# Cook County Urban Forest Summary

**The Chicago Region Trees Initiative** (CRTI) goal is that, by 2050, the Chicago Region will support and host a healthier urban forest, comprised of a diversity of tree species and ages, appropriately distributed across land use types in the region. The forest will provide the region improved environmental, economic, and social benefits. In order to achieve that goal CRTI works with a wide variety of people who work with and manage trees. This document is intended to help municipalities understand their urban forest, and identify strategies that they can use to make it better.

The *urban forest* is comprised of all of the trees in an urban setting, regardless of who owns or manages them. It is made up of street trees, forested natural areas and even the trees in resident's back yards. These trees are all included in the urban forest, because they all provide benefits that municipalities depend on. They improve air and water quality, reduce flooding and the urban heat island effect, and reduce energy use by shading buildings. Trees provide habitat for wildlife and improve residents' quality of life by reducing crime rates, increasing property value and boosting social cohesion in neighborhoods.

The magnitude of benefits that trees provide correlates with the size, structure and location of their canopy. Understanding the extent of tree canopy is critical for urban planning. Canopy maps can be used to quantify the benefits that their trees provide, identify where new plantings would have the greatest impact and to develop priorities and strategies for expanding the canopy.

The Chicago Region Trees Initiative, USDA Forest Service, American Forests, and the University of Vermont mapped land cover across the seven-county Chicago Region. This project not only identifies tree canopy, but also other green infrastructure including grass and shrubs, bare soil and water; and gray infrastructure including buildings, roads and rail and other paved surfaces like sidewalks and parking lots (Fig. 1). Here after, these seven layers will be referred to as *land cover types*.

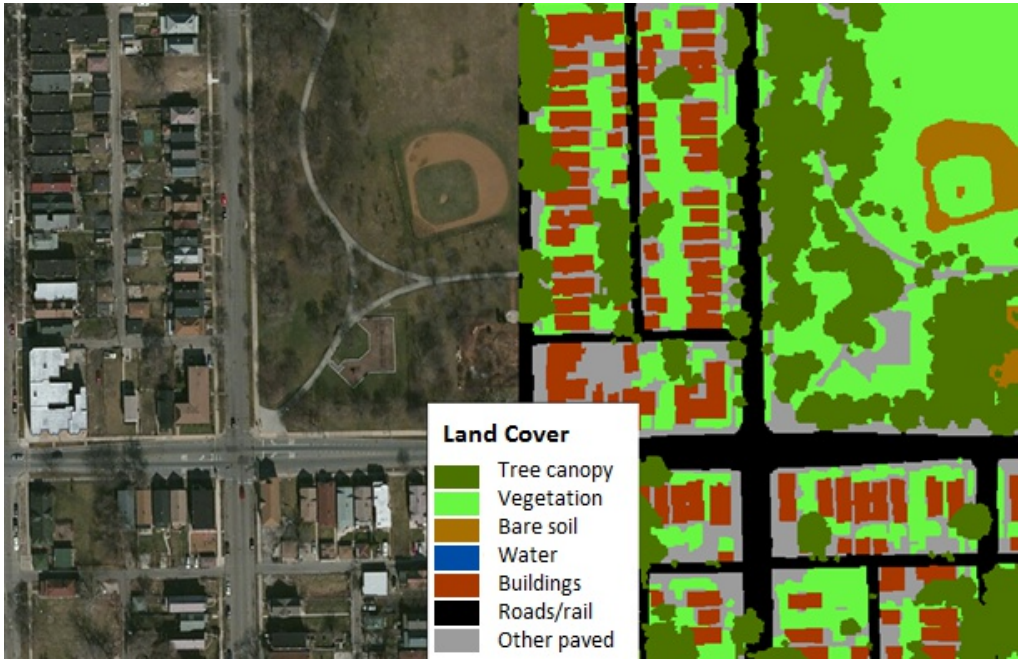


Figure 1: Comparison of satellite image and land cover map. Seven types of gray and green infrastructure are in the land cover map.

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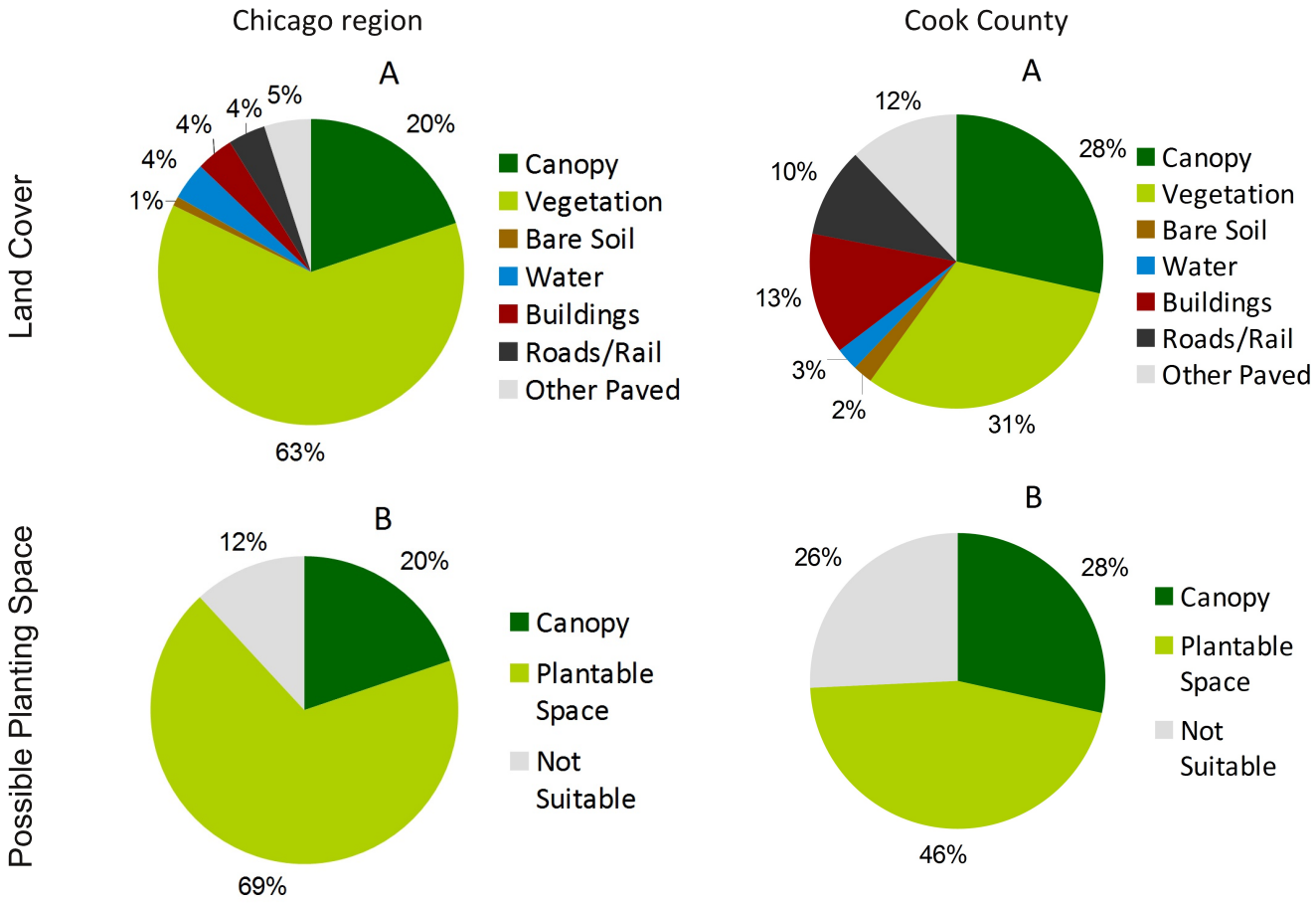


