woody plants, provides a selection of recommended woody species to replace invasive woody species.

Ash

Over the past decade, due to the emerald ash borer, the stem counts of green ash (*Fraxinus pennsylvanica*) dropped from around 9 million to 4 million, and the number of white ash (*Fraxinus americana*) dropped from 4 million to less than 3 million. These population counts include standing dead trees and trees in decline.

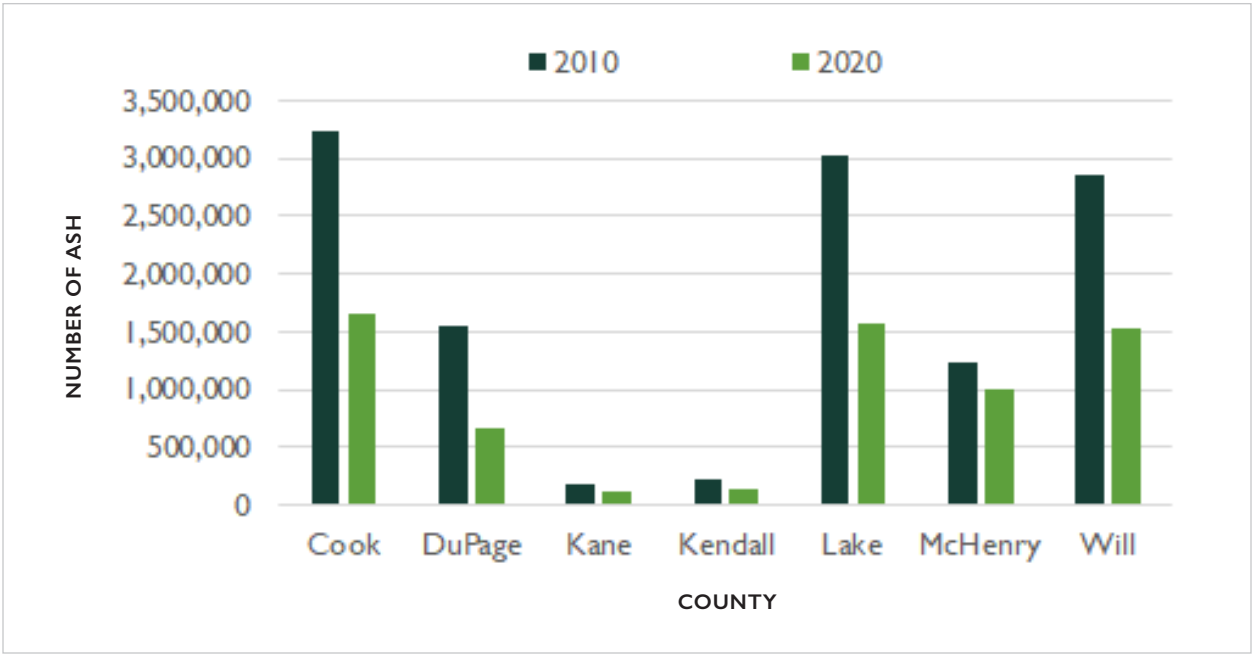


Figure 13: Comparison of the ash populations in the seven-county region. Declines are observed in every county. In 2010, the region had an estimated 13 million ash trees. According to the 2020 tree census, an estimated 10 million ash trees were lost to the emerald ash borer during the past decade. (Kua *et al.* 2021)

Emerald ash borer

Changes in the plots at the genus level

The project crew collected data from the 2010 tree census plots, and changes of the trees found on the plots can be analyzed. The following figures show the changes in basal area (BA) at the genus level.

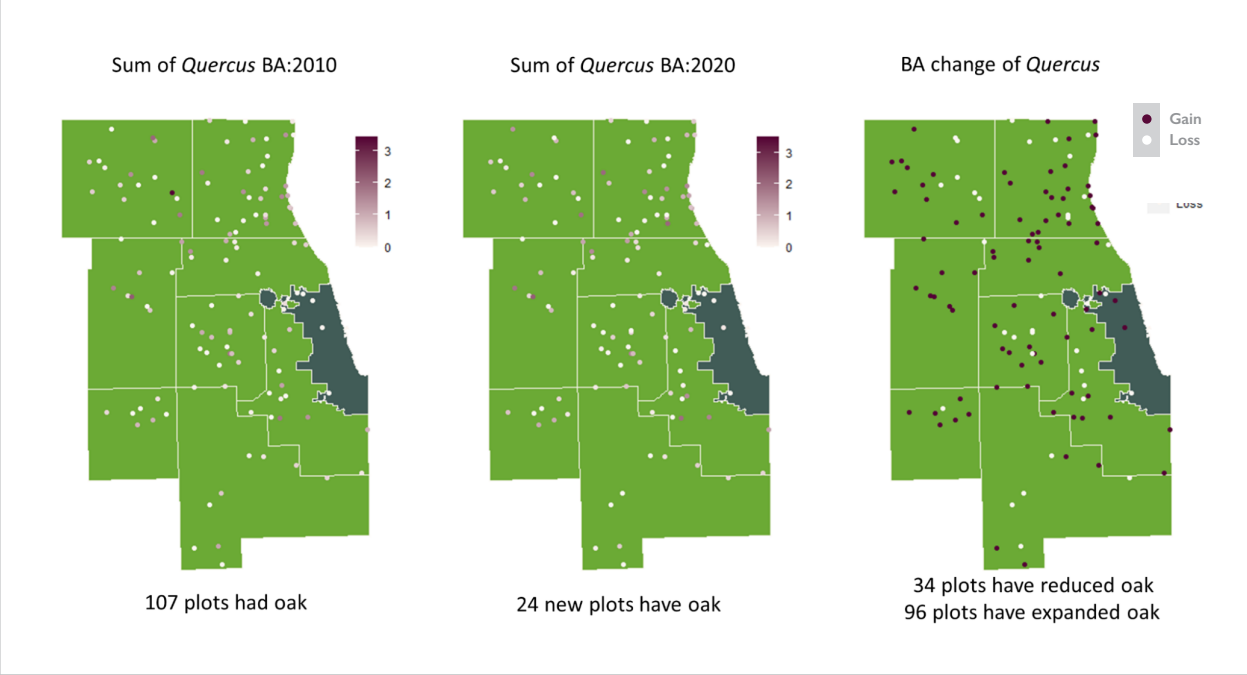


Figure 14: *Quercus* (oak) is an important keystone genus in the region. In 2010, 107 plots had one or more oak trees. In 2020, 24 new plots were found to have oak trees. Despite some reduction in basal area in certain plots, 96 plots have increased basal area, which indicates either new stems or growth.

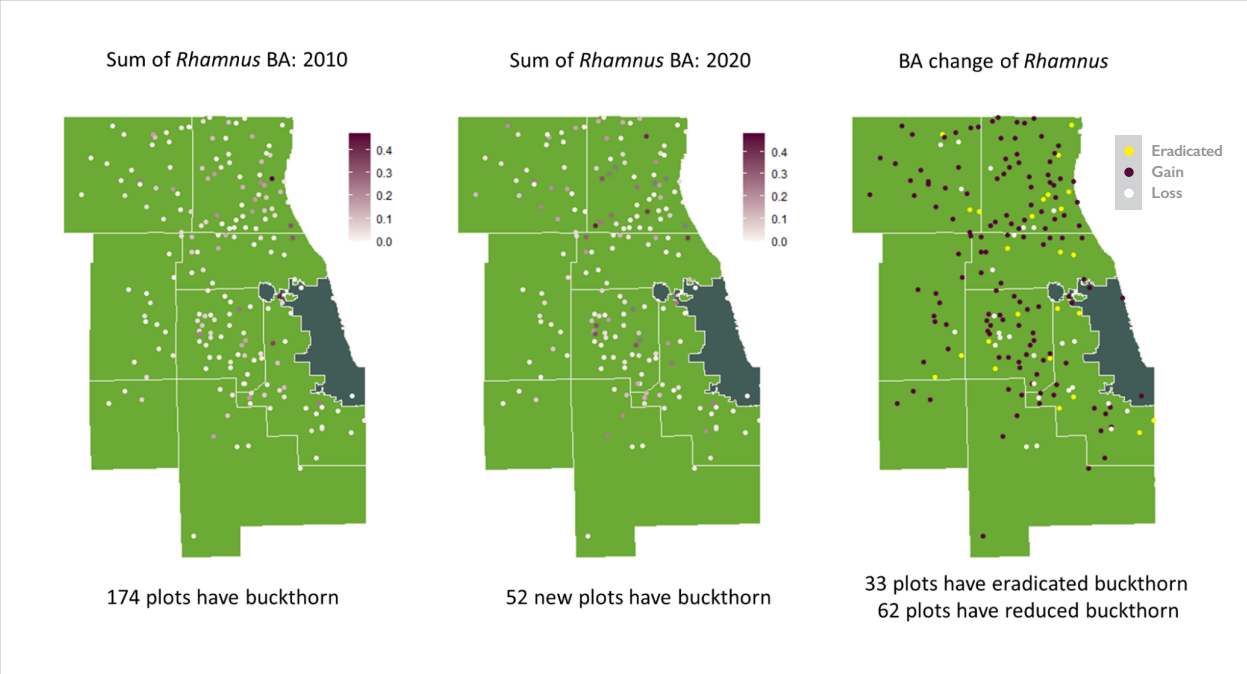


Figure 15: In 2020, genus *Rhamnus* continues to proliferate. Buckthorn was found in 52 new plots. However, researchers also observe the success of buckthorn eradication programs, which have been promoted and conducted throughout the region since the 2010 tree census. In 2020, 62 plots have reduced buckthorn. Among them are 33 plots that no longer have buckthorn.