Figure 2: Chicago region's current land cover (A), including 20% canopy cover. An additional 68% of the county is suitable for planting (B). Cook County currently has 28% canopy cover (C), and 46% of the land cover could potentially be converted to canopy (D).

Overall, 20% of the Chicago region is covered by tree canopy (Fig. 2). There is a lot of room for growth across the region. We can identify spaces where trees could potentially be planted by adding together the vegetation, bare soil and other paved surface land cover types, as these land cover types could be converted to canopy with minimal effort. In all, these land cover types make up 68% of the region's area, meaning that canopy cover could potentially be raised to 88% if all of these surface were converted to trees. It is important to note, that while these surfaces could theoretically be covered with canopy, it is not necessarily preferable. Agricultural fields and baseball diamonds are included as "plantable space," but few would agree that these are ideal sites to expand the forest canopy.

These land cover data can also describe canopy at the county scale. Cook County currently has 28% canopy cover, and could potentially increase their canopy to 74% (Fig. 2).

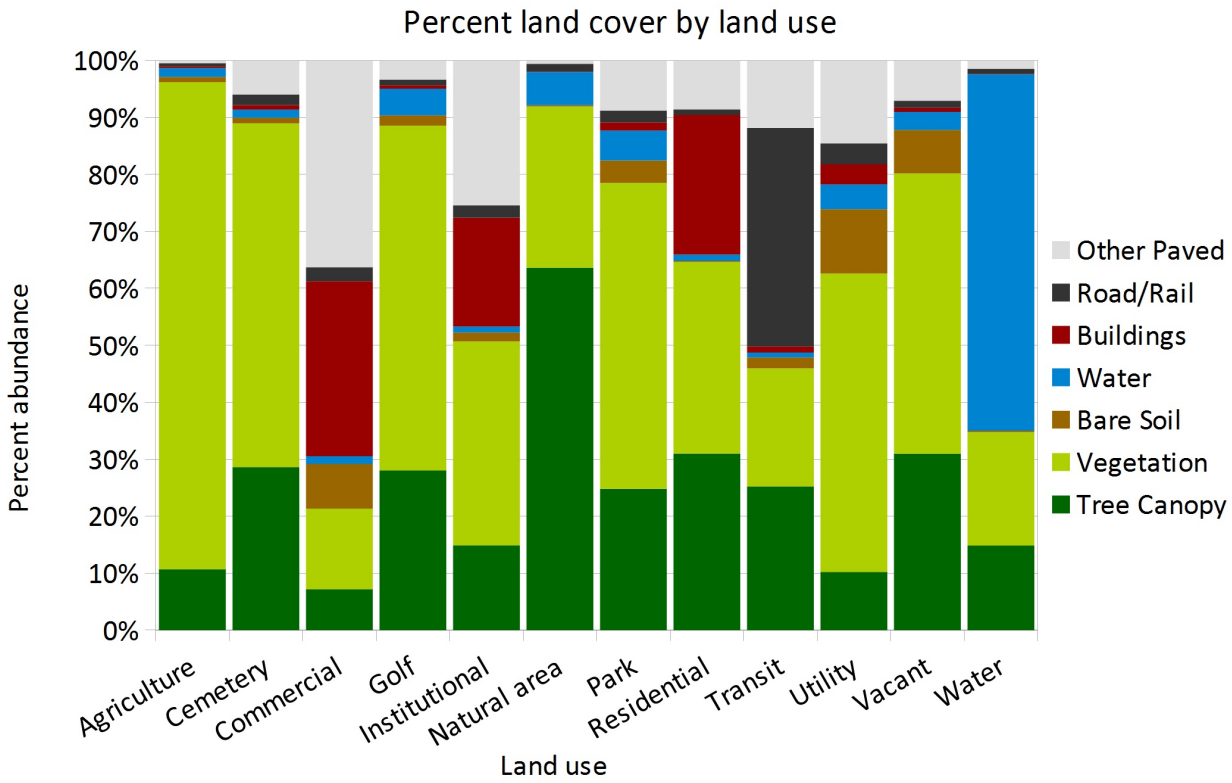


Figure 3: Variations in land cover across land use types.

Canopy cover is not distributed evenly across the region, nor within counties. To better understand how land cover patterns vary, we can compare them across land use types, like residential, commercial or park properties. In Cook County, the highest percentage of canopy is found in natural areas, and in cemeteries and residential properties (Fig. 3). Commercial and utility properties, along with agriculture have the lowest canopy cover. As one might expect, transit areas have the largest proportion of roads, and residential and commercial land use types have an abundance of buildings. See Table 1 on page 6 of this report for more details.

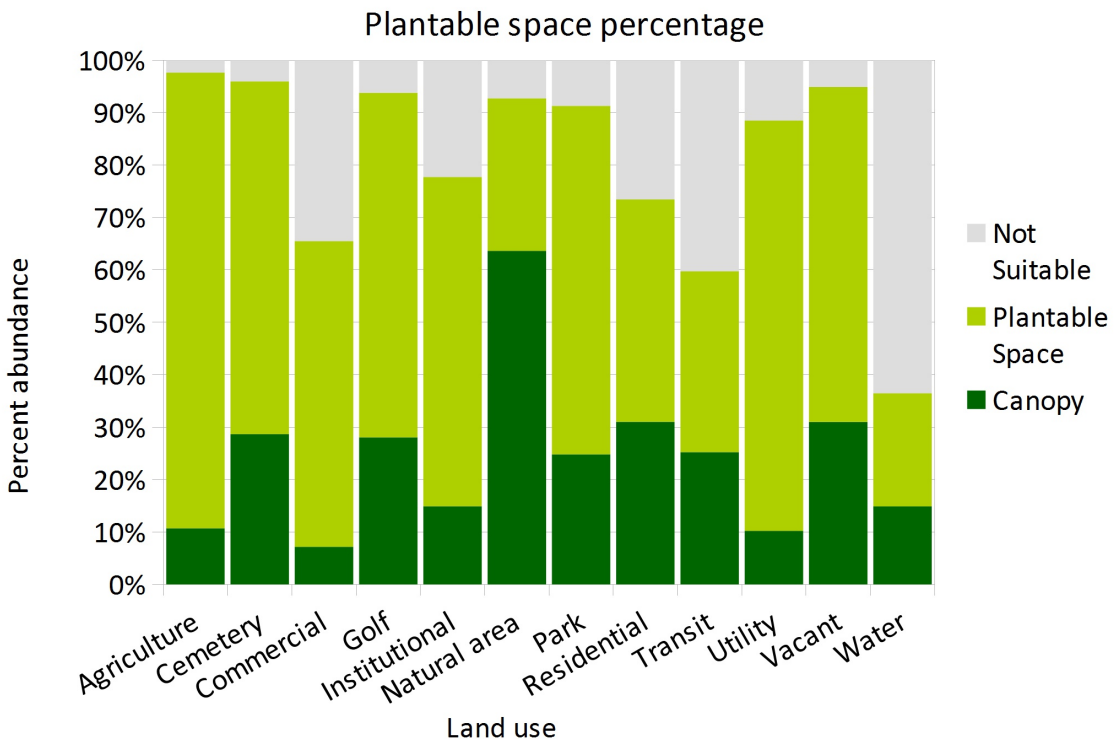


Figure 4: Current canopy and possible planting space across land use types.

By combining vegetation, bare soil and other paved surface categories we can identify which land use types have the most room for growth. In Cook County, the highest proportions of plantable space are found in agriculture, parks and utility sites (Fig. 4).

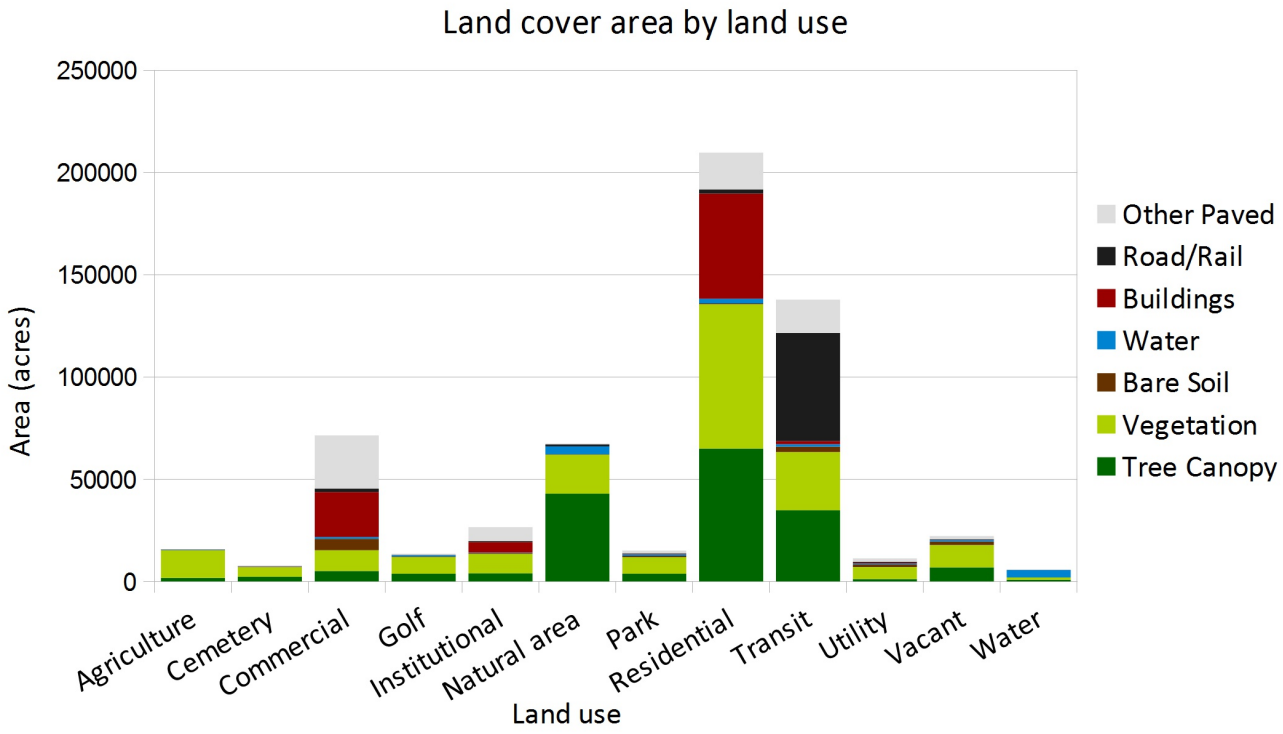


Figure 5: The majority of Cook County is residential, followed by transit.