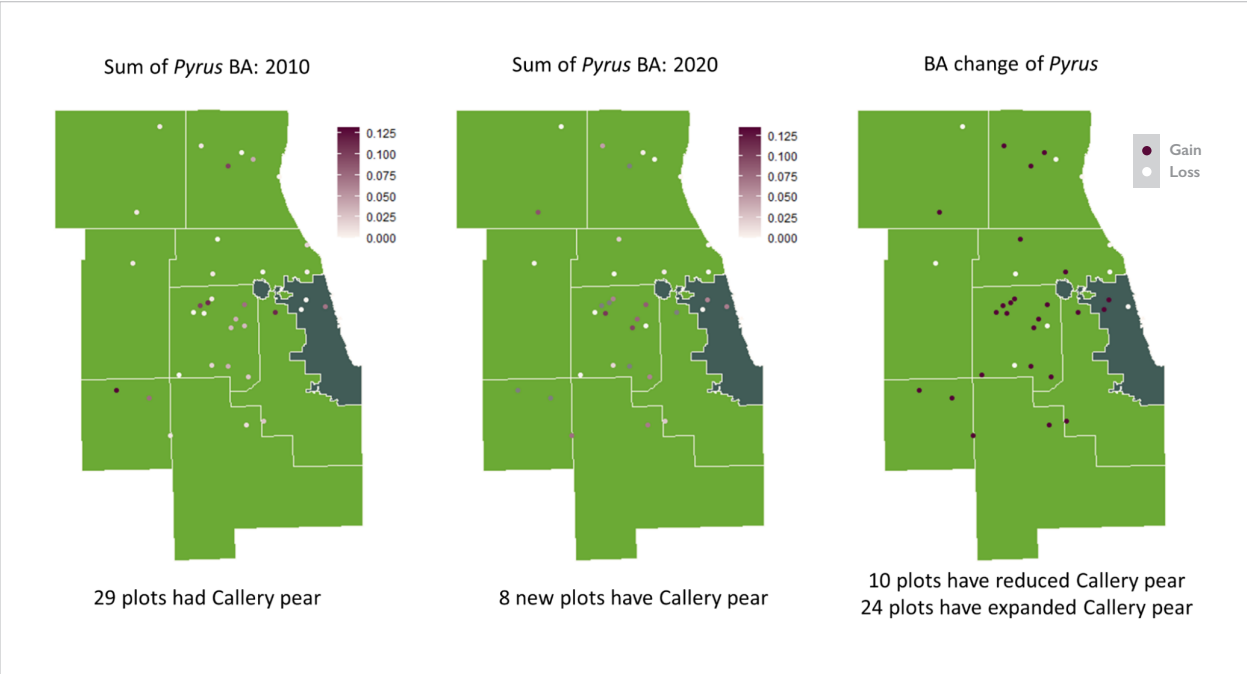
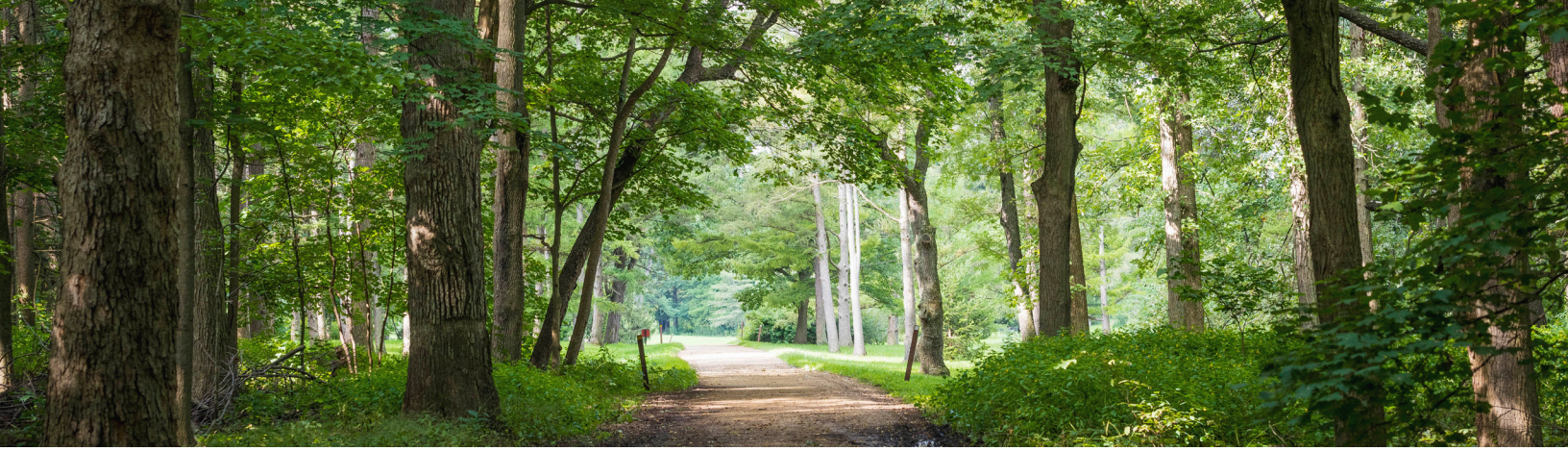


Figure 16: Callery pear, a once widely popular landscaping species, has also seen some expansion during the past decade.

Figure 17: In 2020, 119 out of the original 178 plots have reduced basal area for the genus *Fraxinus* (ash). Although the data indicates that 21 new plots have one or more ash trees, these are mostly young saplings due to the small basal area.



Forest functions, which are determined by forest structure, include a wide range of environmental and ecosystem services such as air pollution removal, carbon sequestration and storage, buffering temperatures during the summer and winter months, as well as helping to manage stormwater. Many other services provided by urban trees are still being researched and are not yet quantified or valued by i-Tree Eco. Three environmental and associated economic benefits are summarized in Figure 18.

The following sections are a brief description for each benefit category, adapted from "The 2020 Chicago Region Tree Census Report" (Kua *et al.*, 2021). Methods, models, and calculations for each benefit are available on the i-Tree resource page (i-Tree Eco, 2021).