While utility sites and agriculture have a high proportion of plantable space, these land use types make up a relatively small area in Cook County (Fig. 5). Residential properties, on the other hand, makes up the vast majority of land. Targeting residential properties for increases in canopy could have the biggest effect in Cook County.

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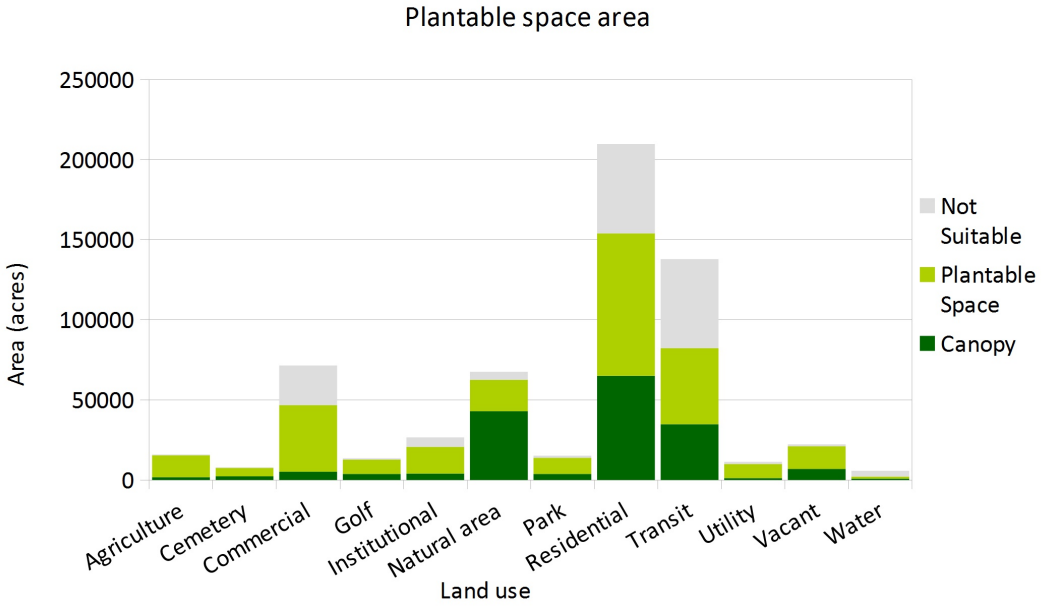


Figure 6: Residential has the greatest potential for increasing the canopy, followed by commercial.

Residential, commercial and transit land use types have the most area that could possibly be converted to canopy (Fig. 6). Targeting these areas could have the greatest impact in expanding the canopy. However, each of these land use types will require different strategies to increase canopy. Residential property owners could be encouraged to plant more trees through tree give-aways, ordinances that encourage tree preservation. Commercial properties could be offered stormwater tax breaks for properties that have more tree canopy. Transit properties are largely publicly owned, and might be some of the easiest targets for canopy increases.

Table 1: Summary of land cover across land use types.

| | Tree canopy | | Vegetation | | Bare soil | | Water | | Buildings | | Roads and rail | | Other paved | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Acres* | *Percent* | *Acres* | *Percent* | *Acres* | *Percent* | *Acres* | *Percent* | *Acres* | *Percent* | *Acres* | *Percent* | *Acres* | *Percent* |
| Agriculture | 1694.4 | 10.7% | 13532.1 | 85.5% | 144.0 | 0.9% | 247.8 | 1.6% | 47.0 | 0.3% | 83.7 | 0.5% | 77.7 | 0.5% |
| Cemetery | 2249.4 | 28.6% | 4736.2 | 60.3% | 77.5 | 1.0% | 111.5 | 1.4% | 62.2 | 0.8% | 144.5 | 1.8% | 471.2 | 6.0% |
| Commercial | 5134.7 | 7.2% | 10115.1 | 14.2% | 5605.4 | 7.8% | 976.1 | 1.4% | 21928.2 | 30.7% | 1755.2 | 2.5% | 25930.6 | 36.3% |
| Golf | 3789.9 | 28.0% | 8180.6 | 60.5% | 244.2 | 1.8% | 633.5 | 4.7% | 80.7 | 0.6% | 128.7 | 1.0% | 458.9 | 3.4% |
| Institutional | 3971.6 | 14.9% | 9531.9 | 35.8% | 417.7 | 1.6% | 281.9 | 1.1% | 5092.0 | 19.1% | 563.6 | 2.1% | 6784.8 | 25.5% |
| Natural area | 42935.5 | 63.6% | 19116.2 | 28.3% | 143.9 | 0.2% | 3917.1 | 5.8% | 37.9 | 0.1% | 950.3 | 1.4% | 402.3 | 0.6% |
| Park | 3760.8 | 24.8% | 8134.2 | 53.7% | 598.3 | 3.9% | 795.4 | 5.2% | 215.7 | 1.4% | 311.1 | 2.1% | 1335.1 | 8.8% |
| Residential | 65035.4 | 31.0% | 70513.2 | 33.6% | 392.3 | 0.2% | 2320.7 | 1.1% | 51399.9 | 24.5% | 2024.1 | 1.0% | 18034.3 | 8.6% |
| Transit | 34801.1 | 25.2% | 28549.4 | 20.7% | 2637.5 | 1.9% | 1182.7 | 0.9% | 1480.1 | 1.1% | 52873.0 | 38.4% | 16335.7 | 11.8% |
| Utility | 1156.1 | 10.2% | 5918.3 | 52.4% | 1274.1 | 11.3% | 491.9 | 4.4% | 398.5 | 3.5% | 412.1 | 3.6% | 1648.6 | 14.6% |
| Vacant | 6902.1 | 31.0% | 10953.3 | 49.2% | 1703.3 | 7.6% | 702.4 | 3.2% | 170.5 | 0.8% | 270.2 | 1.2% | 1574.7 | 7.1% |
| Water | 848.6 | 14.9% | 1135.8 | 19.9% | 14.0 | 0.2% | 3569.8 | 62.6% | 3.5 | 0.1% | 50.9 | 0.9% | 83.3 | 1.5% |
| Total abundance | 172279.8 | 28.5% | 190416.3 | 31.5% | 13252.3 | 2.2% | 15230.7 | 2.5% | 80916.3 | 13.4% | 59567.6 | 9.8% | 73137.1 | 12.1% |

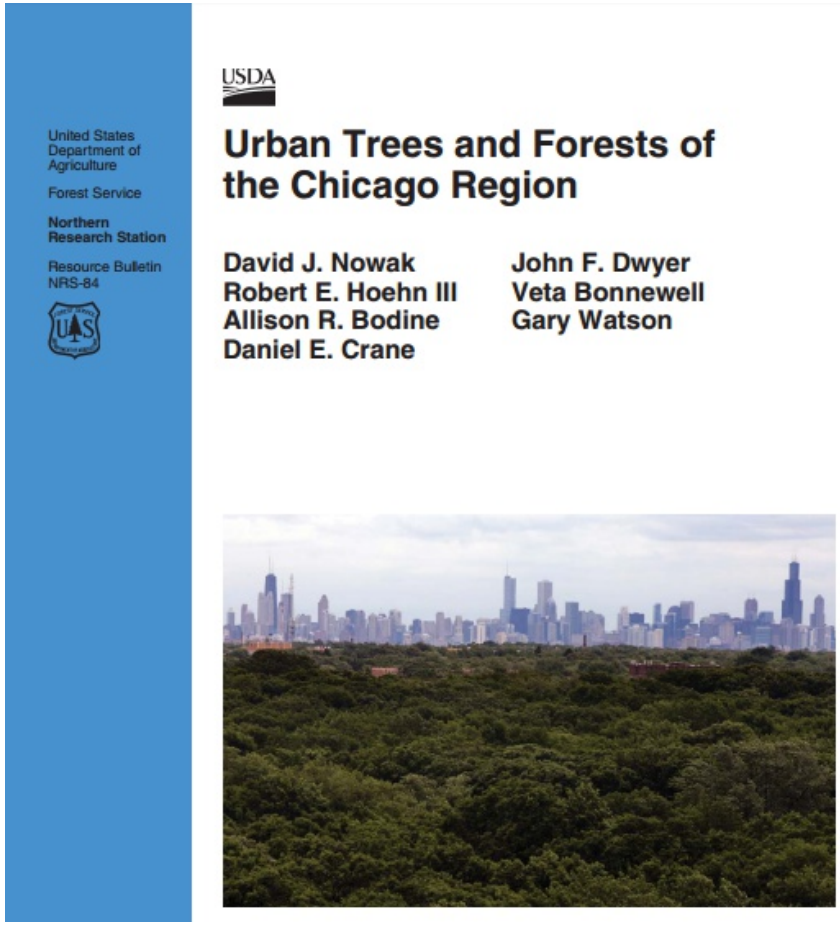


Figure 8: This Forest Service publication be found in its entirety at: http://www.nrs.fs.fed.us/pubs/44566.

While understanding canopy is an important component of urban forestry, canopy alone does not show the whole picture. We can use canopy to quantify the number and extent of trees, but not their identity, health, nor vulnerability to pests, diseases or climate change. In order to better understand the urban forest, we need a tree inventory, which will describe the abundance and location of tree species (Fig. 7).

Tree inventories come in many shapes and sizes. The most complete inventories gather data on every tree in the study area, and include information like each tree's species, any health issues the tree may have, and its specific location. This sort of inventory is invaluable for planning and monitoring the urban forest's health and growth over time. However, a complete inventory is not practical on broad scales, like across an entire county. For this, sample inventories will suffice. In 2013, the Morton Arboretum and the USDA Forest Service published a document that described species distribution in the seven county region (Fig. 8).

Figure 7: Measuring tree size is a critical component to completing a tree inventory.

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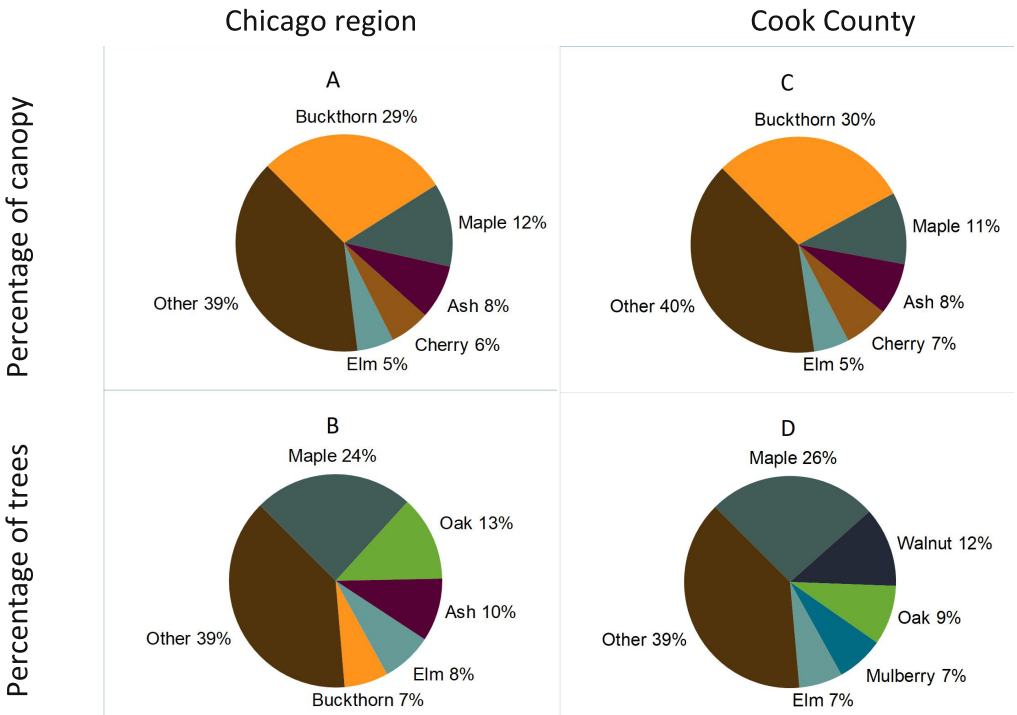


Figure 9: Region-wide, maple is the most abundant genus in the canopy (A), while buckthorn makes up the majority of stems (B). Species abundance in Cook County are very similar to the region as a whole, both in canopy and in stems (C and D).