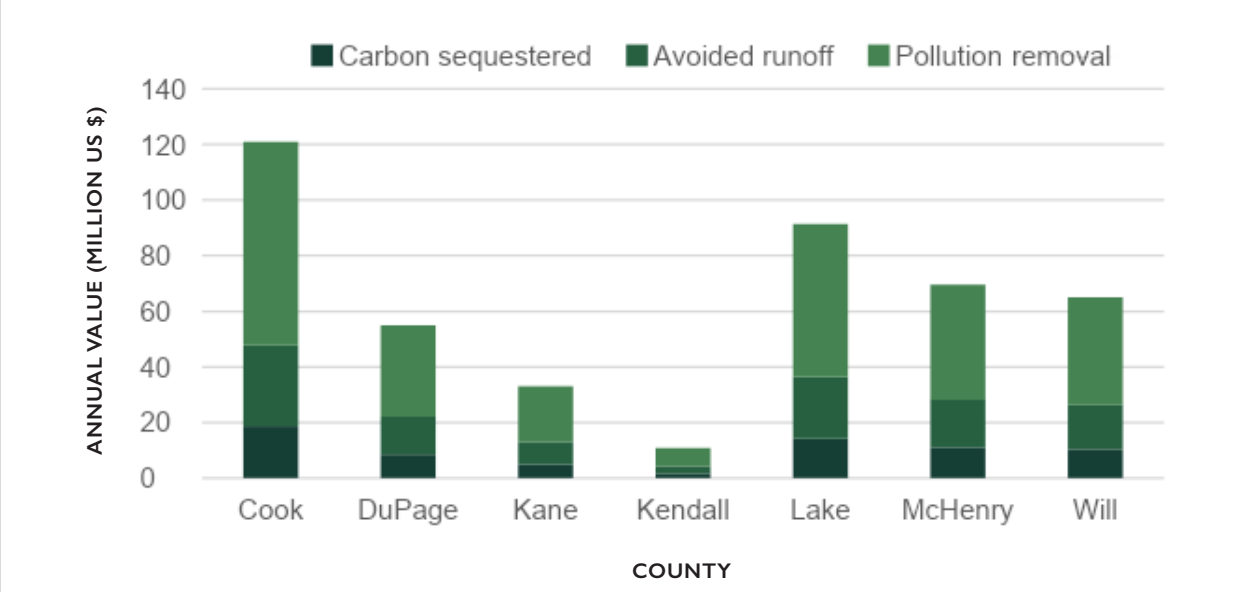


Figure 18: Annual values of three important ecosystem benefits (carbon sequestration, stormwater management/avoided runoff, and pollution removal) provided by trees in the seven counties of the region, 2020. (Cook County data does not include the data from the city of Chicago.)

Air pollution removal by trees

Poor air quality is a common problem in many urban areas. Ozone and particulate matter are two forms of air pollution that have the greatest impact on human health and can cause premature death, heart attacks, irregular heartbeat, asthma attacks, and coughing or difficulty breathing due to irritation of the lungs (Environmental Protection Agency, 2020).

Thoughtfully planted, healthy trees can help improve air quality by reducing air temperature, directly removing pollutants from the air, and trapping it on their surfaces. Trees also can reduce energy consumption in buildings. Reducing energy consumption consequently reduces air pollutant emissions from the power sources. Pollution removal by trees and shrubs in the Chicago region was estimated using field data and recent available pollution and weather data. Trees and shrubs remove an estimated 13,600 tons of air pollution (ozone, O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter less than 2.5 microns (PM2.5), and sulfur dioxide (SO_2) per year, with an associated value of $157 million for the entire region. The estimated amount and value of removed pollutants for each county are listed in the summary section at the beginning of this report.

It is important to note that although a number of tree species can produce the volatile organic compounds (VOCs) that lead to ozone production in the atmosphere, the i-Tree Eco software accounts for both reduction and production of VOCs within its algorithms. While at a site-specific level some trees may cause VOC disservices, the overall effect of the region's trees reduces the production of ozone through evaporative cooling (i-tree Eco, 2021).

Carbon sequestration and storage

Trees reduce the amount of carbon in the atmosphere by sequestering carbon in new growth every year. The amount of carbon sequestered annually is increased with the size and health of the trees.

As a tree grows, it stores carbon by holding it in its accumulated tissue. As a tree dies and decays, it releases the stored carbon back into the atmosphere. Carbon storage is an indication of the amount of carbon that can be released if trees are allowed to die and decompose. Maintaining trees to keep them healthy will keep the carbon stored in trees longer, but activities such as pruning, removal, and wood chipping can also contribute to carbon emissions (Nowak and Crane, 2002).

Regionally, gross carbon sequestration is about 543,000 tons of carbon per year, with an associated value of $93 million. Trees in the regional forest store an estimated 20 million tons of carbon. The value of storing this carbon is estimated to be around $4 billion. Of the species sampled, silver maple (*Acer saccharinum*) stores the most carbon (approximately 11% of the total carbon stored). Having the highest stem count, European buckthorn (*Rhamnus cathartica*) sequesters the most annually (approximately 9% of all sequestered carbon). County level values for carbon sequestration and storage are listed in the summary section at the beginning of the report.

Silver maple (*Acer saccharinum*)

Trees in the regional forest store an estimated 20 million tons of carbon. The value of storing this carbon is estimated to be around $4 billion. Of the species sampled, silver maple (*Acer saccharinum*) stores the most carbon (approximately 11% of the total carbon stored).

Mitigating runoff

The *ON TO 2050* comprehensive plan for the Chicago region noted that the region's infrastructure is aging and insufficient for today's needs (Chicago Metropolitan Agency for Planning, n.d.). Due to the changing climate, the intensity and frequency of storm events has increased in the region. These events are producing more rain than the region's stormwater systems were designed to handle—leading to overtaxed systems and flooding. Impermeable surfaces such as buildings, pavements, roads, and parking areas in the built environment prevent rainwater from entering the ground. Hence, poorly planned urban areas are particularly at risk of flooding, and green infrastructure such as trees can contribute to the mitigation.

Trees can help to better manage stormwater runoff by intercepting rainfall in their canopies during storm events. This intercepted rainfall evaporates from leaves or slowly soaks into the ground, thereby reducing, cooling, and slowing stormwater runoff and lessening erosion (Berland *et al*., 2017). Underground tree root growth and decomposition help to increase the amount of water the soil can retain, allowing for greater absorption of stormwater. Avoided runoff is the amount of water that would become surface runoff to streams, but does not. Estimates incorporate water interception by plants, ground depression storage, infiltration on pervious ground covers, and overland flow on impervious ground covers.

Based on the data from local weather stations, the trees and shrubs in the region help to reduce runoff by an estimated 1.5 billion cubic feet per year, with an associated value of around $100 million. The volume and associated value estimation of stormwater management for individual counties are listed in the summary section at the beginning of this report.

Reduction of energy consumption

A properly planted tree can reduce building energy consumption in the summer and winter months. Shade from large, healthy trees that are properly cared for lowers city and building temperatures by reducing the amount of sunlight that is absorbed and stored by impervious surfaces (e.g., roads, buildings, sidewalks), while their leaves release water vapor (transpiration) to cool the surrounding area. Trees also can block cold winter winds. The estimated impact of trees on energy use is calculated using field measurements of the distance and location of the tree to residential buildings (McPherson and Simpson, 1999). Trees in the regional forest are estimated to reduce energy-related costs from residential buildings by $32 million annually. They provide an additional $10 million in value by reducing the amount of carbon released by fossil fuel–based power plants (a reduction of 58,800 tons of carbon emissions).

Values

Forests have a structural value based on the trees themselves (e.g., the cost of replacing a tree with a similar tree). They also have functional values (either positive or negative) based on the functions and ecosystem services that the trees contribute to the region.

The structural and functional values of a regional forest tend to increase with the number and size of healthy trees (Nowak *et al*. 2002). Through proper management, regional structural and functional forest values can appreciate over time. However, the values and benefits can decrease if the canopy becomes unhealthy or if the trees are mismanaged.

Conclusion

The 2020 tree census provides information on the extent, location, character, functions, and values of the seven-county regional forest. This report presents the quantifiable forest structure, composition, and environmental services as estimated at the county level, with the goal of providing these baseline estimates to help strengthen forest management and advocacy efforts.

This report highlights areas where the regional forest can improve. While the canopy cover has increased, it is still below the national average of 35% (Nowak and Greenfield, 2018), and more than 45% of the trees found in this area are considered invasive. Additionally, approximately 75% of the tree and shrub population is smaller than 6 inches DBH.

> This report highlights areas where the regional forest can improve. While the canopy cover has increased, it is still below the national average of 35%, and more than 45% of the trees found in this area are considered invasive.

Valued at $45 billion, the regional forest is an extremely important asset. At the county level, the structural values range from around $1 billion (Kendall County) to over $10 billion (Cook County). The 172 million trees in the region also provide $416 million in annual benefits to the people who live and work in this region through air pollution removal, carbon storage, carbon sequestration, building energy reduction, and reduced carbon emission.

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Forest Preserve District of McHenry County: Elizabeth Kessler for reading and providing comments on the draft report.