This Forest Service's study allowed us to look at species diversity in two different ways: by the abundance of individual trees, and the proportion of the entire canopy that these trees make up. Both of these measures are important. Number of individual stems is useful when calculating the number of trees that might be affected by a given pest or disease. The abundance of canopy will show how the entire forest might change. That is, losing ten, small apple trees would have a much smaller impact on the ecosystem services that a forest offers then losing ten, mature oaks. Figure 9 shows the most abundant genera across the Chicago region and in Cook County.

There are some serious problems with our region's species composition. Maples and ashes were extremely abundant. Maples made up 12% of all trees by stem, and nearly a quarter of the region's canopy cover. This study was completed before emerald ash borer began to kill the region's ash trees (in 2010). At that time, ashes made up just shy of 10% of the region's trees, both by stem count and leaf area. As devastating as losing ashes was for the Chicago region, losing maples would be much worse.

This illustrates how critical it is to actively increase species diversity where possible. Most pests and diseases (like emerald ash borer and Dutch elm disease) only attack a specific species or genera of plants. By diversifying species, we can ensure that our forest is resilient to these attacks. This is critical when considering new plantings, and diversity requirements should be included in development plans.

Cook County, like the rest of the region, has more maple then is sustainable. Oaks make up a 14% of the county's canopy, but are less than 5% of the trees in the ground.

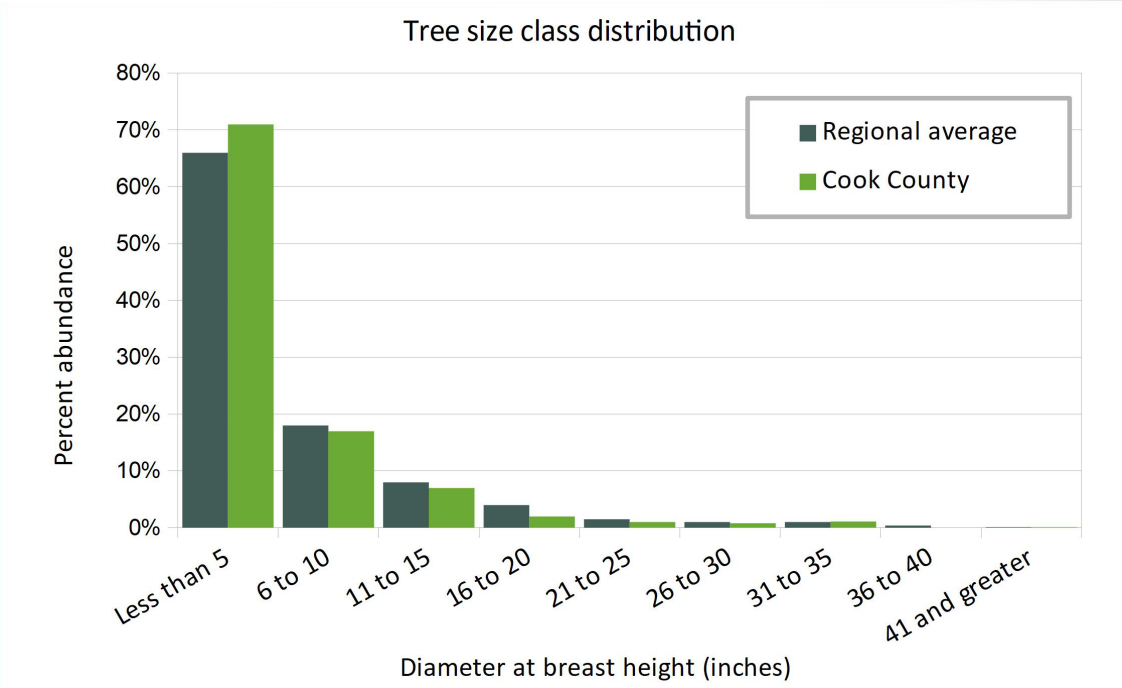


Figure 9: The majority of trees in Cook County and the region as a whole are under five inches in diameter. There are fewer large trees. This pattern generally indicates a sustainable, growing forest. However, it could also indicate an abundance of small, shrubby trees (like buckthorn)

There is another type of diversity to consider beyond species diversity. A sustainable forest has a variety of ages and sizes of trees. If all of the trees in an area were planted at the same time, they will grow, age and die at the same time. When these trees reach the end of their lives, it could leave a property without trees.

For that reason, it is important to try to increase age diversity of a forest. This can be done by planting trees over several years, planting trees with different growth habits (some trees grow quickly and have shorter lifespans than others), and by under planting aging trees, so that something is ready to replace them when they die.

Paying attention to size diversity is especially critical when recovering from emerald ash borer. Many communities have vowed to replace all of the trees that they remove, but this could become problematic if they are planting all of those trees within a short time period. It may be better for overall health of the forest to space these plantings out over several years.

Overall, size diversity for the region and for Cook County look very sustainable (Fig. 10). There is room for some trees to die between each age class, with plenty to remaining to grow into the next size class.

It is possible that the abundance of small trees does not indicate a healthy, growing forest, but instead shows that there is an overabundance of small, weedy species like buckthorn.

While size diversity is sustainable on the county and regional scale, it is also important to zoom into smaller areas, like individual municipalities, subdivisions or properties. Planning for size class diversity on these scales is important to local ecosystem services, like reducing energy use, managing storm water or retaining soil.