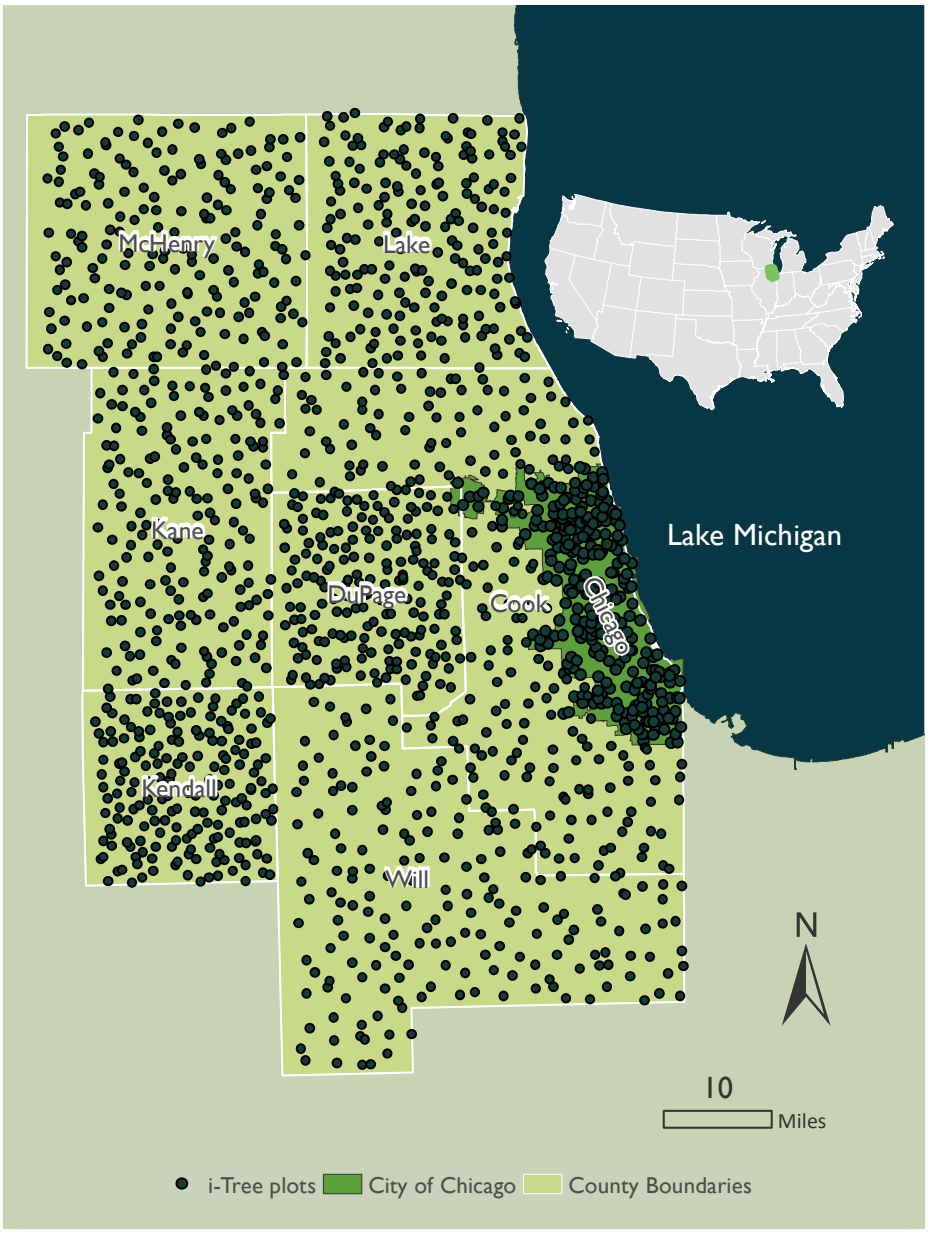

Figure 19: Project area map. Sixteen hundred plots (approximately 200 plots from each of the seven counties and the city of Chicago) were assessed in 2020. Data from 1,576 out of the 1,600 plots were successfully updated.

Plots

Cook County plots (not including the city of Chicago)

Of the 203 randomized i-Tree Eco plots, 199 plots were sampled. The plots were distributed among the following four major land use types:

Residential (91 plots) includes single- and multiple-family dwellings.
Agriculture (10 plots) includes row crops, pastures, and nurseries.
Open space and water and wetland (52 plots):
- Open space (48 plots) includes forest preserves, parks, golf courses, private hunting clubs, and vacant forest and grassland.
- Water and wetland (4 plots) includes lakes, rivers, wetlands, and other open bodies of water.

Commercial and industrial, transportation and utilities, institutional (CTI) (50 plots):
- Commercial and industrial (19 plots) includes places of business, manufacturing, and industrial parks.
- Transportation and utilities (16 plots) includes major roads and highways, airports, and railroads.
- Institutional (15 plots) includes educational facilities, religious facilities, and cemeteries.

DuPage County plots

Of the 194 randomized i-Tree Eco plots, 191 were sampled. The plots were distributed among the following four major land use types:

Residential (91 plots) includes single- and multiple-family dwellings.
Agriculture (2 plots) includes row crops, pastures, and nurseries.
Open space and water and wetland (44 plots):
- Open space (41 plots) includes forest preserves, parks, golf courses, private hunting clubs, and vacant forest and grassland.
- Water and wetland (3 plots) includes lakes, rivers, wetlands, and other open bodies of water.

Commercial and industrial, transportation and utilities, institutional (CTI) (57 plots):
- Commercial and industrial (29 plots) includes places of business, manufacturing, and industrial parks.
- Transportation and utilities (15 plots) includes major roads and highways, airports, and railroads.
- Institutional (13 plots) includes educational facilities, religious facilities, and cemeteries.

Kane County plots

Of the 184 randomized i-Tree Eco plots, 182 were sampled. The plots were distributed among the following four major land use types:

Residential (53 plots) includes single- and multiple-family dwellings.
Agriculture (80 plots) includes row crops, pastures, and nurseries.
Open space and water and wetland (33 plots):
- Open space (30 plots) includes forest preserves, parks, golf courses, private hunting clubs, and vacant forest and grassland.
- Water and wetland (3 plots) includes lakes, rivers, wetlands, and other open bodies of water.

Commercial and industrial, transportation and utilities, institutional (CTI) (18 plots):
- Commercial and industrial (10 plots) includes places of business, manufacturing, and industrial parks.
- Transportation and utilities (5 plots) includes major roads and highways, airports, and railroads.
- Institutional (3 plots) includes educational facilities, religious facilities, and cemeteries.

Kendall County plots

Of the 187 randomized i-Tree Eco plots, 183 were sampled. The plots were distributed among the following four major land use types:

Residential (23 plots) includes single- and multiple-family dwellings.
Agriculture (143 plots) includes row crops, pastures, and nurseries.
Open space and water and wetland (16 plots):
- Open space (13 plots) includes forest preserves, parks, golf courses, private hunting clubs, and vacant forest and grassland.
- Water and wetland (3 plots) includes lakes, rivers, wetlands, and other open bodies of water.

Commercial and industrial, transportation and utilities, institutional (CTI) (5 plots):
- Commercial and industrial (4 plots) includes places of business, manufacturing, and industrial parks.
- Transportation and utilities (0 plots) includes major roads and highways, airports, and railroads.
- Institutional (1 plots) includes educational facilities, religious facilities, and cemeteries.

McHenry County plots

Of the 188 randomized i-Tree Eco plots, 184 were sampled. The plots were distributed among the following four major land use types:

Residential (46 plots) includes single- and multiple-family dwellings.
Agriculture (106 plots) includes row crops, pastures, and nurseries.
Open space and water and wetland (28 plots):
- Open space (18 plots) includes forest preserves, parks, golf courses, private hunting clubs, and vacant forest and grassland.
- Water and wetland (10 plots) includes lakes, rivers, wetlands, and other open bodies of water.

Commercial and industrial, transportation and utilities, institutional (CTI) (8 plots):
- Commercial and industrial (4 plots) includes places of business, manufacturing, and industrial parks.
- Transportation and utilities (1 plots) includes major roads and highways, airports, and railroads.
- Institutional (3 plots) includes educational facilities, religious facilities, and cemeteries.

Lake County plots

Of the 188 randomized i-Tree Eco plots, 185 were sampled. The plots were distributed among the following four major land use types:

Residential (62 plots) includes single- and multiple-family dwellings.
Agriculture (19 plots) includes row crops, pastures, and nurseries.
Open space and water and wetland (76 plots):
- Open space (54 plots) includes forest preserves, parks, golf courses, private hunting clubs, and vacant forest and grassland.
- Water and wetland (22 plots) includes lakes, rivers, wetlands, and other open bodies of water.

Commercial and industrial, transportation and utilities, institutional (CTI) (31 plots):
- Commercial and industrial (16 plots) includes places of business, manufacturing, and industrial parks.
- Transportation and utilities (4 plots) includes major roads and highways, airports, and railroads.
- Institutional (11 plots) includes educational facilities, religious facilities, and cemeteries.

Will County plots

Of the 189 randomized i-Tree Eco plots, 186 were sampled. The plots were distributed among the following four major land use types:

Residential (40 plots) includes single- and multiple-family dwellings.
Agriculture (93 plots) includes row crops, pastures, and nurseries.
Open space and water and wetland (28 plots):
- Open space (23 plots) includes forest preserves, parks, golf courses, private hunting clubs, and vacant forest and grassland.
- Water and wetland (5 plots) includes lakes, rivers, wetlands, and other open bodies of water.