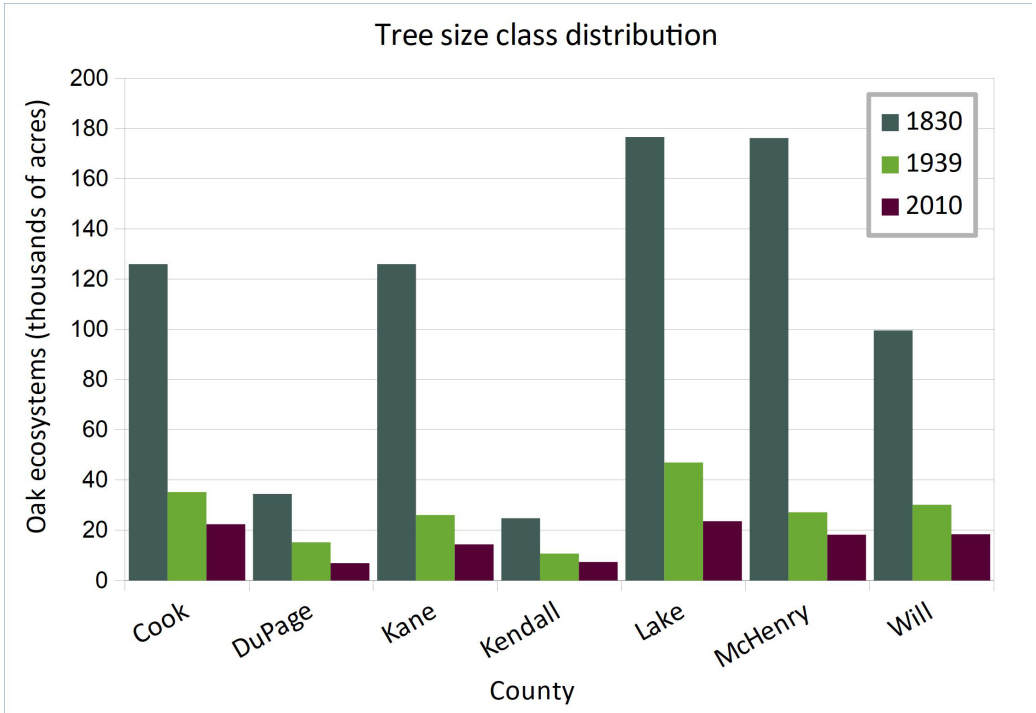


Figure 10: Oak ecosystem abudance across the Chicago region. Only 18% of remnant oak ecosystems remain in Cook County

Oaks are a keystone species in our region's ecology. They provide habitat and food for countless animals, and they influence which plants grow around them. Oaks shape our regions ecosystems, and are in part responsible for the Chicago region being home to more species then the entire state of Wisconsin, and has nearly three times as many species as the entire country of the Netherlands.

Prior to Euro-American settlement, they were the most abundant tree species in the region. However, conversion of natural areas to agriculture and development has removed many of the oaks from our region. Only 17% of oak ecosystems remain region-wide. In Cook County, 18% of the original oak ecosystems still stand. For more information on oak ecosystems in the Chicago region, see Chicago Wilderness's *Oak Ecosystem Recovery Plan*.

While oaks currently make up 14% of Cook County's canopy (Fig. 9), they accounted for 60% prior to Euro-American settlement. Furthermore, oaks make up less than 5% of individual trees in the county. The majority of oaks in Cook County are large and old. These trees are likely reaching the end of their life span, and as they die, there are no young trees to replace them. This could further imperil oak ecosystems.

Restoring oak ecosystems is a major focus of CRTI. One of the largest future threats to oaks is that very few of existing oak ecosystems are protected; in Cook County 20% of remnant oak ecosystems are privately held. CRTI is striving to identify strategies to protect these remnant woodlands, and is reaching out to private land owners to improve how the ecosystems are managed.

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Urban trees are extremely valuable. Research has allowed us to to quantify the values that trees provide, and these values go far beyond the aesthetics that are readily recognized. For example:

- Urban trees save energy by reducing surface temperatures and shading buildings.
- They store carbon dioxide and remove pollutants from the air.
- They intercept stormwater and help reduce flooding.
- Residents preferentially buy properties that have more trees, meaning that trees increase property values.

The i-Tree suite of tools was developed by the US Forest Service. They allow users to calculate tree benefits at a variety of scales, from an individual tree, to entire tree inventories, to landscape scale assessments of canopy and hydrology. For more information on i-Tree tools and methodology visit iTreetools.org.

Figure 12 shows the benefits that all of the trees (including trees public and private property) in Cook County offer. These values were calculated with i-Tree Landscape. Each year, Cook County's trees provide the municipality with $197,175,000 worth of benefits. These trees also store a lot of carbon, which is valued at an additional $550,437,000.

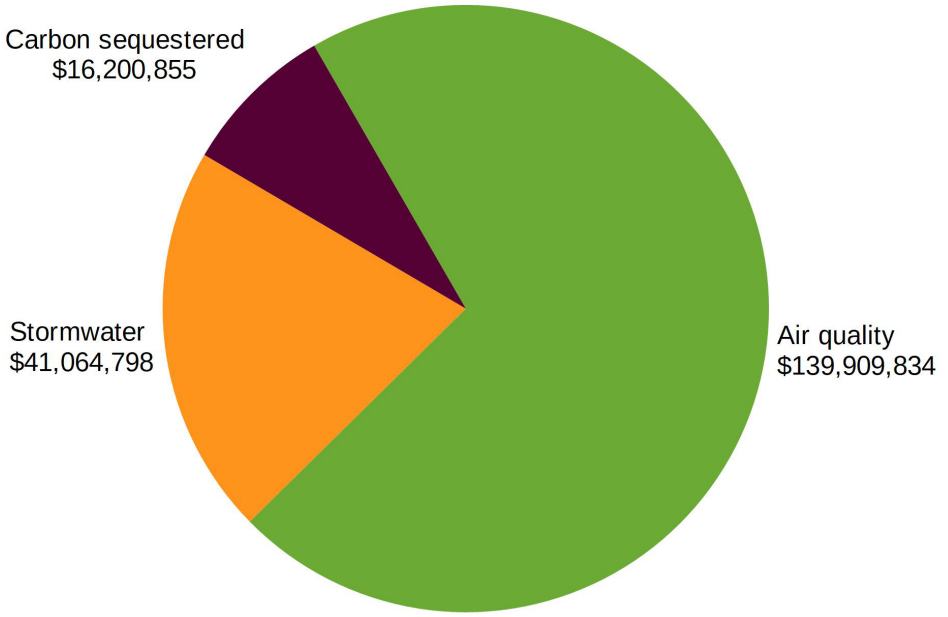


Figure 12: Trees offer myriad benefits, including intercepting stormwater, improving air quality and removing carbon from the atmosphere.