Commercial and industrial, transportation and utilities, institutional (CTI) (28 plots):
- Commercial and industrial (10 plots) includes places of business, manufacturing, and industrial parks.
- Transportation and utilities (10 plots) includes major roads and highways, airports, and railroads.
- Institutional (8 plots) includes educational facilities, religious facilities, and cemeteries.

Method

A standardized field collection method based on i-Tree Eco Manual v. 6.0 was used for data collection. The data collected and updated included:

Plot information

Percent tree cover: the amount of the plot covered by tree canopy.
Percent shrub cover: the amount of the plot covered by shrubs.
Percent plantable: the amount of the plot that is plantable for trees (e.g. impervious land where planting would not be prohibitive or restrictive).
Land use: the land use type identified in the field as well as the percentage of plot covered by each land use.
Ground cover: ground cover types and percentage within the plot area.

Reference objects

A reference object is a landmark that is visible when standing at the plot center. Permanent plots require two, and three reference objects are recommended in all cases where the plot center is difficult to locate or identify. The following were recorded to establish the location of the reference objects:

Object type: tree, building corner, utility pole, etc.
Direction: direction from plot center (in degrees).
Distance: distance from plot center to the closest part of the object (in feet).
Diameter at breast height (if a tree was used): stem diameter at 4½ feet above grade.

Trees

General information collected from the trees:

Species: species and genus (common and Latin).
Land use: land use type where the tree is located.
Status: planted, ingrowth (naturally occurred), unknown.
Direction: direction from plot center (in degrees).
Distance: distance from plot center to closest part of main stem.
Total height: height from the ground to the top of the tree.

Crown:

- **Percent dieback:** percent of crown that is composed of dead branches.
- **Top height:** height from the bottom of the live crown to the top of the live crown.
- **Base height:** height from the ground to the bottom of the live crown.
- **Crown width:** average crown width, based on two dimensions taken at 90 degrees (e.g. north-south, east-west).
- **Percent missing:** percent of crown volume not occupied by leaves or branches.
- **Crown light exposure:** number of sides of the tree receiving sunlight from above.

Percent impervious: percent of impervious ground cover underneath the crown (e.g. asphalt or cement).
Percent shrub: percent of shrubs underneath the crown.
DBH (Diameter at Breast Height): stem diameter at 4½ feet above grade.
Measurement for energy effects
Distance and direction to building from trees: measured from the tree to the closest part of a nearby building.

Shrubs

Percent of shrub area: percentage of shrub species of the total shrub area within the plot.
Species: species and genus (common and Latin).
Height: average height of species group from the ground to the top of the shrub.
Percent crown missing: percent average of the crown volume not occupied by leaves or branches within a species group.

Reaccessing plots

The 2020 project reassessed plots from two previous studies: the 2007 city of Chicago Urban Forest Effects model (UFORE) assessment (Nowak *et al.* 2010) and the 2010 Chicago region i-Tree assessment (Nowak *et al.* 2013). Considerations have been made to ensure the 2020 data best represent the change of the trees and the plots. The following protocols were developed to address four different scenarios:

1. plots where all the trees matched the previous tree census
2. plots where some of the trees matched the 2010 tree census
3. plots where none of the trees matched the 2010 tree census
4. plots in the city of Chicago (plots from a survey done in 2007 in the city of Chicago did not include distance and direction from the plot center for the listed trees)

On plots where all the trees matched, this scenario represented the easiest and most efficient plots to collect data from. GPS coordinates, in conjunction with reference objects, were used to locate the plot center. Trees can be matched up using the given direction and distance from the previous data and then updated starting with Tree 1. Trees that were matched up were coded as *Tree matched* (TM) and entered into the comments column on the data collection form as reference.

On plots where some of the trees matched, this scenario proved to be the most challenging. This situation could occur for a number of reasons: land use change, invasive species overpopulation (i.e. buckthorn), species misidentification, lack of and/or poor reference objects, or misalignment of the plot center with the 2010 plot. An example of this scenario would be a plot with heavy presence of buckthorn but few large key species (such as an oak, a hackberry, and a multistemmed silver maple). In these cases, trees were matched when possible using the given direction and distance. These trees were marked with TM in the comments. Trees that were listed in the 2010 data that could not be matched were marked as *removed, unknown*. Any new trees, or trees that could not be matched (i.e. all of the buckthorn), were collected starting at true north and moving clockwise.

Invasive species overpopulation or the inability to locate plot centers due to poor or nonexistent reference objects led to the third scenario, plots where none of the trees matched. An example would be a plot that may have used a green ash and the road edge as reference objects. The green ash might be dead and no longer exist, making it difficult to locate where exactly along the road edge the plot begins. In these cases, the existing data would be overwritten. Plot center would be located using the GPS coordinates for the given plot. Another example would be if a plot had an abundance of buckthorn that made it nearly impossible to align trees with the given direction and distance. New reference objects would be

recorded from the new plot center. Trees would be collected starting at true north working clockwise back to true north. Codes such as *NPC* for *new plot center* and *ROU* for *reference object updated* would be noted in the plot comments.

The fourth scenario, plots in the city of Chicago, posed its own unique challenge, as distance and direction to the reference objects were missing from the 2007 dataset. This made it difficult to guarantee trees were matched with the previous study. Plots that had a small number of trees (less than five) and a diverse range of species made it relatively easy to match. However, in the plots with more than five trees or a high number of the same species (especially in the plots with small stemmed invasive species), trees were difficult to match. In these instances, the plot center was located using the assigned GPS coordinates and reference objects. Moving clockwise, starting at true north, species and the relative DBH would be used to attempt to match trees from the 2007 study. Those trees that could be confidently matched were updated with distance and direction and marked as *TM* in the comment section of the database.

Similar to the above scenarios, those trees from 2007 that could not be matched were marked as *removed, unknown* and the new trees added to the end of the list. For plots where none of the trees could be matched, data would be overwritten starting at true north proceeding clockwise, as if the plot was being collected for the first time. In these instances, a comment was recorded stating that the trees could not be matched. The issue of matching trees did not occur often as most plots within the city limits had few trees.

Specifically, an example of a plot where trees could not be matched was an unmaintained plot located on two vacant lots in a residential area. It has a fair amount of dead trees and overgrown vegetation. None of the trees could be matched as there were a number of trees that fit the species and relative DBH listed from 2007. In this case, the data from this plot was collected by overwriting the old data.

Top 20 species ranked by stem count

Cook County (not including the city of Chicago)

SPECIES	Number of trees	Percent tree abundance	Tree margin of error	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error
European buckthorn	14,769,000	33.1%	3,683,000	81,700	10.8%	26,100
Juniper spp.	2,244,000	5.0%	2,101,000	9,800	1.3%	8,000
American elm	1,864,000	4.2%	608,000	48,900	6.4%	19,200
Black cherry	1,728,000	3.9%	698,000	19,400	2.6%	11,300
Honeysuckle spp.	1,684,000	3.8%	1,371,000	8,600	1.1%	6,700
Amur honeysuckle	1,623,000	3.6%	1,146,000	4,000	0.5%	2,900
Boxelder	1,592,000	3.6%	500,000	21,600	2.9%	9,800
Eastern cottonwood	1,491,000	3.3%	717,000	99,800	13.2%	49,900
Tree of heaven	1,327,000	3.0%	644,000	22,800	3.0%	9,100
Northern red oak	1,194,000	2.7%	639,000	40,500	5.3%	18,000
Crabapple	1,032,000	2.3%	868,000	8,600	1.1%	4,400
Silver maple	886,000	2.0%	235,000	54,800	7.2%	14,700
Green ash	846,000	1.9%	239,000	11,900	1.6%	4,700
White ash	747,000	1.7%	255,000	4,100	0.5%	1,900
Honeylocust	638,000	1.4%	190,000	25,600	3.4%	10,000
Bush honeysuckle spp.	630,000	1.4%	365,000	2,100	0.3%	1,200
Northern white cedar	621,000	1.4%	225,000	8,900	1.2%	4,100
Hardwood (species unspecified)	565,000	1.3%	186,000	0	0.0%	0
Hawthorn spp.	533,000	1.2%	242,000	500	0.1%	300
Black locust	467,000	1.0%	300,000	9,000	1.2%	6,200

DuPage County

SPECIES	Number of trees	Percent tree abundance	Tree margin of error	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error
European buckthorn	7,443,000	37.7%	2,442,000	29,800	9.3%	8,700
European alder	2,078,000	10.5%	1,811,000	6,700	2.1%	4,100
Amur honeysuckle	1,003,000	5.1%	542,000	5,100	1.6%	2,700
Black cherry	878,000	4.4%	348,000	26,500	8.3%	10,900
Boxelder	765,000	3.9%	243,000	19,200	6.0%	5,300
Slippery elm	623,000	3.2%	470,000	3,400	1.1%	1,400
Green ash	327,000	1.7%	94,000	7,300	2.3%	3,400
White ash	321,000	1.6%	260,000	3,300	1.0%	1,900
American elm	312,000	1.6%	87,000	11,400	3.6%	4,700
Siberian elm	301,000	1.5%	198,000	6,900	2.2%	3,600
Eastern white pine	301,000	1.5%	256,000	8,900	2.8%	7,200
Silver maple	280,000	1.4%	76,000	34,400	10.8%	8,900
Northern white cedar	265,000	1.3%	198,000	1,100	0.4%	600
Norway maple	250,000	1.3%	114,000	15,300	4.8%	4,500
Sumac spp.	247,000	1.3%	169,000	700	0.2%	500
Honeylocust	220,000	1.1%	58,000	9,400	3.0%	2,600
White mulberry	196,000	1.0%	75,000	4,300	1.4%	2,000
Bur oak	176,000	0.9%	101,000	8,800	2.8%	3,700
Shagbark hickory	173,000	0.9%	74,000	2,600	0.8%	1,100
Weeping white mulberry	163,000	0.8%	81,000	4,200	1.3%	2,700

Kane County

SPECIES	Number of trees	Percent tree abundance	Tree margin of error	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error
European buckthorn	1,291,000	15.0%	507,000	4,500	2.4%	1,600
Boxelder	1,173,000	13.7%	603,000	10,300	5.5%	4,700
Black cherry	585,000	6.8%	392,000	5,700	3.0%	3,500
Willow spp.	462,000	5.4%	267,000	4,400	2.4%	2,100
Mulberry spp.	452,000	5.3%	164,000	7,800	4.1%	3,300
White mulberry	409,000	4.8%	178,000	8,800	4.6%	3,700
Black walnut	383,000	4.5%	175,000	19,100	10.1%	12,500
Siberian elm	203,000	2.4%	203,000	2,400	1.3%	2,400
Chinkapin oak	191,000	2.2%	191,000	500	0.3%	500
Silver maple	190,000	2.2%	67,000	19,100	10.1%	7,000
Bur oak	164,000	1.9%	73,000	16,600	8.8%	8,200
Eastern red cedar	152,000	1.8%	152,000	2,500	1.4%	2,500
American elm	151,000	1.8%	93,000	7,000	3.7%	3,500
Northern red oak	140,000	1.6%	140,000	4,800	2.5%	4,800
Eastern cottonwood	138,000	1.6%	69,000	11,400	6.1%	6,900
Apple spp.	127,000	1.5%	36,000	5,100	2.7%	1,600
Honeysuckle spp.	122,000	1.4%	59,000	500	0.3%	200
Blue spruce	101,000	1.2%	49,000	4,200	2.3%	2,600
White poplar	101,000	1.2%	101,000	300	0.2%	300
Norway maple	97,000	1.1%	44,000	5,000	2.7%	2,400

Kendall County

SPECIES	Number of trees	Percent tree abundance	Tree margin of error	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error
Mulberry spp.	360,000	12.0%	327,000	4,400	7.3%	4,100
Black walnut	196,000	6.6%	96,000	5,900	9.8%	2,800
Bur oak	163,000	5.5%	136,000	4,100	6.8%	3,000
Boxelder	148,000	5.0%	113,000	2,600	4.4%	2,100
Eastern white pine	143,000	4.8%	123,000	4,200	7.1%	3,100
White mulberry	133,000	4.5%	68,000	2,300	3.9%	1,300
Black cherry	131,000	4.4%	68,000	1,800	3.1%	1,100
European buckthorn	126,000	4.2%	103,000	900	1.5%	800
Apple spp.	111,000	3.7%	71,000	2,300	3.8%	1,400
Black locust	94,000	3.2%	69,000	2,200	3.7%	2,000
Northern red oak	87,000	2.9%	50,000	1,600	2.8%	1,200
Eastern hophornbeam	84,000	2.8%	60,000	800	1.4%	500
American elm	82,000	2.8%	47,000	3,900	6.6%	2,700
Green ash	80,000	2.7%	52,000	300	0.6%	200
Sycamore spp.	73,000	2.5%	67,000	1,200	2.1%	900
American basswood	66,000	2.2%	54,000	1,900	3.1%	1,300
Callery pear	65,000	2.2%	45,000	1,700	2.8%	1,600
Northern hackberry	64,000	2.2%	30,000	1,200	2.0%	700
Honeysuckle spp.	56,000	1.9%	56,000	100	0.2%	100
Amur honeysuckle	52,000	1.8%	37,000	300	0.5%	200

Lake County

SPECIES	Number of trees	Percent tree abundance	Tree margin of error	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error
European buckthorn	23,354,000	52.2%	5,206,000	97,000	17.3%	21,000
Staghorn sumac	1,601,000	3.6%	1,582,000	2,700	0.5%	2,400
Boxelder	1,556,000	3.5%	370,000	54,600	9.8%	17,200
Eastern cottonwood	1,543,000	3.5%	1,196,000	31,900	5.7%	14,500
White spruce	1,131,000	2.5%	1,094,000	3,600	0.6%	2,800
Shagbark hickory	1,031,000	2.3%	364,000	15,800	2.8%	5,500
Black walnut	962,000	2.2%	697,000	27,200	4.9%	12,700
Black cherry	909,000	2.0%	261,000	14,100	2.5%	3,700
Hawthorn spp.	867,000	1.9%	602,000	2,900	0.5%	1,200
Northern red oak	861,000	1.9%	267,000	59,900	10.7%	18,600
Northern white cedar	849,000	1.9%	393,000	4,200	0.8%	2,100
White ash	840,000	1.9%	296,000	7,200	1.3%	2,900
Apple spp.	586,000	1.3%	240,000	10,700	1.9%	4,300
Green ash	538,000	1.2%	283,000	4,500	0.8%	2,200
Black locust	504,000	1.1%	404,000	12,000	2.2%	9,600
American elm	466,000	1.0%	147,000	6,500	1.2%	2,400
White oak	443,000	1.0%	133,000	25,200	4.5%	8,600
Sugar maple	414,000	0.9%	213,000	5,700	1.0%	3,100
Eastern red cedar	369,000	0.8%	238,000	1,800	0.3%	1,100
Eastern hophornbeam	346,000	0.8%	201,000	4,300	0.8%	2,400

McHenry County

SPECIES	Number of trees	Percent tree abundance	Tree margin of error	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error
European buckthorn	10,189,000	40.9%	2,908,000	38,100	8.8%	10,200
Black cherry	1,513,000	6.1%	700,000	22,600	5.2%	7,500
Bush honeysuckle spp.	1,307,000	5.3%	691,000	3,000	0.7%	1,800
Boxelder	1,159,000	4.7%	395,000	53,800	12.4%	25,600
Black walnut	947,000	3.8%	561,000	41,900	9.6%	19,800
Green ash	943,000	3.8%	917,000	1,600	0.4%	1,500
Honeysuckle spp.	853,000	3.4%	451,000	5,200	1.2%	2,600
Siberian elm	848,000	3.4%	571,000	14,400	3.3%	11,400
Shagbark hickory	699,000	2.8%	368,000	11,600	2.7%	6,700
Silver maple	594,000	2.4%	215,000	70,600	16.2%	21,900
Bur oak	398,000	1.6%	169,000	25,500	5.9%	12,100
Mulberry spp.	382,000	1.5%	158,000	14,300	3.3%	5,700
Eastern cottonwood	317,000	1.3%	256,000	17,700	4.1%	11,100
White oak	261,000	1.1%	120,000	13,400	3.1%	6,900
American elm	240,000	1.0%	181,000	3,600	0.8%	2,100
White mulberry	232,000	0.9%	88,000	2,300	0.5%	1,100
Common prickly ash	231,000	0.9%	231,000	600	0.1%	600
Eastern white pine	229,000	0.9%	109,000	7,100	1.6%	3,900
Hardwood (species unspecified)	221,000	0.9%	97,000	0	0.0%	0
Northern red oak	220,000	0.9%	143,000	4,100	0.9%	3,100