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Cities tend to be hotter than rural areas because buildings and pavement absorb the sun's energy and release it as heat. This is known as the urban heat island effect. High urban temperatures increase the use of energy within buildings. It can also cause a variety of health issues to residents, and extreme heat can even cause death. Trees help lower urban temperatures by shading built surfaces and through evaporative cooling. Urban areas that have more tree canopy tend to have lower surface temperatures (Figure 13). Planting more trees in parking lots and around buildings can be especially helpful in reducing urban temperatures and making cities more comfortable.

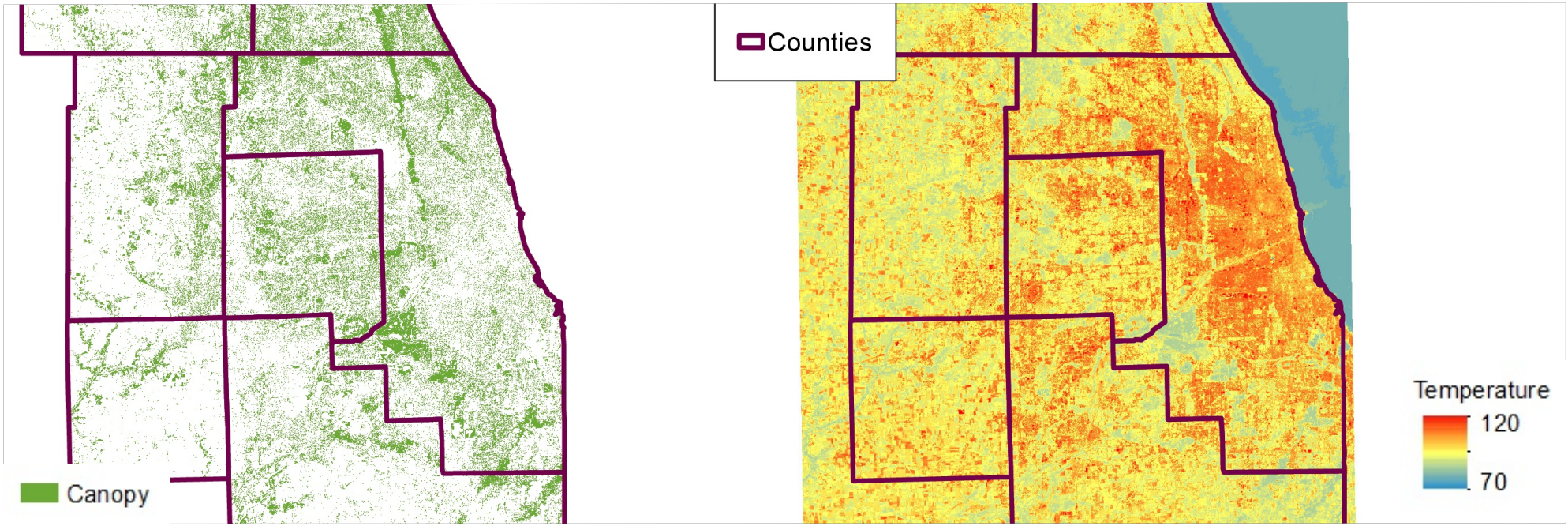


Figure 13: The image on the left shows tree canopy and on the right shows surface temperature. Surface temperature was calculated using a landsat image from September 2014. Areas that have higher tree canopy tend to have lower temperatures.

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Woody invasive species like European buckthorn and bush honeysuckles make up almost one in three trees in the region. These shrubs were introduced as ornamental specimens, but they have escaped cultivation. Birds eat the berries produced by buckthorn and honeysuckle, allowing the seeds to be dispersed into natural areas. Both genera are extremely disruptive to native plants and animals. They create dense thickets, and prevent other species from growing around them (Fig. 15). In natural areas, they are one of the leading contributors to reduced oak regeneration.

Woody invasives are the most abundant in Cook, DuPage and Lake Counties, but they are becoming problematic region-wide (Fig. 16). While there are very few woody invasives in Willowbrook's inventory, these trees likely exist on private property, or on unmanaged land. It is imperative to remove buckthorn from all land uses, as the seeds can easily travel to natural areas. It is difficult to dictate plantings on private property, but educating residents can encourage them to remove it of their own accord. This could include signage explaining invasive removal on public property, or expansion of programs like Conservation@Home.

Figure 14: A buckthorn thicket. Note that no other species are growing beneath the buckthorn.

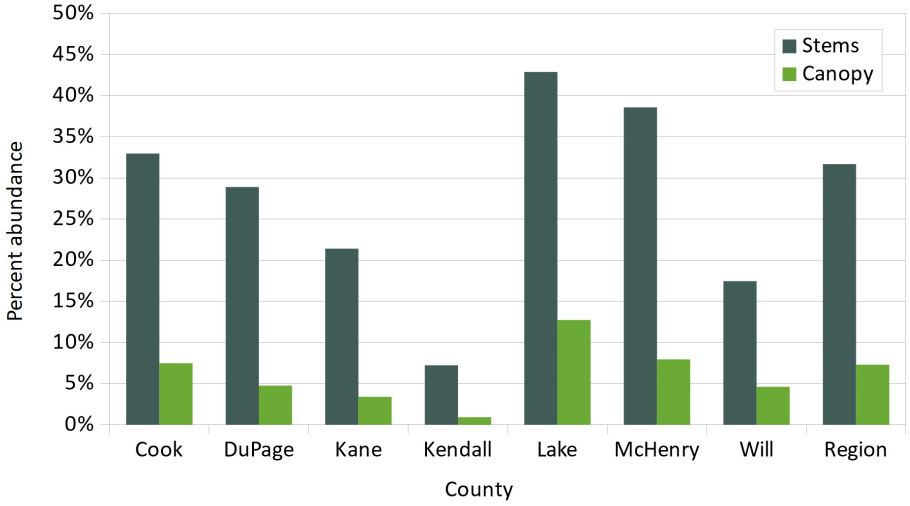


Figure 15: Woody invasive abundance across all counties. Buckthorn is the most abundant in Lake and McHenry Counties, but is a threat region-wide.