Will County

SPECIES	Number of trees	Percent tree abundance	Tree margin of error	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error
European buckthorn	2,994,000	13.9%	1,563,000	16,900	4.0%	9,300
Amur honeysuckle	2,634,000	12.2%	1,339,000	8,100	1.9%	4,200
Sugar maple	2,064,000	9.6%	1,141,000	33,500	7.9%	19,400
Black locust	1,502,000	7.0%	1,156,000	60,000	14.0%	49,500
Green ash	1,328,000	6.2%	544,000	2,600	0.6%	900
American elm	1,286,000	6.0%	671,000	31,000	7.3%	12,900
Black cherry	668,000	3.1%	262,000	16,900	4.0%	9,200
Black walnut	644,000	3.0%	296,000	34,600	8.1%	20,700
Autumn olive	641,000	3.0%	423,000	4,700	1.1%	3,400
White mulberry	617,000	2.9%	255,000	9,800	2.3%	4,200
Boxelder	556,000	2.6%	222,000	6,400	1.5%	3,900
Hawthorn spp.	499,000	2.3%	315,000	2,400	0.6%	1,500
Hardwood (species unspecified)	485,000	2.2%	173,000	300	0.1%	300
Weeping white mulberry	418,000	1.9%	140,000	5,900	1.4%	2,800
Eastern cottonwood	332,000	1.5%	172,000	23,700	5.6%	11,700
American basswood	331,000	1.5%	177,000	11,000	2.6%	6,600
Honeysuckle spp.	308,000	1.4%	209,000	1,100	0.3%	800
Hackberry spp.	297,000	1.4%	180,000	3,300	0.8%	2,100
Black haw	293,000	1.4%	267,000	700	0.2%	700
Blue spruce	266,000	1.2%	124,000	11,500	2.7%	5,500

Top 20 species ranked by leaf area

Cook County (not including the city of Chicago)

SPECIES	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error	Number of trees	Percent tree abundance	Tree margin of error
Eastern cottonwood	99,800	13.2%	49,900	1,491,000	3.3%	717,000
European buckthorn	81,700	10.8%	26,100	14,769,000	33.1%	3,683,000
Norway maple	58,000	7.7%	29,800	451,000	1.0%	145,000
Silver maple	54,800	7.2%	14,700	886,000	2.0%	235,000
American elm	48,900	6.4%	19,200	1,864,000	4.2%	608,000
Northern red oak	40,500	5.3%	18,000	1,194,000	2.7%	639,000
Bur oak	27,700	3.7%	12,700	414,000	0.9%	202,000
Honeylocust	25,600	3.4%	10,000	638,000	1.4%	190,000
White oak	25,300	3.3%	17,900	260,000	0.6%	147,000
Siberian elm	23,100	3.1%	11,700	415,000	0.9%	173,000
Tree of heaven	22,800	3.0%	9,100	1,327,000	3.0%	644,000
Black walnut	21,900	2.9%	9,800	247,000	0.6%	87,000
Boxelder	21,600	2.9%	9,800	1,592,000	3.6%	500,000
Black cherry	19,400	2.6%	11,300	1,728,000	3.9%	698,000
Green ash	11,900	1.6%	4,700	846,000	1.9%	239,000
Red maple	10,500	1.4%	6,000	119,000	0.3%	52,000
White mulberry	10,400	1.4%	6,400	263,000	0.6%	130,000
Juniper spp.	9,800	1.3%	8,000	2,244,000	5.0%	2,101,000
Black locust	9,000	1.2%	6,200	467,000	1.0%	300,000
Northern white cedar	8,900	1.2%	4,100	621,000	1.4%	225,000

DuPage County

SPECIES	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error	Number of trees	Percent tree abundance	Tree margin of error
Silver maple	34,400	10.8%	8,900	280,000	1.4%	76,000
European buckthorn	29,800	9.3%	8,700	7,443,000	37.7%	2,442,000
Black cherry	26,500	8.3%	10,900	878,000	4.4%	348,000
Black walnut	19,400	6.1%	8,300	124,000	0.6%	56,000
Boxelder	19,200	6.0%	5,300	765,000	3.9%	243,000
Norway maple	15,300	4.8%	4,500	250,000	1.3%	114,000
American elm	11,400	3.6%	4,700	312,000	1.6%	87,000
Sugar maple	11,200	3.5%	6,000	112,000	0.6%	49,000
Honeylocust	9,400	3.0%	2,600	220,000	1.1%	58,000
Eastern white pine	8,900	2.8%	7,200	301,000	1.5%	256,000
Bur oak	8,800	2.8%	3,700	176,000	0.9%	101,000
Green ash	7,300	2.3%	3,400	327,000	1.7%	94,000
White poplar	7,000	2.2%	4,900	55,000	0.3%	39,000
Siberian elm	6,900	2.2%	3,600	301,000	1.5%	198,000
European alder	6,700	2.1%	4,100	2,078,000	10.5%	1,811,000
Northern red oak	6,400	2.0%	2,500	158,000	0.8%	63,000
Blue spruce	5,600	1.8%	2,400	83,000	0.4%	32,000
Amur honeysuckle	5,100	1.6%	2,700	1,003,000	5.1%	542,000
American basswood	4,800	1.5%	2,500	77,000	0.4%	35,000
White mulberry	4,300	1.4%	2,000	196,000	1.0%	75,000

Kane County

SPECIES	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error	Number of trees	Percent tree abundance	Tree margin of error
Black walnut	19,100	10.1%	12,500	383,000	4.5%	175,000
Silver maple	19,100	10.1%	7,000	190,000	2.2%	67,000
Bur oak	16,600	8.8%	8,200	164,000	1.9%	73,000
Eastern cottonwood	11,400	6.1%	6,900	138,000	1.6%	69,000
Boxelder	10,300	5.5%	4,700	1,173,000	13.7%	603,000
White mulberry	8,800	4.6%	3,700	409,000	4.8%	178,000
Mulberry spp.	7,800	4.1%	3,300	452,000	5.3%	164,000
White oak	7,500	4.0%	5,500	82,000	1.0%	44,000
American elm	7,000	3.7%	3,500	151,000	1.8%	93,000
Black cherry	5,700	3.0%	3,500	585,000	6.8%	392,000
Apple spp.	5,100	2.7%	1,600	127,000	1.5%	36,000
Norway maple	5,000	2.7%	2,400	97,000	1.1%	44,000
Northern red oak	4,800	2.5%	4,800	140,000	1.6%	140,000
European buckthorn	4,500	2.4%	1,600	1,291,000	15.0%	507,000
Willow spp.	4,400	2.4%	2,100	462,000	5.4%	267,000
Blue spruce	4,200	2.3%	2,600	101,000	1.2%	49,000
Osage orange	3,900	2.1%	3,900	85,000	1.0%	85,000
Norway spruce	3,000	1.6%	3,000	25,000	0.3%	25,000
American basswood	2,900	1.6%	2,100	76,000	0.9%	53,000
Red mulberry	2,700	1.4%	2,000	37,000	0.4%	28,000

Kendall County

SPECIES	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error	Number of trees	Percent tree abundance	Tree margin of error
Black walnut	5,900	9.8%	2,800	196,000	6.6%	96,000
Mulberry spp.	4,400	7.3%	4,100	360,000	12.0%	327,000
Eastern white pine	4,200	7.1%	3,100	143,000	4.8%	123,000
Bur oak	4,100	6.8%	3,000	163,000	5.5%	136,000
American elm	3,900	6.6%	2,700	82,000	2.8%	47,000
Boxelder	2,600	4.4%	2,100	148,000	5.0%	113,000
Silver maple	2,600	4.3%	1,900	33,000	1.1%	18,000
White mulberry	2,300	3.9%	1,300	133,000	4.5%	68,000
Apple spp.	2,300	3.8%	1,400	111,000	3.7%	71,000
Black locust	2,200	3.7%	2,000	94,000	3.2%	69,000
Pin oak	2,000	3.4%	1,800	29,000	1.0%	21,000
American basswood	1,900	3.1%	1,300	66,000	2.2%	54,000
Black cherry	1,800	3.1%	1,100	131,000	4.4%	68,000
Callery pear	1,700	2.8%	1,600	65,000	2.2%	45,000
Northern red oak	1,600	2.8%	1,200	87,000	2.9%	50,000
White oak	1,400	2.4%	1,400	6,000	0.2%	6,000
Sycamore spp.	1,200	2.1%	90	73,000	2.5%	67,000
Northern hackberry	1,200	2.0%	700	64,000	2.2%	30,000
River birch	1,100	1.8%	1,100	6,000	0.2%	6,000
Littleleaf linden	1,000	1.7%	1,000	10,000	0.4%	10,000

Lake County

SPECIES	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error	Number of trees	Percent tree abundance	Tree margin of error
European buckthorn	97,000	17.3%	21,000	23,354,000	52.2%	5,206,000
Northern red oak	59,900	10.7%	18,600	861,000	1.9%	267,000
Boxelder	54,600	9.8%	17,200	1,556,000	3.5%	370,000
Silver maple	32,500	5.8%	11,800	297,000	0.7%	128,000
Eastern cottonwood	31,900	5.7%	14,500	1,543,000	3.5%	1,196,000
Black walnut	27,200	4.9%	12,700	962,000	2.2%	697,000
White oak	25,200	4.5%	8,600	443,000	1.0%	133,000
Siberian elm	17,900	3.2%	11,800	104,000	0.2%	62,000
Shagbark hickory	15,800	2.8%	5,500	1,031,000	2.3%	364,000
Black cherry	14,100	2.5%	3,700	909,000	2.0%	261,000
Bur oak	13,500	2.4%	6,600	262,000	0.6%	134,000
Black locust	12,000	2.2%	9,600	504,000	1.1%	404,000
Apple spp.	10,700	1.9%	4,300	586,000	1.3%	240,000
White ash	7,200	1.3%	2,900	840,000	1.9%	296,000
Norway maple	7,100	1.3%	6,400	207,000	0.5%	171,000
White mulberry	6,600	1.2%	2,700	312,000	0.7%	103,000
American elm	6,500	1.2%	2,400	466,000	1.0%	147,000
Red maple	6,000	1.1%	3,700	86,000	0.2%	54,000
Eastern white pine	5,800	1.0%	3,700	158,000	0.4%	74,000
Sugar maple	5,700	1.0%	3,100	414,000	0.9%	213,000

McHenry County

SPECIES	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error	Number of trees	Percent tree abundance	Tree margin of error
Silver maple	70,600	16.2%	21,900	594,000	2.4%	215,000
Boxelder	53,800	12.4%	25,600	1,159,000	4.7%	395,000
Black walnut	41,900	9.6%	19,800	947,000	3.8%	561,000
European buckthorn	38,100	8.8%	10,200	10,189,000	40.9%	2,908,000
Bur oak	25,500	5.9%	12,100	398,000	1.6%	169,000
Black cherry	22,600	5.2%	7,500	1,513,000	6.1%	700,000
Eastern cottonwood	17,700	4.1%	11,100	317,000	1.3%	256,000
Siberian elm	14,400	3.3%	11,400	848,000	3.4%	571,000
Mulberry spp.	14,300	3.3%	5,700	382,000	1.5%	158,000
White oak	13,400	3.1%	6,900	261,000	1.1%	120,000
Shagbark hickory	11,600	2.7%	6,700	699,000	2.8%	368,000
River birch	10,400	2.4%	5,000	89,000	0.4%	45,000
Pin oak	9,000	2.1%	4,900	215,000	0.9%	138,000
Eastern white pine	7,100	1.6%	3,900	229,000	0.9%	109,000
White spruce	7,000	1.6%	5,600	125,000	0.5%	93,000
Norway maple	6,400	1.5%	3,800	121,000	0.5%	65,000
Sugar maple	5,600	1.3%	4,200	38,000	0.2%	27,000
Honeysuckle spp.	5,200	1.2%	2,600	853,000	3.4%	451,000
Blue spruce	4,500	1.0%	2,500	71,000	0.3%	34,000
Northern red oak	4,100	0.9%	3,100	220,000	0.9%	143,000

Will County

SPECIES	Leaf area (acres)	Percent leaf area abundance	Leaf area margin of error	Number of trees	Percent tree abundance	Tree margin of error
Black locust	60,000	14.0%	49,500	1,502,000	7.0%	1,156,000
Black walnut	34,600	8.1%	20,700	644,000	3.0%	296,000
Sugar maple	33,500	7.9%	19,400	2,064,000	9.6%	1,141,000
American elm	31,000	7.3%	12,900	1,286,000	6.0%	671,000
Eastern cottonwood	23,700	5.6%	11,700	332,000	1.5%	172,000
Siberian elm	23,500	5.5%	15,200	195,000	0.9%	82,000
Black cherry	16,900	4.0%	9,200	668,000	3.1%	262,000
European buckthorn	16,900	4.0%	9,300	2,994,000	13.9%	1,563,000
Northern hackberry	14,100	3.3%	13,600	205,000	1.0%	167,000
Silver maple	12,600	3.0%	6,600	189,000	0.9%	96,000
Blue spruce	11,500	2.7%	5,500	266,000	1.2%	124,000
Freeman maple	11,000	2.6%	6,100	133,000	0.6%	67,000
American basswood	11,000	2.6%	6,600	331,000	1.5%	177,000
Bur oak	10,000	2.4%	7,100	131,000	0.6%	89,000
Apple spp.	10,000	2.4%	8,200	203,000	0.9%	131,000
White mulberry	9,800	2.3%	4,200	617,000	2.9%	255,000
Norway maple	9,600	2.3%	6,500	106,000	0.5	51,000
Amur honeysuckle	8,100	1.9%	4,200	2,634,000	12.2%	1,339,000
Northern red oak	7,700	1.8%	7,100	198,000	0.9%	117,000
Honeylocust	7,600	1.8%	5,100	168,000	0.8%	67,000

References

Berland, A., SA Shiflett, WD Shuster, AS Garmestani, HC Goddard, DL Hermann, and ME Hopton. 2017. "The Role of Trees in Urban Stormwater Management." *Landscape and Urban Planning* 162 (June): 167–177. doi: 10.1016/j.landurbplan.2017.02.017.

Chicago Metropolitan Agency for Planning. n.d. https://www.cmap.illinois.gov/. Accessed October 2020.

Chicago Metropolitan Agency for Planning. n.d. "Improve Natural Resources through the Redevelopment Process." https://www.cmap.illinois.gov/2050/environment/redevelopment. Accessed 2021.

Chicago Region Tree Initiative. n.d. "Healthy Hedges." Invasive Woody Plant Replacement Guides. Healthy Hedges. https://chicagorti.org/program/healthy-habitat-series/#healthy-hedges

Environmental Protection Agency. 2020. "Health and Environmental Effects of Particulate Matter (PM)." http://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm

i-Tree Eco. 2021. "i-Tree Methods Documentation, Model Notes, & Technical Papers." https://www.itreetools.org/support/resources-overview/i-tree-methods-and-files

Kua, C-S, L. Scott, L. Darling, CH Cannon, J. Turner-Skoff, T. Bethke, J. Miesbauer, and N. Cavender. 2021. "2020 Chicago Region Tree Census Report." Lisle, IL: The Morton Arboretum, 2021. https://doi.org/10.17605/OSF.IO/2GF6E.

McPherson, EG and JR Simpson. 1999. "Carbon Dioxide Reduction through Urban Forestry: Guidelines for Professional and Volunteer Tree Planters." *General Technical Reports*. PSW-GTR-171. Albany, CA: USDA Forest Service, Pacific Southwest Research Station.

Nowak, D. and D. Crane. 2002. "Carbon Storage and Sequestration by Urban Trees in the USA." *Environmental Pollution* 116 (no.3): 381–389. https://doi.org/10.1016/S0269-7491(01)00214-7.

Nowak, D. and EJ Greenfield, 2018. "US Urban Forest Statistics, Values, and Projections." *Journal of Forestry* 116 (2): 164–177.

Nowak, D., R. Hoehn, R. Bodine, D. Crane, J. Dwyer, V. Bonnewell, and G. Watson. 2013. "Urban Trees and Forests of the Chicago Region." Resource Bulletin NRS-84. Newtown Square, PA.: USDA Forest Service, Northern Research Station.

Nowak, D., R. Hoehn, D. Crane, J. Stevens, and C. Fisher. 2010. "Assessing Urban Forest Effects and Values, Chicago's Urban Forest." Resource Bulletin NRS-37. Newtown Square, PA: USDA Forest Service, Northern Research Station. https://www.nrs.fs.fed.us/pubs/34760.

USDA Forest Service, Northern Research Station. n.d. "i-Tree Eco version 6." https://www.itreetools.org/. Accessed October 2020.

Mission

The mission of The Morton Arboretum
is to collect and study trees, shrubs, and other plants from around the world,
to display them across naturally beautiful landscapes for people to study and enjoy,
and to learn how to grow them in ways that enhance our environment.
Our goal is to encourage the planting and conservation of trees
and other plants for a greener, healthier, and more beautiful world.

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